DERREENACRINNIG WEST WIND FARM

APPLICATION FOR SUBSTITUTE CONSENT UNDER
S177E OF THE PLANNING AND DEVELOPMENT ACT 2000
[AS AMENDED] ABP-REF-302837-18

20kV GRID CONNECTION TO CONNECT THE PREVIOUSLY CONSENTED
DERREENACRINNIG WEST WIND FARM,
DRIMOLEAGUE, COUNTY CORK
TO THE NATIONAL GRID

ENVIRONMENTAL IMPACT ASSESSMENT REPORT
&
FIGURES
VOLUME I

June 2019

Derreenacrinnig West Wind Farm Limited,
Dreenacreenig West,
Drimoleague,
Co. Cork.

Jennings O'Donovan & Partners Limited,
Consulting Engineers,
Finisklin Business Park,
Sligo.
Tel.: 071 9161416
Fax: 071 9161080
email: info@jodireland.com

JENNINGS O'DONOVAN & PARTNERS LIMITED
Project, Civil and Structural Consulting Engineers,
FINISKLIN BUSINESS PARK,
SLIGO,
IRELAND.

Telephone (071) 9161416
Fax (071) 9161080

Email info@jodireland.com
Web Site www.jodireland.com

DOCUMENT APPROVAL

PROJECT	Application for Substitute Consent Under S177e of the Planning and Development Act 2000 [As Amended] Abp-Ref-302837-18 20kv Grid Connection to Connect the Previously Consented Derreenacrinnig West Wind Farm, Drimoleague, County Cork to the National Grid	
CLIENT / JOB NO	Derreenacrinnig West Wind Farm	4636
DOCUMENT TITLE	Environmental Impact Assessment Report	

	Prepared by	**Reviewed/Approved by**
Document **DRAFT**	Name	Name
Date	Signature	Signature

	Prepared by	**Reviewed/Approved by**
Document **FINAL**	Name Breena Coyle	Name David Kiely
Date June 2019	Signature Breena Coyle	Signature David Kiely

Contents

1 INTRODUCTION.....1

1.1 OVERVIEW.....1
1.1.1 Planning History and Background to the Project Proposals.....1
1.1.2 Planning History Application Reference 19/0010.....2
1.1.3 Statutory Undertaker.....2
1.1.4 Case Law and Background to the Project Proposals.....3
1.1.5 The Status of The Grid Connection.....3
1.1.6 Status of The Grid Connection.....6
1.1.7 Application for Substitute Consent.....6
1.1.8 Screening for Appropriate Assessment.....7
1.1.9 An Bord Pleanála Reference ABP/ PL88.239767.....8
1.1.10 Case Law.....8

1.2 ENVIRONMENTAL IMPACT ASSESSMENT.....9
1.2.1 Environmental Impact Assessment Requirement and National Legislation.....9
1.2.2 Directive 2014/52/EU.....10
1.2.3 National Guidance.....18

1.3 EIAR STRUCTURE.....19

1.4 EIAR PREPARATION.....20
1.4.1 Introduction.....20
1.4.2 Section Structure.....21

1.5 NEED FOR THE PROPOSED DEVELOPMENT.....22

1.6 THE APPLICANT.....22

1.7 CONSULTATION.....22

1.8 AVAILABILITY OF INFORMATION.....23

2 PROJECT DESCRIPTION.....24

2.1 INTRODUCTION AND PROJECT DESCRIPTION.....24

2.2 THE NEED FOR THE DEVELOPMENT.....26

2.3 LEGAL CONTEXT.....26

2.4 SUBSTITUTE CONSENT PROPOSALS.....27

2.5 SITE LOCATION AND ENVIRONS.....37
2.5.1 Introduction / Existing Land Use / Permitted Land Use.....37

2.6 THE PROPOSED GRID CONNECTION.....39

2.7 THE CONSTRUCION OF THE 20KV GRID CONNECTION.....40
2.7.1 Joint Bays Locations for the Proposed Grid Connection.....42

2.8 PROJECT CONSTRUCTION AND COMMISSIONING.....43
2.8.1 Machinery to be used during construction.....43
2.8.2 General Method.....43
2.8.3 Storage of Equipment and Materials.....43
2.8.4 Pollution Prevention & Control.....44
2.8.5 Mitigation Measures.....45
2.8.6 Spoil Management.....47

2.9 TESTING AND COMMISSIONING.....47

2.10 OPERATION AND MAINTENANCE.....47

2.11 DECOMMISSIONING.....47

2.12 WIND RESOURCE.....47

2.13 SITE SELECTION AND EXAMINATION OF ALTERNATIVES.....47

2.13.1 Introduction ... 47
2.13.2 Alternative Locations for the Wind Farm ... 48
2.13.3 Alternative Designs ... 48
2.13.4 Grid Connection Alternatives ... 48
2.13.5 Proximity to Ballylicky Substation ... 52
2.13.6 Alternative Processes ... 55
2.13.7 Alternatives Considered for the Consented Wind Farm ... 55
2.13.8 Reasonable Alternatives ... 56

2.14 PROPOSED DEVELOPMENT SITE INFRASTRUCTURE AND CONSTRUCTION ... 56
2.14.1 Cumulation with other Existing and/or Approved Projects ... 56
2.14.2 Other Development in the Area ... 56

3 PLANNING POLICY ... 58

3.1 INTRODUCTION ... 58

3.2 INTERNATIONAL POLICY ... 58
3.2.1 The United Nations Framework Convention on Climate Change ... 59

3.3 EUROPEAN UNION POLICY ... 60

3.4 NATIONAL POLICY & LEGISTLATIVE FRAMEWORK ... 63
3.4.1 National Strategy for Intensifying Wind Energy Development 2000 ... 63
3.4.2 Ireland's Energy Policy Framework 2007-2020 ... 64
3.4.3 Strategy for Renewable Energy 2012-2020 ... 65
3.4.4 White Paper on Energy Policy in Ireland 2015 – 2030 ... 66
3.4.5 Water Resource Management ... 67
3.4.6 Agriculture ... 67
3.4.7 Biodiversity and Natural Ecosystems ... 68
3.4.8 Emissions Projections ... 68

3.5 NATIONAL CLIMATE CHANGE POLICY ... 69
3.5.1 National Climate Action Plan 2019 ... 69
3.5.2 Climate Action and Low Carbon Development Act 2015 ... 71
3.5.3 National Mitigation Plan ... 72
3.5.4 The National Planning Framework [NPF] ... 73
3.5.5 Transition to a Low Carbon and Climate Resilient Society [NPF] ... 73
3.5.6 Strengthening Ireland's Rural Fabric and Supporting Rural Communities ... 74
3.5.7 As part Section 9.2 –Transitioning to a Low Carbon Economy ... 76

3.6 REGIONAL AND COUNTY PLANNING GUIDANCE ... 79
3.6.1 Regional Planning Guidelines for the Southern Region ... 80
3.6.2 Cork County Development Plan 2014 -2020 ... 81
3.6.3 County Development Plan Objectives ... 83
3.6.4 Current Wind Energy Development in County Cork ... 87
3.6.5 Transmission Lines ... 87
3.6.6 Windfarm Development Guidelines (2006) ... 88
3.6.7 West Cork Municipal District Local Area Plan ... 89

3.7 CONCLUSION ... 91

4 POPULATION AND HUMAN HEALTH ... 92

4.1 INTRODUCTION ... 92
4.1.1 Background and Objectives ... 92
4.1.2 Statement of Authority ... 93
4.1.3 Study Area for the Existing and Proposed Grid Connection ... 93
4.1.4 Study Area for Consented Derreenacrinnig West Wind Farm ... 94
4.1.5 Assessment Structure ... 94
4.1.6 Scope of the Assessment ... 94

4.2 ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA ... 95
4.2.1 Assessment Methodology ... 95
4.2.2 Relevant Legislation and Guidance ... 96
4.2.3 Cork County Development Plan 2014-2020 ... 96

4.2.4 Evaluation of Potential Effects 97
4.3 BASELINE DESCRIPTION....99
4.3.1 Existing Population and Settlement Patterns in the vicinity of The Existing and Proposed Grid Connection 99
4.3.2 Economic Activity and Tourism....102
4.3.3 Accidents / Disasters (incorporating health and safety);....109
4.3.4 Human Health....114
4.4 ASSESSMENT OF POTENTIAL IMPACTS....117
4.4.1 Population and Settlement Patterns 117
4.4.2 Economic Activity and Tourism....118
4.4.3 Employment....120
4.4.4 Topography and Land Use....121
4.4.5 Accidents / Disasters (incorporating health and safety)....121
4.4.6 Human Health....123
4.5 MITIGATION MEASURES AND RESIDUAL EFFECTS....125
4.5.1 Population and Settlement Patterns 126
4.5.2 Economic Activity and Tourism....126
4.5.3 Employment....126
4.5.4 Topography and Land Use....126
4.5.5 Accidents / Disasters (incorporating health and safety)....126
4.5.6 Human Health....130
4.6 CUMULATIVE EFFECTS....134
4.7 SUMMARY OF SIGNIFICANT EFFECTS....134
4.8 STATEMENT OF SIGNIFICANCE 134
4.9 COMPARISON WITH 2010 EIA 134
4.10 REMEDIAL/MITIGATION MEASURES FOR THE EXISTING GRID CONNECTION 134
4.10 CONCLUSION....135
4.11 REFERENCES 136
5 BIODIVERSITY....137
5.1 INTRODUCTION....137
5.1.1 Background 137
5.1.2 Statement of Authority....137
5.1.3 Legislation, Policy and Guidance 138
5.2 BACKGROUND....143
5.3 ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA....144
5.3.1 Relevant Legislation 144
5.4 SCHEUDLE OF WORKS....145
5.5 METHODOLOGY....145
5.5.1 Desk Study 145
5.6 SITE INVESTIGATIONS....146
5.7 SITE EVALUATION....149
5.8 IMPACT ASSESSMENT METHODOLOGY 149
5.8.1 Impact Magnitude....149
5.8.2 Impact Significance 150
5.9 CHARACTERISTICS OF THE DEVELOPMENT....150
5.10 STUDY AREA DESCRIPTION....152
5.10.1 Grid Connection Route 152
5.10.2 Wind Farm Site....152
5.11 DESIGNATED NATURE CONSERVATION AREAS 153

5.11.1 Habitats Directive Assessment 157

5.12 RARE & PROTECTED FAUNA 158

5.13 HABITATS 162
5.13.1 Habitats Along the Grid Connection Route 162

5.14 FAUNA 167
5.14.1 Fauna along the Grid Connection Route 167
5.14.2 Fauna within the Wind Farm Site 170

5.15 SITE EVALUATION OF THE GRID CONNECTION ROUTE 172

5.16 WIND FARM SITE....173

5.17 CONSTRUCTION PHASE IMPACTS OF THE GRID CONNECTION OVERHEAD LINE....173
5.17.1 Designated Conservation Areas 173
5.17.2 Habitats 173
5.17.3 Watercourses....174
5.17.4 Peatland 174
5.17.5 Humid Acid Grassland....175
5.17.6 Improved agricultural grassland 175
5.17.7 Scrub 175
5.17.8 Wet Willow Woodland 175
5.17.9 Hedgerows 176
5.17.10 Birds....176
5.17.11 Bats 176
5.17.12 Badger....176
5.17.13 Otter 176
5.17.14 Freshwater pearl mussels 177

5.18 CONSTRUCTION PHASE IMPACT OF THE GRID CONNECTION UNDERGROUND LINE 177
5.18.1 Designated Conservation Areas....177
5.18.2 Habitats 177
5.18.3 Birds....178
5.18.4 Bats 178
5.18.5 Badger....178
5.18.6 Otter 178
5.18.7 Freshwater pearl mussels 178

5.19 CONSTRUCTION PHASE IMPACTS OF THE WIND FARM....178
5.19.1 Designated Conservation Areas....178
5.19.2 Terrestrial Habitats....179

5.20 OPERATION PHASE IMPACTS OF THE OVERHEAD LINE....181
5.20.1 Designated Conservation Areas....181
5.20.2 Habitats 181
5.20.3 Birds....182
5.20.4 Bats 182
5.20.5 Badgers 182
5.20.6 Otters....182
5.20.7 Freshwater pearl mussels....182

5.21 OPERATION PHASE IMPACTS OF THE GRID CONNECTION UNDERGROUND LINE 183

5.22 CUMULATIVE EFFECTS OF THE GRID CONNECTION ROUTE AND THE WIND FARM SITE 183

5.23 CONSTRUCTION PHASE OF THE GRID CONNECTION ROUTE 184

5.24 CONSTRUCTION PHASE OF THE WIND FARM....185

5.25 OPERATION PHASE OF THE GRID CONNECTION ROUTE....188

5.26 OPERATION PHASE OF THE WIND FARM 188

5.27 MITIGATION BY REMEDIATION....188

5.28 RESIDUAL IMPACTS **188**
5.29 MONITORING **188**
5.30 REFERENCES **202**

6 SOILS AND GEOLOGY 203

6.1 INTRODUCTION **203**
6.1.1 Background and Objectives 203
6.1.2 Statement of Authority 203
6.1.3 Assessment Structure of Chapter 6 206

6.2 ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA **206**
6.2.1 Assessment Methodology 206
6.2.2 Relevant Legislation and Guidance 206
6.2.3 Desk Study 208
6.2.4 Field Work 209
6.2.5 Evaluation of Potential Effects 209

6.3 BASELINE DESCRIPTION **214**
6.3.1 Introduction 214
6.3.2 Site Description 214
6.3.3 Bedrock Geology 214
6.3.4 Soils and Subsoil Geology 218
6.3.5 Composition and Character of PEAT 220
6.3.6 Spatial and Depth Distribution of PEAT 220
6.3.7 Composition and Character of MINERAL SUBSOILS 220
6.3.8 Spatial and Depth Distribution of MINERAL SUBSOILS 220
6.3.9 Relation of Peat and Mineral SUBSOILS to Proposed Infrastructure 221
6.3.10 Turbine Peat Depth (m) Dry/Moist/ Wet/Very Wet Peat Sub-Peat Geology Von Post Humification Shear Vane Test (kPa) Slope & Aspect 221
6.3.11 Von Post Humification 221
6.3.12 Slope Measurements 221
6.3.13 Shear Vane Tests 222
6.3.14 Ground Stability / Stress Indicators 223
6.3.15 Soils – Grid Route 223

6.4 DO NOTHING IMPACT **223**

6.5 POTENTIAL IMPACTS OF THE DEVELOPMENT **224**
6.5.1 Construction Phase 224
6.5.2 Peat, Subsoil and Bedrock Removal 224
6.5.3 Vehicular Movement 225
6.5.4 Excavation Works 226
6.5.5 Storage and Stockpiles 226
6.5.6 Ground / Peat Stability 226
6.5.7 Waste Generation / Management 229
6.5.8 Operational Phase 229

6.6 MITIGATION MEASURES **230**
6.6.1 Mitigation by Avoidance 230
6.6.2 Construction Phase 230
6.6.3 Ground / Peat Stability 232
6.6.4 Waste Generation / Management 234
6.6.5 Spoil Management – Underground Cable Grid Connection 235
6.6.6 Spoil Management – Overhead Line Grid Connection 235
6.6.7 Operation Phase 235

6.7 RESDUAL IMPACTS OF THE DEVELOPMENT **235**
6.7.1 Construction Phase 235
6.7.2 Operational Phase 236

6.8 MONITORING **236**

6.9 CONCLUSIONS **236**

6.10 MITIGATION MEASURES AND RESIDUAL EFFECTS **237**
6.10.1 Construction Phase 237
6.10.2 Operational Phase 241
6.10.3 Decommissioning Phase 242
6.10.4 Cumulative Effects 242

6.11 SUMMARY OF SIGNIFICANT EFFECTS **242**

6.12 STATEMENT OF SIGNIFICANCE **242**

7. WATER **243**

7.1 INTRODUCTION **243**
7.2 METHODOLOGY 245
7.2.1 Relevant Guidance and Legislation 245
7.2.2 Previously Consented Derreenacrinnig West Planning Application 249
7.2.3 Schedule of Works for Previously Consented Derreenacrinnig West Wind Farm 249

7.3 METHODOLOGY **249**
7.3.1 Desk Study 249
7.3.2 Site Investigations 250
7.3.3 Impact Assessment Methodology 250
7.3.4 Characteristics of the Previously Consented Derreenacrinnig West Wind Farm Development 251

7.4 RECEIVING ENVIRONMENT **251**
7.4.1 Surface Water 251
7.4.1.1 Surface Water Drainage – Wind Farm Site 251
7.4.1.2 Surface water runoff – Wind Farm Site 252
7.4.1.3 Grid Connection 252
7.4.1.4 Surface Water Quality 252
7.4.1.5 Groundwater 253

7.5 DO NOTHING IMPACT **255**

7.6 POTENTIAL IMPACTS OF THE DEVELOPMENT **256**
7.6.1 Construction Phase 256
7.6.1.1 Surface Water Runoff 256
7.6.1.2 Surface Water Quality 260
7.6.1.3 Groundwater Flow 261
7.6.1.4 Groundwater Quality 262
7.6.1.5 Operational Phase 263

7.7 MIITGATION MEASURES **264**
7.7.1 Construction Phase Mitigation 264
7.7.1.1 Constructed Drainage 264
7.7.1.2 Surface Water Flow 265
7.7.1.3 Surface Water Quality 267
7.7.1.4 Groundwater Flow 268
7.7.1.5 Groundwater Quality 269
7.7.1.6 Operational Phase Mitigation 271

7.8 RESIDUAL IMPACTS OF THE DEVELOPMENT **272**
7.8.1 Construction Phase 272
7.8.2 Operational Phase 272

7.9 MONITORING **272**

7.10 SUMMARY OF SIGNIFICANT EFFECTS **272**

7.11 STATEMENT OF SIGNIFICANCE **273**

7.12 CONCLUSION **273**

7.13 REFERENCES **273**

8. AIR AND CLIMATE **275**

8.1 INTRODUCTION **275**

8.1.1 Background and Objectives 275
8.1.2 Statement of Authority 276
8.1.3 Assessment Structure 276

8.2 ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA 277
8.2.1 Assessment Methodology 277
8.2.2 Relevant Legislation and Policy 277
8.2.3 Evaluation of Potential Effects 278
8.2.4 Sensitivity 279
8.2.5 Magnitude 279
8.2.6 Significance Criteria 279

8.3 RECEIVING ENVIRONMENT 280
8.3.1 Introduction 280
8.3.2 Existing Climate 282
8.3.3 Existing Air Quality Conditions 282

8.4 DO NOTHING IMPACT 284

8.5 POTENTIAL IMPACTS OF THE PROPOSED DEVELOPMENT 284
8.5.1 Construction Phase 284
8.5.1.1 Dust Emissions 284
8.5.1.2 Sensitive Receptors 285
8.5.1.3 Exhaust Emissions 285
8.5.1.4 Construction Carbon Footprint 286
8.5.2 Operational Phase 286
8.5.2.1 Dust Emissions 286
8.5.2.2 Reduction in Climate Change Emissions 286
8.5.3 Decommissioning Phase 287

8.6 MITIGATION MEASURES AND RESIDUAL EFFECTS 287
8.6.1 Construction Phase Mitigation 287
8.6.2 Operational Phase Mitigation 288
8.6.3 Decommissioning Phase Mitigation 288
8.6.4 Cumulative Effects 288

8.7 RESIDUAL IMPACTS OF THE EIA DEVELOPMENT 288

8.8 SUMMARY OF SIGNIFICANT EFFECTS 289

8.9 STATEMENT OF SIGNIFICANCE 289

8.10 CUMULATIVE AND IN COMBINATION EFFECTS 289

8.11 CONCLUSION 289

9 NOISE 290

9.1 STATEMENT OF AUTHORITY 290

9.2 INTRODUCTION AND METHODOLOGY 290

9.3 ACOUSTIC TERMONOLOGY 291

9.4 EXISTING ENVIRONMENT 292
9.4.1 Noise Sensitive Locations 292
9.4.2 Baseline Noise Survey 294
9.4.3 Baseline Noise Methodology 294
9.4.4 Instrumentation Used 294
9.4.5 Measurement Procedure 294
9.4.6 Noise Survey Results and Analysis of Data 295

9.5 NOISE IMPACT 295
9.5.1.1 Target Criterion and Noise Limits 296
9.5.4.1 Predicted Wind Turbine Noise 297
9.5.4.2 Noise Assessment 302
9.5.4.3 Cumulative Wind Farm Effects 308
9.5.4.4 Assessment of Cumulative Effects 308

9.5.4.5 Construction Noise 308

9.6 COMMENTARY **309**

9.7 MONITORING **310**

9.8 LOW FREQUENCY NOISE AND VIBRATION....**310**

9.9 POTENTIAL IMPACTS OF THE PROPOSED GRID CONNECTION....**310**

9.10 MITIGATION MEASURES....**312**

9.10.1 Construction Phase 312

9.11 RESIDUAL IMPACTS OF THE DEVELOPMENT....**312**

9.12 CUMULATIVE AND IN-COMBINATION IMPACTS **312**

9.13 CONCLUSION....**313**

10. SHADOW FLICKER & ELECTROMAGNETIC INTERFERENCE......314

10.1 INTRODUCTION....**314**

10.2 SHADOW FLICKER **314**

10.1.1 Methodology....316

10.1.2 Shadow Flicker Analysis 317

10.1.3 Seasonal and Hourly Variation 320

10.1.4 Mitigation Measures 320

10.2 ELECTROMAGNETIC INTERFERENCE **321**

10.2.1 Existing Environment 321

10.2.2 Possible Sources of Electromagnetic Emissions from the Proposed Development 321

10.2.3 Possible Impact of Electromagnetic Emissions on the Existing Environment....322

10.3 MITIGATION MEASURES....**322**

10.4 CONCLUSIONS....**322**

11. LANDSCAPE AND VISUAL 324

11.1 INTRODUCTION....**324**

11.1.1 Background and Objectives 324

11.2 METHODOLOGY FOR THE CONSENTED DERREENACRINNING WEST WIND FARM....324

11.3 THE PROPOSED GRID CONNECTION....**330**

11.3.1 Landscape Baseline....330

11.4 THE EXISTING GRID CONNECTION **331**

11.4.1 Vegetation and Land Use....338

11.4.1.1 Cork County Draft Landscape Strategy (2007) 341

11.4.2 Cumulative Baseline 348

11.5 ASSESSMENT OF POTENTIAL EFFECTS....**350**

11.5.1 Do Nothing Impacts....350

11.5.2 Landscape Impacts....350

11.5.2.1 Landscape Character, Value and Sensitivity....350

11.5.2.2 Magnitude of Landscape Impact....351

11.6 MITIGATION MEASURES AND RESIDUAL EFFECTS....**353**

11.6.1 Decommissioning Phase 354

11.6.1.1 Decommissioning Phase Residual Impacts....354

11.7 STATEMENT OF SIGNIFICANCE **354**

11.8 CONCLUSION....**355**

11.9 BIBLIOGRAPHY & REFERENCE DOCUMENTS **355**

12. MATERIAL ASSETS....357

12.1 INTRODUCTION....**357**

12.1.1 Background 357

12.2 RECEIVING ENVIRONMENT....357
12.2.1 Introduction....357
12.2.2 Existing Environment 357
12.2.3 Predicted Impacts....358
12.2.4 Mitigation Measures 358
12.2.5 Conclusion 358

12.3 NATURAL RESOURCES OF ECONOMIC VALUE 358
12.3.1 Introduction....358
12.3.2 Existing Environment 358
12.3.3 Predicted Impact 359
12.3.4 Mitigation Measures 359
12.3.5 Conclusion 359

12.4 ROAD NETWORK....359
12.4.1 Introduction....359
12.4.2 Proposed Haul Route 359
12.4.3 Existing Environment 360
12.4.4 Predicted Impact 361
12.4.5 Mitigation Measures 361
12.4.6 Conclusion 362

12.5 PROPOSED GRID CONNECTION....362
12.5.1 Introduction....362
12.5.2 Predicted Impact 362
12.5.3 Mitigation Measures 362
12.5.4 Conclusion 363

12.6 BORROW PIT....363
12.6.1 Existing Environment 363
12.6.2 Predicted Impacts....363
12.6.3 Mitigation Measures 364
12.6.4 Conclusion 365

12.7 TELECOMMUNICATIONS....365
12.7.1 Existing Environment 365
12.7.2 Predicted Impact 365
12.7.3 Mitigation Measures 365
12.7.4 Conclusion 365

12.8 FORESTRY 366
12.8.1 Existing Environment 366
12.8.2 Predicted Impacts....366
12.8.3 Mitigation Measures 366
12.8.4 Conclusion 366

12.9 AIR NAVIGATION 366
12.9.1 Introduction....366
12.9.2 Existing Environment 367
12.9.3 Predicted Impact 367
12.9.4 Mitigation Measures 367

12.10 RESIDUAL IMPACTS OF THE DEVELOPMENT....367

12.11 CUMULATIVE AND IN-COMBINATION IMPACTS 367

12.12 CONCLUSION....368

13. ARCHAEOLOGY AND CULTURAL HERITAGE....369

13.1 INTRODUCTION....369
13.1.1 Background and Objectives 369
13.1.2 Statement of Authority....369
13.1.3 Assessment Structure 369

13.2 ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA 370
13.2.1 Assessment Methodology 370
13.2.2 Relevant Legislation and Guidance 371
13.2.3 Desk Study 374
13.2.4 Field Survey 374
13.2.5 Predicted Impacts on Archaeological, Architectural and Cultural Heritage 374
13.2.5.1 Level of Impact 376
13.2.5.2 Magnitude 376

13.3 BASELINE DESCRIPTION 378
13.3.1 Introduction 378
13.3.2 Archaeological & Historical Context 379
13.3.3 Cartographic and Placename Evidence 384
13.3.4 Field Inspection 385

13.4 ASSESSMENT OF PROPOSED OVERHEAD CIRCUIT ROUTE 386
13.4.2 Assessment of Potential Impacts 387

13.5 ASSESSMENT OF THE CONSTRUCTED OVERHEAD CIRCUIT 388

13.6 ASSESSMENT OF PROPOSED UNDERGROUND CIRCUIT ROUTE 395

13.7 ASSESSMENT OF WIND FARM SITE 398

13.8 CONCLUSIONS ON CUMULATIVE IMPACTS 400

13.9 STATEMENT OF SIGNIFICANCE 401

13.10 RECOMMENDATIONS 401

13.11 REFERENCES 402

14. INTERACTIONS OF THE FOREGOING 403

14.1 INTRODUCTION 403
14.1.1 Background and Objectives 403

14.2 PREDICTED IMPACT 403

14.3 MITIGATION MEASURES 407

14.4 CUMULATIVE AND IN-COMBINATIONS IMPACTS OF THE PROPOSED GRID CONNECTION AND THE CONSENTED DERREENACRINNING WEST WIND FARM 407

14.5 CONCLUSION ON THE DEVELOPMENT INTERACTIONS AND INTER-RELATIONSHIHPS AND THEIR IMPACTS IN CONTEXT 408

APPENDICES

Appendix A – Decision Notice Relating to Consented Wind Farm
Appendix B – ESB Spec for 20 kV UGC
Appendix C – Screening for Appropriate Assessment
Appendix D – CEMP for The Consented Wind Farm
Appendix E – Outline CEMP dated June 2019
Appendix F– Minerex Soils and Geology Appendices
Appendix G – Shadow Flicker Occurrence Information
Appendix H – Noise & Vibration Consultants – Noise Monitoring Data
Appendix I – Haul Route Assessment
Appendix J – Flood Risk Assessment Report
Appendix K– Landscape and Visual Assessment

1 INTRODUCTION

1.1 OVERVIEW

An application for Substitute Consent under Section 177E of the Planning and Development Act 2000[As Amended] is being sought by ESB Networks [ESBN] to regularise planning permission for a partially built grid connection to connect the already consented Derreenacrinnig West Wind Farm to the existing Ballylicky substation in Co. Cork.

This remedial EIAR includes an evaluation of the proposed Grid Connection route and is assessed in combination with the wind farm and that part of the grid connection which has not yet been constructed and which is the subject of an application for planning permission to Cork County Council under planning reference 19/10. [pending consideration].

1.1.1 Planning History and Background to the Project Proposals

A planning application was submitted by George O 'Mahony for a 10 year planning permission for development of a wind farm comprising seven number wind turbines with a hub height of 55 metres and a rotor diameter of 52 metres, an electrical compound, sub-station building, four number car parking spaces, associated site roads and site works.

A decision to grant planning permission was made in October 2011 by Cork County Council under Reg. Ref. 10/857 for a wind farm, comprising 7 wind turbines, an electrical compound and sub-station and all related electrical equipment, subject to 29 conditions. The decision was appealed by third parties to An Bord Pleanála who subsequently upheld the grant of planning permission on 05th December 2012, subject to 16 conditions under An Bord Pleanála PL88.239767 Decision.

Following the grant of planning permission, the wind farm developer received a connection offer from ESB Networks in 2014. This connection was accepted as a non-contestable offer which means that the wind farm developers agree that the works would be carried out by the applicant, ESB Networks. ESB subsequently commenced works on the Grid Connection as part of the Overhead Line [OHL] and Under Ground Connection [UGC]. Work to the Grid Connection commenced in October 2017.

Prior to the construction of the grid connection, ESBI carried out an Exempted Development Screening Study for ESBN of the proposed grid connection, to determine whether or not it would fall within the planning exemptions available for such development.

The planning permission for the consented Derreenacrinnig West Wind Farm was implemented, and work commenced on site on the 28th August 2017. All pre-commencement conditions relating to the wind farm have been discharged. Civil works at the wind farm site are well advanced although there is no activity at present. Works to the grid connection commenced in October 2017.

1.1.2 Planning History Application Reference 19/0010

A planning application for the construction of the unbuilt grid connection was submitted to Cork County Council in January 2019 under planning application reference 19/10 and is pending consideration. That planning application is for the "*installation of approximately 3.2km of underground cable ducting and associated electrical cabling, approximately 1.2km* of overhead line …*The works, which will take place at separate locations along the 14km grid connection route, are required to completed the grid connection from Derreenacrinnig West Windfarm to the ESB Ballylickey substation."*

The proposals now before the determining authority seek to retain 5 sections of the partially constructed grid connection which consists of overhead lines [OHL] as shown on Drawing No. 4636-P-GCR-00-1.1.

The status of the grid connection which has been partially constructed is as follows:

- OHL already constructed – 9.7 km
- OHL to be constructed 1.2 km
- UGC to be constructed 3.2 km

1.1.3 Statutory Undertaker

Under the Electricity (Supply) Act 1927, ESB were conferred powers as a statutory undertaker to, amongst other things, provide or carry out works for the provision of electricity. Under the Electricity Regulation Act, 1999, which amongst other things established and gave powers to the Commission for Energy Regulation and made amendments to certain provisions of the Electricity (Supply) Act, 1927, "electricity undertaking" is defined as *"any person engaged in generation, transmission, distribution or supply of electricity, including any holder of a licence or authorisation under this Act,....."*

ESB Networks will design, plan and construct the grid route between the consented Derreenacrinnig West Wind Farm, and the existing ESB Substation at Ballylicky. ESB Networks is an undertaker authorised to provide an electricity service (for the purposes of Class

26 & Class 27 of the Planning and Development Regulations 2001 (as amended) by virtue of its power to provide or carry out works for the provision of electricity.

1.1.4 Case Law and Background to the Project Proposals

In Daly v Kilronan, the Court held that as the grid works are part of a development that requires an EIA, the local authority must carry out an environmental assessment of the project as a whole of which the grid connection forms part. The carrying out of an EIA is the function of the planning authority. In this case, no EIA of the grid connection had been carried out by the planning authority.

It is important to note that the cable section of the grid connection that was the subject of the Kilronan case was not the subject of a Section 5 declaration. For that section of the grid connection works, the developer was relying on the fact that the cable was exempt as a matter of law under Class 26 of Part 1 of the second schedule to the Planning and Development Regulations 2001, as amended by the Regulations of 2011.

1.1.5 The Status of The Grid Connection

ESB Networks have carried out the partial construction of a new 20kV grid connection between the consented Derreenacrinnig West Wind Farm, Derreenacrinnig, Co. Cork and the existing ESB Substation at Ballylicky, Co. Cork. This grid connection route traverses through the townlands *of Ardrah, Ards More (East), Ards Beg, Barnagowlane West, Ballylicky, Crossoge, Derreenacrinnig West, Dromlickacrue, Derryarkane, Dromclarig, Gortroe, Gortnacowly, Glanareagh, Laharanshermeen, Maulikeeve, Maularaha, and Shandrum More.*

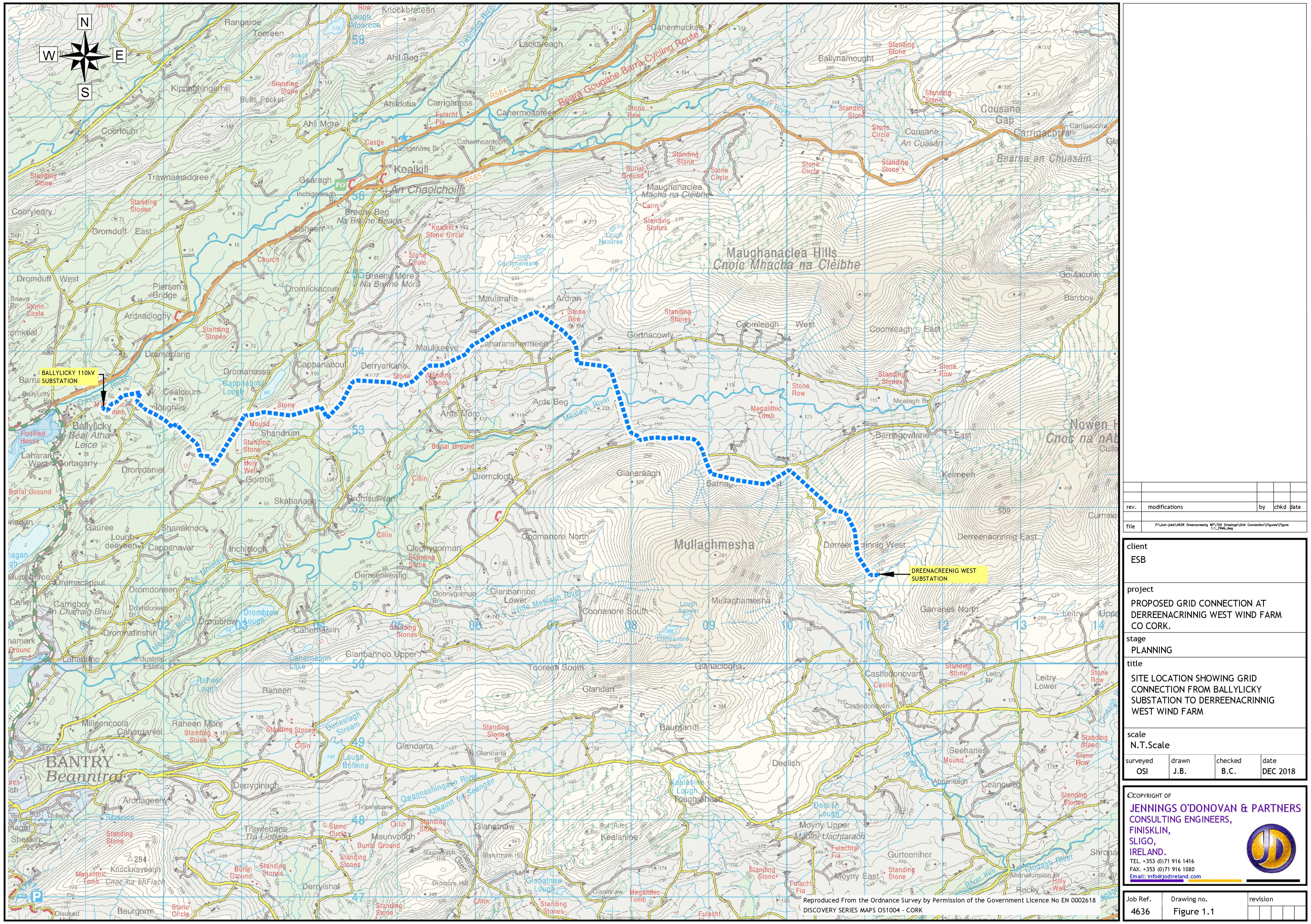


Figure 1.1 Site Location showing Grid Connection from Ballylicky Substation to Derreenacrinnig West Wind Farm

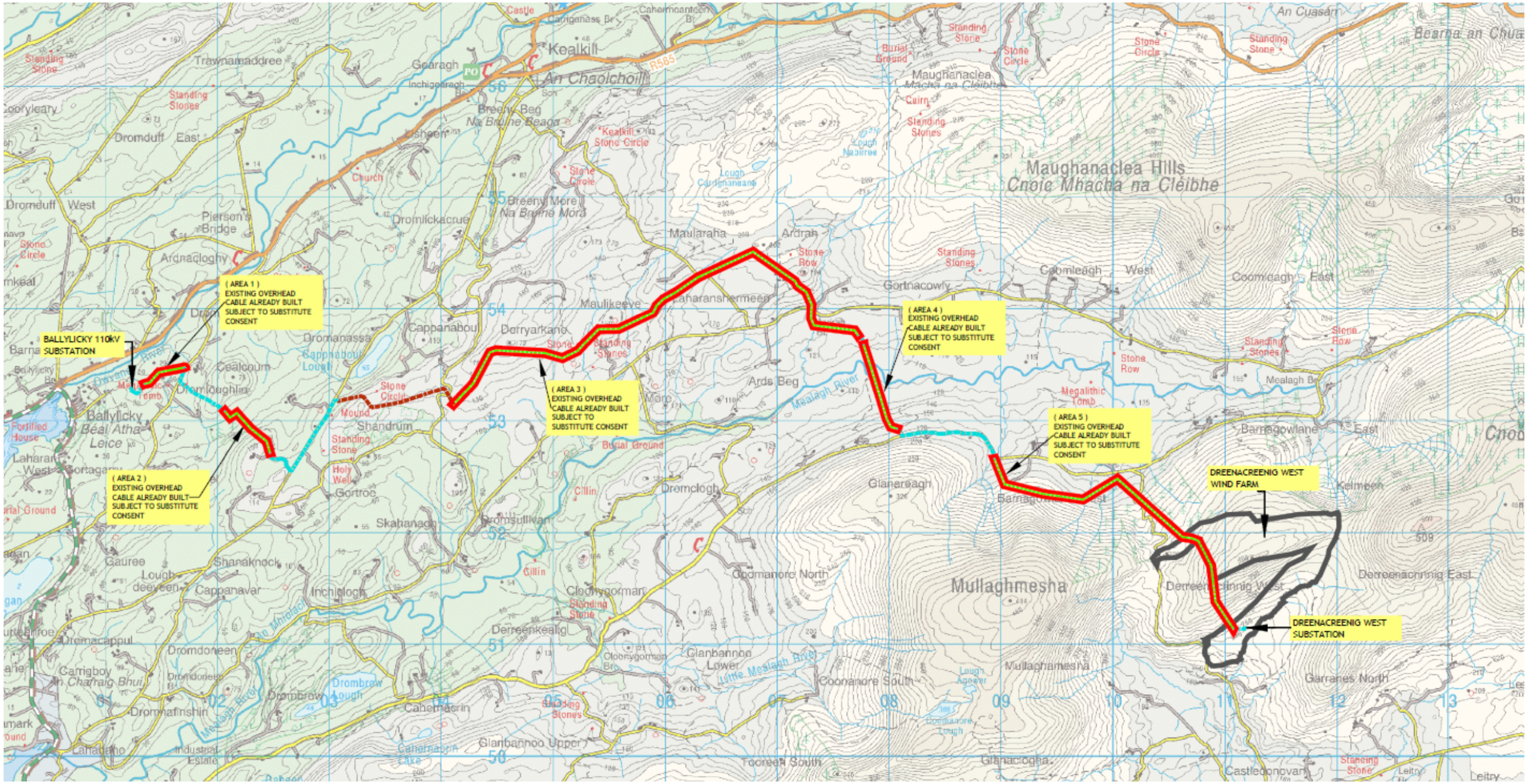


Figure 1.2 Site Location Plan showing the existing overhead grid connection

1.1.6 Status of The Grid Connection

The C.13.916 km grid connection is partially complete with most of the poles erected (9.537km) for the overhead lines and wires strung to some poles. Some 1.201 km of overhead line and 3.178 km of underground cables have yet to be constructed and are the subject of a separate planning application 19/10. An EIAR forms part of the Planning application that was submitted to Cork County Council for the Grid Connection works that have yet to be built.

1.1.7 Application for Substitute Consent

As ESB Networks has responsibility for constructing the grid connection, construction of the line is well advanced. This application for Substitute Consent has been submitted to An Bord Pleanála under Section 177E of the Planning and Development (Amendment) Act 2010 to regularise the partially constructed Grid Connection from the consented Derreenacrinnig West Wind Farm.

Substitute consent is sought only for the existing grid connection works only. Accordingly, "the project" comprises the permitted turbine and on-site infrastructure development ("the permitted development") and the proposed grid connection development and the existing grid connection.

As set out above, the wind farm grid connection consists of a 20kV Electrical Connection (13.916km), of which, 10.738 km is 20kV overhead line (OHL) mounted on single wooden pole sets and 3.178 km is ducted underground power cable in 6 separate locations, so as to connect the Derreenacrinnig West Wind Farm to the existing Ballylicky Substation. The extent of the substitute consent application '" the existing grid connection" is show in **Figure 1.2**.

The grid connection consists of a linear site running in an east to west direction as shown in Figure 1.1. However, it should be noted that although the likely revised significant effects of the grid connection of the Derreenacrinnig West Wind Farm are identified, analysed and evaluated in this revised EIAR, the planning application before Cork County Council is in relation to the proposed grid connection only. Where reference is made to both the proposed wind farm development and the cable route together in this revised EIAR, the term 'project' will be used.

For the purpose of assessing the entire project in compliance with the EIA Directive, this EIAR assesses both the existing grid connection, the proposed grid connection works and the permitted turbines and on-site infrastructure development. However, it is important to note that substitute consent is sought for the 'existing grid connection works' only.

The application site is located in the townlands of Ardrah, Ards More (East), Ards Beg, Barnagowlane West, Ballylicky, Crossoge, Derreenacrinnig West, Dromlickacrue, Derryarkane, Dromclarig, Gortroe, Gortnacowly, Glanareagh, Laharanshermeen, Maulikeeve, Maularaha, and Shandrum More ("the Existing Development Site").The principle of a wind farm development at the Existing Development Site with a total of 7 no wind turbines with a tip height of up to 81 metres has already been approved by An Bord Pleanála with the grant of the existing permission on the 05th December 2012. [A copy of Decision Notice ABP-PL 88.239767 is set out in **Appendix A**]

1.1.8 Screening for Appropriate Assessment

Assessments under Article 6(3) of the Directive involves a number of stages that assess the likelihood of a plan or project to result in significant effects to European Sites. The initial Screening stage examines the likelihood of a project, either alone or in combination with other projects or plans, to result in significant effects to the integrity of European Sites. If the Screening concludes that significant effects are likely, an Appropriate Assessment is required. In effect, the Screening assesses the need for an Appropriate Assessment.

A Screening Assessment of the existing development, incorporating the electricity cable grid connection and the consented Wind Farm was carried out for the European Sites occurring within its zone of influence.

The Screening Assessment concluded that the proposed development would not have the potential to result in likely significant effects to European Sites occurring within the wider zone of influence of the development. As such, an Appropriate Assessment was not required for the proposed development. A copy of that Screening Assessment is set out at **Appendix C**]

The existing grid connection, subject to substitute consent, should be considered in the following context:

- It does not traverse any Natura 2000 site and there was no removal of or interference with habitat within any European site;
- The AA Screening carried out as part of the Exempted Development Screening Study carried out in March 2017 concluded that the "*project alone, or in-combination with other projects will not have any significant direct or indirect adverse impacts on Glengarriff Harbour and Woodland SAC, Derryclogher (Knockboy) Bog SAC and Caha Mountains SAC.*"
- There was no interference with protected species and there is no known rare or protected flora or habitat along the route of the grid connection; and

- There have been no environmental and ecological impacts arising from the constructed grid connection works.

1.1.9 An Bord Pleanála Reference ABP/ PL88.239767

The 2010 Permission was subject to an Environmental Impact Statement ("EIS") and an Environmental Impact Statement ("EIS") was submitted with that application to assess the Wind Farm, sub-station, car parking, associated site roads and ancillary works including the sourcing stone from an on-site borrow pit at Derreenacrinnig West, Drimoleague, Co Cork.

1.1.10 Case Law

It is now considered that the Existing Development should also be subject to EIA, to consider current knowledge and methods of assessment, to ensure clarity and effective public participation and environmental assessment, and to ensure compliance with the EIA Directive 2011/92/EU ("the EIA Directive") and the revised EIA Directive 2014/52/EU ("the Revised EIA Directive").

This remedial EIA Report ("EIAR") has been prepared by Jennings O'Donovan & Partners Limited on behalf of the Applicant to accompany the application for Substitute Consent for the Existing Development. This EIAR takes into account the overall project as a whole (noting that the Existing Development application is for modifications to the 2010 Permission), including the Proposed Development (i.e. the development for which planning permission is sought) and all direct and indirect effects, and cumulative impacts and interactions, including all relevant ancillary and subsidiary elements of the overall project.

This EIAR is prepared in accordance with the EIA Directive and, to the extent possible and appropriate in the absence of national legislation or adopted guidance, the Revised EIA Directive.

In addition to the identification, description and assessment of the Existing Development comprising modifications to an existing permission (the 2010 Permission), this EIAR identifies, describes and assesses the Development as a whole, taking into account the 2010 Permission, the 20kV Substation Permission, the 110kV Substation Permission, and any other existing and permitted developments, together with two proposed haul route options ("the Haul Route Options") which are also identified, described and assessed. Together, each of these elements comprises the EIA Development which is the subject of this EIAR. This EIAR includes the Applicant's reasoned conclusions as to the significance of any such environmental effects, to assist the competent authority to comply with Article 8a of the Revised EIA Directive.

1.2 ENVIRONMENTAL IMPACT ASSESSMENT

1.2.1 Environmental Impact Assessment Requirement and National Legislation

The EIA Directive 85/337/EEC, as amended by Directive 2011/92/EU and Directive 2014/52/EU contains a legal requirement to carry out an environmental impact assessment (EIA) of public or private projects likely to have significant effects on the environment, prior to their authorisation. It is key legislation in EU environmental policy. The EIA Directive aims to determine the likely significant effects of a project on the environment. The EIA process involves a number of stages, namely screening, scoping and the production of an Environmental Impact Assessment Report (EIAR).

European Union Directive 2011/92/EU ("the EIA Directive") requires that, before consent is given for certain public and private projects, an assessment of the effects on the environment is undertaken by the relevant competent authority. The EIA Directive has been transposed to Irish legislation, for the purposes of this EIA Development, by the Planning and Development Act 2000, as amended ("the Planning Acts"), and the Planning and Development Regulations 2001, as amended ("the Planning Regulations").

Section 171A(1) of the Planning Acts defines an EIA as an assessment, which includes an examination, analysis and evaluation, carried out by a planning authority or An Bord Pleanála:

"*that shall identify, describe and assess in an appropriate manner, in light of each individual case and in accordance with Articles 4 to 11 of the Environmental Impact Assessment Directive, the direct and indirect effects of a proposed development on the following:*

(a) human beings, flora and fauna,

(b) soil, water, air, climate and the landscape,

(c) material assets and the cultural heritage, and

(d) the interaction between the factors mentioned in paragraphs (a), (b) and (c)".

Section 172(1)(a)(ii)(I) requires projects of a class specified in Part 2 of schedule 5 of the Planning Regulations to be subject to an EIA where:

"(I) *such development would exceed any relevant quantity, area or other limit specified in that Part*".

Part 2 of schedule 5 of the Planning Regulations includes the following classes of EIA project:
Class 3(i)

"Installations for the harnessing of wind power for energy production (wind farms) with more than 5 turbines or having a total output greater than 5 megawatts."

Class 10(dd)

"*All private roads which would exceed 2000 metres in length"*

Class 15

"*Any project listed in this Part which does not exceed a quantity, area or other limit specified in this Part in respect of the relevant class of development but which would be likely to have significant effects on the environment, having regard to the criteria set out in Schedule 7*".

An EIS was carried out by the competent authority in 2010. The EIA Directive requires that wind farm developments are subject to an EIA where the project is likely to have significant effects on the environment considering design, location, nature and size of the project.

1.2.2 Directive 2014/52/EU

The EIA Directive has been amended on numerous occasions, most recently in 2014. The new approach to EIA seeks to address threats and challenges that have emerged since the original directive came into force. The directive as amended is more concerned with resource efficiency, climate change which are better reflected in the assessment process.

Directive 2014/52/EU ("the Revised EIA Directive") was required to be transposed into national legislation by 16th May 2017 however and has been transposed into Irish Law. The Department of Housing, Planning, Community and Local Government ("DHPCLG") has issued a consultation document 'Transposition of 2014 EIA Directive (2014/52/EU) in the Land Use Planning and EPA Licencing Systems – Key Issues Consultation Paper' ("the Revised EIA Directive Consultation") which outlines how the Revised EIA Directive will be transposed into Irish legislation.

In addition, the DHPCLG have produced guidelines titled 'Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment' [August 2018].

This document, in addition to DHPCLG Circular Letter PL/1/2017, dated 15th May 2017 *"Implementation of Directive 2014/52/EU on the Effects of Certain Public and Private Projects on the Environment (EIA Directive) – Advice on Administrative Provisions in Advance of Transposition*" ("the Revised EIA Directive Circular") have been used in the preparation of this EIAR to ensure, compliance with the New EIA Directive.

The following sections provide an overview of the implications of the Revised EIA Directive, to the extent relevant to the Proposed Development[1].

1.2.2.1 EIA Definition

The Revised EIA Directive defines EIA as a process. Article 1(2)(g) states that EIA means:

> *"(i) the preparation of an environmental impact assessment report by the developer, as referred to in Article 5(1) and (2);*
>
> *(ii) the carrying out of consultations as referred to in Article 6 and, where relevant, Article 7;*
>
> *(iii) the examination by the competent authority of the information presented in the environmental impact assessment report and any supplementary information provided, where necessary, by the developer in accordance with Article 5(3), and any relevant information received through the consultations under Articles 6 and 7;*
>
> *(iv) the reasoned conclusion by the competent authority on the significant effects of the project on the environment, taking into account the results of the examination referred to in point (iii) and, where appropriate, its own supplementary examination; and*
>
> *(v) the integration of the competent authority's reasoned conclusion into any of the decisions referred to in Article 8a".*

The Revised EIA Directive Consultation document indicates that the DHPCLG will adopt the new definition in full in the transposing legislation, replacing Section 171A(1) of the Planning Acts.

1.2.2.2 Arrangements for Pre-existing Applications

Article 3 of the Revised EIA Directive states that:

> *"Projects in respect of which the determination referred to in Article 4(2) of Directive 2011/92/EU was initiated before 16 May 2017 shall be subject to the obligations referred to in Article 4 of Directive 2011/92/EU prior to its amendment by this Directive." ….*

The Revised EIA Directive Consultation document states:

> "*Where an application requiring an EIA is received after 16 May 2017, or where an application was received before this date and screening, commencing after the date, determines that an EIA is required, these will fall to be dealt with under the 2014 Directive.*

[1] The Revised EIA Directive amends the EIA Directive in areas such as Exemption for Defence and Civil Emergency Projects, Joint / Coordinated Procedures, Exemptions, Screening, Screening Determination, Scoping Opinion, Conflict of Interest etc. Whilst these issues are of clear relevance to the EIA process, they are not considered specifically relevant to the EIA preparation process with regard to the Proposed Development.

In the event that transposition is not possible by 16 May 2017, it is intended that the arrangements for pre-existing applications will be applied with effect from the date of the making of the transposing Regulations".

The Revised EIA Directive Circular states that:

In respect of applications for planning permission or other development consent received on or after 16 May 2017 falling within the scope of Directive 2011/92/EU, or within the scope of Directive 2014/52/EU, competent authorities are advised to consider applying the requirements of Directive 2014/52/EU by way of administrative provisions in advance of the transposition of Directive 2014/52/EU into Irish law.

1.2.2.3 Factors of the Environment

The New EIA Directive requires the EIA to identify, describe and assess, in an appropriate manner and in light of each individual case, the direct and indirect significant effects of the Proposed Development on factors of the environment including:

(a) population and **human health**;
(b) **biodiversity**, with particular attention to species and habitats protected under the Habitats and Birds Directives;
(c) **land**, soil, water, air and climate;
(d) material assets, cultural heritage and the landscape;
(e) the interaction between the factors referred to in points (a) to (d).

The implications of the Revised EIA Directive in in relation to human health are considered **in Section 4: Population and Human Health** of this EIAR; the implications in relation to biodiversity are considered in **Section 5: Biodiversity**; and the implications in relation to land are considered in **Section 2: Project Description**, **Section 5: Biodiversity**, **Section 6: Soils and Geology**, **Section 7: Water**, **Section 12: Material Assets**, **Section 13: Cultural Heritage** and **Section 14: Traffic and Transport**.

1.2.2.4 Alternatives to the Proposed Development

Article 5(1) of the EIA Directive sets out the information to be contained in an EIS, and these provisions have been clarified by the Revised EIA Directive, in particular in relation to the requirement that the EIA Report includes a description of the *reasonable* alternatives studied by the developer, which are *relevant to the project and its specific characteristics*, and an indication of the main reasons for the option chosen, taking into account the effects of the project on the environment.

The implications of the Revised EIA Directive in relation to alternatives are considered **in Section 2.4: Site Selection and Examination of Alternatives** of this EIAR.

1.2.2.5 Competent Experts and Quality of EIA

Article 5(3) of the 2014 EIA Directive states that, in order to ensure the completeness and quality of the EIAR, (a) the Applicant shall ensure the EIAR is prepared by competent experts; (b) the competent authority shall ensure that it has, or has access to, sufficient expertise to examine the EIAR; and (c) where necessary, the competent authority shall seek from the Applicant any supplementary information, in accordance with Annex IV (the information to be contained in the EIAR), which is directly relevant to reaching a reasoned conclusion on the significant effects of the Proposed Development / EIA Development on the environment.

The Revised EIA Directive Consultation states that:

> "*It is not proposed to define the terms 'competent experts' or 'sufficient expertise' in legislation given the broad and diverse range of EIA topics and the different areas of specialist expertise.*
> *It is proposed that the competency of experts preparing an EIAR should be a matter for each competent authority, having regard to the diverse range of EIA topics and areas of specialist expertise.*
> *Guidance will address the issue of 'expertise' in both the preparation and assessment of EIARs.*
> *It would be good practice for the EIAR to state who prepared each element of the EIAR and list the qualifications and experience of each such person to assist the competent authority satisfy itself as to the competency of the experts who prepared the EIAR. The level of expertise required for each element of the EIAR would depend on the nature and importance of that element vis-à-vis the size, nature and location of the project and the receiving environment and the likely significant impact on that environment*".

The Applicant considers that each of the experts involved in the preparation of this EIAR should be deemed to be competent where, having regard to the task he or she is required to perform and taking account of the scope of the study for which he or she undertakes work, the person possesses sufficient training, experience and knowledge appropriate to the nature of the work to be undertaken.

JOD staff are degree qualified in their respective specialist fields and have developed their competence through both experience on the job and through training. Each team member has developed the following:

- Sufficient knowledge of the specific tasks to be undertaken and the risks which may arise; and
- Sufficient experience and ability to carry out their duties in relation to the project and to take appropriate actions required under the EIA Directive.

Additionally, Jennings O'Donovan & Partners Limited, has attained certificates in line with industry standards as follows:

- ISO 9001: 2015 – Quality Management;
- ISO 14001:2015 – Environmental Management; and
- ISO 45001:2018 – Safety Management.

Possession of these certificates is, of itself, evidence that JOD, have developed, maintained and implemented systems in quality, safety and environmental related matters and are therefore competent experts.

JOD have developed a Quality Policy Statement (and also an Environmental Policy Statement and a Safety Health and Welfare Policy Statement). It is a stated objective in our Quality Policy Statement that:

"….Jennings O'Donovan and Partners Limited is committed to complying with the requirements of the quality management system and to continually improve its effectiveness…".

Project Team

JOD staff are degree qualified in their respective specialist fields and have developed their competence through both job experience and through training. Each team member has developed the following:

- Sufficient knowledge of the specific tasks to be undertaken and the risks which may arise; and
- Sufficient experience and ability to carry out their duties in relation to the project and to take appropriate actions required under the EIA Directive.

As provided in **Section 1.4.1**, specialist consultancies have been employed to complete some of the EIAR sections. Each section of the EIAR includes a Statement of Authority regarding the competency of the author and includes a summary of relevant qualifications and experience.

1.2.2.6 Electronic Notification of the Public and Electronic Access to Information to Enable Public Consultation

Article 6(2) and Article 6(5) of the Revised EIA Directive provide for the availability of information (including in electronic form) to provide for the effective participation of the public concerned in the decision-making process.

Article 97 of the Planning Regulations requires the Applicant to submit a copy of the EIAR to the planning authority in electronic form. This requirement has been complied with in the case of this EIAR. It is noted that the EIA Directive places additional requirement of the planning authority to make documents available electronically.

1.2.2.7 Information to be Included in a Decision to Grant

Article 8a(1) of the Revised EIA Directive states:

"The decision to grant development consent shall incorporate at least the following information:

(a) the reasoned conclusion referred to in Article 1(2)(g)(iv);
(b) any environmental conditions attached to the decision, a description of any features of the project and/or measures envisaged to avoid, prevent or reduce and, if possible, offset significant adverse effects on the environment as well as, where appropriate, monitoring measures".

The Revised EIA Directive Consultation states that:

"This is a new provision indicating the information to be incorporated into a grant of development consent. The first part refers to the reasoned conclusion by the competent authority on the significant effects on the environment, having considered the EIAR and any supplementary information provided by the developer.

Other information which must be incorporated into a positive consent decision includes the following:

- *Any environmental conditions attached;*
- *A description of any features and measures envisaged to avoid, prevent or reduce and, if possible, offset significant adverse effects on the environment;*
- *Monitoring measures, where appropriate".*

1.2.2.8 Information to Be Included in the EIAR

Article 5(1)(a) to (f) of the Revised EIA Directive provides information to be provided by the developer:

"1. Where an environmental impact assessment is required, the developer shall prepare and submit an environmental impact assessment report. The information to be provided by the developer shall include at least:

(a) a description of the project comprising information on the site, design, size and other relevant features of the project;

(b) a description of the likely significant effects of the project on the environment;

(c) a description of the features of the project and/or measures envisaged in order to avoid, prevent or reduce and, if possible, offset likely significant adverse effects on the environment;

(d) a description of the reasonable alternatives studied by the developer, which are relevant to the project and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the project on the environment;

(e) a non-technical summary of the information referred to in points (a) to (d); and

(f) any additional information specified in Annex IV relevant to the specific characteristics of a particular project or type of project and to the environmental features likely to be affected."

The EIA Directive Circular notes that this is the minimum information that should be provided.

Annex IV of the Revised EIA Directive sets out the information to be included in the EIAR (as referenced to in Article 5(1)(f)):

"*1. Characteristics of projects*

The characteristics of projects must be considered, with particular regard to:

(a) the size and design of the whole project;

(b) cumulation with other existing and/or approved projects;

(c) the use of natural resources, in particular land, soil, water and biodiversity;

(d) the production of waste;

(e) pollution and nuisances;

(f) the risk of major accidents and/or disasters which are relevant to the project concerned, including those caused by climate change, in accordance with scientific knowledge;

(g) the risks to human health (for example due to water contamination or air pollution).

2. Location of projects

The environmental sensitivity of geographical areas likely to be affected by projects must be considered, with particular regard to:

(a) the existing and approved land use;

(b) the relative abundance, availability, quality and regenerative capacity of natural resources (including soil, land, water and biodiversity) in the area and its underground;

(c) the absorption capacity of the natural environment, paying particular attention to the following areas:

(i) wetlands, riparian areas, river mouths;

(ii) coastal zones and the marine environment;

(iii) mountain and forest areas;

(iv) nature reserves and parks;

(v) areas classified or protected under national legislation; Natura 2000 areas designated by Member States pursuant to Directive 92/43/EEC and Directive 2009/147/EC;

(vi) areas in which there has already been a failure to meet the environmental quality standards, laid down in Union legislation and relevant to the project, or in which it is considered that there is such a failure;

(vii) densely populated areas;

(viii) landscapes and sites of historical, cultural or archaeological significance.

3. Type and characteristics of the potential impact

The likely significant effects of projects on the environment must be considered in relation to criteria set out in points 1 and 2 of this Annex, with regard to the impact of the project on the factors specified in Article 3(1), taking into account:

(a) the magnitude and spatial extent of the impact (for example geographical area and size of the population likely to be affected);

(b) the nature of the impact;

(c) the transboundary nature of the impact;

(d) the intensity and complexity of the impact;

(e) the probability of the impact;

(f) the expected onset, duration, frequency and reversibility of the impact;

(g) the cumulation of the impact with the impact of other existing and/or approved projects;

(h) the possibility of effectively reducing the impact".

The EIA Directive Consultation document indicates that Annex IV will be transposed in full into national legislation.

The Revised EIA Directive Circular states that:
"*The developer is required also to submit any additional information specified in a new Annex IV in the 2014 Directive where this information is relevant to the specific characteristics of the project, or type of project, and to the environmental features likely to be affected*".

This EIAR has incorporated for the construction, operational and decommissioning (demolition) phases:
- the reasonable alternatives studied by the developer;
- the resource efficiency and sustainability, biodiversity protection, climate change (e.g. greenhouse gas emissions), and risks of accidents and disasters and vulnerability to climate change;
- the importance of the sustainable use of soil, minimisation of land take, minimisation of erosion and organic matter loss, soil compaction, and soil sealing, subsurface and underground effects;
- biodiversity (with particular attention to species and habitats protected under Directive 92/43/EEC and Directive 2009/147/EC) and avoiding or minimising negative effects on this factor;
- the consideration and management of disaster risk prevention and concerns the risk of those accidents and/or disasters occurring and the implications for the likelihood of significant adverse effects on the environment;
- vulnerability (exposure and resilience) to major accidents, and/or natural disasters (as flooding, sea level rise, or earthquakes);
- the strengthening of public access to information, transparency, and timely environmental information; and
- that the parameters, duration and scale of post-consent monitoring should be proportionate to the level of potential risk to the environment.

1.2.3 National Guidance

The following documents have been referred to in the preparation of this EIAR:
- Environmental Protection Agency (2002) Guidelines on the information to be contained in Environmental Impact Statements;
- Environmental Protection Agency (2003) Advice notes on current Practice (in the preparation of Environmental Impact Statements);

- Environmental Protection Agency (2015) DRAFT Guidelines on the information to be contained in Environmental Impact Statements;
- Environmental Protection Agency (2015) DRAFT Advice notes for preparing Environmental Impact Statements;
- The Revised EIA Directive Circular;
- The Revised EIA Directive Consultation; and
- The draft EPA Guidance (2017).

1.3 EIAR STRUCTURE

The EIAR is structured as follows:

- **Non-Technical Summary**
- **Volume I: EIAR Text:**
  - Section 1: Introduction
  - Section 2: Project Description
  - Section 3: Planning Policy
  - Section 4: Population and Human Health
  - Section 5: Biodiversity
  - Section 6: Land, Soils and Geology
  - Section 7: Hydrology and Hydrogeology
  - Section 8: Air and Climate
  - Section 9: Noise and Vibration
  - Section 10: Shadow Flicker and Electromagnetic Interference
  - Section 11: Landscape and Visual
  - Section 12: Material Assets (including Traffic and Transport and Aviation)
  - Section 13: Cultural Heritage
  - Section 14: Interactions of the Foregoing

-Volume I: EIAR Figures

- **Volume II: EIAR Appendices:**
  - Appendix A: Consented Wind Farm Appeal Decision and Planning Conditions
  - Appendix B: ESB Specification for OHL
  - Appendix C : Screening for Appropriate Assessment
  - Appendix D: Construction Environmental Management Plan for the Consented DCWWF
  - Appendix E: Outline Construction Environmental Management Plan June 2019
  - Appendix F: Soils & Geology including Site Investigation Report

- Appendix G: Shadow Flicker
- Appendix H: Noise
- Appendix I: Proposed Haul Route
- Appendix J: Flood Risk Assessment
- Appendix K: Landscape & Visual Booklet

1.4 EIAR PREPARATION

1.4.1 Introduction

This EIAR has been prepared by Jennings O'Donovan & Partners Limited, Consulting Engineers, Finisklin Business Park, Sligo, F91 RHH9 ("JOD"), on behalf of the Applicant.

Table 1.1 provides details of the author for each EIAR section.

Competent Experts and Quality of EIA

Article 5(3) of the Revised EIA Directive states that, in order to ensure the completeness and quality of the EIAR, (a) the Applicant shall ensure the EIAR is prepared by competent experts; (b) the competent authority shall ensure that it has, or has access to, sufficient expertise to examine the EIAR; and (c) where necessary, the competent authority shall seek from the Applicant any supplementary information, in accordance with Annex IV (the information to be contained in the EIAR), which is directly relevant to reaching a reasoned conclusion on the significant effects of the Proposed Development / EIA Development on the environment.

Table 1.1: EIAR Preparation Details

REIA / EIAR Section	Contributor
1: Introduction	Jennings O'Donovan & Partners Limited, Finisklin Business Park, Sligo, F91 RHH9.
2: Project Description	Jennings O'Donovan & Partners Limited, Finisklin Business Park, Sligo, F91 RHH9.
3: Policy and Climate	Jennings O'Donovan & Partners Limited, Finisklin Business Park, Sligo, F91 RHH9.
4: Population and Human Health	Jennings O'Donovan & Partners Limited, Finisklin Business Park, Sligo, F91 RHH9.
5: Biodiversity	Doherty Environmental Ltd, Glanturkin, Guileen, Whitegate, Co. Cork.
6: Soils and Geology	Jennings O'Donovan & Partners Limited, Finisklin Business Park, Sligo, F91 RHH9. /Minerex Environmental Limited, Taney Hall, Eglinton Terrace, Dundrum, Dublin.

REIA / EIAR Section	Contributor
7: Water	Jennings O'Donovan & Partners Limited, Finisklin Business Park, Sligo, F91 RHH9/Minerex Environmental Limited, Taney Hall, Eglinton Terrace, Dundrum, Dublin.
8: Air and Climate	Jennings O'Donovan & Partners Limited, Finisklin Business Park, Sligo, F91 RHH9.
9: Noise	Noise and Vibration Consultants Limited, Durhamstown, Bohermeen, Navan, Co. Meath.
10: Shadow Flicker and Electromagnetic Interference	Jennings O'Donovan & Partners Limited, Finisklin Business Park, Sligo, F91 RHH9.
11: Landscape and Visual	Jennings O'Donovan & Partners Limited, Finisklin Business Park, Sligo, F91 RHH9.
12: Material Assets	Jennings O'Donovan & Partners Limited, Finisklin Business Park, Sligo, F91 RHH9.
13: Cultural Heritage	John Cronin Associates, 3a Westpoint Trade Centre, Ballincollig, Co Cork.
14: Traffic and Transport	Jennings O'Donovan & Partners Limited, Finisklin Business Park, Sligo, F91 RHH9.
15: Interactions of the Foregoing	Jennings O'Donovan & Partners Limited, Finisklin Business Park, Sligo, F91 RHH9.

No difficulties, such as technical deficiencies, lack of information or knowledge, were encountered in compiling any specific information of the EIAR.

1.4.2 Section Structure

Each technical assessment included in the EIAR has followed the same general format:

- Assessment Methodology and Significance Criteria: A description of the methods used in baseline surveys and in the assessment of the significance of effects;
- Baseline Description: A description of Proposed Development Site baseline relevant for the assessment, based on the results of surveys, desk information and consultations, and a summary of any information required for the assessment that could not be obtained;
- Assessment of Potential Environmental Effects: A description of how the baseline environment could potentially be affected for the EIA Development, including a summary of the measures taken during the design of the EIA Development to minimise effects;
- Mitigation Measures and Residual Effects - A description of measures recommended that will be implemented to minimise and/or off-set potential negative effects and a summary

of the assessed level significance of the effects of the Proposed Development and/or the EIA Development after mitigation measures have been implemented;

- Cumulative Effects: A description identifying the potential for effects of the EIA Development to combine with those from other existing and/or permitted developments to affect resources;
- Summary of Significant Effects;
- Statement of Significance of effects; and
- Comparison with the original 2010 EIS, ("the 2010 EIS") for the 2012 Permission, to include commentary identifying any material variations in potential effects and levels of significance.

1.5 NEED FOR THE PROPOSED DEVELOPMENT

Independence and security of energy supply is particularly important due to Ireland's lack of indigenous fossil fuel resources. Presently the Irish State relies heavily on Energy imports. At present, 85 % of Ireland's energy is imported, costing approximately €5.7 bn annually. Ireland's reliance on fossil fuel imports also makes the country vulnerable to volatile fossil fuel prices. Wind energy provides a clean, carbon-free and sustainable alternative to fossil fuels in generating electricity, without the direct emission of greenhouse gases. This is particularly important in the context of climate change. Wind energy is currently the largest contributing resource of renewable energy in Ireland. It is both Ireland's largest and cheapest renewable electricity resource. In 2017 wind provided 85% of Ireland's renewable electricity and 24 % of our total electricity demand. It is the second greatest source of electricity generation in Ireland after natural gas. With an-installed wind capacity of 3,458MW in the Republic of Ireland and an average power consumption of 3 GW Ireland is the country with the highest level of new installed wind capacity relative to its total power consumption. The proposed development project will help to provide an increasingly sustainable and reliable power supply for the region.

1.6 THE APPLICANT

The applicant behind the 2010 Permission was George O'Mahony. The Applicant for the Proposed Development for which substitute consent is now sought is ESB Networks ("the Applicant") who are providing the Grid Connection so as to connect the wind farm.

ESB Networks are a statutory undertaker for operating the Grid Connection. The asset will be owned, operated and maintained by ESB Networks.

1.7 CONSULTATION

The Revised EIA Directive Circular notes that:

"It is a requirement of the EIA process to consult with statutory consultees and to consider any submissions made by these consultees. Such submissions may contain expert specialist opinions on topics to be assessed in the EIA process…".

Table 1.2 documents individuals and organisations that have been consulted as part of the EIA process. The purpose of this consultation process was to provide a focus for the EIA by identifying the key issues of relevance. As such, the consultation process aims to inform the various organisations of the existence of the project, thereby providing an opportunity to submit comments and to offer information relevant to the preparation of this EIAR. No responses following the scoping exercise have been received to date.

A pre-application meeting was held with Cork County Council on 1st August 2018. At the meeting, the Applicant outlined the proposed approach and reasoning behind the approach to regularising planning permission for the Grid Connection; the EIA requirements and the need to include the wind farm and the grid connection and assess the cumulative impacts of the projects.

Following further refinement of the approach to this EIAR, via written correspondence with Cork County Council, it was agreed that the use of both a Project Description (the Proposed Development for which planning permission is sought) and an EIA Description (the project as a whole, including both the 2010 permitted development) was was a suitable approach.

The Existing Grid Connection was assessed considering the potential cumulative impacts that could arise from the Derreenacrinnig West Wind Farm and in combination impacts from other plans and projects in the area. This report will also have regard to the following documents:

- The 2010 EIS Statement prepared for the Derreenacrinnig West Wind Farm
- Screening Statement for Appropriate Assessment May 2016
- The 2018 EIAR report prepared for the proposed grid connection

1.8 AVAILABILITY OF INFORMATION

A copy of the EIAR may be viewed online on the Cork County Council website or at the offices of An Bord Pleanála, Malborough Street, Dublin

A paper copy of the EIAR can be viewed, during office opening hours at the following addresses:

- The Offices of An Bord Pleanála,64 Marlborough Street Dublin 1
- Jennings O'Donovan & Partners Limited, Consulting Engineers, Finisklin Business Park, Sligo, Co. Sligo, F91 RHH9.

2 PROJECT DESCRIPTION

2.1 INTRODUCTION AND PROJECT DESCRIPTION

This section of the EIAR sets out details relating to the main project elements and provides details relating to the construction, operation and decommissioning of the development. ESB Networks, The Applicant, is seeking substitute consent from An Bord Pleanála for part of the Grid Connection that has already been constructed in order to connect the project from the Derreenacrinnig West Wind Farm to the existing 110kV Ballylicky ESB substation in Co Cork.

The Development traverses the townlands of Ardrah, Ards More (East), Ards Beg, Barnagowlane West, Balllicky, Crossoge, Dromlickacrue, Derryarkane, Derreenacrinnig West, Dromclarig, Drumloughlin, Gortroe, Gortnacowly, Gleanreagh, Laharanshermeen, Maulikeeve, Maularaha and Shandrum More, in Co. Cork ("the Proposed Development Site"). The principle of a wind farm development at the Proposed Development Site has already been approved by An Bord Pleanála with the grant of planning permission on 05th December 2012.

A planning application was submitted to Cork County Council for the proposed elements of the grid connection route under planning application reference 19/10 and is currently pending consideration. Those elements of Grid Connection for which planning permission is sought comprises the following sections of Grid Connection:

- 1.201km of Overhead Cables
- 3.178km of Underground Cables

Existing Grid Connection

The location of the existing Grid Connection route is shown in **Figure 2.1.** The site of the existing development is located between the townlands of Derreenacrinnig West and Ballylickey passing through various townlands as listed above.

The design principle of the proposed development is to develop a Grid Connection between the consented Derreenacrinnig West Wind Farm substation and the 110kV substation in Ballylicky. The design of the OHL as constructed complies with appropriate technical and operational requirements including mechanical and operational requirements as set out in the ESB Specifications for 20kV for Overhead Lines, as set out **Appendix B.**

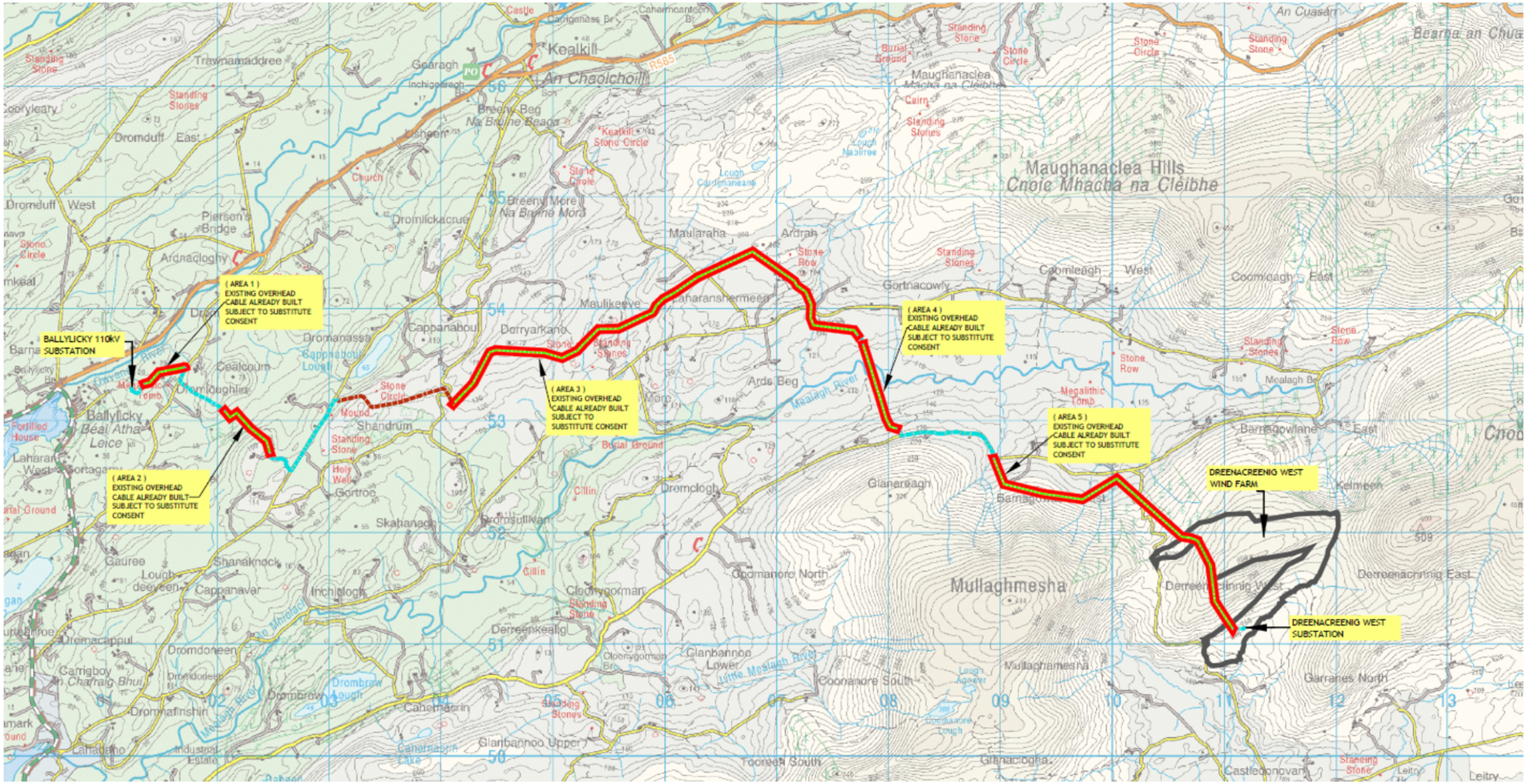


Figure 2.1 Overview Map showing Existing Grid Connection [Extract from Drawing No 4636-P-GCR-000-1]

2.2 THE NEED FOR THE DEVELOPMENT

The Grid Connection between the consented Derreenacrinnig West Wind Farm and the Ballylicky substation is required to connect the consented wind farm to the national grid. The Derreenacrinnig West Wind Farm will have the capacity to generate up to 5.8 MW with 5 no Enercon E48 turbines and 2 no Enercon E44 turbines. The energy generated will need to be transferred from the on-site substation to the national grid and therefore there is a requirement to develop the necessary c.14 km of Grid Connection to connect to the 110kV substation.

The Derreenacrinnig West Wind Farm will help the Government meet its renewable energy targets and avoid potential penalties from the European Commission. The Grid Connection works are essential to allow the wind farm to become operational and transfer the energy to the national grid.

The development will be of benefit to the local economy providing additional key infrastructure which may assist in the further development of the area in addition to facilitating the Derreenacrinnig Wind Farm.

2.3 LEGAL CONTEXT

This Substitute Consent Application applied reflects changes to the legislative context and case law referred to above. The objective of the EIA Directive is to determine if the project is likely to have significant effects on the environment. The seven wind turbines and all related electrical infrastructure (as granted under CCC Reg. Ref. 10/857 / ABP PL88.239767 - the original planning permission) have already gone through the EIA process.

It is the practice of ESBN to carry out all developments in accordance with planning legislation. ESBN is not aware of any unauthorised development carried out by or on its' behalf in relation to the subject matter of this application.

However, following recent High Court rulings it has been established that the grid connection connecting the wind farm to the national grid must go through a similar process, so as to allow for the entire project to be assessed in the context of the EIA directive.

Daly vs. Kilronan Windfarm Ltd. 2017 IEHC 308

The most recent judgment in Daly vs. Kilronan Windfarm Ltd. 2017 IEHC 308 is the authoritative statement of the law as it currently applies to wind farm grid connections. The Judgment states "as a matter of European law the assessment of whether the grid connection works can be treated as exempted development is one that must be considered in the context of a reading that best achieves the aims and objectives of the EIA Directive. I consider that on account of the fact that the grid works cannot be lawfully separated from the project as a whole, that to treat the grid works as exempt fails to give effect to this principle."

This report has been produced to assess the impact of the grid connection in combination with other plans and projects in the area, particularly the consented Derreenacrinnig West Wind Farm.

2.4 SUBSTITUTE CONSENT PROPOSALS

Existing Grid Connection

The section of Over Ground Connection which has already been constructed [9.537km] which is now the subject of the substitute consent application to An Bord Pleanála.

Table 2.1: Existing Grid Connection

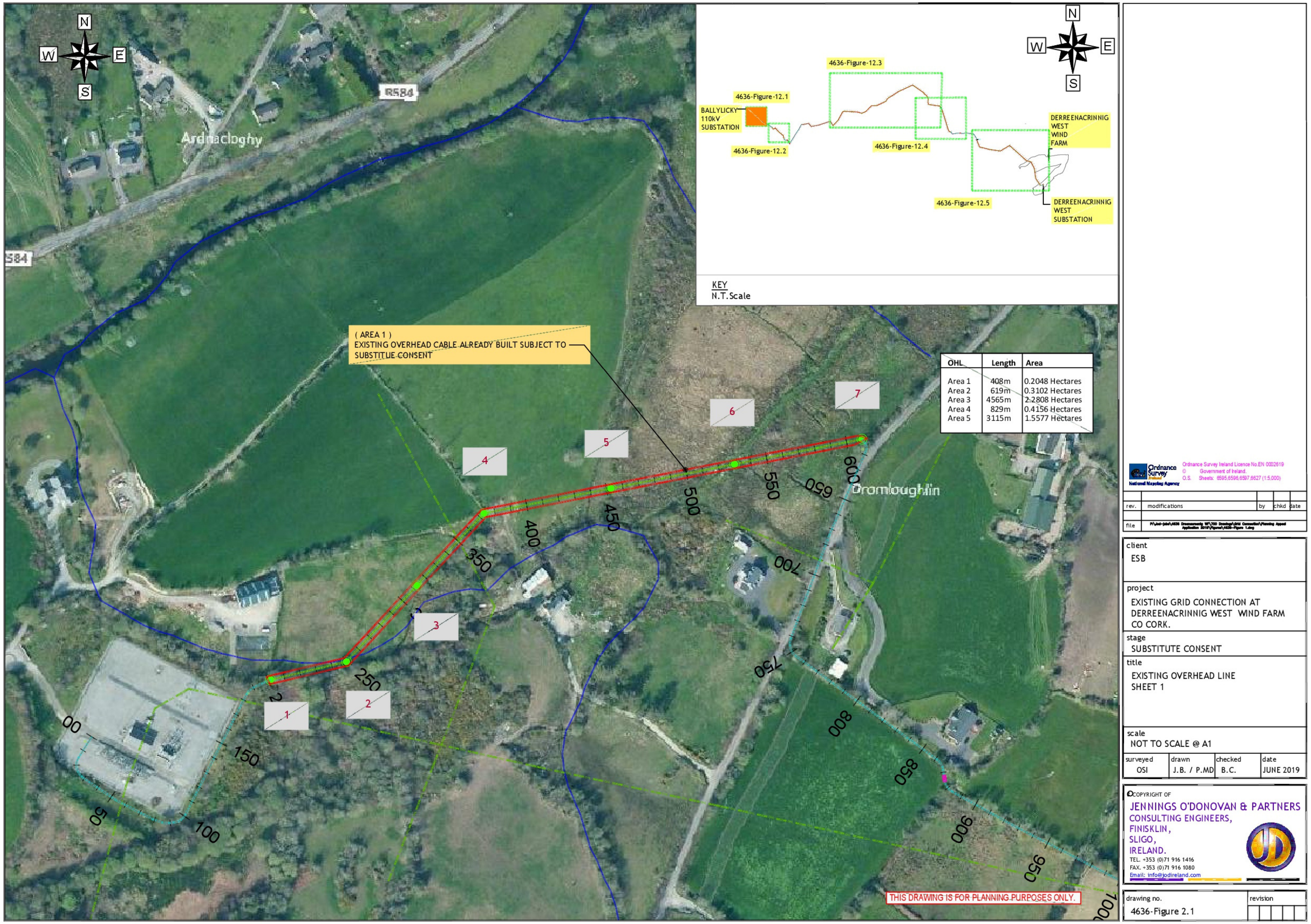
Area 1	Comprises 408 metres of Overhead Lines.
Area 2	Comprises 619 metres of Overhead Lines.
Area 3	Comprises 4.565 km of Overhead Lines.
Area 4	Comprises 829 metres of Overhead Lines.
Area 5	Comprises 3.115 km of Overhead Lines.

Overview of Grid Connection Route

The proposed Grid Connection originates from the Derreenacrinnig West Wind Farm and the route travels uphill across an area of wet heath occurring on the south-facing slopes of the ridge at Derreenacrinnig West. Descending from the crest of the ridge, the route cuts through first and second rotation forestry before passing through an area dominated by rough unenclosed grazing and wet heath. The route then travels west along the Mealagh River valley, predominantly through areas of improved pasture and wet grassland.

Originating at the Derreenacrinnig West Wind Farm, the OHL route travels uphill across an area of wet heath occurring on the south-facing slopes of the ridge at Derreenacrinnig West. Descending from the crest of the ridge, the route cuts through 300m of first and second rotation forestry before passing through an area dominated by rough unenclosed grazing and wet heath. The route then travels west along the Mealagh River valley, predominantly through areas of improved pasture and wet grassland.

The route turns northwest at Glanareagh hill and crosses the Mealagh River 1km southeast of Ardrah Bridge, before rising up the north side of the valley to Ardrah townland. From here, the route turns southwest again and descends steadily towards Shandrum, crossing areas of improved and unimproved grassland with occasional areas of heath and mature coniferous forestry. Between Shandrum and Ballylicky substation, the route environs are dominated by improved grassland and grassy verge along the margins of the public road in which the underground section of the route will be laid. The extent of works already carried out is shown in the **Figures 2.1- 2.5.**



OHL	Length	Area
Area 1	408m	0.2048 Hectares
Area 2	619m	0.3102 Hectares
Area 3	4565m	2.2808 Hectares
Area 4	829m	0.4156 Hectares
Area 5	3115m	1.5577 Hectares

Figure 2.1

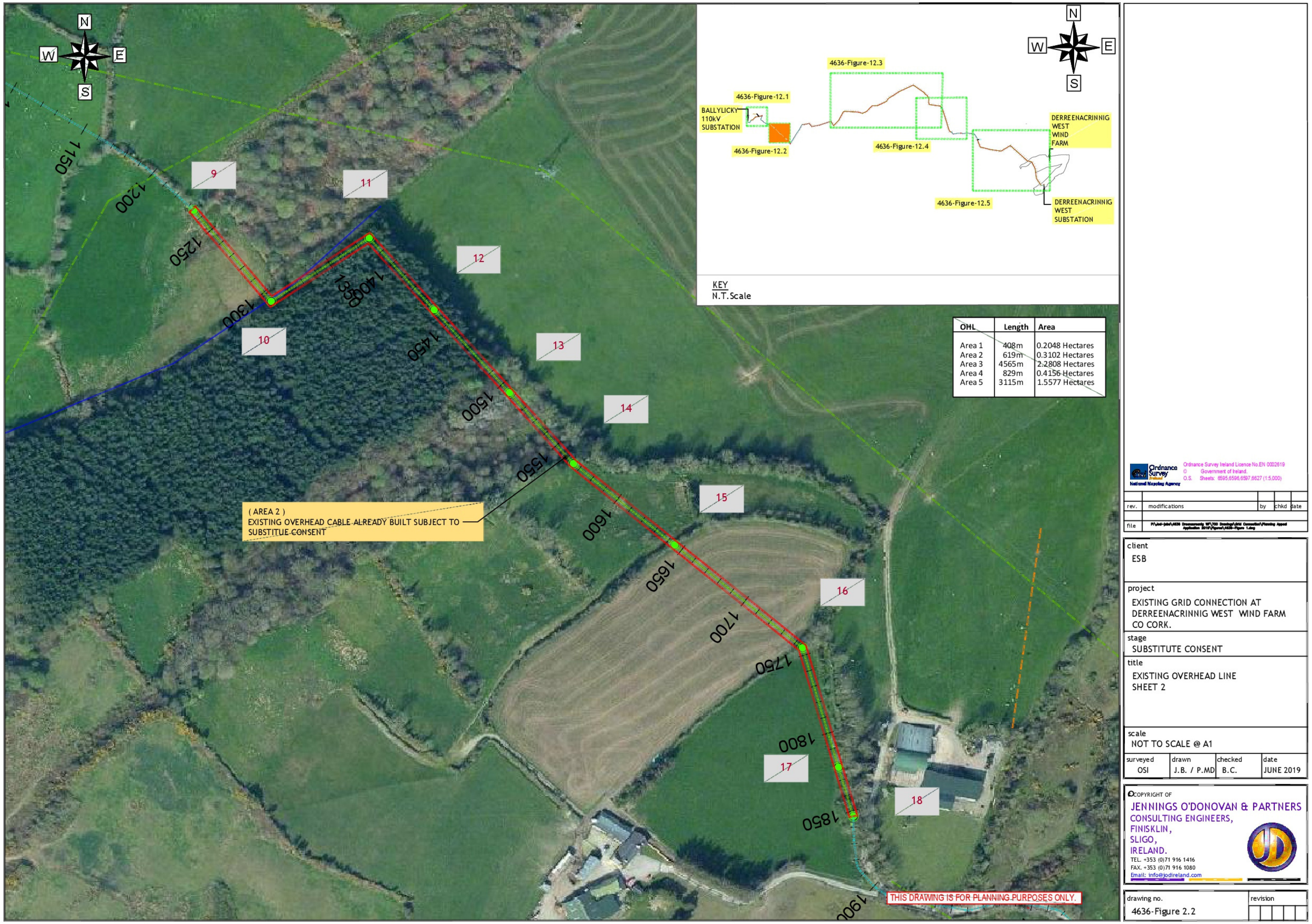

N
W
E
S
1150
1200
1250
1300
1350
1400
1450
1500
1550
1600
1650
1700
1750
1800
1850
1900
9
10
11
12
13
14
15
16
17
18
(AREA 2)
EXISTING OVERHEAD CABLE ALREADY BUILT SUBJECT TO SUBSTITUE CONSENT
4636-Figure-12.1
4636-Figure-12.2
4636-Figure-12.3
4636-Figure-12.4
4636-Figure-12.5
BALLYLICKY 110kV SUBSTATION
DERREENACRINNIG WEST WIND FARM
DERREENACRINNIG WEST SUBSTATION
KEY
N.T.Scale
OHL | Length | Area
Area 1 | 408m | 0.2048 Hectares
Area 2 | 619m | 0.3102 Hectares
Area 3 | 4565m | 2.2808 Hectares
Area 4 | 829m | 0.4156 Hectares
Area 5 | 3115m | 1.5577 Hectares
THIS DRAWING IS FOR PLANNING PURPOSES ONLY.
rev. modifications by chkd date
file
client
ESB
project
EXISTING GRID CONNECTION AT DERREENACRINNIG WEST WIND FARM CO CORK.
stage
SUBSTITUTE CONSENT
title
EXISTING OVERHEAD LINE SHEET 2
scale
NOT TO SCALE @ A1
surveyed OSI
drawn J.B. / P.MD
checked B.C.
date JUNE 2019
©COPYRIGHT OF
JENNINGS O'DONOVAN & PARTNERS
CONSULTING ENGINEERS,
FINISKLIN,
SLIGO,
IRELAND.
drawing no.
4636-Figure 2.2
revision

Figure 2.2

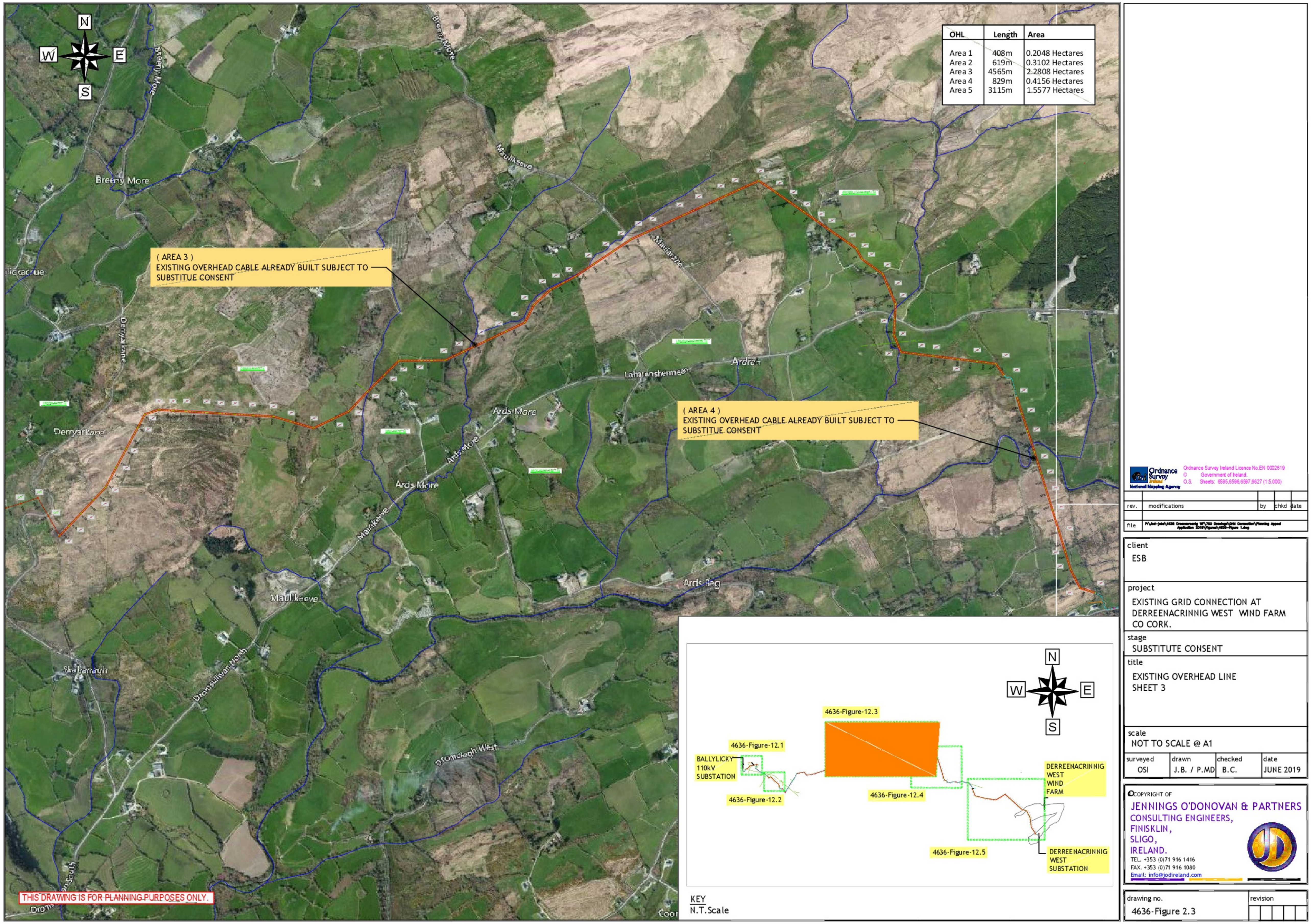
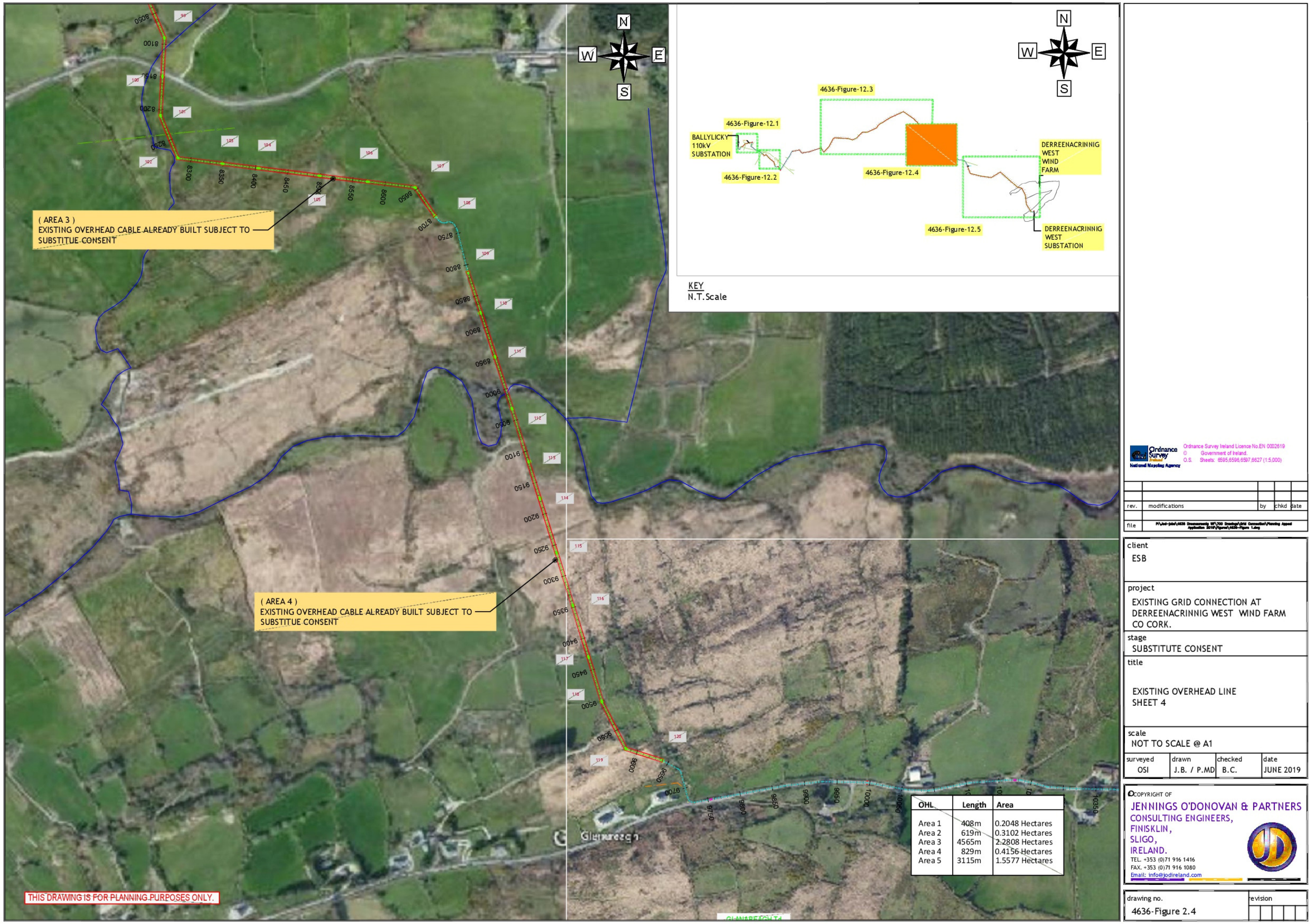
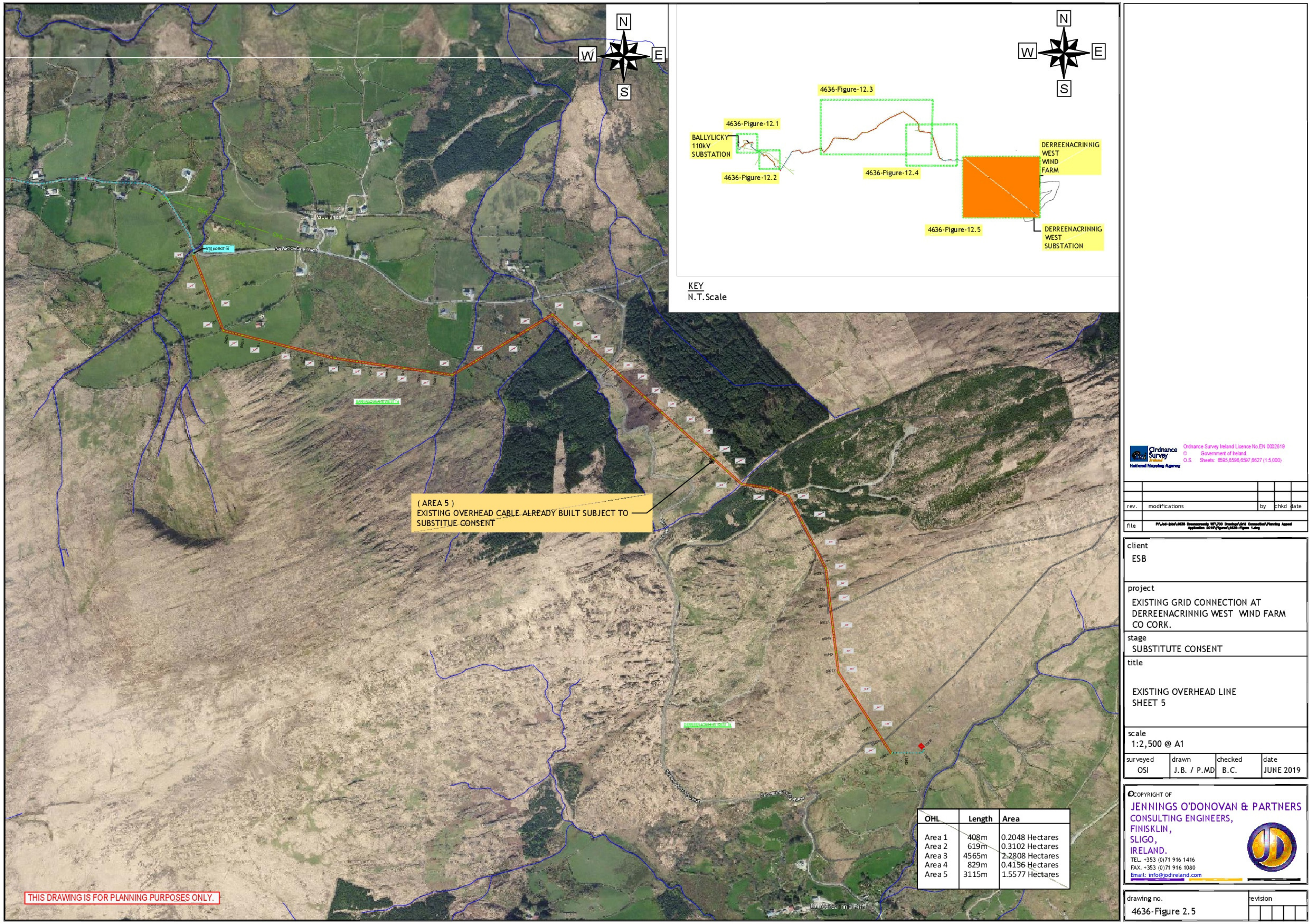

N
W
E
S
OHL | Length | Area
Area 1 | 408m | 0.2048 Hectares
Area 2 | 619m | 0.3102 Hectares
Area 3 | 4565m | 2.2808 Hectares
Area 4 | 829m | 0.4156 Hectares
Area 5 | 3115m | 1.5577 Hectares
Breeny More
(AREA 3)
EXISTING OVERHEAD CABLE ALREADY BUILT SUBJECT TO
SUBSTITUE CONSENT
Derryarkane
Ardrah
Lahalanshermeen
Ards More
(AREA 4)
EXISTING OVERHEAD CABLE ALREADY BUILT SUBJECT TO
SUBSTITUE CONSENT
Maulikeeve
Ards Beg
Skahanagh
Dromoclogh West
THIS DRAWING IS FOR PLANNING PURPOSES ONLY.
4636-Figure-12.3
4636-Figure-12.1
BALLYLICKY
110kV
SUBSTATION
4636-Figure-12.2
4636-Figure-12.4
DERREENACRINNIG
WEST
WIND
FARM
4636-Figure-12.5
DERREENACRINNIG
WEST
SUBSTATION
KEY
N.T.Scale
Ordnance Survey Ireland Licence No.EN 0002619
© Government of Ireland.
rev. modifications by chkd date
file
client
ESB
project
EXISTING GRID CONNECTION AT
DERREENACRINNIG WEST WIND FARM
CO CORK.
stage
SUBSTITUTE CONSENT
title
EXISTING OVERHEAD LINE
SHEET 3
scale
NOT TO SCALE @ A1
surveyed OSI
drawn J.B. / P.MD
checked B.C.
date JUNE 2019
©COPYRIGHT OF
JENNINGS O'DONOVAN & PARTNERS
CONSULTING ENGINEERS,
FINISKLIN,
SLIGO,
IRELAND.
TEL. +353 (0)71 916 1416
FAX. +353 (0)71 916 1080
Email: info@jodireland.com
drawing no.
4636-Figure 2.3
revision

Figure 2.3



OHL	Length	Area
Area 1	408m	0.2048 Hectares
Area 2	619m	0.3102 Hectares
Area 3	4565m	2.2808 Hectares
Area 4	829m	0.4156 Hectares
Area 5	3115m	1.5577 Hectares

Figure 2.4



N
W
E
S
4636-Figure-12.1
BALLYLICKY 110kV SUBSTATION
4636-Figure-12.2
4636-Figure-12.3
4636-Figure-12.4
4636-Figure-12.5
DERREENACRINNIG WEST WIND FARM
DERREENACRINNIG WEST SUBSTATION
KEY
N.T.Scale
(AREA 5)
EXISTING OVERHEAD CABLE ALREADY BUILT SUBJECT TO SUBSTITUE CONSENT
OHL | Length | Area
Area 1 | 408m | 0.2048 Hectares
Area 2 | 619m | 0.3102 Hectares
Area 3 | 4565m | 2.2808 Hectares
Area 4 | 829m | 0.4156 Hectares
Area 5 | 3115m | 1.5577 Hectares
THIS DRAWING IS FOR PLANNING PURPOSES ONLY.
Ordnance Survey Ireland
National Mapping Agency
Ordnance Survey Ireland Licence No.EN 0002619
© Government of Ireland.
O.S. Sheets: 6595,6596,6597,6627 (1:5,000)
rev. modifications by chkd date
file
client
ESB
project
EXISTING GRID CONNECTION AT DERREENACRINNIG WEST WIND FARM CO CORK.
stage
SUBSTITUTE CONSENT
title
EXISTING OVERHEAD LINE SHEET 5
scale
1:2,500 @ A1
surveyed OSI
drawn J.B. / P.MD
checked B.C.
date JUNE 2019
©COPYRIGHT OF
JENNINGS O'DONOVAN & PARTNERS
CONSULTING ENGINEERS,
FINISKLIN,
SLIGO,
IRELAND.
TEL. +353 (0)71 916 1416
FAX. +353 (0)71 916 1080
Email: info@jodireland.com
drawing no.
4636-Figure 2.5
revision

Figure 2.5

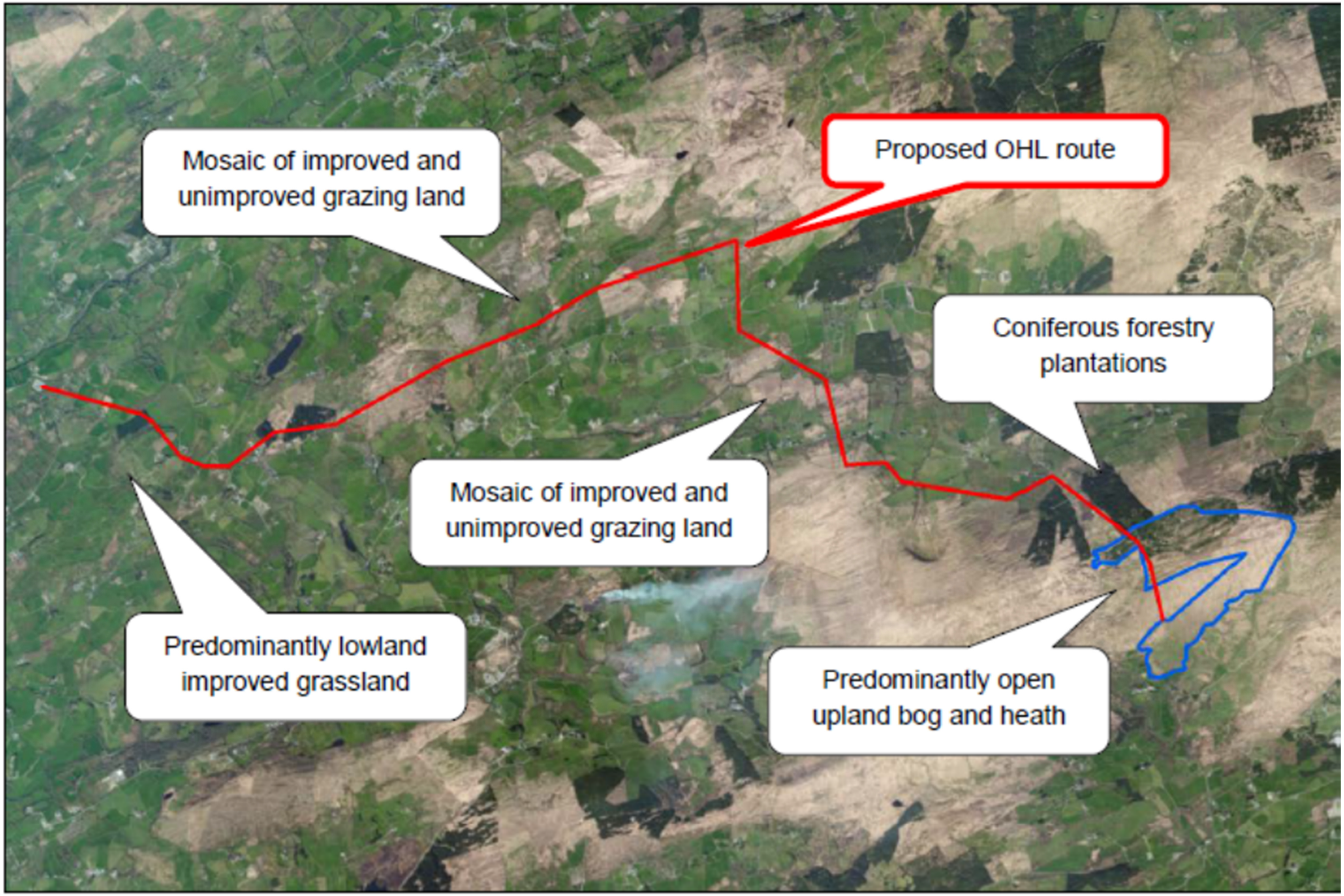


Figure 2.6 Aerial View of Habitats along the Route

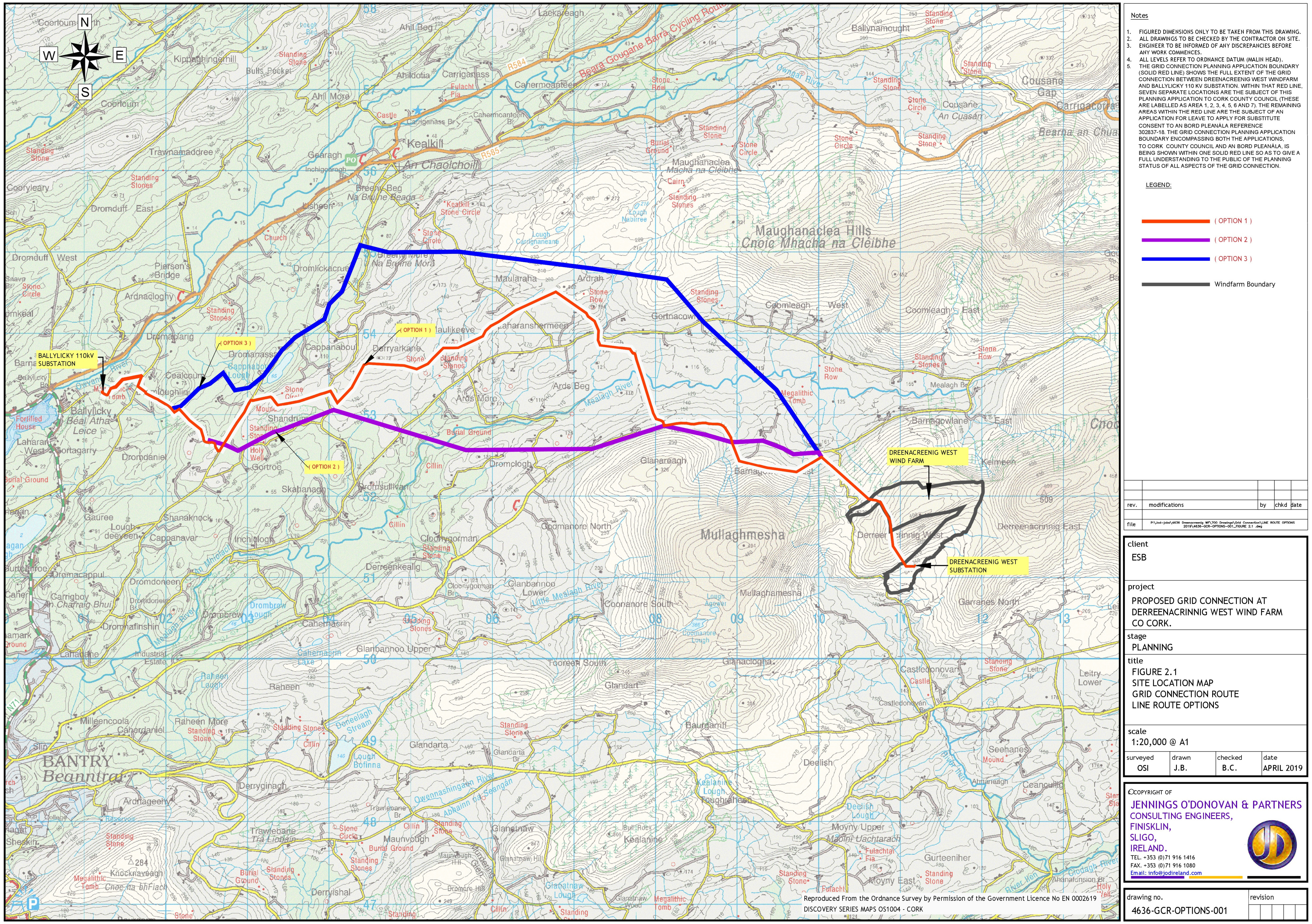


Figure 2.7 Grid Connection Route

Land Use of The Existing Grid Connection

The environs of the route are dominated by agriculture, with a small degree of commercial forestry. The eastern extent of the route traverses a more upland area with more unenclosed or unimproved grazing of sheep and drystock cattle rearing. The section in the lower Mealagh valley and the western extent of the route crosses more improved agricultural land with increased fertiliser usage, though stocking densities are unlikely to be very high.

Proposed Grid Connection Route – Planning Application Ref 19/10

The proposed Grid Connection, the subject of a planning application, will be constructed by ESB Networks to the requirements and specifications of ESB Networks. The asset will be owned, operated and maintained by ESB Networks.

Six sections of underground cable, amounting to approximately 3.178km are required to the western half of the route. The underground route will result in temporary disturbance to improved agricultural grassland and road verges. In addition, discrete sections of six hedgerows will be temporarily disturbed during the excavation of trenches to accommodate the underground trench.

The Consented Derreenacrinnig West Wind Farm Project

The existing permission (Cork County Council P/10/00857 An Bord Pleanála Reference PL88.239767) was granted for a:

> *"10-year planning permission for development of a wind farm comprising seven (7) number electricity generating wind turbines with a hub height of 55 metres and a rotor diameter of 52 metres, an electrical compound, sub-station building, four number car parking spaces, associated site roads and site works. It is proposed to source stone from an on-site borrow pit, all in the townland of Derreenacrinnig West, Drimoleague, County Cork."* ("the 2012 Permission)

The proposed development will also include foundations and hardstanding areas in respect of each turbine, new internal site access tracks, upgrade of existing access tracks, associated drainage, one borrows pit, an on-site substation and welfare facilities, temporary compounds as well as temporary minor alterations to the public roads for the delivery of turbines to the site (turbine delivery route). The turbines will be connected via associated underground cables which will run predominately along the access track network linking back to a proposed on-site substation.

Lands along the proposed grid connection route and within and surrounding the consented Wind Farm are not subject to any nature conservation designations under national and European legislation.

Habitats of County Importance include the wet heath habitat, particularly the examples at Laharanshermeen and Ards Beg, the dry heath along the ridge line of Derreenacrinnig West and the wet willow woodland. The humid acid grassland is considered to be of local (higher) value while other habitats such as gorse scrub, conifer plantation, recently felled woodland improved agricultural grassland, amenity grassland and built land are of local (lower) value. Overall the lands occurring within the route corridor range from local (low value) to national ecological value.

No significant change will result from the proposed development. It is envisaged that access to pole locations in enclosed and improved agricultural areas will use existing farm access points. In the more upland areas along the eastern sector of the route, where open bog and heath habitats will be encountered, construction materials will be transported by means of tracked machinery along demarcated access routes, which will be defined in advance based on site-specific geotechnical and ecological surveys. Low ground pressure machinery will be used in peat areas and bog mat access routes will be installed in areas of particularly poor bearing. These bog mat routes will be removed on completion.

2.5 SITE LOCATION AND ENVIRONS

2.5.1 Introduction / Existing Land Use / Permitted Land Use

The Derreenacrinnig West Wind Farm site is located in an elevated position (402m) at Derreenacrinnig West, approx. 11.5km east of Bantry, 5.8km north of Drimoleague and approx. 11.6km east of Dunmanway. Derreenacrinnig West forms part of a ridge trending west from Nowen Hill (530m) toward Mullaghmesha (494m).

The total Wind Farm site area is approximately 81 hectares and ranges in elevation from 200 m to 402 m OD (Malin Head). The site can be located on Discovery Series Map No. 85 at the approximate grid co-ordinates E 111,310 N 52,180. The site is irregular in outline, approximately 1.6 kilometres in length and up to 1.7 kilometres in width. The development will comprise of 7 electricity generating wind turbines with a hub height of up to 55 m and a rotor diameter of up to 52 m, an electrical compound and substation building, car parking spaces, borrow pit, associated site roads and site works.

The wind farm site extends from the local road at Castledonovan on the southern slopes of Derreenacrinnig West, over the ridge to include the upper northern slopes of the hill. The southern slopes are relatively steep with extensive areas of exposed rock. Agricultural tracks provide access to the southern areas of the site. There is a difference of approx. 200m between the lower elevations of the site and the ridge line. The south-eastern site boundary is formed for a large part by a tributary of the Ilen, flowing southwest. The northern slopes of the hill, are partly under forestry, accessed from the local road to the west. Within this forestry area, there is an area previously used for the extraction of rock, presumably associated with forestry road construction.

The Wind Farm and Grid Connection route is set out at **Figure 2.1: Site Location Map**. The proposed wind farm site is not covered by any nature conservation designation. There is no designated area within 5km of the proposed site. Carriganass Castle pNHA, code 002099, is the closest designated area, approximately 7km to the north west of the proposed Derreenacrinnig West site. This pNHA is a nursery roost for the Daubenton's bat. The 2012 Planning Permission allows the development of an area contained within the Proposed Development Site to be used for the construction and subsequent operation of a wind farm.

The Existing Grid Connection

The existing Grid Connection traverses mainly agricultural land as shown in **Figures 2.1-2.5**. The existing Grid Connection comprises 5 separate sections for Overhead Lines, running in an East – West direction.

The Grid Connection and The Necessity for an EIA

It is considered that the Proposed Development should also be subject to EIA, to take into account current knowledge and methods of assessment, to ensure clarity and effective public participation and environmental assessment, and to ensure compliance with the EIA Directive 2011/92/EU ("the EIA Directive") and the revised EIA Directive 2014/52/EU ("the Revised EIA Directive").

This remedial EIA Report ("EIAR")[2] has been prepared by Jennings O'Donovan & Partners Limited on behalf of the Applicant, ESBN to accompany the application for permission for the Proposed Development. This EIAR takes into account the overall project as a whole, including the Proposed Development (i.e. the development for which retrospective panning permission

[2] In the interests of clarity, it is proposed to continue to use the term 'Environmental Impact Statement ("EIS") in addition to the term Environmental Impact Assessment Report ("EIAR") as provided for in the Revised EIA Directive until national legislation is adopted introducing EIA Report as a defined term.

is sought) and all direct and indirect effects, and cumulative impacts and interactions, including all relevant ancillary and subsidiary elements of the overall project, as follows.

In addition to the identification, description and assessment of the Existing Development included the existing permission (the 2012 Permission), this EIAR identifies, describes and assesses the Proposed Development as a whole, taking into account the 2012 grant of planning permission, the 20kV Substation, and any other existing and permitted developments.

Following the grant of planning permission, the wind farm developers received a connection offer from ESB Networks in 2014. This connection offer was accepted as a non-contestable offer which means that the wind farm developers agreed that the works would be carried out by the applicant, ESB Networks. Following this, ESB Networks commenced the detailed design of the grid connection as part OHL and part UGC.

The planning permission was partially implemented, and work commenced on site on the 28th August 2017. Civil works at the wind farm site are well advanced although there is no activity at present until such time as planning permission for the grid connection has been regularised. Construction of the grid connection commenced in October 2017. Development of the windfarm commenced in August 2017 and civil works such as roads, hardstands and drainage have been partially completed. All works have now ceased on the project.

2.6 THE PROPOSED GRID CONNECTION

In accordance with the Group Processing Principles set out by the Commission for Energy Regulation (CER), ESB Networks as the Distribution System Operator specified the connection method in the Derreenacrinnig West Wind Farm's ESB Networks Connection Agreement to be via a new dedicated 20kV connection from the Derreenacrinnig West Wind Farm site to a proposed 20kV bay which will be constructed within existing Ballylicky Substation.

Construction of the 20k V Grid Connection

The proposed 20kV grid connection will connect the permitted 7-turbine Derreenacrinnig Wind Farm to the existing Ballylicky 110kV substation in County Cork. The circuit will consist of 1.201 km of 20kV overhead line (OHL) mounted on single wooden pole sets and 3.178 km of ducted underground power cable. The proposed electrical connection is to be constructed by ESB Networks to the requirements and specifications of ESB Networks.

Proposed/Unbuilt Underground Grid Connection

Six discrete sections of underground ducted line occur along the proposed grid connection route including:

Table 2.2: Proposed/Unbuilt Grid Connection

Area 1 UGC	201.5m of underground cables from Ballylicky Substation.
Area 2 UGC	624.5m metres of underground cable in Crossoge and Dromlouglin townlands.
Area 3 UGC	1081m of the grid connection route will be ducted along the verge of the existing local road at Glencreagh.
Area 4 OHL	1201m of Overhead Lines
Area 5 UGC	112.3 metres in the townland of Gortnacowley.
Area 6 UGC	1046m within the carriageway of the road at Glanareagh.
Area 7 UGC	113m of Grid Connection at Derreenacrinnig West.

2.7 THE CONSTRUCION OF THE 20KV GRID CONNECTION

The Grid Connection has been constructed by ESBN to the requirements and specifications of ESB Networks. The 20kV overhead line conductor construction type is 150mm2 AAAC (All Aluminium Alloy Conductor) designed according to ESB Networks 'Functional Design Specification for MV Overhead Lines'. 164 standard 20kV single poles, with an average span distance of 85m is required. The wooden poles are standard ESB Networks 20kV wooden poles which vary in length on this project between 11 and 13 metres. The top of pole diameter varies between 200mm and 220mm. The actual height of pole above ground will vary between 8.8m and 10.7m and between 2.2 to 2.3m of the pole will not be seen as it will be buried in the ground.

Pole and line installation works will be standard for a 20kV ESB overhead line:

- Poles are carried from adjacent roadways to each erection site and placed into an excavated hole using a wheeled or tracked excavator fitted with a pole grab attachment

- The pole hole is manually backfilled and tamped down to a minimum depth of 1.0m until the backfill is capable of supporting the pole; the excavator then continues the backfilling and tamping

- Where rock is encountered, the pole hole is formed using a hydraulic rock-breaker attachment mounted on the excavator

- Where the line changes direction and at pole set locations with poor ground conditions, stay wires will be required. These wires are supported by means of stay blocks, which are made of wooden sleepers and are buried underground

- Stringing of the conductor involves pulling out polypropylene rope along the route by hand, attaching the conductors and then pulling into position with stringing machine.

The 20k V underground power cable construction type is 20kV XLPe cable to be ducted according to ESB Networks' Specification for the Installation of Ducts & Structures for Underground 10-20kV Power Cables & Communication Cable'. The 20kV power cable will be laid in a single 125mm diameter uPVC duct in a cable trench. [See **Appendix B**]

Cable Duct Design

The 20kV power cable will be laid in a cable trench according to:

- ESBN Drawing 1A: '20kV Single Circuit Standard Trench Cross - Section' on page 1 of the ESB Networks specification document. (Note only one 110mm Communications duct at 750mm below the finished surface is required for this installation).
- ESBN Drawing 2A: '20kV Single Circuit Joint Bay - Section' on page 1 of the ESB Networks specification document.

The typical trench cable arrangement will be 1 duct. The typical trench dimensions will be 600mm wide and 1220mm deep following the ESB Networks' Standard Detail for a Single Circuit 20kV Underground Cable

2.7.1 Joint Bays Locations for the Proposed Grid Connection

Joint Bays are the locations where individual lengths of cables will be joined and are typically 500 metres apart. A joint bay is constructed in a pit. The bay typically is approximately 2.5 metres x 1.815m x 1.21m deep. A reinforced concreted slab is constructed in the bay to accommodate the joint enclosure.

The Joint Bay locations have been dictated by suitable terrain and access to facilitate the operation of cable pulling equipment at any phase of the development and future operation of the installation in accordance with the ESBN own specifications.

Trench Layout

The trench layout shall be as per the appropriate ESBN drawings. The specification of the relevant Local Authorities must be followed for the excavation and reinstatement of the ducted cable trenches. When the trench has been excavated to the required depth and all loose material and protruding stones have been removed, a bedding layer of sand shall be laid and compacted to a minimum thickness of 50mm.

Ducts

All joining ducts shall be laid in straight lines to even gradients. Once the ducts have been installed and backfilled with lean-mix concrete and with Clause 804 stone the duct run must be thoroughly cleaned by pulling the appropriate size of ESB Networks approved duct brush through the duct.

All reinstatement works shall be in accordance with the NRA Specification for Road Works and any conditions specified in the Road Opening Licence

Details of the construction methodology are detailed in dedicated CMS but are summarised below:

- Preparatory Works
  - Preparatory Trial Pit Survey along the cable route
  - Access to the start point and setting out
  - Access to joint bays
  - Silt Attenuation Features and watercourse set back buffer
  - Joint Bay Excavation
- Trenching Works
  - Storage of Materials
  - Trench Operations

- Managing excess material from trench

2.8 PROJECT CONSTRUCTION AND COMMISSIONING

2.8.1 Machinery to be used during construction

The items of construction plant and machinery, which will typically be used during the course of construction, are as follows:

- 1 Excavator Operator
- 1 no. tracked excavator
- 1 no. tracked dumper or tractor and trailer

2.8.2 General Method

The trench will be developed in 100m sections. Once one section of 100m has been excavated and the majority reinstated, the second 100m can be excavated and so on for the length of the grid connection. The excavated trench will be approximately 600mm wide. Trackway material within the temporary working area will be stripped and stockpiled adjacent to the excavation with subsoil being stockpiled separately.

Any earthen banks impacted will be carefully excavated with surface sods stored separately and maintained. Other earthen banks will be fenced off to prevent them from being damaged by construction traffic.

All ducting will be strung out, welded and tested prior to excavation of the trench. The duct trench will be excavated, and the material will be stockpiled. No dewatering of the trench is anticipated. Should dewatering be required it will be discharged through sedimats or similar which will capture the sediment prior to discharge to the roadside drain.

The base of the excavated trench will be lined with sand. The pipeline duct sections will be lowered into the trench by side booms and backfilled with sand lean-mix concrete, Clause 804 gravel and the original excavated material. All soil and road layers will be reinstated in reverse order to which they were excavated.

2.8.3 Storage of Equipment and Materials

It is expected that a tracked dumper or tractor and trailer will be used for the construction of the underground cable. Concrete, Clause 804 material, bundles of 125 mm PVC diameter duct and a water trailer will be used, and these will need to be stored overnight and when not in use. All equipment will be stored on or immediately adjacent to the trench on the existing road that as far as possible drains away from any watercourse.

2.8.4 Pollution Prevention & Control

2.8.4.1 Refuelling

The issue of accidental spillage of hydrocarbons such as diesel and lubrication oil during refuelling of plant machinery is a potential risk during the construction phase.

Where possible, fuel will be brought to site in a bunded fuel bowser. The carriage of Dangerous Goods by Road Regulations 2003 classifies diesel as a dangerous substance.

If dangerous goods are being transported by road then they must now be conveyed in a container which complies with the ADR. ADR is the European Agreement on the international and national Carriage of Dangerous goods by Road under Directive 95/55/EC. The manufacturer of the bunded fuel bowser must supply with each bowser:

- a copy of the Institutional Bio-safety Committee (IBC) approval certificate,
- a test certificate for the ‘leakproofness’ test,
- An identification plate attached to the container.

Such containers are suitable for diesel and kerosene and are designed to help companies comply with current and pending EU Environmental Regulations by eliminating accidental spillage. The outer container bund has in excess of 110% capacity of the inner container. For loads in excess of 1,000 litres transported by road, the vehicle driver must have undergone training and hold a special licence.

Re-fuelling off-site is the most effective way of controlling hydrocarbon spillages from construction plant. Where possible, re-fuelling of construction plant will take place off site, in order to reduce the risk of impact to zero. Off-site refuelling should occur at a controlled fuelling station.

Re-fuelling will not occur within 20m of any watercourse and all machinery will be maintained in good working order, free from leakage of fuel or hydraulic fluid. Equipment, fuel transfer areas and attenuation measures must be checked regularly during the construction phase.

The incident management plan of the construction phase CEMP must include an approved, certified clean-up consultancy, nominated by the contractor and available on 24-hour notice to commence a clean-up in the event of a hydrocarbon spillage.

Sampling of soils and adjacent surface waters will be undertaken on a regular basis to ascertain that **no pollution by hydrocarbons has occurred.**

2.8.4.2 Servicing

Where it is necessary to service machinery on-site, drip trays will be used, and no vehicle maintenance will occur within 20m of any watercourse. All machinery will be maintained in good working order, free from leakage of fuel or hydraulic fluid.

Parking of vehicles overnight or in periods of cessation of operations will be on hardstand areas and never close to open excavations or surface watercourses.

On site discharge of wash water from concrete mixers will be avoided at all times.

2.8.4.3 Disposal

Oily water condensate and recovered oil from any accidental spillage will be disposed of by recycling and the services of a specialist, licensed, waste oil recycler will be engaged for this task.

Any contaminated surface soils (in the unlikely event that contamination occurs) will be removed and similarly disposed of by a specialist, licensed contractor. Disposal will be undertaken with prior approval from Cork County Council.

2.8.5 Mitigation Measures

2.8.5.1 Construction Phase:

- Oils, greases and hydraulic fluids will be stored in bunded containers at least 20m from any watercourse.
- Refuelling of machinery will be carried out as described under ‘Refuelling’ outlined earlier in Section 2.5.6.
- Excavated soil should be stored at least 50m from watercourses and 20m form surface drains.
- Drainage will be via overland filtration, or through a stilling pond as necessary.

- A Construction Management Plan (CMP) will be provided to IFI prior to commencement to outline good practice and contain mitigation measures and provide a mechanism for compliance with legislation and statutory consents.
- Monitoring of the watercourses will be carried out during construction at watercourse crossing locations along the underground cable route to see that construction works are not significantly impacting the watercourse.
- Truck rutting will be kept to a minimum by confining plant and machinery movement to the development footprint area.
- A working wayleave of 3m will be maintained along the existing roadway.
- Plant will travel slowly across bare ground at a maximum of 5km/hr. If truck rutting is observed, then bog mats or rolling road will be employed.
- Silt fencing will be erected at a setback distance of 5m from the joint bays during excavation.
- Any excess construction material shall be removed from the works areas and disposed of in a fully licensed landfill.
- No re-fuelling of machinery will take place on site or within 50metres of any watercourse.
- All construction workers will be given a toolbox talk addressing the environmental topics and the drilling prior to commencement of construction.
- If truck rutting is observed, then bog mats or rolling road will be employed.
- No concrete will be batched on site. Concrete will be delivered from off site. Concrete will be transferred into a power barrow outside of the 50m watercourse buffer zone. Concrete contaminated water should be pumped away from the site and contained for disposal at an appropriately licensed facility off site.
- Any channel/riparian area will be fully reinstated post construction to minimise erosion potential.

2.8.5.2 Operational Phase:

During the operation of the underground cable maintenance may be required in the event of a cable fault. If this is necessary, the following methods will be employed:

- All vehicles visiting the site will be refuelled off-site.
- Trained personnel will carry out maintenance /repair when required. An emergency response will be included in their training for accidental hazards that could potentially occur on-site.

2.8.6 Spoil Management

For general trenching operations it is estimated that for each 100m section of duct, 90m3 of subsoils will be excavated. This material will be stored adjacent to the trench with 30m3 of this material being reinstated in the trench. The remaining 60m3 will be transported to a licenced facility for disposal.

2.9 TESTING AND COMMISSIONING

Plant commissioning will follow completion of the plant construction phase and will involve setting up and testing the equipment so that it is fully functional and that all technical, environmental and safety requirements have been met. Commissioning takes approximately 2 weeks.

2.10 OPERATION AND MAINTENANCE

Periodic maintenance may be required on the underground cable throughout its lifetime.

2.11 DECOMMISSIONING

When the Derreenacrinnig West Wind Farm ceases operation, the proposed Grid Connection cable will be removed. The Derreenacrinnig West Wind Farm has a permission for a 25 year operational life (Condition 3 of the grant of planning (Ref: PL:88:239767 & Ref 10/857), after which the turbines and associated infrastructure will need to be decommissioned in accordance with a plan that has been agreed with Cork County Council.

2.12 WIND RESOURCE

Due to the location in the southwest of Ireland and its proximity to the Atlantic seaboard, the Proposed Development Site experiences high average annual wind speeds. A preliminary examination of the wind resource at the proposed site was undertaken using the Sustainable Energy Authority of Ireland ("SEAI") Wind Atlas. It is noted the SEAI Wind Atlas was fully revised and updated in 2013. In addition, wind speed and direction data has been obtained from a meteorological mast previously erected on site. Wind speed at the Proposed Development Site is considered sufficient for a commercially viable wind energy development.

2.13 SITE SELECTION AND EXAMINATION OF ALTERNATIVES

2.13.1 Introduction

Article 5(3)(d) of the EIA Directive requires an

"outline of the main alternatives studied by the developer and an indication of the main reasons for his choice, taking into account the environmental effects".

Article 5(1) of the Revised EIA Directive requires

"*Where an environmental impact assessment is required, the developer shall prepare and submit an environmental impact assessment report. The information to be provided by the developer shall include at least: ...*

(d) a description of the reasonable alternatives studied by the developer, which are relevant to the project and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the project on the environment";

2.13.2 Alternative Locations for the Wind Farm

The application to which this EIAR relates is an application for permission for modifications to the 2012 Permission. As such, an alternative site selection assessment was not considered applicable. In addition, a site selection process was considered in the 2010 EIS submitted as part of the Derreenacrinnig West Wind Farm. Section 2.6 of the 2010 EIS had looked at alternative sites for the project. The key site selection constraint in Ireland was considered to be separation distances to houses, and this factor has not changed.

2.13.3 Alternative Designs

The preliminary site layout design for the EIA Development was developed from the 2012 Permission layout and infrastructure, with proposed modifications kept to the minimum necessary for proper planning and sustainable development. The finalised turbine layout for the Proposed Development was informed by the constraints identified as the revised EIA process progressed. This section details the design evolution and details the differences between the Proposed Development and the 2010 Permission.

2.13.4 Grid Connection Alternatives

The grid connection route was not considered in the 2010 EIS. The planning permission for the Grid Connection and its likely impacts are assessed in this EIAR.

The range of alternatives can include a 'Do Nothing' alternative where appropriate. This examines likely land use changes or other interventions, the likely effects of climate change, and the significance of these changing conditions.

The do-nothing alternative is a general description of the evolution of the key environmental factors of the site and environs if the proposed project did not proceed. It is similar to but typically, less detailed than the 'likely future receiving environment' description set out in the EIAR. It should consider the effects of projects which already have consent but are not yet implemented. It may also be appropriate to consider other projects that are planned but not yet permitted.

The do-nothing alternative should describe consequences that are reasonably likely to occur. It ought not be used to exaggerate or catastrophize environmental consequences that may occur without the proposed project.

It is best practice in Environmental Impact Assessments (EIA) to consider the 'Do Nothing' alternative – i.e. where no development occurs. Under a 'Do Nothing' alternative, the Derreenacrinnig West Wind Farm would not be constructed. The land upon which such development is proposed to occur – primarily comprising public road and agricultural land - would remain unchanged (unless developed for some separate purpose). Consequently, the environmental impacts, identified in the EIAR, positive and negative, would not occur.

Not proceeding with the current proposal (i.e. the grid connection) would serve to significantly frustrate the completion of a fully permitted and partially constructed wind farm. This will undermine current Government targets under Ireland's Draft National Energy and Climate Plan 2021-2030. The National Energy and Climate Plan will set the ambition level for renewable energy to 2030, (likely to be 70% from renewables by 2030) which will support the EU renewable energy target of 32%.

The Irish energy system is undergoing a significant transformation. Reliance on fossil fuels in Total Primary Energy Supply (TPES) has dropped by five percentage points since 2010 but remains high at 90%. Renewable energy has steadily increased, accounting for just over 10% of TPES in 2017, up from 4.6% in 2010.

Having regard to all the above, the 'Do Nothing' alternative was not considered to be appropriate.

A rigorous grid connection route assessment was carried out as part of the EIA process. Three high level options were initially explored as part of the Grid Connection Assessment. These options are shown in **Figure 2.9.**

With a non-contestable Gate 3 grid connection agreement in place between Derreenacrinnig and ESB Networks (ESBN), it was important for the applicant and ESBN to consider a number of alternative grid connection layouts and routes. Prior to the commencement of development, a number of alternative grid connection routes were considered as part of the EIA process. The most important factors were to provide an environmentally acceptable and cost-effective solution.

Key considerations were given to environmental matters. For example, some locations have more inherent environmental sensitivities than others. It was possible to avoid such routes in favour of a route which has fewer constraints and more capacity to sustainably assimilate the grid connection.

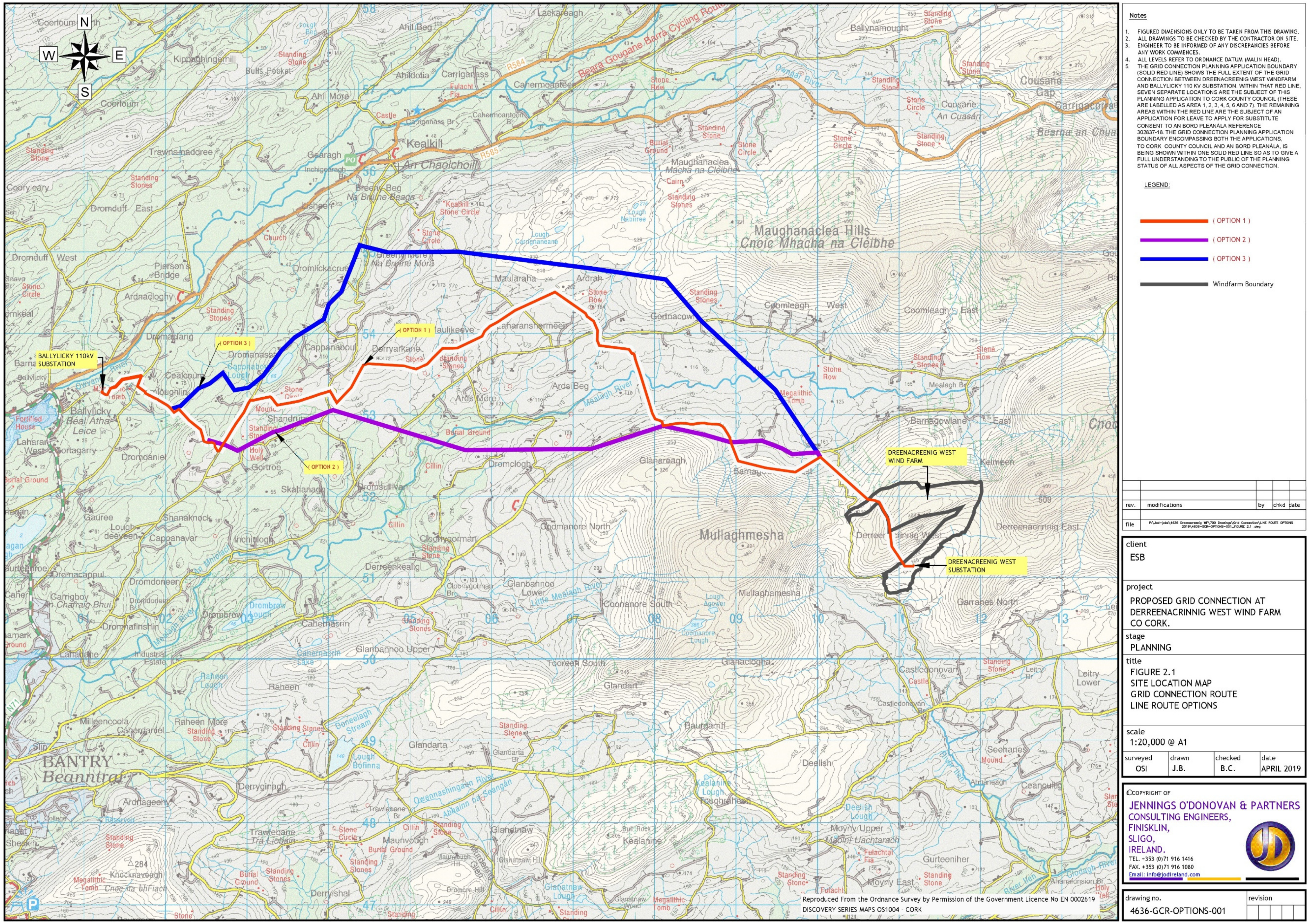


Figure 2.8– Grid Connection Alternatives

2.13.5 Proximity to Ballylicky Substation

Ballylicky Substation was chosen by the applicant (ESBN) as being the most favourable electricity node to connect into and a connection offer was made by ESBN to the wind farm development on this basis. Each of the route options shown in Figure 2.1 connect in to Ballylicky Substation. Both overhead and underground grid connections were considered as options. Therefore, the next step of the process was to select the optimum route option. The key criteria in selecting the route options are as follows:

- Minimise Environmental Constraints.
- Routes were selected to minimise the number of watercourse crossings.
- Minimise disruption to local residents.
- Minimise traffic and transportation obstruction.
- Minimise Archaeological Constraints.
- Outcomes of Engagement with landowners.
- Minimise underground cable route length to keep the construction period as short as possible and minimise financial outlay.

The processes associated with the construction and operation of the Grid Connection were identified by the Design and EIAR evaluation teams and also through consultation with interested parties.

As shown in Figure 2.1, consideration was given to alternative options from the outset of the project where the key consideration was given to the avoidance of adverse effects on the environment. The three options identified above do not traverse any European Sites which a key feature of the route selection.

As set out above, a number of options were explored for the Grid Connection as part of the EIAR. Consideration was given to various grid connection route alternatives. Both overhead and underground cables (and/or a mix of both) were considered to be technically feasible and viable alternatives for this project.

Option 1

Option 1 was considered to be the preferred route option as it posed the least environmental constraints and was a more cost-effective option than Option 2 and 3.

Option 2

Option 2 located to the south of the site of The Derreenacreenig West Wind Farm was discounted on the basis that it is located in close proximity to a number of archaeological sites. There are a number of dwellings along this route which were not receptive to the proposals and on that basis that option was discounted.

Option 3

Option 3 located to the north of The Derreenacreenig West Wind Farm was discounted because of topographical constraints relating to steep gradients and irregular landform. The route explored as part of option 3 entailed a number of stream and river crossings.

Detailed Route Analysis

Following the selection of Option 1 identified above, a more detailed route analysis was carried as part of the EIA process as shown in Figure 2.7 'Grid Connection Alternatives.'

Environmental Impacts

Key consideration was given to Environmental considerations. In some cases (e.g. river crossings) an overhead line can have a lower environmental impact than a trenched cable crossing. This was another key consideration in the determination of the preferred route. River crossings were unavoidable as each of the identified routes involve a river crossing.

Archaeological Constraints

Key consideration was given to archaeological sites are part of the preferred grid connection route. There are two recorded archaeological sites located within 100 metres of the yet to be constructed overhead circuit portion of the grid connection route.

There are three recorded archaeological sites located within 100 metres of the yet to be constructed underground cable portions of the grid connection route. There will be no direct, negative impacts on any recorded archaeological monument due to the construction of the remaining section of the Overhead Grid Connection.

There is no predicted direct, negative impact on the known archaeological resources due to the proposed construction of the underground cable portion of the grid connection route. While the route does pass through the zone of two recorded monuments in Shandrum Beg townland the nature of the topography in the area, combined with the construction of the road that will carry the cable, substantially reduces the archaeological potential of this section of the route.

Landowner Engagement

Landowner consent was another critical factor in determining the preferred route. For example, Option 2 and Option 3 shown in Figure 2.9 were considered less viable due to landowners not being willing to engage in a reasonable way with these options.

Technical Feasibility

Over longer distances and higher power levels, there are fundamental electrical engineering constraints on how much power can be transported efficiently on cables. Out of the three route options shown in Figure 2.9, option 1 proved to be the most technically feasible.

Visual Impact

In terms of visual impact each of the options explored are located within a High Landscape Area in the Cork County Development Plan. The preferred Grid Connection route was considered to have the least visual impact, is located where possible, close to forestry for background screening.

The Grid Connection will run through a number of rural townlands in Co Cork connecting the permitted Derreenacrinnig West Wind Farm site with the existing Ballylicky Substation.

A search was conducted on the Cork County Council Planning portal within the townlands of the proposed 20kV grid connection in relation to permitted plans and projects that may have the potential to result in cumulative impacts have been undertaken. The searches revealed no additional large scale permitted projects that have the potential to result in likely significant cumulative impacts. Planning applications identified in the townlands and vicinity of the 20Kv grid connection were small scale domestic or small scale agricultural, equestrian, electrical or retention applications. No large scale permitted developments were identified within the scope of the search, aside from Derreenacrinnig West Wind Farm.

The environs of the proposed route are dominated by agriculture, with a small degree of commercial forestry. The eastern extent of the route traverses a more upland area with more unenclosed or unimproved grazing of sheep and dry stock cattle rearing. The section in the lower Mealagh valley and the western extent of the route crosses more improved agricultural land with increased fertiliser usage, though stocking densities are unlikely to be very high.

The cumulative impacts in terms of neighbouring developments will be negated by the employment of a construction design to the highest standards, incorporating best practice methods. Considering this, significant effects on the environment are not likely, as outlined in the following sections.

The proposed Grid Connection route has been revised due to take into account topographical constraints of the area and buffers of existing archaeological features. The proposed Grid Connection was chosen to give ample buffer to designated areas, archaeological features and visual amenities.

2.13.6 Alternative Processes

Alternatives processes are with respect to alternative technologies for the generation of electricity for supply to the national grid. EIAR **Section 3: Planning Policy** provides an Ireland context for the international and national policy for increasing electricity generation from renewable energy sources. This has a number of drivers and benefits such as the security of energy supply, security of the cost of electricity (due to variability of international fossil fuel costs) and reducing emissions.

Alternatives processes are also with respect to alternative wind energy technologies that may be employed. There are different manufacturers (and models from manufacturers) of wind turbines available on the market, which will have slightly different characteristics. The EIAR approach was to assess a non-exhaustive number of turbine types on the market that may be used in the Proposed Development.

Alternatives processes are also with respect to other renewable energy technologies. While hydropower is an established renewable generating technology, the potential for this technology to generate significant amounts of energy is limited in Ireland compared to wind energy. This is mainly due to few inter-related factors: Ireland is a low-lying country with few high mountains, those available are not extensive in the local geographic area and fish spawning grounds are afforded a high degree of protection. While solar photovoltaic power is becoming more cost effective it is currently more expensive than wind energy but is likely to be able to contribute to renewable energy targets post-2020. While biomass power can be cost effective there is currently no large-scale electrical generation plant using biomass as a fuel in Ireland but is likely to be able to contribute to renewable energy targets post-2020.

2.13.7 Alternatives Considered for the Consented Wind Farm

As detailed in **Section 2.6 of the 2010 EIS** the Proposed Development. The 2010 EIS had assessed alternatives prior to beginning the project design.

The alternatives included 3 options:

- Option 1 – Glannannoo Upper
- Option 2 – Garranes North
- Option 3 – Derreenacrinnig West

2.13.8 Reasonable Alternatives

If the development, as permitted by the 2012 Permission or as proposed in this current application, is not carried out, non-renewable energy sources will be required to supply a greater proportion of Irish energy generation current and future energy demands. This will further contribute to greenhouse gas and pollutant production and impede Ireland's commitment to meet its EU and national emissions targets and to strive towards sustainable development. The proposed EIA Development is intended to produce renewables energy to meet national policy and international legally binding commitments.

2.14 PROPOSED DEVELOPMENT SITE INFRASTRUCTURE AND CONSTRUCTION

2.14.1 Cumulation with other Existing and/or Approved Projects

A search was conducted on the Cork County Council Planning portal within the townlands of the proposed 20kV grid connection in relation to permitted plans and projects that may have the potential to result in cumulative impacts have been undertaken. The searches revealed no additional large scale permitted projects that have the potential to result in likely significant cumulative impacts. Planning applications identified in the townlands and vicinity of the 20kV grid connection were small scale domestic or small scale agricultural, equestrian, electrical or retention applications. No large scale permitted developments were identified within the scope of the search, aside from Derreenacrinnig West Wind Farm.

The grid connection runs through a number of rural townlands in the County of Cork connecting the permitted Derreenacrinnig West Wind Farm site with the existing Ballylicky Substation.

At the end of the operational duration, all infrastructure will be decommissioned and in so far as is practical, dismantled and removed from the Proposed Development Site. The development is low impact, and represents a temporary use in the landscape, which is fully reversible in nature.

2.14.2 Other Development in the Area

The permitted Barrboy Wind Farm is located approximately 2km north east of the proposed Derreenacrinnig West Wind Farm site, consisting of 5 turbines with a hub height of 46m and a roto diameter of 62m. Planning permission was granted and never implemented, and this permission has now lapsed.

From an assessment of the planning applications on the Cork County Council planning website there are other plans and projects in the vicinity of the c.13.2 km underground cable grid connection route. The main project that needs consideration in relation to cumulative impacts is the consented Derreenacrinnig West Wind Farm (Cork County Council Pl. Ref. 10/857) which is where the grid connection begins.

Aside from the Derreenacrinnig West Wind Farm other planned or consented projects in the area consist mainly of applications for new single dwellings and extensions to existing dwellings. Many of these applications date from some years back and so it is likely many will have already been constructed or will not be carried out at all.

3 PLANNING POLICY

3.1 INTRODUCTION

This section sets out the planning policy context relevant to the proposed EIA Development by providing an overview of the international, national and regional legislation and policy of relevance, as well as a detailed review of the planning policy framework within which the application will be assessed. This section also provides a brief overview of the most up-to-date statistics on Irish renewable energy production, climate emissions, and the benefits the proposed EIA Development can bring to helping meet Ireland legally binding 2020 and 2030 targets.

The key drivers for renewable energy, and therefore the Derreenacrinnig West Wind Farm project are reducing greenhouse gas emissions, providing energy security, and maximising economic opportunities from investment for Ireland. In addition, this project is considered to represent a significant opportunity for cost reduction in wind energy, an increasingly. The proposed project would have a generation capacity of up to 22.4 MW. Irish legislation is underpinned by a number of international (e.g. EU and United Nations (UN)agreements, which are outlined in this section.

The proposed grid connection between the consented Derreenacrinnig West Wind Farm and the Ballylicky 110kV Substation is required to connect the Derreenacrinnig West Wind Farm to the national energy grid. The energy generated will need to be transferred from the consented on-site substation to the national grid and therefore it is proposed to develop the necessary 13.916km of cable to connect to the 20kV Ballylicky Substation.

The Derreenacrinnig West Wind Farm itself is consented and will help the government meet its 2030 renewable energy targets and avoid potential penalties from the European Commission. The grid connection works are needed to allow the wind farm to become operational and transfer energy to the national grid.

This development is also of considerable benefit to the local economy providing additional key infrastructure which may assist in the further development of the area.

3.2 INTERNATIONAL POLICY

This sub-section contains information on international policy considered to be relevant to the proposed EIA Development.

3.2.1 The United Nations Framework Convention on Climate Change

3.2.1.1 Initial Treaty (1992)

The United Nations Framework Convention on Climate Change ("UNFCCC") was set up in 1992 and sets an overall framework for intergovernmental efforts to tackle the challenge posed by climate change. The UNFCCC recognises that the climate system is a shared resource whose stability can be affected by industrial and other emissions of carbon dioxide and other greenhouse gases. The convention enjoys near universal membership, with 197 countries listed as being Parties to the Convention[3].

3.2.1.2 The Kyoto Protocol Targets

The Kyoto Protocol is an international treaty which extends the 1992 United Nations Framework Convention. The Kyoto Protocol came into effect in 2005, as a result of which, emissions reduction targets agreed by developed countries, including Ireland, are now binding. Under the Kyoto Protocol, the EU agreed to achieve a significant reduction in total greenhouse gas emissions of 8% below 1990 levels in the period 2008 to 2012. Ireland's contribution to the EU commitment for the period 2008 – 2012 was to limit its greenhouse gas emissions to no more than 13% above 1990 levels.

3.2.1.3 The Doha Amendment to the Kyoto Protocol (2012)

In Doha, Qatar, on 8 December 2012, the Doha Amendment to the Kyoto Protocol was adopted. The amendment includes:

- New commitments for Annex I Parties to the Kyoto Protocol who agreed to take on commitments in a second commitment period from 1 January 2013 to 31 December 2020;
- A revised list of greenhouse gases ("GHG") to be reported on by Parties in the second commitment period; and
- Amendments to several articles of the Kyoto Protocol which specifically referenced issues pertaining to the first commitment period and which needed to be updated for the second commitment period.

Under the protocol, countries must meet their targets primarily through national measures, although market-based mechanisms (such as international emissions trading) can also be utilised.

[3] http://unfccc.int/essential_background/items/6031.php

3.2.1.4 The Paris Agreement (2016)

The Paris Agreement seeks to accelerate and intensify the actions and investment needed for a sustainable low carbon future. Its central aim is to strengthen the global response to the threat of climate change by keeping a global temperature rise this century well below 2 degrees Celsius above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5 degrees Celsius. The Agreement also aims to strengthen the ability of countries to deal with the impacts of climate change.

On 5 October 2016, the threshold for entry into force of the Paris Agreement was achieved. The Paris Agreement entered into force on 4 November 2016. Ireland is legally bound by Article 7 of the United Nations COP21 Paris Agreement[4], signed in December 2015, to prepare and submit periodic updates on its national adaptation and mitigation plans in the global effort to keep global warming below 1.5 °C.

3.3 EUROPEAN UNION POLICY

The European Union (EU) Directive on the Promotion of the Use of Energy from Renewable Sources (Directive 2009/28/EC) was adopted on 23rd April 2009. This Directive establishes a binding target of a minimum 20% reduction in greenhouse gas emissions based on 1990 levels, 20% of overall EU energy consumption to come from renewable sources by 2020, as well as a binding 10% minimum target for energy from renewable resources in the share of transportation fuels and 20% reduction in primary energy use compared with projected levels by improving energy efficiency.

Directive 2009/28/EC imposes a legal obligation on each Member State to:

- Ensure that its 2020 target is met.
- Introduce “appropriate measures” and outline them in a National Renewable Energy Plan.

Failure by Ireland to meet its legally binding EU targets on the use of energy from renewable sources could result in EU sanctions. Ireland’s mandatory target under Directive 2009/28/EC is for renewable resources to account for 16% of total energy consumption by 2020. This will be met by sub-targets of 40% from renewable electricity, 12% from renewable heat and 10% from the renewable transport sector.

The 2030 Climate and Energy Framework was adopted by EU leaders in October 2014 and marks a further development of EU renewable energy policy. The framework defines further

[4] United Nations Framework Convention on Climate Change (2015) *Adoption of the Paris Agreement*. Available at https://unfccc.int/resource/docs/2015/cop21/eng/l09r01.pdf

EU wide targets and builds on the 2020 climate and energy package. The Framework sets three key targets for the year 2030 as follows:

- A binding commitment at EU level of at least 40% domestic Green House Gas reduction by 2030 compared to 1990;
- An EU wide, binding target of at least 27% renewable energy by 2030; and
- An indicative EU level target of at least 27% energy efficiency by 2030.

On the 30th November 2016, the EU Commission published a proposal for a revised Renewable Energy Directive, setting a target of at least 27% renewables in the final energy consumption in the EU by 2030.

Progress Towards Reaching Targets

While the EU as a whole is projected to exceed its 2020 target of reducing GHG emissions by 20%, Ireland is currently one of the countries projected to miss its national targets. The Europe 2020 report emphasises the importance of continued action on climate change:

*"Despite the EU's shrinking share in global CO_2 emissions, recent findings on the potentially catastrophic impacts of climate change confirm the ongoing importance of its climate and energy goals. EU emission cuts alone cannot halt climate change, but if it can show that a low-carbon economy is feasible, and can even increase innovation and employment, it will serve as a role model to other regions. Continuous investment in advanced low-carbon technologies can also help the EU uphold technological leadership and secure export markets. A successful transformation of the energy sector, discussed in the next section, is pivotal in this respec*t."

The Irish contribution of renewables to gross final energy consumption (GFC) was 9.1% in 2015, compared to a 2020 target of 16%. In 2015, with five years to go, Ireland was just over halfway towards each of the separate targets for contributions of renewable energy in electricity, transport and heat.[5]

Figure 3.1 shows the latest data available for the share of renewable energies in gross final energy consumption according to Eurostat online data and the targets that have been set for 2020. The share of renewables in gross final energy consumption stood at 17% in the EU-28 in 2016.

[5] Energy in Ireland 1990 – 2015', Sustainable Energy Authority of Ireland, 2016

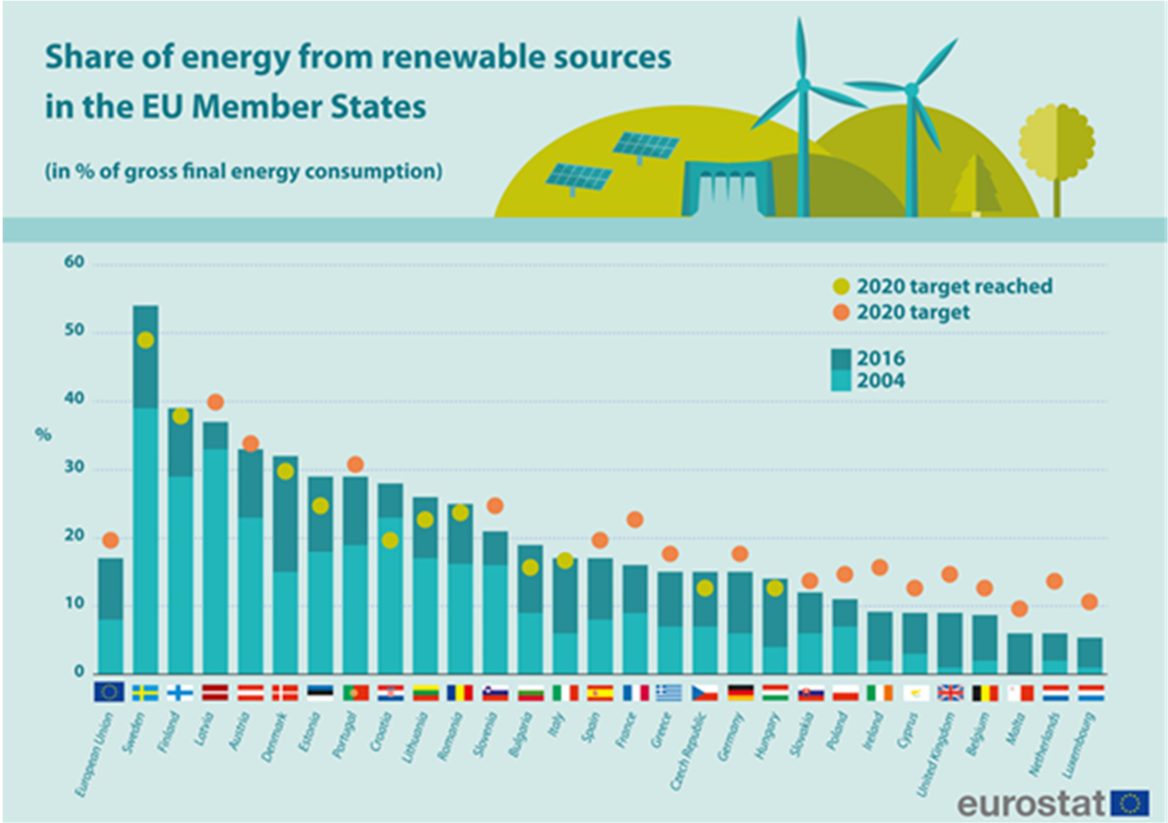


Figure 3.1 – Share of energy from renewable sources, 2004 and 2016 in the EU Member States (in % gross final energy consumption)

The European Commission report 'Report from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions' was published in February 2017. This report provides a comprehensive overview of renewable energy deployment in the EU and progress towards meeting the 2020 targets. The report states that the vast majority of Member States are "well on track in terms of renewable energy deployment". However, four Member States, namely: Ireland, Luxembourg, the Netherlands and the United Kingdom are currently below their national binding targets. The shortfall of renewable energy deployment in the United Kingdom is however very small (approximately 0.2%) so it is expected that Ireland will be one of only three Member States projected to not meet their national binding 2020 targets.

It is estimated that 1MW of wind capacity can provide enough electricity to supply approximately 650 homes. EirGrid in their Generation Capacity Statement 2017 – 2026, published in April 2017, stated that the amount of wind energy installed on the island of Ireland at the end of November 2016 had reached 2,800 Megawatts (MW) and over the course of 2016, 22% of all electricity consumed in Ireland was provided by wind. EirGrid estimates that between 3.9 and 4.3 Gigawatts (GW) of wind energy may be required to meet the 2020

Renewable Energy Supply Electricity target of 40%. This means that approximately 340 MW of extra wind capacity is required to be installed each year between 2017 and 2020 to achieve targets.

A report published by the Sustainable Energy Authority of Ireland in December 2018 entitled 'Energy in Ireland' presents the latest national data and trends on energy efficiency and renewable energy in Ireland. The report states the Ireland faces a significant challenge in trying to reduce our reliance on fossil fuels for transport, heating and electricity and production.

The December 2018 report states that by the end of 2017, the installed capacity of wind generation reached 3,318 MW. However, we still have a considerable way to go to meet our renewable energy targets, in particular for heat and transport which account for 80% of final energy demand.

The EirGrid Generation All Island Capacity Statement states "*A key driver for electricity demand in Ireland for the next number of years is the connection of large data centres*". There is presently about 250 MVA of installed data centres in Ireland. Furthermore, there are connection offers in place (or in the connection process) for up to 600MVA extra. At present, there are enquires for more than 1,000MVA of additional data centres.

3.4 NATIONAL POLICY & LEGISTLATIVE FRAMEWORK

This sub-section contains information on national policy considered to be relevant to the Development.

3.4.1 National Strategy for Intensifying Wind Energy Development 2000

The Strategy for Intensifying Wind Energy Development was published in 2000 by the Renewable Energy Strategy Group as part of the Department of Communications, Energy and Natural Resources (now called Department of Communications, Climate Action and Environment). The main aim of the group was to develop a strategy for the increased contribution of onshore wind energy to electricity generation. During the initial six-month period of the preparation of the strategy, the group examined many aspects of, and constraints to, the further development of wind energy.

The principal conclusion of the Renewable Energy Strategy Group was that three key elements: Electricity Market, Electricity Network and Spatial Planning, need to be integrated into a plan-led approach to wind energy deployment. The recommended strategy, arising from this approach, has been designed to meet the targets set for deployment of renewable energy at least cost.

The recommended plan-led approach as described in the strategy sees spatial planning considerations as crucial in determining suitable areas where wind farms may be accommodated. It states that these decisions should be informed by the availability of the resource (wind), the strength of the electricity networks, and landscape and other planning considerations.

3.4.2 Ireland's Energy Policy Framework 2007-2020

A Government White Paper entitled 'Delivering a Sustainable Energy Future for Ireland: The Energy Policy Framework 2007 – 2020' was published by the Department for Communications, Marine and Natural Resources in 2007. In 2014, 85% of Irish energy requirements were imported. This reliance on imported energy combined with Ireland's peripheral location, leaves the state vulnerable to supply disruption and imported price volatility. The primary objectives of the Government's energy policy as set out in the Paper are security of supply, environmental sustainability and economic competitiveness. The Energy Policy Framework 2007 – 2020 sets out clear actions, targets and timeframes for meeting these interlinked objectives.

Ireland's energy policy priorities are framed in the context of the European Union. Directive 2009/28/EC on the Promotion of the Use of Energy from Renewable Sources sets a target for Ireland for 16% of energy consumption to come from renewable sources by 2020. This target will be made up of contributions from renewable energy in electricity (RES-E), renewable energy in transport (RES-T) and renewable energy for heating and cooling (RES-H):

- RES-E: Renewables contribution to gross electricity consumption 40% by 2020;
- RES-T: Renewables (biofuels & the renewable portion of electricity) contribution to transport energy 10% by 2020; and
- RES-H: Renewable contribution to heat (Thermal requirement - heating & cooling) 12% by 2020.

The 2007 Government White Paper sets a more ambitious target of 33% for energy consumption from renewable sources by 2020. In Ireland, it is widely acknowledged that the vast majority of the renewable electricity requirement is expected to be met through the development of indigenous wind power, as Ireland has a strong wind resource potential, with one of the best onshore wind speed averages in Europe ('The Value of Wind Energy to Ireland', Pőyry, 2014).

The Energy White Paper 2007 states that renewable energy will be a critical and growing component of Irish energy supply to 2020 and beyond. The Government’s strategic goals for sustainable energy include addressing climate change by reducing energy-related greenhouse gas emissions and accelerating the growth of renewable energy sources. Renewable energy and enhanced efficiency in power generation are integral to the Government’s strategy to deliver Ireland’s climate change targets under the Kyoto Protocol. The Paper states:

“Renewable energy is an integral part of our climate change strategy and sustainability objectives. The additional diversity which renewables bring to Ireland’s energy demand will also make a direct contribution to our goal of ensuring secure and reliable energy supplies.”

As of April 2018, there are 341 wind farms on-line and operational, in 32 counties on the island of Ireland (260 wind farms in the Republic of Ireland). The current grid connected and operational installed wind capacity on the island of Ireland is 4,429MW. It is estimated that 1MW of wind capacity can provide enough electricity to supply approximately 650 homes. Based on this figure, an installed capacity of 3,916MW can provide enough electricity to power over 2.8 million homes. (Source: IWEA website, figures correct as of 12th April 2018).

3.4.3 Strategy for Renewable Energy 2012-2020

The Government’s Strategy for Renewable Energy 2012 – 2020 was published by the Department of Communications, Energy and Natural Resources in May 2012. It acknowledges the national importance of developing renewable energy and confirms the Government’s commitment to this. It notes the significant potential for Ireland to become a renewable energy exporter within a short time and the Strategy seeks to realise this.

The Strategy sets out 5 no. strategic goals, the first of which is as follows:
“Strategic Goal 1 - Progressively more renewable electricity from onshore and offshore wind power for the domestic and export markets.”

To achieve the above goal, the Strategy sets out a number of key actions, including the following:

- Support delivery of the 40% target for renewable electricity through the existing GATE processes. A further targeted Gate may be developed, if necessary, following a review of the take-up of Gate 3 offers, while developing a next phase plan led approach for additional onshore capacity in future.

- Review with the Department of Environment and the Commission for Energy Regulation (CER) the scope for further streamlining authorisation and planning processes for renewable energy projects.
- Implement REFIT 2 for onshore renewable energy and maintain a predictable and transparent REFIT support framework for onshore wind which is cost competitive.
- Provided the cost benefit analysis is positive, put in place the necessary legal and planning and infrastructure framework to support the development of onshore and offshore wind as an export opportunity without cost for the Irish consumer and to the benefit of the economy, in the context of the cooperation mechanisms under the Directive.

3.4.4 White Paper on Energy Policy in Ireland 2015 – 2030

A Government White Paper entitled 'Ireland's Transition to a Low Carbon Energy Future 2015-2030' was published in December 2015 by the Department of Communications, Energy and Natural Resources. This Paper provides a complete energy update and a framework to guide policy up to 2030. The Paper builds upon the White Paper published in 2007 and takes into account the changes that have taken place in the energy sector since 2007. The White Paper states the advances in Ireland's energy efficiency and renewable energy and generation use between 2007 and 2015. Renewable electricity sources (including wind) accounted for 27% of Ireland's electricity consumption in 2015, which is just over halfway to Ireland's 2020 target of 40% (Energy in Ireland: 2016 Report, SEAI, November 2016).

The policy framework sets out a vision for a low carbon future that maintains Ireland's competitiveness and ensures a supply of affordable energy. The paper advises that a range of policy measures will be employed to achieve this vision and will involve generating electricity from renewable sources, of which there is plentiful indigenous supplies, and increasing the use of electricity and bioenergy to heat homes and fuel transport. The White Paper states that onshore wind continues to be the main contributor of renewable energy, 18.2% of total generation and 81% of renewable electricity (RESE) in 2014. The impacts of climate change in the context of EU and national policy refers to the change in climate that is attributable to human activity arising from the release of greenhouse gases into the atmosphere and which is additional to natural climate variability (Department of the Environment, Heritage and Local Government, 2006). In 2008, the Environmental Protection Agency (EPA) published the results of a study entitled 'Climate Change – Refining the Impacts for Ireland', as part of the STRIVE (Science, Technology, Research and Innovation) Programme 2007 – 2013. This report states that mean annual temperatures in Ireland have risen by 0.7 o Celsius (C) over the past century. Mean temperatures in Ireland relative to the 1961 to 1990 averages are likely to rise by 1.8 to 4.0o C by the 2050s and by in excess of 2 o C by the end of the century due to climate change.

Future precipitation changes are less certain to predict than temperature but constitute the most important aspect of future climate change for Ireland. The study projects that winter rainfall in Ireland by the 2050's will increase by approximately 10%, while summer rainfalls will reduce by 12 – 17%. Lengthier heatwaves, much reduced number of frost days, lengthier rainfall events in winter and more intense downpours and an increased propensity for drought in summer are also projected. The STRIVE report on climate change impacts states that Ireland can and must adapt to the challenge of climate change. It notes that:
"Barriers to this, both scientific and socio-economic, are required to be identified and addressed in order that Ireland can be optimally positioned to thrive in a changing world."

The report discusses the impacts of climate change in terms of water resource management, agriculture and biodiversity, as described below.

3.4.5 Water Resource Management

The hydrological impacts of projected climate change encompass significant reductions in soil moisture storage in the nine representative catchments across Ireland. Soil moisture deficits will commence earlier and extend later in the year as the century proceeds. This will result in a tendency for groundwater recharge to be lower for longer, sustained periods, increasing the risk of drought when a dry summer follows a drier than average winter. The STRIVE report states that such impacts would be felt greatest in catchments more dependent on groundwater, such as the Suir, Blackwater and Barrow. Significant changes in stream flow are likely to occur, with implications for flood management in winter and water resource availability in summer:
"In the vital water supply rivers of the east, for example, stream flow reductions in excess of 70 % can be expected for some autumn months by the end of the century."

3.4.6 Agriculture

The STRIVE report states that the principal challenges to agriculture will come from wetter Winter and drier Summer soils, though increased temperatures will also play an important role. Different challenges will be posed in different regions, depending on crop type and dairying output. The report stresses however that Irish agriculture can, if positioned appropriately, adapt successfully to the challenges of climate change.

3.4.7 Biodiversity and Natural Ecosystems

Changes in species behaviour and viability and in ecosystem distribution across Ireland will occur in conjunction with the projected climate changes. Changes in the timing of life-cycle events such as leafing, bud burst, and leaf fall can be expected as preliminary responses and will be instrumental in altering biodiversity. The report states that particularly vulnerable ecosystems can be identified where successful adjustment to new conditions is unlikely. The most vulnerable habitats include sand dunes, lowland calcareous grasslands, montane heath, raised bogs, calcareous fens, turloughs and upland lakes. Increased decomposition of Irish peatlands will be facilitated mainly by cracking during drier periods and will be further exacerbated by compositional changes. The suitable climate area for fens may have declined by 40% by mid-century with corresponding losses for raised and blanket bogs of over 30% and 45% for turloughs over the same period.

3.4.8 Emissions Projections

In 2016, the EPA published an update on Ireland's Greenhouse Gas Emissions Projections to 2020[6]. Ireland's target is to achieve a 20% reduction of non-Emissions Trading Scheme (non-ETS) sector emissions, i.e. agriculture, transport, residential, commercial, non-energy intensive industry and waste, on 2005 levels, with annual binding limits set for each year over the period 2013 – 2020.

Greenhouse gas emissions are projected to 2020 using two scenarios; '*With Measures*' and '*With Additional Measures*'. The '*With Measures*' scenario assumes that no additional policies and measures, beyond those already in place by the end of 2014 are implemented. The '*With Additional Measures*' scenario assumes implementation of the '*With Measures*' scenario in addition to full achievement of Government renewable and energy efficiency targets for 2020, as set out in the National Renewable Energy Action Plan and the National Energy Efficiency Action Plan.

The EPA Emission Projections Update (2016) notes the following key trends:

- Ireland's non-Emissions Trading Scheme (ETS) emissions are projected to be 6% and 11% below 2005 levels in 2020 under the 'With Measures' and 'With Additional Measures' scenarios, respectively. The target for Ireland is a 20% reduction.
- Ireland is projected to exceed its annual binding limits in 2016 and 2017 under both scenarios, 'With Measures' and 'With Additional Measures'.

[6] EPA, 2016, '*Greenhouse Gas Emission Projections to 2020 – An Update*'

- Over the period 2013 – 2020, Ireland is projected to cumulatively exceed its compliance obligations by 12 Mt CO_2 (metric tonnes of Carbon Dioxide) equivalent under the 'With
- Measures' scenario and 3 Mt CO_2 equivalent under the 'With Additional Measures' scenario.

The EPA report (2016) states that "*Failure to meet 2020 renewable and energy efficiency targets will result in Ireland's emission levels moving even further from its emission reduction targets*". The report also concludes: *"The latest projections estimate that by 2020 non-ETS emissions will be at best 11% below 2005 levels compared to the 20% reduction target. Emission trends from agriculture and transport are key determinants in meeting targets, however emissions from both sectors are projected to increase in the period to 2020."*

3.5 NATIONAL CLIMATE CHANGE POLICY

3.5.1 National Climate Action Plan 2019

The "Climate Action Plan 2019" was published by the Government on 17 June 2019. The aim of the plan is to make Ireland a world leader in responding to climate change. The Plan is ambitious, affecting almost every sector of the economy. The key difference however, between this Plan and previous ones is that it creates new governance structures necessary to implement the far-reaching changes. The key focus of the Plan is to identify how the Government plans to reduce Ireland's growing greenhouse gas emissions.

The goal is that Ireland will achieve its EU emission reduction targets for the year 2030. The Plan includes a new commitment to make Ireland 100% carbon neutral by 2050. The Plan contains 183 action points designed to achieve our national climate change targets. The scale of the challenge is huge, and the Plan identifies the need for everyone to contribute in tackling the challenges posed by climate change. It includes increased renewable electricity targets4, the end of single use non-recyclable plastics and new building regulations. It will impact how our homes and businesses are heated, how we generate and consume electricity, how we travel and how food is produced.

The Irish Government has published its long-awaited climate action plan. It is designed to set the country on a trajectory to achieve net zero-carbon emissions by 2050.
By 2030, 70 per cent of power generation will be from renewable energy – more than double the current position.

Energy Sector

The goal in the energy sector is to make Ireland less dependent on imported fossil fuels. To achieve this, energy needs to be decarbonised by harnessing renewable resources, particularly wind (both onshore and offshore), solar PV and biomass powered CHP.

The targets set out in the Climate Action Plan 2019 envisages a radical step-up of our existing targets in order to meet the required level of emissions reduction by 2030, including:

- A reduction in CO2 eq. emissions by 50–55% relative to 2030 NDP projections
- An increase in electricity generated from renewable sources to 70%
- An objective to meet 15% of electricity demand by renewable sources contracted under

Corporate PPAs

The plan sets out 4 key measures to meet these targets:

1. Harnessing Renewable Energy

The transition to 70% renewable electricity will be made possible by a significant increase in onshore wind, offshore wind and solar PV. The recently announced Renewable Electricity Support Scheme (RESS)7 will be a key policy measure to drive this growth. It is hoped that RESS will be open for applications by the end of 2019. However, given that the detailed auction design and State Aid approval are still awaited, that deadline may well slip into Q1 or even Q2 of 2020.

Although RESS is expected to be designed as a series of technology neutral auctions based on the lowest levelised cost of energy (LCOE), the Government has set out the following indicative levels of renewable electricity generation in the Plan:

- at least 3.5 GW of offshore wind
- up to 8 GW of onshore wind
- up to 1.5 GW of grid scale solar energy

The massive increase in offshore wind capacity will require putting in place a new planning and consenting regime and a new grid connection framework for offshore wind that aligns with the RESS auction timeframes. Enhanced interconnection will also be required. In this regard the Plan makes specific reference to the planned Celtic Interconnector to France and further interconnection to the UK.

The Plan also envisages that 15% of electricity demand will be met by renewable sources contracted under Corporate PPA's. It is expected that a key driver in the growth of Corporate PPA's will be the expected increase in data centres, which will lead in turn to a massive increase in demand for electricity.

2. Phasing out Fossil Fuels

Removing fossil fuels from the grid will be essential in the coming years. There are plans to replace coal fired generation with low carbon and renewable technologies. Bord Na Mona are committed to transitioning away from peat by 2028. There will be an end to coal burning at ESB's Moneypoint generation plant by 2025.

3. Micro-generation

There will be a change in the electricity market rules in early 2020 in order to enable micro-generated electricity to be sold by businesses and householders to the grid. The Plan provides this should include provision for a feed-in-tariff for micro-generation to be at set at least at the wholesale price point. Mechanical electricity meters will be replaced by new smart meters in households by 2024 under the Smart Metering Programme.

4. Other Measures

Other measures include continued support for the DS3 programme, support for research on nascent ocean energy technologies (e.g floating wind, tidal and wave technologies) and continued support for the development of combined heat and power generation (CHP).

3.5.2 Climate Action and Low Carbon Development Act 2015

The Climate Action and Low Carbon Development Act, 2015 was signed into law on 10 December 2015. The Act provides for the establishment of a national framework with the aim of achieving a low carbon, climate resilient, and environmentally sustainable economy by 2050, referred to in the Act as the “national transition objective”. The Act provides the tools and structures to transition towards a low carbon economy and it anticipates that it will be achieved through a combination of:

- A national mitigation plan (to lower Ireland’s level greenhouse emissions);
- A national adaptation framework (to provide for responses to changes cause by climate change);
- Tailored sectoral plans (to specify the adaptation measures to be taken by each Government ministry); and

- Establishment of the Climate Change Advisory Council to advise Ministers and the Government on climate change matters.

3.5.3 National Mitigation Plan

Ireland's first statutory National Mitigation Plan (NMP), published in July 2017, gives effect to the provisions of the Climate Action and Low Carbon Development Act, 2015, and represents a landmark national milestone in the evolution of climate change policy in Ireland and provides for the statutory basis for the transition to a low carbon, climate resilient and environmentally sustainable economy by 2050.

The NMP reaffirms Ireland's commitment to concerted and multilateral action to tackle climate change following the adoption of the legally binding Paris Agreement, of which Ireland is a co-signatory. Under the Paris Agreement, the EU is committed to reducing greenhouse gas emissions by at least 40% by 2030, compared with 2030 levels. The Paris Agreement represents a landmark accord in tackling climate change, which is recognised by all parties as the defining global issue of this generation. The NMP addresses the role of local authorities in facilitating the transition towards a low carbon economy and recognises that this requires engagement from all levels of Government and that a bottom-up approach is also essential to promote awareness and engagement within individual communities across Ireland. The NMP further states that there *"is also recognition within the Local Authority sector of the need for the sector to assume a leadership role within their local communities to encourage appropriate behavioural change". Moreover, the Plan emphasises that local authorities also have a key role to play "in addressing climate change mitigation action and are well places to assess, exploit and support opportunities within their administrative areas, in cooperation with each other and with national bodies, and through the involvement and support of local communities".*

The NMP further emphasises the important role wind energy development plays in its contribution to renewable energy deployment in the state and in the progress towards renewable energy targets. In this regard, the NMP states:

"To date, wind energy has been the largest driver of growth in renewable electricity. The total amount of renewable generation connected to the grid at December 2016 was 3,120MW, of which wind generation was approximately 2,796MW, hydro was 238MW and biomass was 86MW. Eirgrid estimates that a total of between 3,900MW and 4,300MW of onshore renewable generation capacity will be required to allow Ireland to achieve 40% renewable electricity by 2020. This leaves a further requirement of between 780MW and 1,180MW to be installed by 2020 if the 2020 electricity target is to be reached, requiring an increased rate of installation".

3.5.4 The National Planning Framework [NPF]

The Department of Housing Planning and Local Government, on behalf of the Government, the National Planning Framework (NPF) under Project Ireland 2040, the overarching policy and planning framework for social, economic and cultural development in Ireland. The NPF is a national document that will guide at a high-level strategic planning and development for the country over the next 20 years, so that as the population grows, that growth is sustainable (in economic, social and environmental terms).

The NPF alongside the ten-year National Development Plan intends put together one plan to guide strategic development and infrastructure investment at national level. The NPF with the National Development Plan will also set the context for each of Ireland’s three regional assemblies to develop their Regional Spatial and Economic Strategies taking account of and co-ordinating local authority County and City Development Plans in a manner that will ensure national, regional and local plans align. The National Planning Framework is based on a set of values that will ensure Ireland’s “*long term economic, environmental and social progress for all parts of the country”*.

3.5.5 Transition to a Low Carbon and Climate Resilient Society [NPF]

The National Planning Framework states that in relation to rural areas and renewable energy that:

“The National Climate Policy Position establishes the national objective of achieving transition to a competitive, low carbon, climate-resilient and environmentally sustainable economy by 2050. This objective will shape investment choices over the coming decades in line with the National Mitigation Plan and the National Adaptation Framework. New energy systems and transmission grids will be necessary for a more distributed, renewables-focused energy generation system, harnessing both the considerable on-shore and off-shore potential from energy sources such as wind, wave and solar and connecting the richest sources of that energy to the major sources of demand.

There is significant alignment between the UN SDGs and the National Planning Framework’s National Strategic Outcomes (NSOs) in areas such as climate action, clean energy, sustainable cities and communities, economic growth, reduced inequalities and innovation and infrastructure, as well as education and health.”

Page 46 of the NPF states that the key future planning and development and place-making policy priorities for this Region include:

“Harnessing the potential of the region in renewable energy terms across the technological spectrum from wind and solar to biomass and wave energy, focusing in particular on the

extensive tracts of publicly owned peat extraction areas in order to enable a managed transition of the local economies of such areas in gaining the economic benefits of greener energy."

3.5.6 Strengthening Ireland's Rural Fabric and Supporting Rural Communities

Section 5.2 of the NPF provides objectives for Strengthening Ireland's Rural Fabric and Supporting Rural Communities.

"Rural communities, and particularly those engaged in farming, operate as custodians of the landscape by undertaking agricultural land management at varying scales. However, the viability of many landholdings is such that around half of farm families now depend on off-farm employment, much of which is focused on urban settlements. Alternative land uses such as forestry and renewable energy related development are also becoming more prevalent"

National Policy Objective 14 *"Protect and promote the sense of place and culture and the quality, character and distinctiveness of the Irish rural landscape that make Ireland's rural areas authentic and attractive as places to live, work and visit. The Action Plan for Rural Development will support this objective up to 2020; thereafter a review of the Action Plan will be undertaken to ensure continued alignment and consistency with the National Policy Objectives of this Framework."*

National Policy Objective 17 *Enhance, integrate and protect the special physical, social, economic and cultural value of built heritage assets through appropriate and sensitive use now and for future generations.*

National Policy Objective 21 *"Enhance the competitiveness of rural areas by supporting innovation in rural economic development and enterprise through the diversification of the rural economy into new sectors and services, including ICT-based industries and those addressing climate change and sustainability."*

Page 77- Energy Production

"Rural areas have significantly contributed to the energy needs of the country and will continue to do so, having a strong role to play in securing a sustainable renewable energy supply. In planning Ireland's future energy landscape and in transitioning to a low carbon economy, the ability to diversify and adapt to new energy technologies is essential.

Innovative and novel renewable solutions have been delivered in rural areas over the last number of years, particularly from solar, wind and biomass energy sources.

In meeting the challenge of transitioning to a low carbon economy, the location of future national renewable energy generation will, for the most part, need to be accommodated on large tracts of land that are located in a rural setting, while also continuing to protect the integrity of the environment and respecting the needs of people who live in rural areas."

Chapter 9 of the NPF 'Realising our Sustainable Future' sets out policies relating to environmental and sustainability goals. The NPF states amongst other things that "*The manner in which we plan is important for the sustainability of our environment. Our planning system has influence across a wide range of sectors, both directly and indirectly and interacts with many common issues related to effective environmental management, including water services, landscape, flood risk planning, protection of designated sites and species, coastal and marine management, climate mitigation and adaptation, and land use change."*

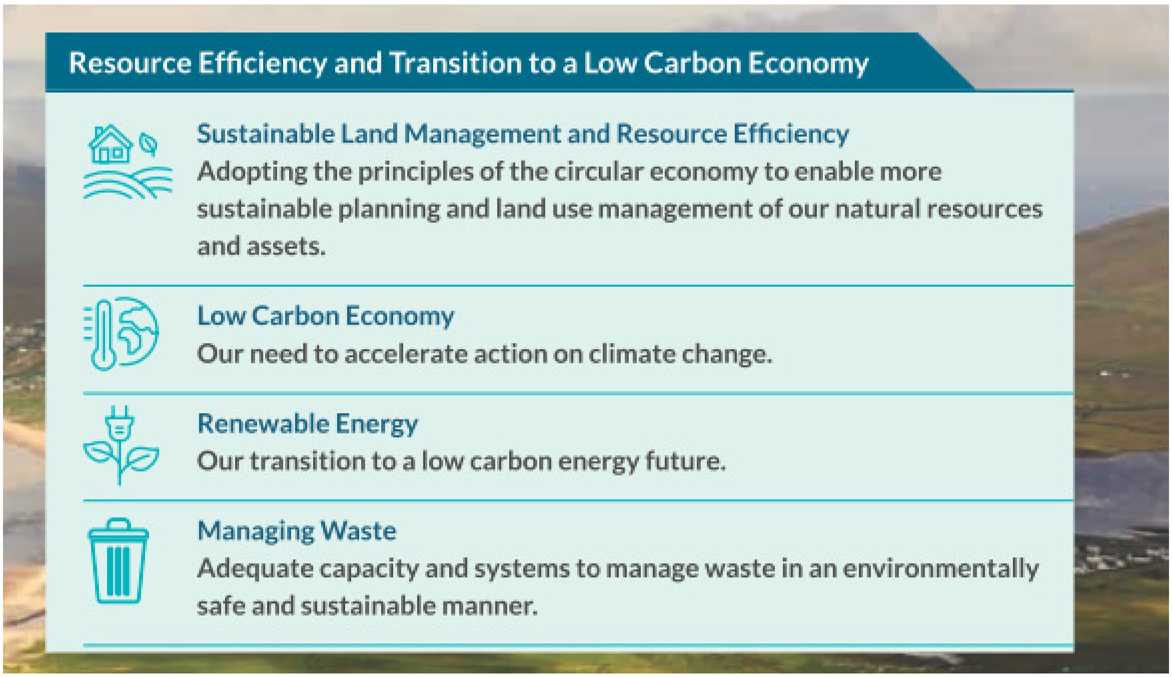


Figure 3.2 – Extract from page The National Planning Framework

Ireland's environment and its diverse landscapes form part of our 'green' persona and we have much to be proud of. While the overall quality of our environment is good, this masks some of the threats we now face. Key national environmental challenges include the need to accelerate action on climate change, health risks to drinking water, treating urban wastewater, protecting important and vulnerable habitats as well as diminishing wild countryside and dealing with air quality problems in urban areas. It is also important to make space for nature into the future, as our population increases.

The manner in which we plan is important for the sustainability of our environment. Our planning system has influence across a wide range of sectors, both directly and indirectly and interacts with many common issues related to effective environmental management, including water services, landscape, flood risk planning, protection of designated sites and species, coastal and marine management, climate mitigation and adaptation, and land use change.
As part of the National Planning Framework, in line with the EU vision of living well, within our limits and in support of environmental policy at European and national level, Government will address our environmental challenges through the following overarching aims:

National Policy Objective 52*"The planning system will be responsive to our national environmental challenges and ensure that development occurs within environmental limits, having regard to the requirements of all relevant environmental legislation and the sustainable management of our natural capital."*

3.5.7 As part Section 9.2 –Transitioning to a Low Carbon Economy

Page 119 of the NPF sets out objectives for climate action and planning:
"The global climate is changing and the changes underway will have consequences for Ireland in the period to 2040 and beyond. It is necessary to address the long-term causes of climate change through reducing our greenhouse gas emissions, while adapting to its effects over the short, medium and longer terms.

The Government is committed to a long-term climate policy based on the adoption of a series of national plans over the period to 2050, informed by UN and EU policy. This is being progressed through the National Mitigation Plan and the National Climate Change Adaptation Framework, both of which will be updated and reviewed periodically.

In addition to legally binding targets agreed at EU level, it is a national objective for Ireland to transition to be a competitive low carbon, economy by the year 2050. The National Policy Position establishes the fundamental national objective of achieving transition to a competitive, low carbon, climate is resilient and environmentally sustainable economy by 2050, guided by a long-term vision based on:

- *an aggregate reduction in carbon dioxide (CO2) emissions of at least 80% (compared to 1990 levels) by 2050 across the electricity generation, built environment and transport sectors; and*
- *in parallel, an approach to carbon neutrality in the agriculture and land-use sector, including forestry, which does not compromise capacity for sustainable food production.*

Meeting our commitments will require investment and ambitious and effective action across all sectors, as well as societal behavioural change. As an island, it is in our interest to ensure we respond to climate change and its impacts such as sea level change, more frequent and sustained rainfall events and greater vulnerability of low-lying areas to flooding. Our most densely populated areas, including our cities, are potentially vulnerable if we do not take the appropriate steps in flood risk management. Climate change also has significant consequences for food production and biodiversity.

If Ireland is to make up for lost ground in relation to carbon reduction targets and move towards the objective of a low carbon and climate resilient Ireland by 2050, it is necessary to make choices about how we balance growth with more sustainable approaches to development and land use and to examine how planning policy can help shape national infrastructural decisions.

In addition, Ireland's forests play an important role in helping with climate change mitigation, through carbon sequestration in forests and the provision of renewable fuels and raw materials. Irish forestry is a major carbon sink and afforestation is the most significant mitigation option that is available to Ireland's land use sector.

The planning process provides an established means through which to implement and integrate climate change objectives, including adaptation, at local level. Planning legislation also requires different levels of the planning process to address climate change.

If Ireland is to make up for lost ground in relation to carbon reduction targets and move towards the objective of a low carbon and climate resilient Ireland by 2050, it is necessary to make choices about how we balance growth with more sustainable approaches to development and land use and to examine how planning policy can help shape national infrastructural decisions."

National Policy Objective 54 "*Reduce our carbon footprint by integrating climate action into the planning system in support of national targets for climate policy mitigation and adaptation objectives, as well as targets for greenhouse gas emissions reductions.* "

Increases in population, economic growth, higher levels of food demand, transitioning to a more sustainable energy market and conservation goals will ultimately result in increased competition for suitable land to facilitate these accumulating pressures. Some parts of Ireland are more suitable than others for facilitating particular national sectoral aims by reason of physical factors, environmental sensitivities, land capacity and existing settlement patterns.

Ireland's national energy policy is focused on three pillars: (1) sustainability, (2) security of supply and (3) competitiveness. The Government recognise that Ireland must reduce greenhouse gas emissions from the energy sector by at least 80% by 2050, compared to 1990 levels, while at the same time ensuring security of supply of competitive energy sources to our citizens and businesses

National Policy Objective 55 *"Promote renewable energy use and generation at appropriate locations within the built and natural environment to meet national objectives towards achieving a low carbon economy by 2050."*

Transition to a Low Carbon and Climate Resilient Society

New energy systems and transmission grids will be necessary for a more distributed, more renewables focused energy generation system, harnessing both the considerable on-shore and off-shore potential from energy sources such as wind, wave and solar and connecting the richest sources of that energy.

State-owned commercial enterprises are significant players in the energy market, which is subject to an EU regulatory framework. Promotion of renewable energy is supported by policy in the form of a public service obligation levy.

The diversification of our energy production systems away from fossil fuels and towards green energy such as wind, wave, solar and biomass, together with smart energy systems and the conversion of the built environment into both generator/consumer of energy and the electrification of transport fleets will require the progressive and strategic development of a different form of energy grid.

The development of onshore and offshore renewable energy is critically dependent on the development of enabling infrastructure including grid facilities to bring the energy ashore and connect to major sources of energy demand. We also need to ensure more geographically focused renewables investment to minimise the amount of additional grid investment required, for example through co-location of renewables and grid connections.

Ireland benefits from interconnection with the UK gas pipeline network and while there are two gas pipelines with two separate entry points into the island of Ireland, both pipelines are connected through a single facility in Moffat, Scotland. In addition, our gas storage capacity is limited, which poses a security of supply risk and constrains smoothing of seasonal fluctuation in gas prices.

Green Energy

Deliver 40% of our electricity needs from renewable sources by 2020 with a strategic aim to increase renewable deployment in line with EU targets and national policy objectives out to 2030 and beyond. It is expected that this increase in renewable deployment will lead to a greater diversity of renewable technologies in the mix.

Reinforce the distribution and transmission network to facilitate planned growth and distribution of a more renewables focused source of energy across the major demand centres. Strengthen energy security and resilience to support an island population of 8 million people through effective north-south electricity grid interconnection as well as exploring other EU interconnection options in the longer term to 2040.

Consideration of carbon neutral electricity generation that would be facilitated through harnessing carbon capture and storage (CCS).

National Interconnector (Sub-sea Ring around Ireland) or other solutions offer the potential to connect Ireland to the EU electricity grid System.

Roll-out of the National Smart Grid Plan enabling new connections, grid balancing, energy management and micro grid development.

3.6 REGIONAL AND COUNTY PLANNING GUIDANCE

The South West Regional Authority adopted and published Regional Planning Guidelines in 2004. Legislation requires that the Guidelines are reviewed by the authority within six years.

The South West Region of Ireland, comprising Cork City and the Counties of Cork and Kerry has an area of approximately 12,100 sq. kilometres. The 2006 census records the regional population as 621,130 persons. Cork City is the second largest city in the State and the Greater Cork Area (CASP area), with a population in 2006 of 377,596, is one of the most dynamic areas of modern Ireland in terms of education, research and development, internationally traded services and high-technology manufacturing. The region is the European Headquarters for many multinational corporations in the electronics, software, food pharmaceutical, biopharma and associated sectors.

The Regional Planning Guidelines 2010-2022 for the South West Region provide a planning framework for the future physical, economic and social development of the Region. The Energy section of the RPG notes that the principal energy resources of the region comprise:

- The region’s natural gas resource including an extensive associated pipeline network; The Conoco Phillips oil refinery at Whitegate, County Cork; Major thermal electricity generating stations at Tarbert, County Kerry; Aghada/Whitegate, County Cork and Cork City Docklands;
- Inniscarra hydro-electric scheme, County Cork;
- A growing network of wind powered electricity generating stations in both Cork and Kerry.
- A modern electricity distribution grid serving the region

Within the region, the Regional Planning Guidelines support the sustainable development of renewable energy generation subject to the sustainable development of local areas and the protection of areas of high scenic amenity. Possible effects on Natura 2000 Sites, including effects on water supply and hydrology, wildlife disturbance, habitat loss and species mortality associated with collisions should be an essential consideration when planning for renewables and these should be considered at project-level stage.

3.6.1 Regional Planning Guidelines for the Southern Region

Arising under the Local Government Reform Act 2014 the Southern Regional Assembly has assumed a number of new functions. Chief among these responsibilities is the preparation of a Regional Spatial and Economic Strategy (RSES) for the Southern Region. Each one of the three Regional Assemblies will prepare their own Regional Spatial and Economic Strategy (RSES). The Regional Spatial and Economic Strategies will provide a long-term regional level strategic planning and economic framework in support of the implementation of the National Planning Framework.

The Southern Regional Assembly published its draft RSES on 19th December 2018 for consultation with a return date for observations of 8 March 2019.

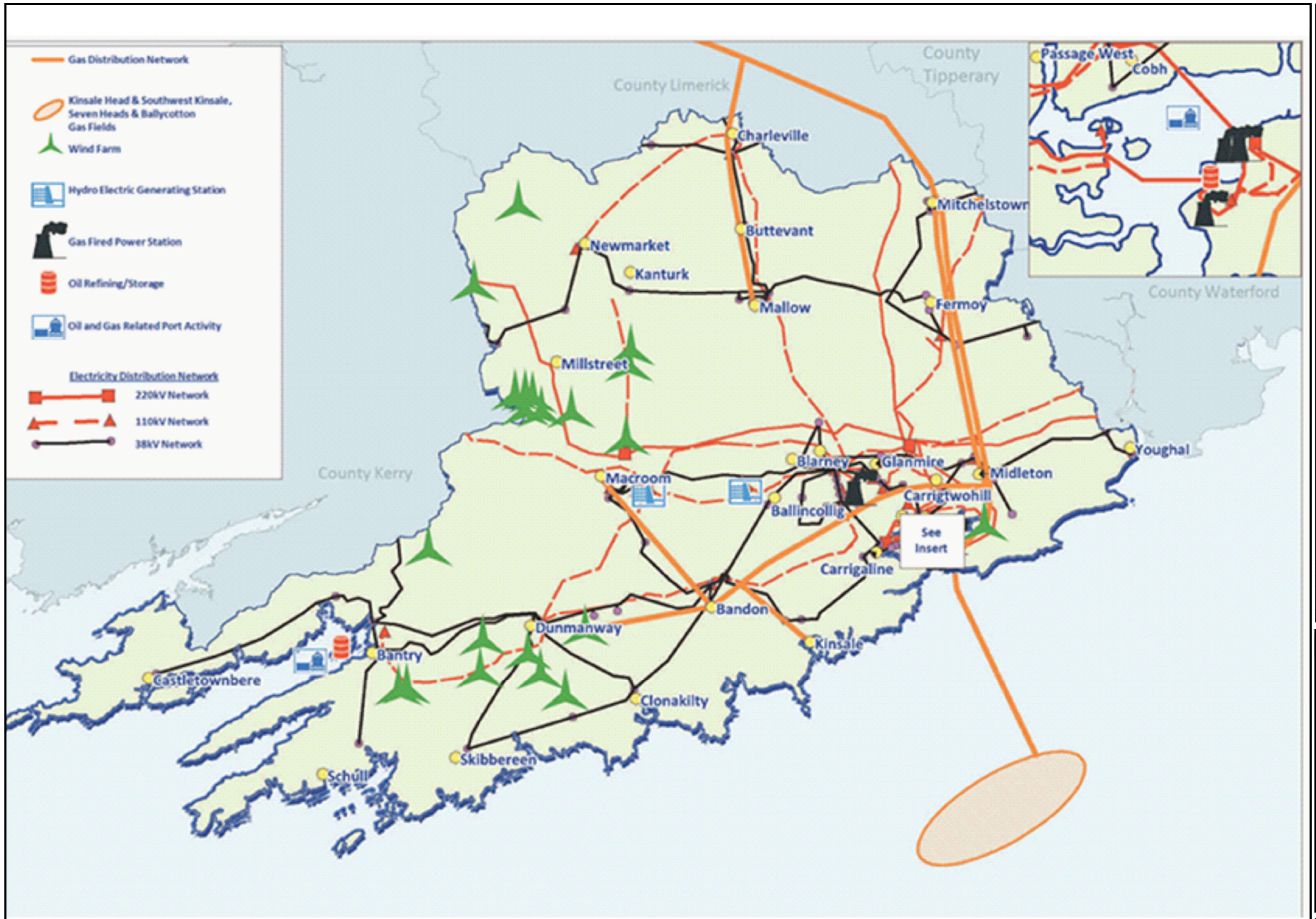
Section 5.1 mirrors the National Planning Framework is striving to achieve a Low Carbon Economy and RPO 85 includes within that objective *“….and increase the use of renewable energy sources across the key sectors of electricity supply, heating, transport and agriculture.”* RPO 91 states *“it is an objective to support and leverage the Southern Region as a leader and innovator in sustainable renewable energy generation”*.

3.6.2 Cork County Development Plan 2014 -2020

The Cork County Development Plan 2014 – 2020 (“the CDP”) was adopted on 08th December 2014 and presents an extensive list of policies regarding development management within the County. Variations were made to the Plan on the 12th February 2018.

Page 13 of the CCDP states that *“Environment - National Policy requires biodiversity to be considered as part of decision making and for biodiversity loss to be reduced and for substantial recovery to be achieved by 2020. This plan seeks to ensure a balance between protection of the environment including the maintenance and improvement of water quality and biodiversity and meeting the development needs of the County in accordance with relevant environmental legislation and guidance such as the Water Framework, Floods, Habitats and Birds Directives, Our Sustainable Future – a Framework for Sustainable Development in Ireland (DECLG, 2012), the National Biodiversity Plan and the National Climate Change Strategy.”*

Chapter 9 of the Cork County Development Plan sets out policies which relate to renewable energy. The Chapter 9 titled “*Energy and Digital Economy*” sets out planning policies relating to renewable energy and in particular onshore wind energy. Set out below are the key planning policies relation to the project proposals:



rev.	modifications	by	chkd	date
file	P:\Jod-jobs\4636 Dreenacreenig WF\700 Drawings\Grid Connection\Figures\Figure 3.3_FINAL.dwg			

client
ESB

project
PROPOSED GRID CONNECTION AT DERREENACRINNIG WEST WIND FARM CO CORK.

stage
PLANNING

title
KEY ENERGY AND RENEWABLE ENERGY INFRASTRUCTURE IN COUNTY CORK (EXTRACT FROM THE CORK COUNTY DEVELOPMENT PLAN 2014-2020)

scale
N.T.Scale

surveyed	drawn	checked	date
OSI	J.B.	B.C.	DEC 2018

JENNINGS O'DONOVAN & PARTNERS
CONSULTING ENGINEERS,
FINISKLIN,
SLIGO,
IRELAND.
TEL. +353 (0)71 916 1416
FAX. +353 (0)71 916 1080
Email: info@jodireland.com

Job Ref.	Drawing no.	revision
4636	Figure 3.3	

Figure 3.3 – Key Energy and Renewable Energy Infrastructure in County Cork [Extract from the Cork County Development Plan 2014-2020]

Paragraph 9.3.1 of the Cork County Development Plan "*sets out a plan led approach to on-shore wind energy development in County Cork and identifies suitable areas for sustainable wind energy development.*"

Paragraph 9.3.2 of the CCDP highlights that the Wind Energy Policy for the county has been largely unchanged since its inception in 2001. Reference is made to the 2006 Wind Energy Guidelines which are the current statement of government policy on onshore wind energy.

3.6.3 County Development Plan Objectives

ED 3-1: National Wind Energy Guidelines

Development of onshore wind shall be designed and developed in line with the 'Planning Guidelines for Wind Farm Development 2006" issued by DoELG and any updates of these guidelines.

ED 3-2: Wind Energy Projects

On-shore wind energy projects should focus on areas considered 'Acceptable in Principle' and Areas 'Open to Consideration' and generally avoid "Normally Discouraged" areas in this Plan.

ED 3-3: Wind Energy Generation Support a plan led approach to wind energy development in County Cork and identify areas for wind energy development. The aim in identifying these areas is to ensure that there are no significant environmental constraints, which could be foreseen to arise in advance of the planning process.

Paragraphs 9.3.5 to 9.3.7 set out the picture of wind energy development in County Cork. Paragraph 9.3.5 states that *"County Cork has the largest wind energy capacity in the Country at present with 283MW from 20 wind farms which is approximately 13.8% of Ireland's overall wind energy production."*

Paragraph 9.3.7 states that "*There is considerable potential for additional wind energy capacity if all the granted and pending wind farm developments are constructed.*"

Paragraph 9.3.9 of the Development Plan sets out key planning policy considerations for wind generation in the county. These considerations were:

- "*The approach taken by other adjoining Local Authorities (Kerry, Limerick, South Tipperary and Waterford) to Wind Energy in their respective County Development Plans.*

Of particular importance are the instances where adjoining Counties have adopted a policy discouraging wind energy projects.

- *The location of all existing and proposed wind energy developments and their cumulative impacts.*
- *The pattern of population distribution, so that the main centres of population can be avoided.*
- *Accessibility to the electricity distribution grid.*
- *Important or high value landscapes.*
- *Nature conservations sites and in particular Natura 2000 sites (SPA and SAC).*
- *The Water Framework Directive and River Basin Management Plans for the County, so that impacts on the rivers, lakes and other waterbodies of the County could be avoided.*
- *The Sustainable Energy Ireland (SEI) Wind Atlas, 2003 was utilised to identify areas with viable wind speeds."*

The development including the proposed grid connection is located within an area which is open to consideration in the County Development Plan as shown in figure 3.4. The development is not located in an area of 'High Value Landscape' as shown in Figure 13.2 of the Cork County Development Plan. Further details on the surrounding landscape and the potential impact the proposed development could have on these areas, are discussed in Chapter 11of this EIAR

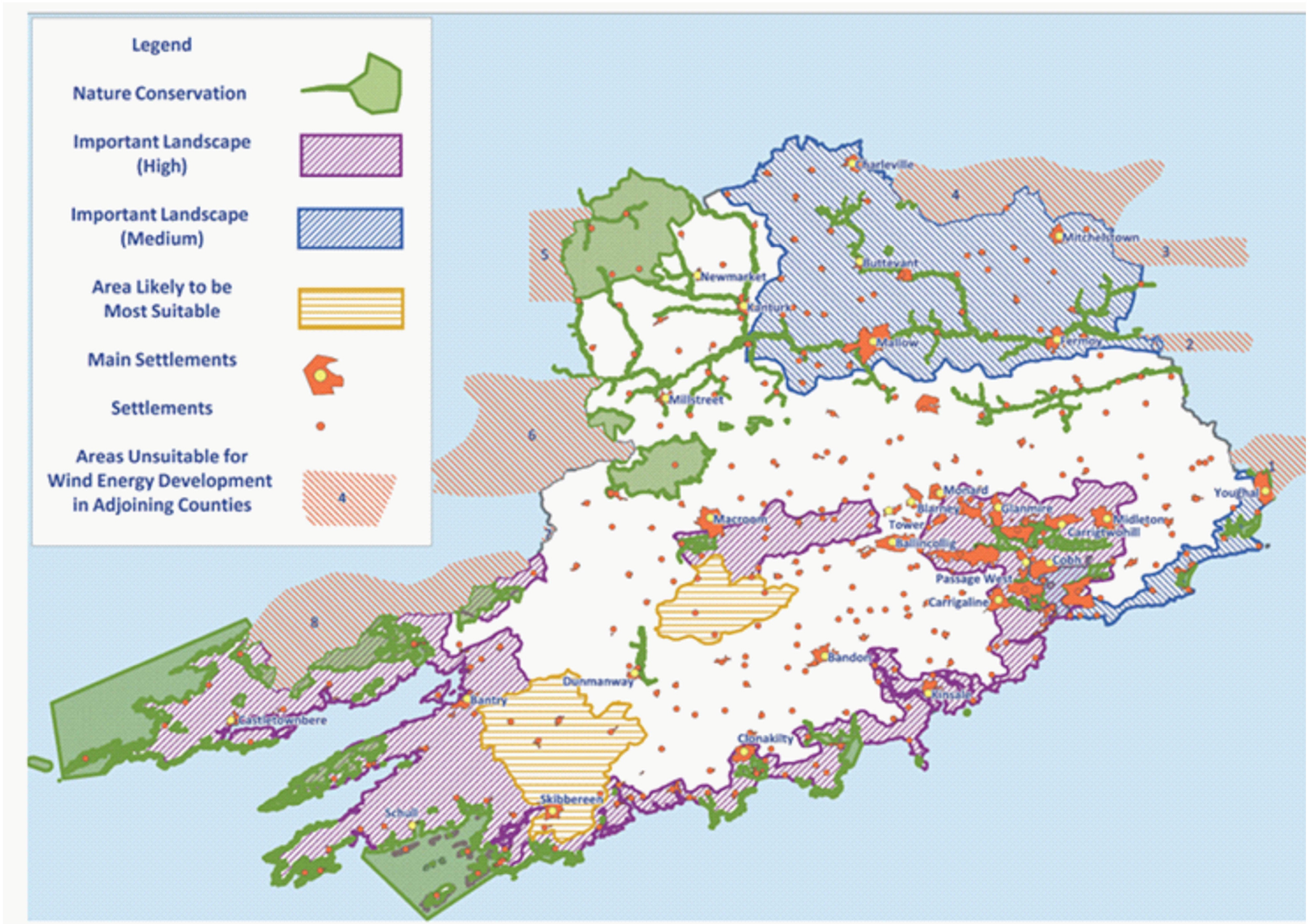


Figure 9.2 Policy Considerations for Wind Energy Projects

rev.	modifications	by	chkd	date

client
ESB

project
PROPOSED GRID CONNECTION AT DERREENACRINNIG WEST WIND FARM CO CORK.

stage
PLANNING

title
EXTRACT FROM PAGE 137 OF THE CCDP SHOWING POLICY CONSIDERATIONS FOR WIND ENERGY PROJECTS

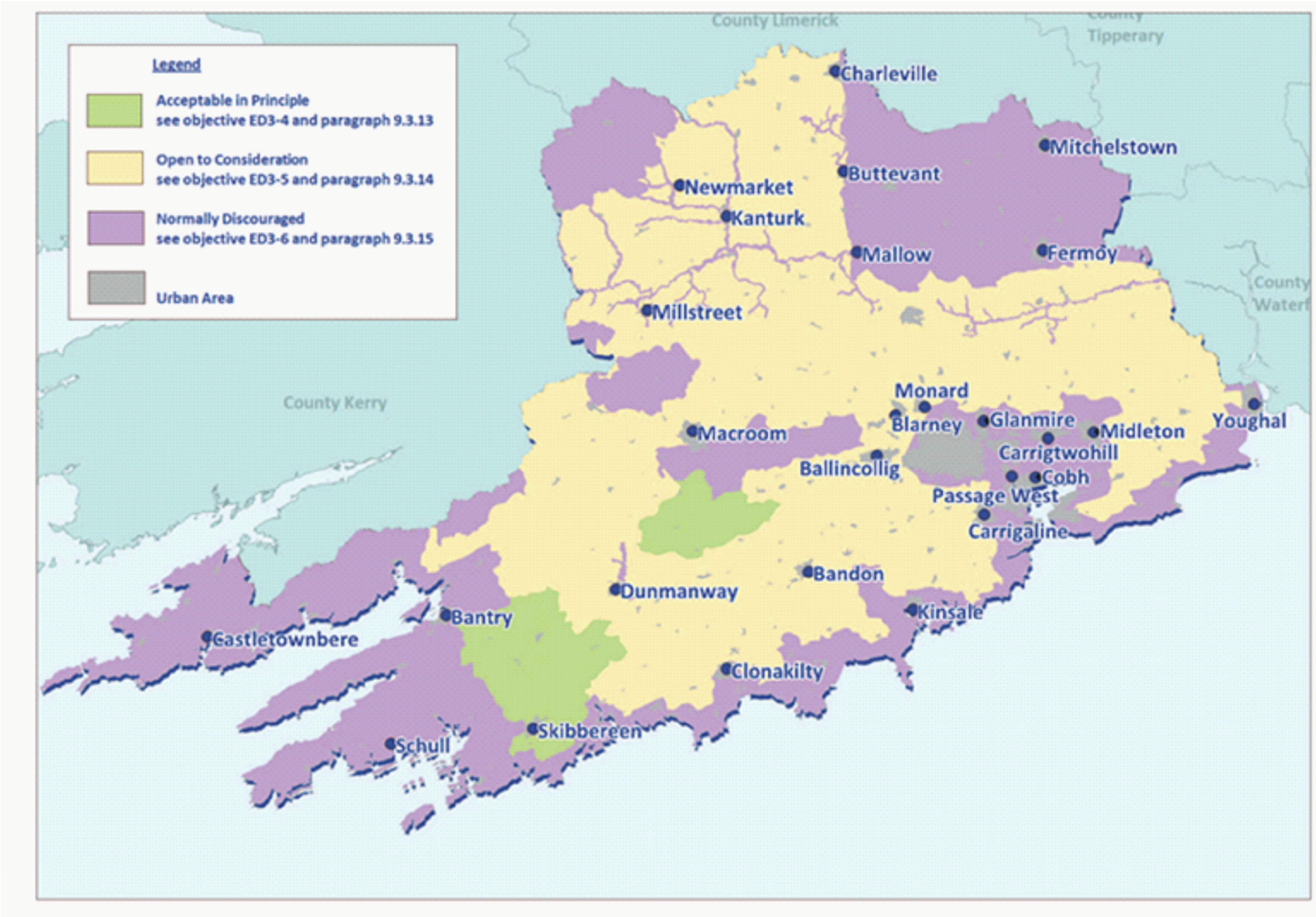
scale
N.T.Scale

surveyed	drawn	checked	date
OSI	J.B.	B.C.	DEC 2018

COPYRIGHT OF
JENNINGS O'DONOVAN & PARTNERS
CONSULTING ENGINEERS,
FINISKLIN,
SLIGO,
IRELAND.
TEL. +353 (0)71 916 1416
FAX. +353 (0)71 916 1080
Email: info@jodireland.com

Job Ref.	Drawing no.	revision
4636	Figure 3.4	

Figure 3.4 – Extract from page 137 of the CCDP showing policy considerations for wind energy projects



rev.	modifications	by	chkd	date
file	P:\Jod-jobs\4636 Dreenacreenig WF\700 Drawings\Grid Connection\Figures\Figure 3.5_FINAL.dwg			

client
ESB

project
PROPOSED GRID CONNECTION AT DERREENACRINNIG WEST WIND FARM CO CORK.

stage
PLANNING

title
EXTRACT MAP FROM THE CORK COUNTY DEVELOPMENT PLAN 2014-2018

scale
N.T.Scale

surveyed	drawn	checked	date
OSI	J.B.	B.C.	DEC 2018

JENNINGS O'DONOVAN & PARTNERS
CONSULTING ENGINEERS,
FINISKLIN,
SLIGO,
IRELAND.
TEL. +353 (0)71 916 1416
FAX. +353 (0)71 916 1080
Email: info@jodireland.com

Job Ref.	Drawing no.	revision
4636	Figure 3.5	

Figure 3.5 – Extract map from the Cork County Development Plan

ED 3-5: Open to Consideration "*Commercial wind energy development is open to consideration in these areas where proposals can avoid adverse impacts on:*

- *Residential amenity particularly in respect of noise, shadow flicker and visual impact;*
- *Urban areas and Metropolitan/Town Green Belts;*
- *Natura 2000 Sites (SPA and SAC), Natural Heritage Areas (NHA's) or adjoining areas affecting their integrity.*
- *Architectural and archaeological heritage;*
- *Visual quality of the landscape and the degree to which impacts are highly visible over wider areas."*

3.6.4 Current Wind Energy Development in County Cork

There have been planning applications for a total of 79 wind farms in County Cork to date; 19 of these wind farms have been commissioned to date producing 269MW of electricity or 13.1% of the national total. There is the potential for a total of 720 MW of wind energy to be produced in County Cork as a result of the existing, permitted and pending wind farm applications should all these be granted.

3.6.5 Transmission Lines

The County Development Plan for County Cork has two objectives relating to transmission lines, as follows:

Objective ED 6-1: *"Electricity Network Support and facilitate the sustainable development, upgrade and expansion of the electricity transmission grid, storage and distribution network infrastructure.*
Support the sustainable development of the grid including strategic energy corridors and distribution networks in the region to international standards.

Facilitate where practical and feasible infrastructure connections to wind farms and other renewable energy sources subject to normal proper planning considerations.

Proposals for development which would be likely to have a significant effect on nature conservation sites and/or habitats or species of high conservation value will only be approved if it can be ascertained, by means of an Appropriate Assessment or other ecological assessment, that the integrity of these sites will not be adversely affected."

Objective ED 6-2: *"Transmission Network Proposals for new electricity transmission networks need to consider the feasibility of undergrounding or the use of alternative routes especially in* *landscape character areas that have been evaluated as being of high landscape sensitivity. This is to ensure that the provision of new transmission networks can be managed in terms of their physical and visual impact on both the natural and built environment and the conservation value of European sites.*

Proposals for development which would be likely to have a significant effect on nature conservation sites and/or habitats or species of high conservation value will only be approved if it can be ascertained, by means of an Appropriate Assessment or other ecological assessment, that the integrity of these sites will not be adversely affected."

The given policies from the Cork County Development Plan are given for ease of reference and are thought those most relevant by the applicant to this type of development. Individual technical assessments included with the EIAR will also refer to CDP policies where relevant.

The Grid25 Implementation Programme provides a foundation for more detailed work on specific reinforcements in coming years and will lead to plans for particular projects which will be delivered in consultation with the public and in line with planning legislation. Grid25 is fully consistent with the Gate process for the connection of Renewable Energy in Ireland.

Grid connection can be either through direct connection to the transmission network (110kV/220kV/400kV), controlled by EirGrid, or to a local distribution system (normally 38kV), controlled by ESB networks and depends on the amount of electricity generated.

The project proposals meet all relevant planning policy consideration in the Cork County Development Plan 2014. Although there has been a change in County Development Plan since the grant of the Wind Farm element, it is considered that the current local plan policies take a more proactive approach to renewable energy in the County. Cork accounts for 13% of Ireland's energy use and Cork accounts for 24% of Ireland's energy use requirements (the rest of Ireland produces 21% and the remaining 55% is imported).

3.6.6 Windfarm Development Guidelines (2006)

The Department of Environment, Heritage and Local Government ("the Department") Planning Guidelines for Wind Energy (2006) ("the 2006 Guidelines") offer guidance to planning authorities on planning for wind energy through the County Development Plan process, and in determining applications for planning permission. They also offer guidance to developers and the wider public in making informal decisions about wind farm development. The aim of the document is to:

"… offer advice to planning authorities on planning for wind energy through the development plan process and in determining applications for planning permission. The guidelines are also intended to ensure a consistency of approach throughout the country in the identification of suitable locations for wind energy development and the treatment of planning applications for wind energy developments. They should also be of assistance to developers and the wider public in considering wind energy development".

Detailed guidelines are given on all aspects of wind farm development – including site choice, visual aesthetics, turbine layout, construction considerations etc. Advice is also given on the need to balance any potential impacts of the wind farm development on environmental heritage, with the benefits of the development – reduced dependency on fossil fuels and a subsequent reduction in greenhouse gases amongst others.

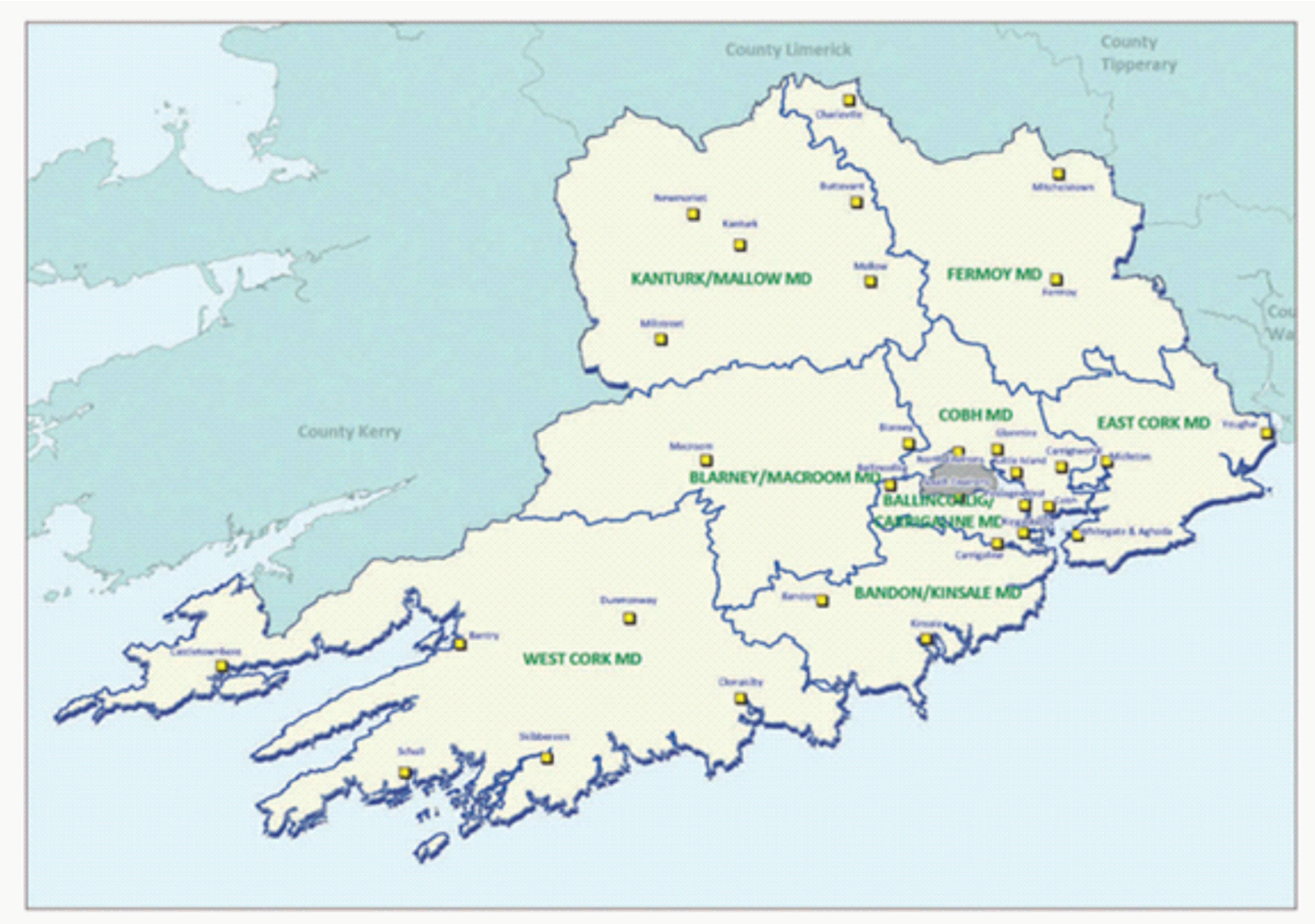
The Department of the Environment, Community and Local Government has recently published the provisional results of a targeted review of the 2006 Guidelines in relation to noise, proximity and shadow flicker. Relevant sections of the 2006 Guidelines on these specific issues were updated and put forward in a proposed revisions document for public consultation. There was also a number of technical appendices developed to assist planning authorities in relation to noise assessment, monitoring and the setting of planning conditions. Written submissions on the proposed revisions to the 2006 Guidelines were invited. Submissions on other sections of the 2006 Guidelines or additional matters were not considered as it was not proposed to carry out a full review at that time.

It is noted by the Department that as this was a targeted review focusing on specific issues, all the other sections of the current 2006 Guidelines (including existing appendices) will remain in place.

The draft approach identified by the Department in June 2017 to update the 2006 Guidelines is currently subject to a Strategic Environmental Assessment process.

3.6.7 West Cork Municipal District Local Area Plan

The Local Area Plan for the West Cork Municipal District was adopted on the 24th July 2017 and came into effect on the 21st August 2017. It sets out the detailed planning strategy and land use zoning as appropriate for the towns and villages of the Municipal District.



rev.	modifications	by	chkd	date

client: ESB

project: PROPOSED GRID CONNECTION AT DERREENACRINNIG WEST WIND FARM CO CORK.

stage: PLANNING

title: Municipal District Map (The Local Area Plan for The West Cork Municipal District 2017)

scale: N.T.Scale

surveyed	drawn	checked	date
OSI	J.B.	B.C.	DEC 2018

JENNINGS O'DONOVAN & PARTNERS
CONSULTING ENGINEERS,
FINISKLIN,
SLIGO,
IRELAND.
TEL. +353 (0)71 916 1416
FAX. +353 (0)71 916 1080
Email: info@jodireland.com

Job Ref.	Drawing no.	revision
4636	Figure 3.6	

Figure 3.6 – Municipal District Map

The plan sets out a number of Local Area Plan Objectives for the Plan Area. Section 4.5 of the local area plans set out details relating to the village of Drimoleague.

3.7 CONCLUSION

At present, there is specific supporting international, national, regional, and local policy and/or guidance for commercial onshore wind energy development in Ireland.

Since the grant of planning permission for the consented Derreenacrinnig West Wind Farm, there has been a change in both local and national planning policy which are more proactive in terms of renewable energy. There is acknowledgment that there is a pressing need to meet renewable energy targets.

The National Planning Framework, Regional Planning Guidelines, the Cork County Development Plan are considered supportive of the development of renewable energy technology, particularly in the context of reducing the carbon emissions of the country and meeting renewable energy production targets.

Recent SEAI reports show that while significant progress has been made to date, there is still an acceleration of effort required to implement renewable energy developments to meet future targets. This effort is also likely going to be persistent throughout the 2020s and to 2050 to meet long-term climate change aims.

Ireland's capacity to generate electricity through wind energy is significant being one of the windiest nations in Europe. The wind, if harnessed properly can provide a significant, sustainable and renewable source of energy. Wind energy has the potential to provide an important conventional electricity generating capacity.

One of the main reasons behind the emergence of wind energy is that is environmentally friendly reputation. One of the key environmental benefits is the harnessing of renewable energy that reduces Ireland's reliance on non-renewable sources of energy, which contribute to greenhouse gas emissions.

4 POPULATION AND HUMAN HEALTH

4.1 INTRODUCTION

4.1.1 Background and Objectives

Jennings O'Donovan & Partners Ltd. ("JOD"), have been commissioned by to assess the potential impacts of the EIA Development on population and human health. Full details of the EIA Development are provided in **Section 2: Project Description**.

ESBN apply to An Bord Pleanála for substitute consent for an overhead Grid Connection to connect the already consented Derreenacrinnig West Wind Farm, Co Cork to the national grid at the existing 110kV Ballylicky ESB substation in Co. Cork.

This section of the EIA examines the potential population and human health impacts of the overall development which includes the existing grid connection, the consented wind farm, the proposed grid connection and the cumulative impacts of both the grid connection and wind farm and all on-site infrastructure.

This section examines the baseline of the area where the EIA Development is situated, identifies, describes and assesses the potential population and human health effects of the EIA Development during the construction, operation and decommissioning phases. Where appropriate, mitigation measures have been proposed to avoid, prevent, reduce or, if necessary, offset any identified significant adverse effects.

The assessment also includes additional information as required by the EIA Directive, where relevant to the proposed EIA Development. 'Population' and 'human health' are the terms now referred to in the Revised EIA Directive, replacing the term 'human beings' in the EIA Directive. The EIA Directive Consultation (refer to Section 1.2.2) states that:

"It is considered that the change from "human beings" to "population and human health" in relation to EIA is primarily clarificatory and to ensure consistency with, in particular, the SEA Directive.

It is intended that the consideration of the effects on populations and on human health should focus on health issues and environmental hazards arising from the other environmental factors, for example water contamination, air pollution, noise, accidents, disasters, and not requiring a wider consideration of human health effects which do not relate to the factors identified in the Directive.

It is not considered this should be understood as requiring consideration of social and/or economic impacts.
Where other health and safety requirements are addressed in accordance with other regulatory requirements, the EIA report should take account of the results of such assessments without duplicating them.

Guidance on the information in relation to 'population human health' to be included in an Environmental Impact Assessment Report will be provided".

This section of the EIAR provides an impact assessment on the effects of the proposed EIA Development on those issues listed above, in addition to other factors deemed relevant to the proposal.

One of the principle concerns in the development process is that people, as individuals or communities, should experience no diminution in their quality of life from the direct or indirect impacts arising from the construction and operation of a development. Ultimately, all the impacts of a development impinge on human beings, directly and indirectly, positively and negatively. The key issues examined in this section of the EIAR include population, human health, employment and economic activity, land-use, residential amenity, community facilities and services, tourism, property values, health and safety. Shadow Flicker and Noise are dealt with in Chapters 9 and 10 respectively. This section of the EIAR provides an impact assessment on the effects of the proposed EIA Development on those issues listed above, in addition to other factors deemed relevant to the proposal.

4.1.2 Statement of Authority

JOD have extensive experience in all aspects of wind farm development, from design and planning stages through to construction. JOD have been active as engineering consultants in the wind energy market in Ireland since 1998 and have completed numerous wind farm projects, varying from single wind turbine installations to large-scale, multi-turbine developments with a total of over 2,000 MW generation capacity.

4.1.3 Study Area for the Existing and Proposed Grid Connection

The study area for both the existing and proposed grid connection relating to the population and human health aspects of the EIAR is defined in terms District Electoral Division [DED]. The site of the wind farm and the existing and proposed grid connection is situated with the townlands of *Ardrah, Ards More (East), Ards Beg, Barnagowlane West, Ballylicky, Crossoge, Derreenacrinnig West, Dromlickacrue, Derryarkane, Dromclarig, Gortroe, Gortnacowly,* *Glanareagh, Laharanshermeen, Maulikeeve, Maularaha, and Shandrum More ("the Existing Development Site.).*

4.1.4 Study Area for Consented Derreenacrinnig West Wind Farm

The study area for the consented Wind Farm is shown in **2.1**. The 2010 EIS for the permitted Derreenacrinnig West Wind Farm examined the potential impacts that the consented wind farm may have on Human Beings, during the construction and operational phase of the project. Those aspects relating to Human Health relating to the population and human health aspects of the EIAR is defined in terms District Electoral Division [DED]. The site of the wind farm and the existing and proposed grid connection is situated with the Municipal District of West Cork.

4.1.5 Assessment Structure

This Section contains the following sections:

- Assessment Methodology and Significance Criteria – a description of the methods used in baseline surveys and in the assessment of the significance of effects;
- Baseline Description - a description of the socio-economic profile of the area of the Proposed Development Site (i.e. County Cork and the local area) based on a desk-based study using Central Statistics Office (CSO) data;
- Assessment of Potential Effects - identifying the ways in which the population and human health of the area could be affected by the EIA Development;
- Mitigation Measures and Residual Effects - a description of measures recommended to avoid, prevent, reduce or, if necessary, offset any potential significant adverse effects and a summary of the significance of any residual effects of the EIA Development after mitigation measures have been implemented;
- Cumulative Effects – identifying the potential for effects of the EIA Development to combine with those from other developments to affect the population and human health;
- Summary of Significant Effects;
- Statement of Significance; and
- Comparison with EIS, November 2010, prepared by JOD ("the 2010 EIS") - commentary identifying any material variations in potential effects and levels of significance.

4.1.6 Scope of the Assessment

The effect of a development on population and human health includes the following broad areas of investigation:

- Population and Settlement Patterns;
- Economic Activity and Tourism;

- Employment;
- Topography and Land Use;
- Accidents / Disasters (incorporating health and safety); and
- Human Health.

Where a negative impact can be foreseen it is avoided, prevented, reduced or, if necessary, offset by way of practical mitigation measures.

This assessment has considered the following criteria:

- Sensitive receptors in the area;
- Existing land use in the area;
- General amenities in the area; and
- Potential effects from traffic, shadow flicker, noise and air quality (including dust).

These criteria are assessed for the construction, operational and demolition / decommissioning phases.

Where appropriate, a Study Area of 20km from the proposed EIA Development has been used.

4.2 ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA

4.2.1 Assessment Methodology

A desk study was undertaken to assess the potential impacts on population and human health. The desk study involved the assessment of data from the Central Statistics Office (CSO) and a review of the Cork County Development Plan 2014 – 2020 ("the CDP") was undertaken along with the West Cork Local Area Plan [August 2017] ("the Local Area Plan").

Websites of the following organisations were also consulted:

- Central Statistics Office (www.cso.ie);
- National Parks and Wildlife Services (www.npws.ie);
- Sustainable Energy Authority of Ireland (www.seai.ie);
- Environmental Protection Agency (www.epa.ie);
- Fáilte Ireland (www.faillteireland.ie);
- Discover Ireland (www.discoverireland.com);
- Irish trails (www.irishtrails.ie);
- National Roads Authority (www.nra.ie); and
- Cork County Council (www.corkcoco.ie).

4.2.2 Relevant Legislation and Guidance

The population and human health section of this EIAR is carried out in accordance with guidance contained in the following documents:

4.2.3 Cork County Development Plan 2014-2020

The Cork County Development Plan 2014 – 2020 (“the CDP”) contains the following policies of relevance:

Chapter 1: Introduction

There are a number of development plan principles which are or relevance to the project proposals. Paragraph 1.2.8 sets out details relating to sustainability and climate change.

Climate Change Adaption

- While we do not have a complete understanding of how climate change in Ireland will unfold, it is clear that human activity is influencing climate change, and that this in turn will lead to a range of current and future impacts. The climate change impacts include rising sea levels, more intense rainfall events and flooding. Adaptation to the adverse effects of climate change is vital in order to reduce the impacts of climate change that are happening now and increase resilience to future impacts. The National Climate Change Strategy 2007-2012 has set a target to cut emissions by at least 20% by 2020. The plan addresses the main areas where this can be achieved in the sections dealing with energy, land use planning, transport, waste management and biodiversity

There is a plethora of planning policies contained in CCDP which support energy generation from renewable sources.

4.2.3.1 The Cork County Local Economic and Community Plan

The Cork LECP was prepared in 2015/ 2016 and essentially the plan identifies key social and economic assets and seeks to reflect the residents of the county value, what Cork’s strengths are, what Cork’s ambition is, what investors desire, and, how stakeholders might co-ordinate to protect and enhance those Key assets. The plan looks at the following key priorities:

- Employment
- R&D / Innovation
- Climate Change / Energy
- Education, and,
- Poverty / Social Inclusion

The LECP sets out a number of strategic policies for Climate Change/Energy. Those policies are set out below:

Climate Change / Energy

HLG 1: *"Provide for the alignment of County Cork with the national targets for emission reductions"*

HLG 2: *"Provide for potential climate change impacts within County Cork, including adaption"*

HLG 3: "*Ensure that our activities and places, existing and proposed, are robust in terms of energy choice"*

HLG 4: *"Provide for the harnessing of County Cork's energy potential, including the protection of Cork's locational and other energy assets"*

HLG 5: "*Provide for the creation of a local circular economy model of sustainability"*

CS 5-1: Climate Change Adaptation: "*The LECP recognises the importance of climate change adaption and supports the drafting of a climate change adaption strategy for the Cork region, in order to future-proof our communities and regional economy."*

4.2.3.2 Investigation into the Assessment of Health Impacts within National Environmental Regulation Processes

The 'Investigation into the Assessment of Health Impacts within National Environmental Regulation Processes' (2015[7], produced by Golder Associated and commissioned by the EPA, was a study into how human health impacts are dealt with throughout the European Union ("EU") by environmental regulators with an emphasis on the role of at the planning / environment interface.

4.2.4 Evaluation of Potential Effects

Following on from the identification of the baseline environment, the available data is utilised to identify, categorise and assess potential impacts likely to have a significant effect on the population and human health, as a result of the proposed EIA Development.

The statutory criteria (EPA, 2002; EPA, 2003) for the assessment of impacts require that likely impacts are described with respect to their extent, magnitude, type (i.e. negative, positive or neutral) probability, duration, frequency, reversibility, and transboundary nature (if applicable). The descriptors used in this EIAR are those set out in EPA (2002) 'Glossary of Impacts'.

[7] Golder Associates (2015) 'Investigation into the Assessment of Health Impacts within National Environmental Regulation Processes'. Available at: http://www.epa.ie/pubs/reports/research/health/assessmentofhealthimpactsreport.html

Impacts may be categorised as follows:

- Direct: where the existing socio-economic baseline along or in close proximity to the EIA Development is altered, in whole or in part.
- Indirect: where the socio-economic baseline beyond the EIA Development is altered by activities related to the construction or operation of the EIA Development.
- No Impact: where the EIA Development has neither negative nor a positive impact upon the socio-economic baseline.

4.2.4.1 Magnitude

The magnitude of potential impacts has been defined in accordance with the criteria provided in the 2002 EPA publication 'Guidelines on the information to be contained in Environmental Impact Statements' as outlined within **Table 4.1** below.

<u>Table 4.1:</u> Impact Assessment Criteria

Magnitude of Impact	**Description**
Imperceptible	An impact capable of measurement but without noticeable consequences
Slight	An impact that alters the character of the environment without affecting its sensitivities
Moderate	An impact that alters the character of the environment in a manner that is consistent with existing or emerging trends
Significant	An impact, which by its character, magnitude, duration or intensity alters a sensitive aspect of the environment
Profound	An impact which obliterates all previous sensitive characteristics
Magnitude of Impact	Description

4.2.4.2 Significance Criteria

The significance of the potential effects of the EIA Development have been classified by taking into account the sensitivity of receptors and the magnitude of the potential effect on them, combined with the likelihood of an impact occurring as defined in **Table 4.2**.

Table 4.2: Rating of Significant Environmental Impacts

	Magnitude of Impact				
Importance of Attribute		**Negligible**	**Small**	**Moderate**	**Large**
	Extremely High	Imperceptible	Significant	Profound	Profound
	Very High	Imperceptible	Significant/ Moderate	Profound/ Significant	Profound
	High	Imperceptible	Moderate/ Slight	Significant/ Moderate	Severe/ Significant
	Medium	Imperceptible	Slight	Moderate	Significant
	Low	Imperceptible	Imperceptible	Slight	Slight/ Moderate

4.3 BASELINE DESCRIPTION

The existing environment, as it relates to population and human health is outlined in the following section.

4.3.1 Existing Population and Settlement Patterns in the vicinity of The Existing and Proposed Grid Connection

The existing and proposed grid connection is located within a rural area which traverses some a number of townlands in Co Cork. The grid connection, yet to be constructed, comprises some 4.379km of Grid Connection as depicted in Figure 4.1. The grid connection already constructed will not have an adverse impact on the existing population.

4.3.1.1 The National Picture

Ireland has seen a rapid population growth in recent years with improved standard of living and infrastructure growth resulting in net inflows of population. The Country has seen a population increase since 1911 from 3,139,688 to 4,588,252 as per the 2011 Census. The population of Ireland was 4,761,865 in April 2018 and increase of 173,613. Figure 4.2 shows the total population and intercensal change, 1956-2016.

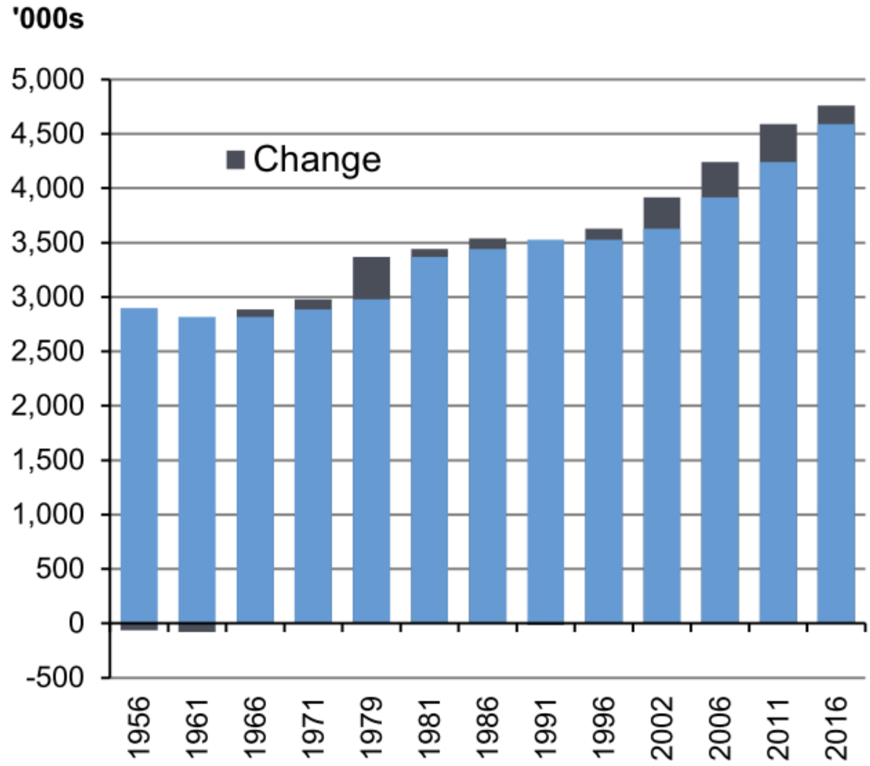


Figure 4.2 – Extract from CSO [2016]

Table 1.1 Population, 1956-2016

Census year	Population	Change	%
1956	2,898,264	-62,329	-2.1
1961	2,818,341	-79,923	-2.8
1966	2,884,002	65,661	2.3
1971	2,978,248	94,246	3.3
1979	3,368,217	389,969	13.1
1981	3,443,405	75,188	2.2
1986	3,540,643	97,238	2.8
1991	3,525,719	-14,924	-0.4
1996	3,626,087	100,368	2.8
2002	3,917,203	291,116	8.0
2006	4,239,848	322,645	8.2
2011	4,588,252	348,404	8.2
2016	4,761,865	173,613	3.8

Figure 4.3 – Extract from CSO [2016]

4.3.1.2 Regional Quality of Life in Ireland 2013

The National Statistics Board further requested that the CSO provide a comprehensive set of social indicators with the emphasis on disaggregation by key characteristics such as the nine equality grounds. This was the background to the production of the first report on the Regional Quality of Life in Ireland in 2008. Reports on the theme of gender, ageing and young people have since been produced. This is the second report on the Regional Quality of Life in Ireland.

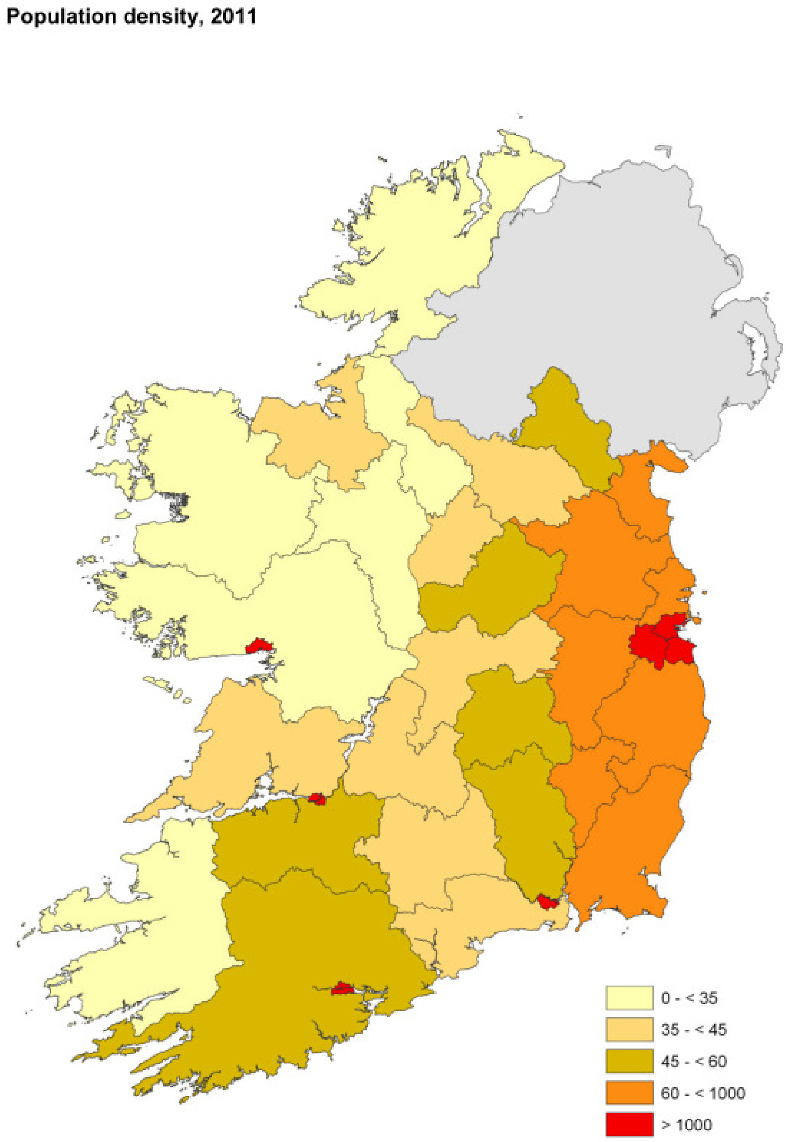


Figure 4.4 – Extract from CSO Website

4.3.1.3 Population

Population change by county varied widely within the County of Cork. For example, Cork city grew by 5.4% compared with Cork county 4.4% as a whole. According to the 2016 census the population of County Cork [excluding Cork City] was 417,211 at the time of the 2016 Census. This represents an increase of 4.4% in population from the 2011 Census.

For West Cork, the population was 57,052 at the time of the 2016 Census, representing an overall population increase of 0.9% compared to the 2011 census. Skibbereen Rural had a population of 1,300 at the time of the 2016 Census which represents a 3.8% increase from the 2011 census.

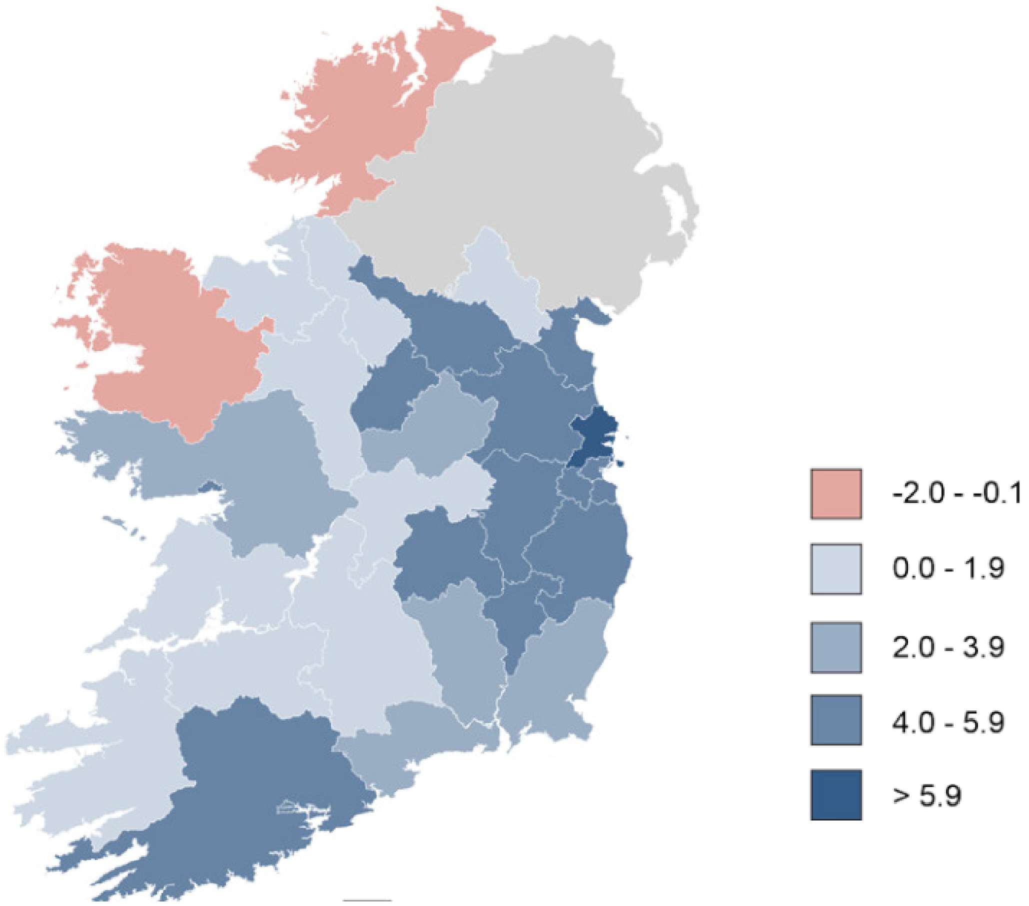


Figure 4.5 - Percentage population change by county, 2011-2016 [Extract from CSO website]

4.3.2 Economic Activity and Tourism

<u>Table 4.3:</u> Broad Occupational Groups in County Cork (CSO 2016)

Persons at work by industry	Total
Agriculture, forestry and fishing	11,873
Building and construction	20,899
Manufacturing industries	30,155
Commerce and trade	
Transport and communications	12,800
Public administration	

Persons at work by industry	Total
Professional, technical and health	40,256
Other	53,358
Total	

4.3.2.1 Employment

The Central Statistics Office states that the number of persons at work stood at 2 million, up 11 per cent since 2011 while the number of unemployed persons was 297,396, down 30.0 per cent. The number of persons looking after the home/family continued to decline, down 10.1 per cent over the five years. The number of retired persons increased to 545,407, up 88,013 or 19.2 per cent on 2011 and has more than doubled since 1996.

Table 1.1 Persons aged 15 or over by economic status, 2006 - 2016

	2006	2011	2016
Persons at work	1,930,042	1,807,360	2,006,641
Looking for first job	29,372	34,166	31,434
Unemployed	150,084	390,677	265,962
Labour force (A)	2,109,498	2,232,203	2,304,037
Not in labour force (B)	1,265,901	1,376,459	1,451,276
Population aged 15 or over (=A+B)	3,375,399	3,608,662	3,755,313
Labour force participation rate	62.5%	61.9%	61.4%
Unemployment rate	8.5%	19.0%	12.9%

Figure 4.6 – Extract from CSO 2016

Employment figures by industry for County Cork have been compiled by the Central Statistics Office (CSO). The unemployment rate for the County stood at 9.2 %.

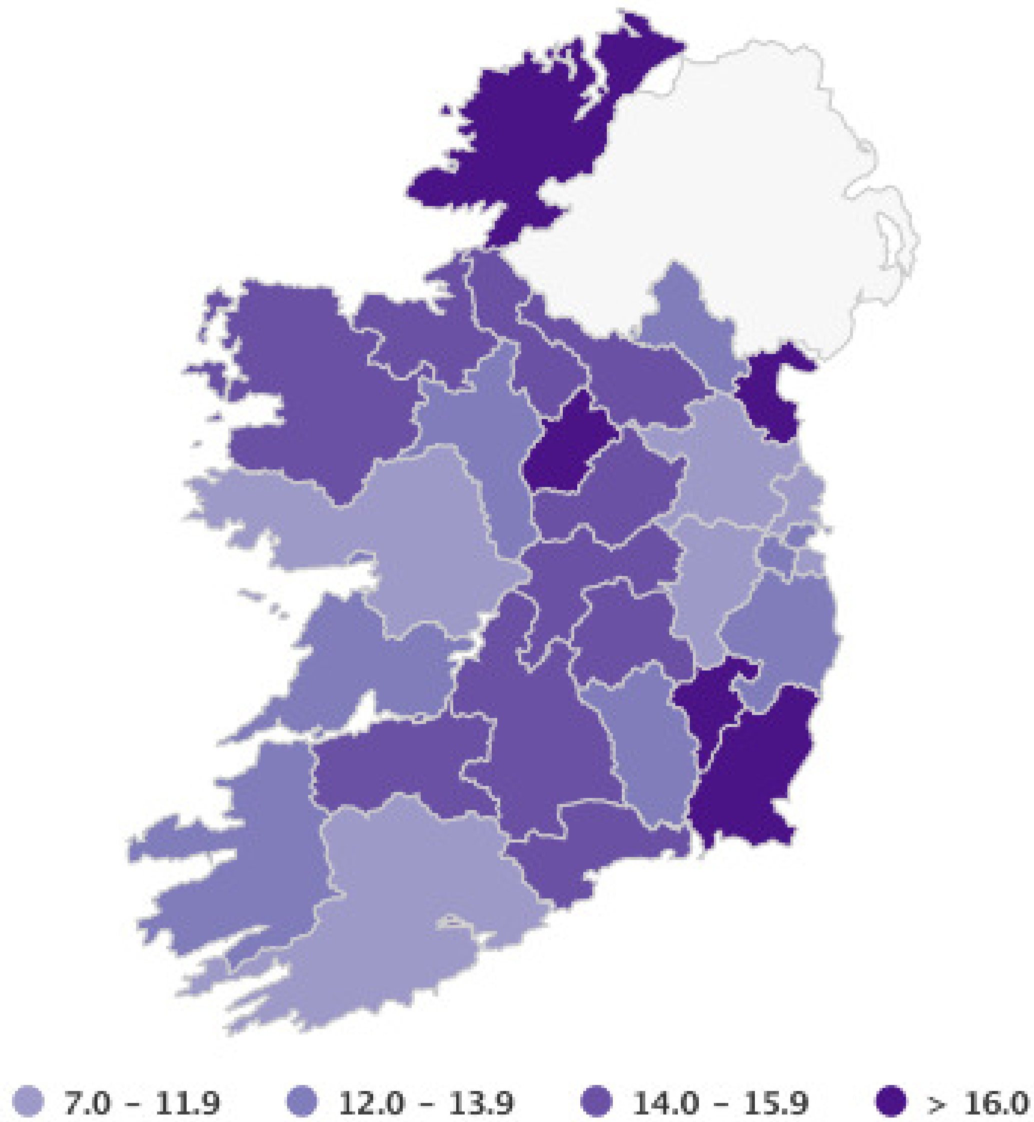


Figure 4.7 – Map showing unemployment rate by county [CSO 2016]

Live Register figures for County Cork are available from the CSO. Recent figures. These figures, presented in Figure 4.2, show a marked decrease in the numbers of people drawing social welfare payments from 2008 to 2010. The Live Register figures increased by approximately 179.8% between 2007 to 2010, from 16,227 in September 2007 to 45,538 in September 2010.

Employment in the rural areas of Cork are mainly related to agriculture and fishing, whereas the towns host most of the manufacturing industries in the County.

Cork has the most people employed in agriculture in the County. A number of. A number of indigenous enterprises operating international markets have developed outside of Metropolitan Cork from this base. These include Dairygold (a global agri-food co-operative from North Cork, an example of how Cork can help develop the Munster Agri-Cluster being promoted via the South West Action Plan for Jobs structures) and Middleton Distillery (a distillery from East Cork housing globally renowned drinks brands). Ballymaloe House in East Cork is another enterprise with a national and international profile and straddles both the food and tourism sectors. Together these enterprises complement West Cork's growing reputation for artisan food and offer significant potential to link throughout the Region.

4.3.2.2 Settlement Patterns

County Cork has a highly rural population, with only approximately 33% living in urban areas. Of the urban based population, the largest population centre is Cork City, with a population of over 119,000. These factors make Cork relatively secure against population decline, as major industries are inclined to move to such areas.

According to the 2006 census the rural population of Bantry increased in between 2002-2006. It can be assumed that the increase in population in these areas must be from a combination of low mortality, increased births and relocation.

Table 4.4: Population of Towns in Cork, 2002 and 2006 (CSO, 2006)

	Persons 2002	Persons 2006	% change 2002-2006
Cork City	123,063	119,418	-3.0
Clonakilty	3,432	3,745	9.1
Cobh	6,767	6,541	-3.3
Fermoy Urban	2,270	2,275	0.2
Kinsale Town	2,257	2,298	1.8
Macroom	2,836	3,407	20.1
Mallow	7,091	7,864	10.9
Midelton	3,798	3,934	3.6
Skibereen	2,000	2,338	16.9
Youghal	6,203	6,393	3.1
Bandon Rural	17,963	20,323	13.1
Bantry Rural	8,684	9,260	6.6
Castletown Rural	4,192	4,146	-1.1
Clonakilty Rural	9,959	10,933	9.8
Cork Rural	104,941	119,520	13.9

	Persons 2002	Persons 2006	% change 2002-2006
Dunmanway Rural	7,671	7,937	3.5
Fermoy Rural	15,265	18,579	21.7
Kanturk Rural	15,507	16,093	3.8
Kinsale Rural	17,073	19,643	15.1
Macroom Rural	13,675	14,672	7.3
Mallow Rural	19654	21870	11.3
Midelton Rural	21,133	26,633	26.0
Millstreet Rural	6,235	6,384	2.4
Mitchelstown Rural	7,489	7,704	2.9
Skibereen Rural	10,856	11,129	2.5
Skull Rural	4,009	4,077	1.7
Yougal Rural	3,807	4,179	9.8

4.3.2.3 Health and Safety

It is not possible to quantify the health and safety of the population of County Cork or of the locality. However, any development project, in its construction phase in particular, has the potential to affect health and safety of workers and the public. During its operational phase, the development will contribute to a reduced usage of fossil fuels and the resultant positive affect on climatic conditions will ultimately benefit human beings in the locality, the region and the country.

4.3.2.4 Land Use

The site has been used in the past and present day for grazing sheep and consists predominately of upland blanket bog. The seven proposed turbines on the site and associated works will take up less than 2.5 % of the total area of the site. Land Use and Topography in the vicinity of the Existing and Proposed Grid Connection. The Proposed Development Site covers an area of c.80ha and ranges in elevation from approximately 31 to 61m above sea level (Ordnance Datum at Malin Head). The Proposed Development Site lands are used almost exclusively for agricultural purposes, primarily cattle pasture with field boundaries separated by hedgerows and which feature mature trees.

The Mapping from the Corine Land Cover Survey reference shows the extent of Grid Connection can be predominantly classified as existing agricultural fields and existing roadways.

4.3.2.5 Tourism

Tourism is important to the local economy and tourism expenditure will help support local enterprises such as hotels, B&B, camping and caravan parks, shops, restaurants, public houses, golf clubs, and the visitor attractions themselves. Cork as a county, is a very popular destination for international and Irish tourists alike, as it is well known for its outstanding scenery such as

Cork, as a county, is a very popular destination for foreign and Irish tourists alike, as it is well known for its outstanding scenery. In 2009, a total of 3,336,000 tourists visited the South West of Ireland; this generated approximately 1,102 million euro for the region.

Tourism remains an essential complement to the economy of Cork's towns, villages, rural areas and islands. Nationally and regionally significant attractions outside of Metropolitan Cork include Kinsale (including Charles Fort and harbour cruises); Midleton Distillery; the Blackwater Valley; Doneraile House & Park, and West Cork (including Mien Head, Bantry and Skibbereen). Alongside a rich programme of food, film and music festivals these tourism assets contribute to Cork's c.1.4 million visitors annually.

The towns, villages, and rural areas of East and North Cork form part of Ireland's Ancient East, whilst those of West Cork form part of the Wild Atlantic Way. This makes Cork Ireland's southern entry point to both of the nation's flagship tourism concepts, guiding and feeding visitors along the Wild Atlantic Way into Kerry and Limerick, and into Ireland's Ancient East.

4.3.2.6 Marine & Fisheries

The Government projects that by 2020 Ireland's marine economy could grow from €3.4 billion to €6.4 billion turnover. Cork has the longest coastline in the Southern Region, numerous ports and related infrastructure, as well as an extensive marine environment. Cork's assets and infrastructure have significant potential to support the development of ocean and offshore energy and facilitate new jobs in the wave and tidal industry (for example at the Castletownbere / Bere Island port facilities).

Castletownbere also remains home to one of Ireland's most important fishing fleets and Ireland's largest whitefish fleet. Although smaller than Agri-food, aquaculture also offers long term potential in Cork, with a thriving shellfish industry in West Cork. These assets, embedded knowledge and infrastructure, offer significant potential for local communities to benefit from engaging with maritime related industries.

4.3.2.7 Energy & Forestry

Being the County with the largest land area in the Country, Cork offers significant potential in land-based energy generation, particularly forestry, biofuels and wind. Cork has the largest installed and committed wind energy generation capacity nationally, with farms concentrated in the Derrynasaggart Mountains, the Boggeragh Mountains, and south of Dunmanway. Cork has significant additional wind resources and potential to expand its wind energy generation capabilities in ways that benefit local communities.

Cork has the highest forest cover levels in Ireland, almost 50% more than the next highest (Donegal). This key asset supports a strong private and public forestry products industry. The Irish forestry industry makes a significant and growing contribution to the Irish economy, estimated to be €2.3billion, and includes value from recreational use and corresponding visitor numbers. Energy sources such as these offer significant potential to diversify communities' economic base and tackle energy poverty. Ownership of and involvement in sustainable energy generation is a key opportunity to support the resilience and self-sufficiency of local communities.

Nationally Cork is by far the largest economy outside of Dublin and is a leader internationally in key sectors. Ireland and the Southern Region benefit hugely from the strategic economic contribution that Cork, in particular Metropolitan Cork, makes as the primary economic driver nationally outside of Dublin.

There are various amenities in the surrounding area, which would be of interest to tourists. Drimoleague is a peaceful village situated on the main Dunmanway – Bantry road. Dunmanway Town is located in the heart of West Cork and is sheltered by mountains on three sides. Every August the Ballabuidhe races and Horse Fair is held in the town. The Ballabuidhe races take place over three days and on the fourth day of the festival the Horse Fair and Horse show take place in the town. Bantry is a market town situated at the head of Bantry Bay that is surrounded by stunning countryside. There is a market in the town every Friday with stalls selling local produce such as arts, crafts and local foods. There are many walks and drives in the surrounding area. There are two scenic routes designated by the Cork County Development Plan 2009 running east to west, one c. 5.2km north of the site and the other running east to west c. 2km south of the site. According to the development plan, the main features of land cover along these routes are mountains, rivers and rugged remote rural landscape. These scenic routes are discussed in more detail in **Chapter 11** Landscape.

Cork offers unspoilt scenery and a variety of outdoor activities. Tourism is an important component of Cork's income sector. The area in which the proposed wind farm will be located is a mountainous area and covers two Landscape Character Types (LCT) as defined in the County Cork Development Plan 2009. The two LCT's are LCT 9, a broad shallow basin serving the River Ilen and its tributaries enclosed by rugged ridges and rocky outcrops, and LCT 15a, a ridged, peaked and forested upland landscape that flanks much of the mid-western boundary of County Cork.

The Grid Connection Route traverses a number of townlands from the consented wind farm site to Ballylicky Substation. The Grid Connection is located in West Cork. There are a number of designated scenic routes and protected views within County Cork that fall within the study area, however many of these are outside of the ZTV pattern (indicating no potential visibility).

4.3.3 Accidents / Disasters (incorporating health and safety);

A wind farm is a fairly simple development type and there is a limited type of major accidents that can occur. These will be addressed under two main headings, accidents to personnel and accidents to plant and equipment ('infrastructure').

4.3.3.1 Accidents to Personnel

Potential risks associated with the EIA Development for personnel may arise in the construction, operation and decommissioning phases, as follows:

- General construction accidents;
- Land and peat slides;
- Driving to and from site;
- Slips, trips, and falls;
- Climbing inside turbine towers;
- Working on live electrical equipment;
- Working on pressurised hydraulic equipment;
- Rotating machinery;
- Working at height; and
- Working in confined spaces.

4.3.3.2 Accidents to Infrastructure

Potential risk to infrastructure, again for the construction, operation and decommissioning phases are mainly from:

- Fire in turbine or electrical substation;

- Loss of power and control of turbine;
- Loss of mechanical break;
- Failure of gearbox;
- Blade separation from rotating turbine rotor.
- Offload of turbine during haulage;
- Turbine tower collapse; and
- Forestry fire posing risk to wind farm equipment.

4.3.3.3 Effects of Weather

Due to the exposed nature of windfarm sites, wind turbines are designed to withstand extreme weather conditions.

4.3.3.4 Extreme Winds

Modern turbines are fitted with sensors which will automatically shut down and break the turbines should very high wind speeds occur that exceed safe operating limits (wind speeds greater than 25 m/s). This prevents excessive wear on the gear box.

4.3.3.5 Lightning Strike

Modern turbines are equipped with lightning protection equipment. If lightning strikes a turbine, this equipment effectively and safely conducts the lighting strike into the earth.

4.3.3.6 Ice Throw

As a result of certain meteorological conditions, such as still, cold weather, ice can form on the rotor blades. In the event that this happens, two types of risk may occur:

- Ice fragments may be thrown from the rotor; and
- Ice may fall from the turbines while shut down.

Ice throw has been noted as a risk in extremely cold conditions that occur in locations such as the high latitudes of Scandinavia or high altitudes in mainland Europe. Ice fall can occur if ice accumulates on the turbine and falls to ground as the melting process begins. This can happen when the temperature increases falling a period of extremely cold weather conditions. Guidance from Scotland[8] states that:

"The build-up of ice on turbine blades is unlikely to present problems on the majority of sites. When icing occurs the turbines' own vibration sensors are likely to detect the imbalance and inhibit the operation of the machines. However, warning signage may be a useful precaution."

[8] Scottish Government (2012) Onshore Wind Turbines. Available at: http://www.scotland.gov.uk/Topics/Built-Environment/planning/National-Planning-Policy/themes/renewables/Onshore

4.3.3.7 Vulnerability to Climate Change

The potential causes of accidents / disasters associated with the vulnerability of the EIA Development to climate change are identified as follows. Information is drawn from 'Local Authority Adaptation Strategy Development Guidelines' (EPA 2016)[9].

<u>Table 4.10:</u> Climate impact projections: 30-year overview

Variable	Summary	Confidence	Projected changes
Sea level Rise	Strong increase Sea levels are rising and will continue to do so for the foreseeable future.	High	Projections of SLR to 2100 suggest a global increase in the range of 0.09–0.88m with a mean value of 0.48m. For 2050 it is reasonable to assume a sea level rise in the region of 25cm above present levels. It should be noted that due to an as yet limited understanding of some of the important effects that contribute to rates of increase, these estimates of sea level rise may prove optimistic, and estimates of up to 4–6 m have been projected by some models.
Storm Surge	Strong increase (N&W) In the north-west, surges between 50 and 100cm will be 30% more frequent.	Medium	An increase in the number of intense cyclones and associated strong winds are expected over the north-east Atlantic. By the 2050s, storm surge heights in the range of 50–100cm are expected to increase in frequency for all coastal areas with the exception of the southern coast.
Coastal Erosion	Moderate increase Increasing sea levels and wave heights may result in increased levels of coastal erosion.	Low	Currently approximately 20% of Ireland's coastline is at risk of coastal erosion, particularly areas of the south and east coast and also in isolated areas on the west coast. Rates of increase will be determined by local circumstances; however, it is expected that areas of the south-west are likely to experience the largest increases.
Cold Snaps/Frost	Moderate decrease (winter/night)	High	By mid- century, minimum temperatures during winter are projected to increase by ~2ºC in the south-east and ~2.9ºC in the north. This change will result

[9] http://www.epa.ie/pubs/reports/research/climate/EPA_Research_Report164.pdf

Variable	Summary	Confidence	Projected changes
	Increasing average air temperatures may act to decrease the duration and intensity of cold snaps.		in fewer frost days and milder night-time temperatures.
Heatwaves	Strong increase (summer) Increasing average air temperatures are likely to increase the duration and intensity of heatwaves.	High	Seven significant heatwaves (defined as 5+ days @ >25ºC) have been recorded in Ireland over the past 30 years, resulting in approximately 300 excess deaths. By mid-century, a projected increase in summer maximum daily temperature of approximately 2ºC will likely intensify heatwaves, with maximum temperatures increasing and heatwave duration lengthening.
Dry Spells	Strong increase (summer) Increased seasonality in precipitation is very likely to result in more severe dry spells in summer.	Medium	There have been seven periods of insignificant rainfall in Ireland in the past 40 years. Of these, the events of 1976 and 1995 were the most severe, averaging 52 and 40 days in duration respectively across Irish rainfall stations. An approximate 20% decrease in summer precipitation receipts in many areas is strongly indicated under a high emissions scenario. This decrease is likely to result in progressively longer periods without significant rainfall, posing potentially severe challenges to water-sensitive sectors and regions.
Extreme Rainfall	Strong increase (winter) Increasing seasonality in rainfall distribution is likely to result in a >20% increase	Low	Heavy precipitation days (in which more than 20mm of rain falls) are likely to increase in frequency in winter. By the 2050s an increase in the number of heavy precipitation days of around 20% above the level of 1981–2000 is projected under both low–medium and high emissions scenarios. This may have serious consequences for flood risk in sensitive catchments.

Variable	Summary	Confidence	Projected changes
	in the number of very Extreme Rainfall wet days.		
Flooding	Moderate increase (winter) Projected increases in winter rainfall will likely increase the risk of fluvial flooding in “fast response” catchments.	Low	An Irish Reference Network of hydrometric stations has been established to assess signals of climate change in Irish hydrology. This network has detected an increasing trend in high river flows since 2000. Projections of future flows are beset by uncertainties at the catchment scale, but a broad signal of wetter winters and drier summers is evident across a number of independent studies.
Wind Speed	Minor increase (winter) Models predict a slight increase in wind energy in winter of between 0 and 8%, with a minor decrease in summer of 4–14%.	Medium	Observed wind speed over Ireland has not changed significantly in recent times, but it is anticipated that the distribution of wind will alter slightly in future, with winters marginally windier and summers marginally less so. Though the average wind speed is anticipated to change in only a minor way over the coming decades, the frequency of extreme windstorms is expected to increase due to alterations Wind Speed in the origin and track of tropical cyclones.

4.3.3.8 Health and Safety Procedures

A comprehensive health and safety assessment are required for all major construction projects in Ireland. This would generally be carried out prior to construction by the selected contractor in accordance with legislation.

4.3.4 Human Health

Common concerns around wind farms in terms of human health are generally associated with electromagnetic fields, shadow flicker and noise. Air quality, water contamination and accidents / disasters are also considered.

4.3.4.1 Electromagnetic Fields

Electromagnetic fields ("EMF") are invisible lines of force that surround electrical equipment, power cords, wires that carry electricity and outdoor power lines. Electric and magnetic fields can occur together or separately and are a function of voltage and current. When an electrical appliance is plugged into the wall, an electric field is present (there is voltage but no current); when that appliance is turned on, electric and magnetic fields are present (there is both voltage and current). Both electric and magnetic fields decrease with distance. Electric fields are also dissipated by objects such as building materials. On a daily basis people are exposed to extremely low frequency ("ELF") EMF as a result of using electricity. The results of a 2014 study from Canada[10] found that

> *"there is nothing unique to wind farms with respect to EMF exposure; in fact, magnetic field levels in the vicinity of wind turbines were lower than those produced by many common household electrical devices and were well below any existing regulatory guidelines with respect to human health".*

4.3.4.2 Shadow Flicker

Section 10.2.2 provides the baseline assessment of shadow flicker.

4.3.4.3 Noise

Noise may have various effects on human beings exposed to it ranging from discomfort and annoyance to various psychological and pathological conditions. How people react to the effects of noise varies widely and depends on the characteristics of the sounds and the recipient's attitude towards it. The negative effects can be to health, quality of sleep, communications, working efficiently, industrial accidents and mental stress.

An increase in noise will occur around the Proposed Development Site during the construction, operational, and decommissioning phases of the proposed EIA Development. Construction and decommissioning noise will be typical of construction activities and will be short-term. An increase in noise will occur when the wind farm is operational and generating electricity.

[10] Lindsay C McCallum, *et al.* (2014) *Measuring electromagnetic fields (EMF) around wind turbines in Canada: is there a human health concern?*

The baseline assessment of the impacts of the proposed EIA Development on noise is shown at **Section 9**.

4.3.4.4 Health Effects from Wind Turbines

While there are anecdotal reports of negative health effects on people who live near wind farms there is no peer reviewed scientific research in supported of these views. Several peer reviewed scientific research publications are outlined below to alleviate concerns the reader may have with the proposed EIA Development.

Frontiers in Public Health published a study[11] in 2014 on wind turbines and human health. This review completed a bibliographic-like summary and analysis of the science around this issue specifically in terms of noise (including audible noise, low-frequency noise, and infrasound), EMF, and shadow flicker. The study noted that:

"*Based on the findings and scientific merit of the research conducted to date, it is our opinion that the weight of evidence suggests that when sited properly, wind turbines are not related to adverse health effects. This claim is supported (and made) by findings from a number of government health and medical agencies and legal decisions*".

Australian Government National Health and Medical Research Council (NHMRC)[12] carried out a review of the evidence from current literature on the issue of wind turbines and potential impacts on human health and, in particular, to validate the finding of the 'Wind Turbine Sound and Health Effects - An Expert Panel Review' (see preceding referenced and quoted paper). The report noted that:

- *"There are no direct pathological effects from wind farms and that any potential impact on humans can be minimised by following existing planning guidelines.*
- *There is currently no published scientific evidence to positively link wind turbines with adverse health effects.*
- *This review of the available evidence, including journal articles, surveys, literature reviews and government reports, supports the statement that: There are no direct pathological effects from wind farms and that any potential impact on humans can be minimised by following existing planning guidelines."*

[11] L. D. Knopper, *et al*. (2014) *Wind turbines and human health*.

[12] Australian Government National Health and Medical Research Council (NHMRC), Wind Turbines & Health (2010), *A Rapid Review of the Evidence*.

The Massachusetts Departments of Environmental Protection and Public Health established an expert panel to evaluate peer-reviewed scientific studies, other reports, popular media and public comments and to assess the magnitude and frequency of any potential impacts and risks to human health from wind farms. In its final report[13], the expert panel set out its conclusions on noise and shadow flicker.

In relation to noise, the panel concluded that there was limited or no evidence to indicate any causal link between noise from wind turbines and health effects, including the following:

- *"There is no evidence for a set of health effects, from exposure to wind turbines that could be characterized as a "Wind Turbine Syndrome."*
- *The strongest epidemiological study suggests that there is not an association between noise from wind turbines and measures of psychological distress or mental health problems. There were two smaller, weaker, studies: one did note an association, one did not. Therefore, we conclude the weight of the evidence suggests no association between noise from wind turbines and measures of psychological distress or mental health problems.*
- *None of the limited epidemiological evidence reviewed suggests an association between noise from wind turbines and pain and stiffness, diabetes, high blood pressure, tinnitus, hearing impairment, cardiovascular disease, and headache/migraine."*

In relation to shadow flicker, the expert panel found that:

- *"Scientific evidence suggests that shadow flicker does not pose a risk for eliciting seizures as a result of photic stimulation.*
- *There is limited scientific evidence of an association between annoyance from prolonged shadow flicker (exceeding 30 minutes per day) and potential transitory cognitive and physical health effects."*

4.3.4.5 Air Quality

Section 8 provided an assessment of air quality in relation to the proposed EIA Development. The baseline assessment is referenced at **Section 8.3**.

4.3.4.6 Water Contamination

Section 7 provided an assessment of the hydrological impacts in relation to the proposed EIA Development, including the potential for water contamination. The baseline assessment is referenced at **Section 7.3**.

[13] Massachusetts Departments of Environmental Protection and Public Health, (2012), *Wind Turbine Health Impact Study -Report of Independent Expert Panel*.

4.4 ASSESSMENT OF POTENTIAL IMPACTS

This section assesses the potential effects associated with the EIA Development during the construction, operational and decommissioning phases of the project.

4.4.1 Population and Settlement Patterns

This project does not contain a housing or services element and is not considered to have any direct positive or negative impact on the local or regional population levels. However, employees who are not based in the region may temporarily relocate, this is more likely for the construction and decommissioning phase than for the operational phase. The overall impact is considered to be **imperceptible** in terms of population.

During the construction phase, there is the potential for limited impacts on the residential amenity of the local population. These would be short-term impacts relating primarily to an increase in construction traffic causing noise, dust, and an increase in traffic volume. The levels of these impacts are assessed in **Section 14: Traffic & Transport** and have been defined as **slight negative** in the construction and decommissioning phases and **imperceptible** in the operational phase.

The predicted effect on the immediate settlement patterns and social patterns is also slight to non-existent. There is, however, the possible benefit which would accrue to the region in terms of the ability to provide electricity to industry and business in a high-quality supply. This will lead to the region becoming more attractive to business with the subsequent benefit of increased employment opportunities in the region. A renewable, green energy supply could potentially be attractive.

While this is not likely to result in a marked increase in settlement in the area, or a change in social patterns in the area it will, should the provision of a secure, renewable energy source prove attractive to industry, reduce the population drain out of the area. This is dependent on national and global economic conditions, as well as the types of industry which may locate in the region.

The overall impact during construction and decommissioning is predicted to be a slight positive and short-term in nature should workers relocate to the area for the duration of these phases. The overall impact is predicted to be **slight positive** at the local level in terms of settlement patterns should increase business be attracted to the area during operation.

4.4.2 Economic Activity and Tourism

4.4.2.1 Economic Activity

During its construction phase, some jobs are likely to be created. Local employment will be provided, as well as employment on local, national and international levels both directly and indirectly. Throughout the project lifetime, which will be approximately 25 years, employment will be both created and maintained on local, regional, national and international levels.

It is envisaged that labour and materials will be sourced from the local area during construction where possible. It is envisaged that, subject to quality and quantity being available, that any rock needed will be sourced from a local quarry, as will ready-mix concrete.

Employees involved in the construction and decommissioning of the proposed wind farm will use local shops, restaurants and hotels/accommodation. Therefore, overall there will be a slight positive impact on employment in the area.

Employees involved in the operation of the proposed EIA Development will use local shops, restaurants and hotels/accommodation

During the operational phase of the proposed EIA Development, some maintenance and operational staff employed will make regular visits to the site. The employment provided by this development in the construction and operational phases is not likely to greatly affect the overall regional or county profile.

The likely total cost of the project will be approximately €7.5 million. This expenditure will result in economic benefit to both the national and local economy. Approximately 35%[14] of expenditure will be on the supply of construction material, non-turbine equipment and services.

Cork County Council will benefit from payments under both the Development Contribution Scheme and from the annual rate payments.

It is anticipated that during the construction phase of the project, local contractors will be used if possible. Any rock needed will be sourced from an onsite borrow pit, Ready-mix concrete will be sourced from a local supplier, again subject to quality and quantity being available.

[14] JOD Internal Estimate

The overall impact is predicted to be **moderate, positive, short-term** impact during the construction and decommissioning phases of the proposed EIA Development and **moderate, positive and long-term** during the operational phase.

4.4.2.2 Tourism

Fáilte Ireland published guidelines in 2011 for the treatment of tourism in an EIS which describes the effects of projects on tourism. Many of the issues covered in the report are similar to those covered in this EIAR, for example, scenery is assessed in the Landscape and Visual Impact Assessment (see **Section 11**).

Fáilte Ireland published a study on 'Visitor Attitudes on the Environment' in 2012[15] to assess the perceived impacts of wind farms on potential future visits to an area. The study found that 12% of those surveyed responded that wind farms would have a strong positive impact on their decision to visit Ireland with 27% responding it would have a slight positive impact, while 38% said it would have no impact. 7% of respondents stated it would have a strong negative impact and 15% stated it would have a slight negative impact. The survey also found that wind farms were seen as more favourable than other forms of development such as housing, mobile phone masts or electricity pylons.

Biggar Economics conducted a report[16] into wind farms and tourism in Scotland in 2016 which found that there was no relationship between onshore wind farm development and employment levels in tourism in Scotland.

Sustainable Energy Ireland produced a report in 2003, called *Attitudes Towards the Development of Wind Farms in Ireland*. This study was the first independent study of its kind and discovered that 80% of people are favourable to having a wind farm built in their area, while just 1 in 4 felt that wind farms superimposed on highly scenic landscapes and impacted negatively upon the view presented.

Nine out of ten tourists visiting some of Scotland's top beauty spots say the presence of wind farms makes no difference to the enjoyment of their holiday, and twice as many people would return to an area because of the presence of a wind farm than would stay away, according to a poll carried out by MORI Scotland, commissioned by the British Wind Energy Association (BWEA) and the Scottish Renewables Forum (SRF) 2002. According to this study, wind farms

[15] http://www.failteireland.ie/FailteIreland/media/WebsiteStructure/Documents/3_Research_Insights/4_Visitor_Insights/Visitor-Attitudes-on-the-Environment.pdf?ext=.pdf
[16] http://www.biggareconomics.co.uk/wp-content/uploads/2016/07/Research-Report-on-Wind-Farms-and-Tourism-in-Scotland-July-16.pdf

have the potential to benefit the tourist industry of an area, and the proposed wind farm could have a positive effect on the tourist industry of County Cork.

These studies convey that most people are in favour of the generation of renewable energy from wind turbines. They also demonstrate that once the wind farm becomes operational, people generally have no concerns with the development.

Effects of the EIA Development with regards to tourism are considered to be **imperceptible** during both construction and operation with a **slight positive** impact during operation.

4.4.3 Employment

Employees involved in the construction of the proposed EIA Development will use local shops, restaurants and hotels/accommodation. Therefore, overall there will be a **slight positive** short-term impact on employment in the area.

The proposed EIA Development will create the most employment during the construction and decommissioning phases. Approximately 50 persons will be employed during the peak construction phase of civil engineering of access track, crane hardstand, turbine foundation, and substation construction. These numbers will be somewhat less for the turbine delivery, assembly, and commissioning activities. A mixture of skills will be required, including unskilled/semi-skilled/skilled manual (construction labour, machine operators, *et cetera*), non-manual (administration roles), Managerial and technical (civil, electrical, mechanical technical and engineering), and Professional roles (legal, business, accounting, *et cetera*). The manual roles will be site based with the other roles being predominately office based with site visits as and when required. During construction and decommissioning, personnel will be at the site over a number of months and during these times will likely use local accommodation and restaurants and other facilities.

The proposed EIA Development will create approximately 2 full time jobs during the operational phase. These roles will tend to be non-manual (administration roles), Managerial and technical (civil, electrical, mechanical technical and engineering), and Professional roles (legal, business, accounting, *et cetera*). The persons fulfilling these roles may live and work anywhere in Ireland, visiting the site as and when required to operate and maintain the plant and equipment. During major service operations, personnel may be at the site over several days and during these times may use local accommodation and restaurants.

During the operational phase of the proposed EIA Development, some employment will be created in maintenance and operational activities. It is likely that maintenance and operational staff will be based outside the area and hence the level of impact is predicted **to be slight positive** during the operational phase.

4.4.4 Topography and Land Use

The proposed Grid Connection Development will involve an increase in the permitted development site boundary (i.e. of the 2010 Permission) of approximately4 hectares of land comprising mainly improved agricultural grassland and pasture.

The existing permitted land use will not be altered by the construction, operation, and decommissioning of the EIA Development (which includes the permitted development under the 2010 Permission and the Proposed Development). The routes of the access tracks were designed in consultation with the landowners. These tend to follow the routes that landowners use to access their land, so they will benefit the landowners. It is envisaged that agriculture will continue on site.

The overall impact is predicted to be **slight, direct, negative, long-term, and reversible** during construction, operation and decommissioning with the land being able to be reinstated upon decommissioning of the Proposed Development Site.

4.4.5 Accidents / Disasters (incorporating health and safety)

4.4.5.1 Accidents to Personnel

Due to the health and safety legislative environment associated with the construction, operation and decommissioning of projects such as windfarms, this embedded mitigation reduces the risk materially. The construction of the EIA Development will be managed in accordance with the Safety Health and Welfare at Work (Construction) Regulations 2006 – 2013 as amended.

A comprehensive health and safety assessment are required for all major construction projects in Ireland. This will be carried out prior to construction by the selected contractor in accordance with legislation and best practice guidelines.

Due to the absence of peat on side and the relatively low gradients, there is no risk of peat slide within the Proposed Development Site (see **Section 6: Soils**).

The overall impact is predicted in this context is assessed to be **slight, negative, direct and irreversible**.

4.4.5.2 Accidents to Infrastructure

Potential risks to infrastructure were identified in **Section 4.3.5.2**.

On very rare occasions, the structural integrity of wind turbines has failed. This is an extremely rare occurrence and given that the turbines will be designed and installed by an experienced turbine contractor and are located well away from public roads and dwellings (160m from the nearest public road, 383m from the nearest dwelling), it is not considered that the unlikely event of an accident of this type would result in any significant impacts to population or human health.

Potential accidents, such as a risk of incident during haulage, a fire on site or the risk of a turbine structural failure is assessed to be a **slight, negative, long-term** effect.

4.4.5.3 Effects of Weather

4.4.5.3.1 Extreme Winds

Extreme winds may pose issues during the construction and decommissioning of turbine components where cranes are used to erect the components.

Once operational, turbines are designed to withstand extreme winds and the EIA Development has been designed so that if a turbine should suffer from structural failure during operation then it will pose no risk to the general public. The turbines are located at greater than a fall-over distance from local roads and dwellings.

The overall impact of extreme winds on wind farm infrastructure is predicted to be **imperceptible**.

4.4.5.3.2 Lightning Strike

Lightning could potentially strike EIA Development infrastructure such as turbines, meteorological mast or substation. These elements of infrastructure are fitted with lightning rods.

The impact of the potential for lightning strikes is predicted to be **slight, negative, indirect and irreversible** during construction, operation and decommissioning.

4.4.5.3.3 Ice Throw

The design of the EIA Development has taken into account the possibility of ice throw occurring and turbines have been sited in locations so that the rotor blades do not oversail any public roads or recreational routes to minimise the risk from ice fall. The low risk of ice throw is further minimised by the turbine's vibration sensors (or other ice detection measures) which detect any imbalance which might be caused by icing. The turbines which are affected by icing would be temporarily shut down until normal balance is restored.

Operational procedures will be put in place for the safety of both workers and the public in relation to ice throw and ice fall. Procedures will include turbine shutdown and warning signage.

The overall impact of ice throw from turbines is predicted to be **slight, negative, indirect and irreversible**.

4.4.5.4 Vulnerability to Climate Change

Section 4.4.5 identified the possible sources of accident / disaster for the proposed EIA Development.

4.4.6 Human Health

4.4.6.1 Electromagnetic fields

Electromagnetic fields from wind farm infrastructure, including the grid connection, are very localised and are considered to be **imperceptible, long-term** impact.

4.4.6.2 Shadow flicker

Section 10 provides an impact assessment of shadow flicker from the EIA Development. That assessment concludes that:

"The shadow flicker assessment found that the proposed Derreenacrinnig West Wind Farm will cause a flickering effect on all eight of fifteen houses assessed. These houses are expected to experience on average 10 hours a year of shadow flicker. House No.1 (Reference Table 10.2) experiences the most hours of Shadow Flicker (34.2hrs). House No. 1 is over 884 m from the proposed development; this is seventeen times the rotor diameter of the proposed turbines. According to the Wind Farm Planning Guidelines 2006 shadow flicker will not be an issue at more than ten times the rotor diameter of the turbines. This means that shadow flicker from the proposed Derreenacrinnig West Wind Turbines will have minimal effect on House No. 1.

. As the analysis for the Derreenacrinnig West Wind Farm shows, shadow flicker typically occurs for a small period of time each day on houses 1,2,9,10,11,12,14 and 15. The given data provided a computerised worst-case estimate of shadow flicker, but is restricted in accuracy due to the following factors:

•The houses predicted to experience shadow flicker have outbuildings, landscaping or other intervening structures between the wind turbines and the house. This analysis has not taken any of these possible obstructions into account.

•Window orientations are likely to differ from the generic windows used in this analysis, which would be the main factor responsible for actual shadow flicker differing from that predicted in this analysis.

•The Danish Wind Energy Association has determined that actual shadow flicker is reduced by, on average, 63% of the worst-case results. This was estimated by taking into account the fact that the sun is not always shining, that the turbines are not always rotating and that there could be intervening structures or vegetation. Therefore, House 1, which has the highest predicted total hours per year, at 34.2 total hours per year, would in reality produce a shadow flicker of 12.6 total hours per year. This figure is below the recommended limit of 30 hours per year. This calculation does not take into account the hours when people are asleep or out of the house.

If the proposed Derreenacrinnig West Wind Farm is constructed and shadow flicker occurs in such a way as to be deemed an impact on health and safety, the developer would be responsible for pre-programming the turbine to shut down during the specific dates and times when shadow flicker would cause a nuisance.

During the operation phase the proposed Derreenacrinnig West Wind Farm is not expected to cause any electromagnetic interference on the existing environment. It is concluded that the proposed development will cause no major long-term negative impacts relating to Shadow Flicker or Electromagnetic Emissions."

4.4.6.3 Noise

The full details of the noise assessment for the construction, operational, and decommissioning phases are detailed in **Section 9**. That assessment concludes that:

"The impact of the proposed wind turbine on the local environment has been assessed in line with the recommendations documented in the Department of the Environment, Heritage and Local Government recently published 'Wind Energy Development Guidelines'- Guidelines for Planning Authorities June 2006. Noise levels have been predicted at the nearest residences and, at all of these, the predicted noise levels meet the requirements of the Wind Energy Development Guidelines for noise for both day and night-time. The noise impact at all residence should be negligible.

The cumulative effect of the permitted Barrboy wind farm should at maximum be no more than negligible to marginal and well within the requirements of the Wind Energy Development Guidelines for noise for both day and night-time.

The low frequency noise and vibration from the proposed wind farm operation is predicted to have a negligible impact on residents and on local properties."

4.4.6.4 Other Health Effects

Other health effects include effects from wind turbines during operation as outlined in **Section 4.3.6.4**. The potential impact is predicted to be **imperceptible, negative, indirect and reversible**.

4.4.6.5 Air Quality

Section 8 provided an assessment of air quality in relation to the proposed EIA Development. The impact assessment is referenced at **Section 8.10** and concluded that:

> *"This Section has assessed the significance of potential effects of the EIA Development on air quality. The proposed EIA Development has been assessed as having the potential to result in effects of slight, negative, temporary/short-term effect during construction. There will be a slight, positive, long-term effect in terms of helping Ireland meet its international obligations to reduce greenhouse gas emissions.*
>
> *Potential cumulative effects were assessed as being of a slight, negative, short-term impact."*

4.4.6.6 Water Contamination

Section 7 provided an assessment of the hydrological impacts in relation to the proposed EIA Development, including the potential for water contamination.

Section 7.4.1.8.1 assessed the pre-mitigation impact of the EIA Development for the Proposed Development Site or Haul Route Options in terms of effects on local groundwater supplies as *"**Indirect, negative, slight, long term, low probability** impact on groundwater flows and quality"*.

4.5 MITIGATION MEASURES AND RESIDUAL EFFECTS

Although no negative impact of significance has been established, there are a number of measures, which may be implemented for the safety of workers and the public during the construction, operational and decommissioning phases.

- A code of construction practice will be established with the Local Authority and will have regard to Health and Safety on site and off site.
- Off-site Health and Safety shall include adherence to the rules of the road at all times and proper signage when wide or long vehicles are in use. The use of a lead vehicle with warning lights at periods when large, wide or long vehicles are in use shall be established.
- Members of the public shall not be allowed onto the site during construction without the permission of the developer.

4.5.1 Population and Settlement Patterns

Given that no negative impacts have been identified, no mitigation measures are proposed.

4.5.2 Economic Activity and Tourism

Given that no negative impacts have been identified, no mitigation measures are proposed.

4.5.3 Employment

Given that no negative impacts have been identified, no mitigation measures are proposed.

4.5.4 Topography and Land Use

Given that no negative impacts have been identified, no mitigation measures are proposed (other than embedded mitigation of minimising land take).

4.5.5 Accidents / Disasters (incorporating health and safety)

Mitigation to avoid accidents / disasters to personnel and infrastructure is described below.

4.5.5.1 Design or Avoidance

The main mitigation measure is by design or avoidance. A suitable separation distance from turbines and other key infrastructure to properties has been embedded in the EIA Development design. Additional mitigation to protect site personnel and the public will also be implemented in the event of damage to a turbine and subsequent likely turbine or turbine component failure. These are:

- Turbines will be procured from a reliable manufacturer and will have undergone vigorous safety checks during design, construction, commissioning and operation.
- Physical and visual warnings such as signs will be erected as appropriate for the protection of site personnel and the public.
- Facility for remote turbine deactivation will be provided.
- Access to turbines for site personnel will be restricted in storm events. Where access by site personnel is required safety precautions may include remotely shutting down the

turbine, yawing to place the rotor on the opposite side of the tower door and parking vehicles at a distance of at least 100m from the tower. All personnel will be fitted with appropriate PPE.

- Regular maintenance and inspections will take place during the 25-year operational phase. The final turbine model chosen will be in line with International Electrotechnical Commission IEC 61400-1 safety standards. Maintenance visits will take place as needed with the Scada control system monitoring turbine performance remotely. Access to the turbines will be via the door at the base of the turbines. The turbine access door will otherwise to securely locked at all times.

4.5.5.2 Health and Safety Procedures

The design and construction of the EIA Development will be managed in accordance with the Safety, Health & Welfare at Work Act 2005 and subsequent amendments and regulations made thereunder, including the Safety, Health & Welfare at Work (Construction) Regulations 2013 (S.I. No. 291 of 2013) as amended. The Health & Safety Plan for the EIA Development will be developed in accordance with the regulations and the duties of the Project Supervisor Design Process ("PSDP") and the Project Supervisor Construction Stage ("PSCS"). Access to site will be restricted at all times and all visitors and contractors will go through a site induction prior to entering the site. The site will be constructed by a reputable, appropriately insured contractor who will develop a method statement and safe systems of work.

The appointed PSDP will liaise with the PSCS on design related issues. The PSCS will have responsibility for coordinating activities of all the contractors employed on site and see that the relevant regulations and guidance are followed.

Dust control measures such as damping down of surfaces where material could become friable will be implemented on site. Materials stockpiles and site roads will be maintained to a high standard. A wheel wash facility will be installed on site which all HGVs will be required to pass through prior to entering the public road network.

Vehicle emissions will be reduced through providing for regular maintenance of all vehicles and plant and turning off motors when idle. Regular maintenance of vehicles and plant will also provide that noise emissions are reduced.

During construction and decommissioning of the EIA Development the weather will be monitored so that if high winds are predicted then turbine component erection and dismantling will not take place.

Local residents will be notified in advance of abnormal loads and large volumes of HV traffic, for example, during turbine base concrete pours. Any damage to the road network will be repaired by the Developer in a timely fashion. Any signage needed for the construction traffic routes will be agreed with Cork County Council for the proposed turbine components haul route. The turbine component traffic movements will also be agreed with An Garda Síochána in advance so that disruption to the public is minimised.

4.5.5.3 Design and Construction

The layout and design of the EIA Development takes into account the following health and safety considerations:

- Proposed Development Site boundary;
- Location and prevention of contact with underground and overhead services;
- Public access and safety;
- Other structures on-site;
- Access and egress;
- Traffic control;
- Stability of slopes; and
- Effects of the design life of the structures.

4.5.5.4 Risk Assessment

In order to effectively guard against the risk of accidents, a clear system of identifying hazards and implementing effective control measures would be put into place. The most effective manner of achieving this is through clear concise risk analysis.

This will take place at three different levels during the lifetime of the EIA Development:

- Designers will undertake a design review to design out in so far as is practicable any risks associated with the project. Those risks that cannot be designed out will be highlighted to the principal contractor within a pre-tender health and safety plan in the form of clear concise risk assessments;
- The principal contractor will be responsible for carrying out regular risk assessments for all operations that have an inherent risk of severe injury; and
- The designers and the principal contractor will liaise in order to produce risk assessments for all remaining residual risks involving the day-to-day running and maintenance operations and eventual decommissioning of the Development.

4.5.5.5 Health and Safety File

A competent, adequately resourced site supervisor will be appointed for the works. All relevant information relating to health and safety will be passed on to the site supervisor. The site supervisor will notify the relevant safety authorities and prepare the pre-tender health and safety plan and see that a construction phase health and safety plan is adequately developed. The site supervisor will collate information from the designers and principal contractor to produce a health and safety file for the project.

The site health and safety file will be completed as soon as is possible after the construction of the Development. It will contain all relevant health and safety information relating to the EIA Development in relation to the day to day running and maintenance operations and eventual decommissioning. It is the owner’s duty to hold and make available any information contained in the file to anyone who would need such information.

4.5.5.6 Operation

A Supervisory Control and Data Acquisition (“SCADA”) system will monitor the EIA Development’s performance. If a fault occurs, then a message is automatically sent to the engineer preventing emergency situations.

Warning signs and security infrastructure will be in place around the onsite switchgear and control building to provide for public safety.

4.5.5.7 Residual Risk

Once the above mitigation is taken into account, the residual risk is assessed to be an **imperceptible, long-term** effect.

4.5.5.8 Effects of Weather

4.5.5.8.1 Extreme Winds

Once the above mitigation is considered, the residual risk is assessed to be an **imperceptible, long-term** effect.

4.5.5.8.2 Lightning Strike

Once the above mitigation is taken into account, the residual risk is assessed to be an **imperceptible, long-term** effect.

4.5.5.8.3 Ice Throw

Once the above mitigation is taken into account, the residual risk is assessed to be an **imperceptible, long-term** effect.

4.5.5.8.4 Vulnerability to Climate Change

No mitigation measures beyond the mitigation by design (avoidance of potential impacts) are considered to be required for the EIA Development. The residual risk will remain as an **imperceptible, long-term** impact.

4.5.6 Human Health

4.5.6.1 Electromagnetic Fields

No mitigation measures beyond the mitigation by design (avoidance of potential impacts) are considered to be required for the proposed EIA Development. The residual risk will remain as an **imperceptible, long-term** impact.

4.5.6.2 Shadow Flicker

If shadow flicker is found to be occurring and complaints are received, then an appropriate investigation will be undertaken to confirm the shadow flicker levels. This would involve a line of sight assessment, as well as window sizes, use of rooms and existing natural screening assessments. Residents will then be consulted of vegetative planting and/or screens or blinds may be specified. Turbines can also be programmed to shut down under specific weather conditions to prevent shadow flicker nuisance on affected properties. The residual risk will remain as a **slight, negative long-term** impact.

4.5.6.3 Noise

A warranty will be sought from the selected turbine manufacturer for the EIA Development to confirm that an assessment of noise would result in noise levels at all receptors being less than or equal to the noise limits set out in **Section 9: Noise**. The warranty will include the provision that there will be no clear tonal components audible at any receptor.

4.5.6.4 Other Health Effects

Given that no negative impacts have been identified, no mitigation measures are proposed.

4.5.6.5 Air Quality

Mitigation measures proposed include:

- Approach roads and construction areas will be cleaned on a regular basis to prevent mud built-up and from migrating around the site and off-site;

- Wheel wash facilities will be provided near the site compound to prevent mud/dirt being transferred from the site to the public road network;
- 'Damping down' will be used if dust becomes an issue on any part of the site;
- Vehicles delivering materials to the site will be covered appropriately when transporting materials that could result in dust, e.g. crushed rock or sand;
- Ready-mix concrete will be delivered to site and it is envisaged that no batching of concrete will take place on site;
- Speed restrictions on access tracks will be implemented to reduce the likelihood to dust becoming airborne;
- Public roads along the construction haul route will be inspected regularly and if dirt/mud is identified that could result in dust generation then the road will be cleaned as necessary;
- Stockpiling of materials will be carried out in such a way as to minimise their exposure to wind where possible and damping down will be carried out where needed; and
- A complaints procedure will be implemented on site where complaints will be reported to the site manager, logged and appropriate action taken.

Post mitigation residual effects were assessed as follows:

- *"This Section has assessed the significance of potential effects of the EIA Development on air quality. The proposed EIA Development has been assessed as having the potential to result in effects of* ***slight, negative, temporary/short-term*** *effect during construction. There will be a* ***slight, positive, long-term effect*** *in terms of helping Ireland meet its international obligations to reduce greenhouse gas emissions.*
- *Potential cumulative effects were assessed as being of a* ***slight, negative, short-term*** *impact."*

4.5.6.6 Water Contamination

Mitigation measures proposed are outlined in the Water Chapter include:

Management of excavation seepages and subsequent treatment prior to discharge into the drainage network will be undertaken as follows:

- Appropriate interceptor drainage, to prevent upslope surface run-off from entering excavations will be put in place;
- If required, pumping of excavation inflows will prevent build-up of water in the excavation;
- The interceptor drainage will be discharged to the site constructed drainage system or onto natural vegetated surfaces and not directly to surface waters;

- The pumped water volumes will be discharged via volume and sediment attenuation ponds adjacent to excavation areas, or via specialist treatment systems such as a Siltbuster unit;
- There will be no direct discharge to surface watercourses, and therefore no risk of hydraulic loading or contamination will occur;
- Daily monitoring of excavations by a suitably qualified person will occur during the construction phase. If high levels of seepage inflow occur, excavation work should immediately be stopped and a geotechnical assessment undertaken; and,
- A mobile 'Siltbuster' or similar equivalent specialist treatment system will be available on-site for emergencies in order to treat sediment polluted waters from settlement ponds or excavations should they occur. Siltbusters are mobile silt traps that can remove fine particles from water using a proven technology and hydraulic design in a rugged unit. The mobile units are specifically designed for use on construction-sites.

Mitigation for hydrocarbon spillages:

- Seal/line sub-soil and bedrock at the Proposed Development Site by laying a proprietary geosynthetic clay liner where infrastructure is to be provided directly on top of bedrock or where the thickness of sub-formation overburden is less than 0.6m;
- On site re-fuelling of machinery at the Proposed Development Site and at those areas of construction works associated with the Haul Route Options will be carried out using a mobile double skinned fuel bowser. The fuel bowser, a double-axel custom-built refuelling trailer will be re-filled off site and will be towed around the site by a 4x4 jeep to where machinery is located. The 4x4 jeep will also carry fuel absorbent material and pads in the event of any accidental spillages. There shall not be any refuelling within a 20m buffer of all site drains. The fuel bowser will be parked on a level area in the construction compound when not in use and only designated trained and competent operatives will be authorised to refuel plant on site. Mobile measures such as drip trays and fuel absorbent mats will be used during all refuelling operations;
- Fuels stored at the Proposed Development Site will be minimised. Any storage areas will be bunded appropriately for the fuel storage volume for the time period of the construction. No fuel will be stored at those areas of construction works associated with the Haul Route Options;
- The electrical control building should be bunded appropriately to the volume of oils likely to be stored, and to prevent leakage of any associated chemicals and to groundwater or surface water. The bunded area will be fitted with a storm drainage system and an appropriate oil interceptor;
- The construction plant used should be regularly inspected for leaks and fitness for purpose; and,

- An emergency plan for the construction phase to deal with accidental spillages will be contained within Environmental Management Plan. Spill kits will be available to deal with accidental spillages at the Proposed Development Site and at the areas of construction works associated with the Haul Route Options.
- Mitigation for wastewater disposal is as follows: A Wastewater holding tank will be provided at the temporary site compound for the Proposed Development Site, maintained by the providing contractor, and removed from site on completion of the construction works;
- Sewage will be removed twice weekly (or more frequently if required) by a licenced contractor to a designated Wastewater Treatment Plant for treatment and disposal;
- Water supply for the site office and other sanitation will be brought to site;
- No water will be sourced on the site or discharged to the site.
- No wastewater facilities are required at any of the areas where construction work is required associated with the Haul Route Options due to short duration (1-2days) for works at these sites.

Mitigation for release of cement-based products are:

- At the Proposed Development Site, seal/line sub-soil and bedrock by laying a proprietary geosynthetic clay liner where infrastructure is to be provided directly on top of bedrock or where the thickness of sub-formation overburden is less than 0.6m.
- No batching of wet-cement products will occur at the Proposed Development Site. Ready-mixed supply of wet concrete products and where possible, emplacement of pre-cast elements, will take place;
- Where possible pre-cast elements for culverts and concrete works will be used;
- No concrete will be used at those areas where construction works are required for the Haul Route Options;
- No washing out of any plant used in concrete transport or concreting operations will be allowed at the Proposed Development Site;
- Where concrete is delivered to the Proposed Development Site, only the chute need be cleaned, using the smallest volume of water possible. No discharge of cement contaminated waters to the construction phase drainage system or directly to any artificial drain or watercourse will be allowed. Chute cleaning water is to be tanked and removed from the site to a suitable, non-polluting, discharge location;
- Use weather forecasting to plan dry days for pouring concrete; and,
- See that pour site is free of standing water and plastic covers will be ready in case of sudden rainfall event.

There will be no residual impacts for the Proposed Development Site or Haul Route Options in terms of effects on local groundwater supplies.

4.6 CUMULATIVE EFFECTS

The nearest wind farm in County Cork to the proposed EIA Development is located approximately is Barroy Wind Farm located approximately 2km north east of Derreenacrinnig West. That planning permission has now lapsed. Therefore, no significant cumulative effects are predicted on population and human health. The Landscape and Visual Impact Assessment contained in **Section 11** confirms that there will be no cumulative impact on the landscape from other wind farms in combination with the proposed EIA Development.

4.7 SUMMARY OF SIGNIFICANT EFFECTS

The assessment has not identified any likely significant effects from the EIA Development on population and human health.

4.8 STATEMENT OF SIGNIFICANCE

This Section has assessed the significance of potential effects of the proposed EIA Development on population and human health. The EIA Development has been assessed as having the potential to result in effects of a slight positive, long-term impact overall.

No likely significant cumulative effects are predicted.

4.9 COMPARISON WITH 2010 EIA

The results of the 2010 EIS are broadly in line with the results of this assessment.

4.10 REMEDIAL/MITIGATION MEASURES FOR THE EXISTING GRID CONNECTION

No remedial measures are proposed for the as constructed Overhead Lines.

For the proposed cable, a number of mitigation measures will be employed. The developer will consult with the local community and local businesses prior to the commencement of any construction work required on the cable route. The community will be advised of construction duration and of any road or lane closures proposed so to minimise the temporary disruption to the area.

Care has been taken to identify alternatives routes for road users for sections of the proposed grid connection route which will require lane closures as detailed in **Appendix H.** Road works in the town centre will be timed in consultation with the County Councils so that the works are programmed at such a time as not to coincide with a particular occasion on which the town centre is predicted to be busier than usual.

Operation

No mitigation measures required as the operational impacts are positive in the context of the overall EIA development.

Decommissioning

No mitigation measures required.

Land Use

The cable route is located primarily along the public road. Following the construction of the grid connection all roads and verges have been reinstated as per their pre-construction condition. At off road locations, the land has been left to recolonise naturally and return to the pre-existing use.

Construction

Regular updates will be provided to the local community in relation to the construction programme. This will be co-ordinated by an appointed liaison officer. Any disruption will be mitigated by considerate programming of the works in consultation with the local community. The works programme and the scope of works will be clearly communicated to the local community, local tourist operators, walking grounds and local tourist offices.

Operation

There is not expected to be any mitigation measures required during the operation stage of the grid connection.

Decommissioning

No mitigation measures are required.

4.10 CONCLUSION

Overall, the Grid Connection can be said to have the potential for a minor positive impact in terms of employment generation and a minor negative impact in terms of land take. No impact can be said to be significant in terms of any of the above topics. Having regard to the challenges faced as a result of Climate Change the project proposals will have a positive impact on Human Health and Population.

The CSO/Met Eireann Climate Data Rescue Project August 2018 study which was carried out in March 2018 by CSO staff. The purpose of the programme is to show how Climate Change has impacted on human health and the environment. The study concluded that climate change impacts on all aspects of life and the environment. Ecosystem services would be affected by significant climate change

4.11 REFERENCES

1. Central Statistics Office (CSO) Census 2016 www.cso.ie

2. Central Statistics Office (CSO) 2010 Live Register www.cso.ie

3. Failté Ireland Regions South West Facts 2009 www.failteireland.ie

4. SEI "Attitude Towards the Development of Wind Farms in Ireland" 2003 www.sei.ie

5. British Wind Energy Association (BWEA) and the Scottish Renewables Forum (SRF) 2002.

5 BIODIVERSITY

5.1 INTRODUCTION

5.1.1 Background

Doherty Environmental was commissioned by Jennings O'Donovan to undertake an Ecological Impact Assessment ("EcIA") for the EIA Development"). Full details of the proposed EIA Development are provided in **Section 2: Project Description**.

The EIA Development traverses the townlands of Ardrah, Ards More (East), Ards Beg, Barnagowlane West, Ballylicky, Crossoge, Derreenacrinnig West, Dromlickacrue, Derryarkane, Dromclarig, Gortroe, Gortnacowly, Glanareagh, Laharanshermeen, Maulikeeve, Maularaha, and Shandrum More ("the Existing Development Site").

("the Proposed Development Site"). The location of the EIA Development is illustrated in **Figure 5.1: EIA Development Location Map.**

The EIA Development includes the Haul Route Options, which are also described and assessed within this section of the EIAR. Further details of the Haul Route Options are shown in **Section 14: Traffic and Transport**.

This chapter of the revised The Environmental Impact Assessment Report ("EIAR") evaluates the effects of the EIA Development on terrestrial biodiversity. The assessment details the methods used to establish the terrestrial biodiversity interest within the Development Site and hinterland area, and the process used to determine the nature conservation importance of the populations present. It then sets out the potential effects on local biodiversity during construction, operation and decommissioning and assesses the significance of these effects. Means to mitigate any significant effects are then proposed. As well as considering potential impacts on flora and fauna, this chapter also considers impacts on designated areas.

5.1.2 Statement of Authority

The biodiversity chapter has been prepared by Mr. Pat Doherty MSc, MCIEEM, of DEC Ltd. Mr. Doherty is a consultant ecologist with over 15 years' experience in completing ecological impact assessment and contributing to Environmental Impact Assessment. He has been involved in the completion of assessments of multiple wind farm developments in both the Republic of Ireland and Northern Ireland where he has completed detailed habitat and fauna surveys to inform the assessment process. He has completed focused certified professional development training in a range of ecological survey techniques and assessment processes. Training has been completed for National Vegetation Classification (NVC) and Irish Vegetation

Classification (IVC) surveying, bryophyte survey for habitat assessment and identification, professional bat survey and assessment training, mammal surveying and specific training for bird surveys for Wind Farm developments. Training has been completed by approved training providers such as CIEEM, British Trust for Ornithology and the Field Studies Council.

5.1.3 Legislation, Policy and Guidance

This EcIA has been undertaken with full account of legislation, policy and guidance relating to species and habitat protection, importance and survey protocol. The guiding legislation, policy and guidance includes the following:

5.1.3.1 Legislation

5.1.3.1.1 EU Habitats Directive 92/43/EEC, European Communities (Natural Habitats) Regulations 1997, European Communities (Birds and Natural Habitats) Regulations 2011

The Habitats Directive provides the basis of protection for Natura 2000 sites, namely Special Protection Areas (“SPAs”) and Special Areas of Conservation (“SACs”). Article 6 of the EU Habitats Directive requires that any proposal that may have a significant effect on a Natura 2000 site must be subject to an Appropriate Assessment. An Appropriate Assessment is required in order to ascertain the potential impact of a proposal on the reasons for which the site is designated, and thereby ascertain the potential for adverse impact on the integrity of the site. A proposal that may adversely impact the integrity of the site may not be consented except in the absence of Feasible Alternative Solutions and in the event of Overriding Public Interest. A Natura Impact Statement has been undertaken for the proposed EIA Development. This concludes that the proposed EIA Development will not, adversely affect the integrity of any European Site (Natura 2000 site), either directly, indirectly or cumulatively.

The Habitats Directive also provides for the protection of species listed under Annex IV of the Directive wherever they occur. These species include otter and all bat species.

The Habitats Directive was transposed into Irish law by the European Communities (Natural Habitats) Regulations 1997 and subsequently amended in the European Communities (Birds and Natural Habitats) Regulations 2011. Regulation 42 of the 2011 regulations requires that any proposal likely to have a significant effect on a European Site, alone or in combination with other operations or activities, needs to be assessed with respect to its potential impact in the site’s conservation objectives (an Appropriate Assessment) and that the decision-making authority should be furnished with a Natura Impact Statement that incorporates a Screening Assessment and Appropriate Assessment as necessary.

5.1.3.1.2 Environmental Impact Assessment Directive (2011/92/EU)

European Union Directive 2011/92/EU ("the EIA Directive") considers the assessment of the effects of certain public and private projects on the environment. It has been transposed to Irish legislation by the Planning and Development Act 2000 (as amended), and the Planning and Development Regulations (2000 – 2015) (hereafter referred to as the "2011 EIA Regulations").

The Planning and Development Act 2000 (as amended) Part X, Section 171A (1) requires that an EIA is carried out by the competent authority (i.e. the local planning authority or An Bord Pleanála):

"*that shall identify, describe and assess in an appropriate manner, in light of each individual case and in accordance with Articles 4 to 11 of the Environmental Impact Assessment Directive, the direct and indirect effects of a proposed development on the following:*

(a) human beings, flora and fauna….,"

5.1.3.1.3 Environmental Impact Assessment Directive (2014/52/EU)

The requirements of the revised EIA Directive (2014/52/EU) ("the Revised EIA Directive"), which will be incorporated into Irish law, are taken into account by the observance of draft *Revised Guidelines on the information to be contained in Environmental Impact Statements*[17]. Annex IV of the Revised EIA Directive provides requirements for information to be included in the EIAR (as referred to in Article 5(1)(f). Additional emphasis has been placed on 'biodiversity' in the 2014 EIA Directive (see **Section 1: Introduction** of this REIS / EIAR for further details).

5.1.3.1.4 EU Birds Directive 79/409/EEC

EU Birds Directive 79/409/EEC ("the Birds Directive") establishes a system of general protection for all wild birds throughout the European Union. Annex I of the Birds Directive comprises 175 bird species that are rare, vulnerable to habitat changes or in danger of extinction within the European Union. Article 4 establishes clearly that wherever those species occur, they should be the subject of special conservation measures concerning their habitat in order to ensure their survival and reproduction in the area of distribution. Similar actions should be taken by Member States regarding migratory species, even if they are not listed in Annex I.

[17] Environmental Protection Agency. *Revised Guidelines on the information to be contained in Environmental Impact Statements*. Draft, September 2015. Available at: http://www.epa.ie/pubs/consultation/reviewofdrafteisguidelinesadvicenotes/

5.1.3.1.5 Bern and Bonn Convention

The Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention 1982) exists to conserve all species and their habitats. The Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention 1979, enacted 1983) was instigated to protect migrant species across all European boundaries.

5.1.3.1.6 The Wildlife Act (1976) as amended (2000)

The Wildlife Act 1976 gives protection a wide variety of birds, animals and plants in the Republic of Ireland. It is unlawful to disturb, injure or damage to their breeding or resting place wherever these occur without an appropriate licence from National Parks and Wildlife Service ("NPWS"). All birds, their nests and eggs are protected under law in Ireland through the Wildlife Act 1976 (as amended in 2000). Wilful destruction of an active nest from the building stage until the chicks have fledged is an offence. The act also provides a mechanism to give statutory protection to Natural Heritage Areas ("NHAs"). The amendment in 2000 broadens the scope of the Wildlife Acts to include most species, including the majority of fish and aquatic invertebrate species which were excluded from the 1976 Act.

5.1.3.1.7 Flora (Protection) Order, 1999

The Flora (Protection) Order affords protection to 56 vascular plants, fourteen mosses, four liverworts and two stoneworts. It is illegal to cut, uproot or damage the listed species in any way, or to offer them for sale. This prohibition extends to the taking or sale of seed. In addition, it is illegal to alter, damage or interfere in any way with their habitats. This protection applies wherever the plants are found and is not confined to sites designated for nature conservation.

5.1.3.2 Policies from The Cork County Development Plan 2014-2020

Relevant objectives and policies from the Cork County Development Plan 2014-2020 ("the CDP")[18] are given below.

- HE 1-1: County Biodiversity Action Plan: *"Continue to implement the County Biodiversity Action Plan (2008) in partnership with all relevant stakeholders*."
- **HE 1-2: County Heritage Plan:** *"Continue to implement with current County Heritage Plan (2005) in partnership with relevant stakeholders and any successor to this document."*
- **HE 2-1: Site Designated for Nature Conservation** *"Provide protection to all-natural heritage sites designated or proposed for designation under National and European legislation and International Agreements, and to maintain or develop linkages between*

[18] Cork County Development Plan (2014). *Cork County Development Plan 2014-2020*. Volume 1: Written Statement. April 2014. Available at: http://www.corkcocoo.ie

these. This includes Special Areas of Conservation, Special Protection Areas, Natural Heritage Areas, Statutory Nature Reserves, Refuges for Fauna and Ramsar Sites."

- **HE 2-2: Protected Plant and Animal Species: "Provide** *protection to species listed in the Flora Protection Order 1990, on Annexes of the Habitats and Birds Directives, and to animal species protected under the Wildlife Acts in accordance with relevant legal requirements. These species are listed in Volume 2, Chapter 4 of the plan. "*
- **HE 2-3: Biodiversity outside Protected Areas: "***Retain areas of local biodiversity value, ecological corridors and habitats that are features of the County's ecological network, and to protect these from inappropriate development. This includes rivers, lakes, streams and ponds, peatland and other wetland habitats, woodlands, hedgerows, tree lines, veteran trees, natural and seminatural grasslands as well as coastal and marine habitats. It particularly includes habitats of special conservation significance in Cork as listed in Volume 2 Chapter 3 Nature Conservation Areas of the plan."*

5.1.3.2.4Wind Energy Development Guidelines for Planning Authorities

Relevant guidance from the current 2006 Wind Energy Planning Guidelines ("the 2006 WEPG")[19] is given below.

- Section 3.7 Natural and Built Heritage and Wind Energy Development - *"The designation of an area for protection of natural or built heritage or as an amenity area does not automatically preclude wind energy development. However, consideration of any wind energy development in or near these areas must be subject to Ireland's obligations under the Habitats Directive (92/43/EEC), the EU (Birds) Directive (79/409/EEC) and the Environmental Impact Assessment Directive (97/11/EC). Clear guidance on policy and objectives should be available in development plans on the natural and built heritage, and the information contained therein on location and status should be accurate and up-to-date."*

5.1.3.2.5 Appropriate Assessment of Plans and Projects in Ireland – Guidance for Local Authorities (2010)

The 'Appropriate Assessment of Plans and Projects in Ireland – Guidance for Local Authorities' (2010) ("the Appropriate Assessment Guidance")[20] provides methodological and legislative guidance on Appropriate Assessment for any proposals that may impact on Natura 2000 sites

[19] Department of Environment, Heritage and Local Government, 2006). *Wind Energy Development Guidelines for Planning Authorities*. Available at: http://www.housing.gov.ie/sites/default/files/migrated-files/en/Publications/DevelopmentandHousing/Planning/FileDownLoad%2C1633%2Cen.pdf

[6] Department of Environment, Heritage and Local Government, 2009. Appropriate Assessment of Plans and Projects in Ireland: Guidance for Planning Authorities. Available at: https://www.npws.ie/sites/default/files/publications/pdf/NPWS_2009_AA_Guidance.pdf

in Ireland. These guidelines are highly relevant in assessing the potential impact on neighbouring Natura 2000 sites.

5.1.3.3 Guidance

5.1.3.3.1 CIEEM Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal.

The 'CIEEM Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal' (2016)[21] (the CIEEM Guidelines"), published by the Chartered Institute of Ecology and Environmental Management ("CIEEM"), are the acknowledged reference on ecological impact assessment and reflect the current thinking on good practice in ecological impact assessment across the UK and Ireland. They are consistent with the British Standard on Biodiversity, which provides recommendations on topics such as professional practice, proportionality, pre-application discussions, ecological surveys, adequacy of ecological information, reporting and monitoring.

These CIEEM Guidelines have the endorsement of the Institute of Environmental Management and Assessment ("IEMA"), the Chartered Institute of Water and Environmental Management, Northern Ireland Department of the Environment, Scottish Natural Heritage, The Wildlife Trusts and other leading environmental organisations.

5.1.3.3.2 Guidelines on the information to be contained in Environmental Impact Statements[22]

The Environmental Protection Agency's 2002 'Guidelines on the information to be contained in Environmental Impact Statements' were prepared in response to the 1992 Environmental Protection Agency Act (Section 72), which states that those preparing and evaluating Environmental Impact Statements shall have regard to such guidelines. The aim of these Guidelines is to improve the quality of Environmental Impact Statements in Ireland, and as such they address a wide range of project types and potential environmental issues.

5.1.3.3.3 EPA Draft revised guidelines on the information to be contained in Environmental Impact Statements[23]

The EPA Draft revised guidelines on the information to be contained in Environmental Impact Statements ("the revised EPA Draft Guidelines") have been produced by the Environmental Protection Agency in response to the adoption of revised Environmental Impact Assessment Directive 2014/52/EU. The new guidelines also incorporate experience arising from EU and

[21] CIEEM (2016) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal, 2nd edition. Chartered Institute of Ecology and Environmental Management, Winchester.

[22] EPA (2002). Guidelines on the information to be contained in Environmental Impact Statements. EPA, 2002

[23] EPA (2015). Revised Guidelines on the information to be contained in Environmental Impact Statements. Draft report.

Irish court cases, appeals and various pieces of new legislation adopted since the publication of the previous (2002) guidelines.

The revised EPA Draft Guidelines provide guidance on the principles and associated practice of preparing Environmental Impact Statements, with the aim of ensuring that the information that they contain is available in a format that is clear, concise and accessible to the greatest number of people.

Ecological designations/ Natural Heritage Designations

The Natura 2000 sites (SAC and SPA), the NHA and the pNHA are listed in more detail in the Cork County Development Plan. All such nature conservation areas were identified as key policy considerations and are shown in Figures 5.1-5.3.

Careful consideration has been given to the impacts of the developments on nature conservations sites and in particular Natura 2000 sites given the requirements to comply with EU Guidelines on carrying out Appropriate Assessment, which says that '*you must apply the precautionary principle and the focus of the assessment should be on objectively demonstrating, with supporting evidence, that there will be no adverse effects on the integrity of the Natura 2000 site.*' This is supported by ECJ ruling (Waddenzee Judgement) which says that the competent authority must be certain that the plan or project that they are assessing will not adversely affect the integrity of any Natura 2000 site. It also says that where this is not the case, adverse effects must be assumed. There is a checklist of questions that you must be able answer in order to conclude that there will be no adverse effects on integrity.

While the development of renewable energy can have social and economic benefits, it must be developed in an environmentally sustainable manner. In this respect, environmental benefits and constraints will be a key consideration in the preparation of the Draft County Development Plan and SEA and HDA shall be carried out in relation to the County Development Plan. The Draft County Development Plan will also be subject to flood risk assessments (FRA).

5.2 BACKGROUND

This section of the EIAR assesses the potential impacts of the proposed Derreenacrinnig West Wind Farm grid connection on the flora and fauna of the area. This assessment has been undertaken by Doherty Environmental Ltd., on behalf of Jennings O'Donovan & Partners Ltd. and examines the potential ecological impacts of the 14.km grid connection route, the consented Wind Farm and the cumulative effect on biodiversity of both the grid connection route and the Wind Farm. The purpose of this assessment is to:

- identify the habitats along the route;
- identify the existing fauna of the along the route;
- identify the potential impact of the proposed development;
- recommend measures to mitigate probable impacts; and
- identify any residual impacts to the ecology along the route.

The scope of the following assessment follows the guidance outlined in *IEEM's* Guidelines for Ecological Impact Assessment (2006). The following impact assessment is based upon a review of existing desktop information and the results of field surveys along the proposed route outlined below.

5.3 ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA

5.3.1 Relevant Legislation

Flora and fauna in Ireland are protected at a national level by the Wildlife Act, 1976 and the Wildlife (Amendment) Act, 2000 and the Flora (Protection) Order, 1999 (SI 94/1999). They are also protected at a European level by the EU Habitats Directive (92/43/EEC) and the EU Birds Directive (79/409/EEC).

The transposition of the EU Habitats Directive by the European Communities (Natural Habitats) Regulations 1997 – 2013 (referred to as the Habitat Regulations) provides the legal basis for the protection of habitats and species of European importance in Ireland.

The legislative protection of habitats and species provided by the Habitats Directive has been implemented in Ireland and throughout Europe through the establishment of a network of designated conservation areas known as the Natura 2000 (N2K) network (with individual sites being referred to as Natura 2000 Sites). The N2K network includes sites designated as Special Areas of Conservation (SACs), under the EU Habitats Directive and Special Protection Areas (SPAs) designated under the EU Birds Directive. SACs are designated in areas that support habitats listed on Annex I and/or species listed on Annex II of the Habitats Directive. SPAs are designated in areas that support: 1% or more of the all-Ireland population of bird species listed on Annex I of the EU Birds Directive; 1% or more of the population of a migratory species; and more than 20,000 waterfowl. Under the National Habitat Regulations all designated Natura 2000 Sites are referred to as European Sites.

The Wildlife Act 1976 (as amended) also provides for the statutory designation of nature conservation areas. These areas are referred to under the Wildlife Acts as Natural Heritage Areas and are designated in areas that support habitats and/or species of national importance.

Other relevant national legislation concerning the protection of flora, fauna and fisheries include the:

- Planning Act 2010;
- European Communities (Quality of Salmonid Waters) Regulations, 1988;
- The Freshwater Fish Directive 1978 (78/659/EEC); and
- The Surface Water Regulations, 2009.

5.4 SCHEUDLE OF WORKS

Doherty Environmental Ltd. was commissioned in March 2017 to undertake an Ecological Impact Assessment of the proposed Derreenacrinnig West Wind Farm Grid Connection route. A desktop review of the proposed grid connection route was completed in early March 2017. Targeted habitat surveys were undertaken by Doherty Environmental on the 6th & 7th March 2017, May 2017, 19th, 22nd and 26th October 2018.

5.5 METHODOLOGY

5.5.1 Desk Study

A desktop assessment was carried out to collate available information on the ecological baseline of the proposed grid connection route. The principal aspect of the desktop assessment was a review of satellite imagery and Google Street View to identify the habitats occurring along the proposed route. Following this review, a preliminary habitat map was prepared. A 50m corridor was established either side of the proposed grid connection route and all habitats were mapped to Level 3 of Fossit’s Guide to Habitats in Ireland.

Areas of semi-natural habitat occurring along the grid connection route were identified during the desktop assessment and these areas were then targeted for habitat surveying in the field.

In addition to the preparation of a preliminary habitat map, the following research was also undertaken:

- A review of the National Biodiversity Database to identify the presence or otherwise of protected species occurring within close proximity to the proposed route;
- A review of the NPWS online database to identify the presence or otherwise of designated conservation areas (i.e. SPAs, SACs, NHAs etc.);
- Review of Bat Conservation Ireland’s Batlas.
- Review of other published census data for a range of protected species.

5.6 SITE INVESTIGATIONS

Grid Route Site Investigations

Habitat Surveys

Habitat surveys were carried out on the 6th and 7th March 2017, 14th May 2017 and 19th, 22nd and 26th October 2018 to identify, describe, map and evaluate habitats and to verify information gathered at the desk study stage. The basis of the surveys undertaken on the above dates comprised ground truthing of the preliminary habitat map prepared during the desktop assessment and targeted Phase 1 Habitat surveys in areas identified as being representative of semi-natural habitats. the Phase 1 Habitat Survey of semi-natural habitats was completed with regard to the Heritage Council's publication Best Practice Guidance for Habitat Survey and Mapping (Smith et al., 2011).

Ground truthing of "improved" habitats, such as improved grassland and artificial built surfaces, was undertaken by visually assessing land cover from points along the grid connection route. Points along public roads intersecting the route and at vantage points overlooking the proposed route were used to ground truth the improved habitats mapped during the preliminary habitat mapping exercise.

In this report, scientific and common names for higher plants follow those in the Botanical Society of the British Isles (BSBI) standard list, published on its website www.bsbi.org.uk. Scientific and common names for bryophytes follow Smith (2004). Scientific and common names of mammals follow Whilde (1993).

Terrestrial Mammals

A survey for protected ground dwelling mammals, particularly badgers, was completed along proposed underground sections of the grid connection route. Surveys were completed on the 14th May 2017. The mammal survey involved walking either side of hedgerows and other field boundaries bisected by or parallel to the proposed underground sections of the grid connection route. These field signs, as described in Neal & Cheeseman (1996) and Bang & Dahlstrom (2006), include:

- mammal breeding and resting places, such as setts, holts, lairs;
- pathways;
- prints;
- faecal deposits;
- latrines (and dung pits used as territorial markers);
- feeding signs (snuffle holes);
- hair; and

- Scratch marks.
- Bird Surveys
- Wind Farm Site Investigations

Habitat Survey

A site visit was carried out on 8th July 2010 to identify, describe, map and evaluate habitats and watercourses and to verify the information gathered at the desk study stage. Habitats were classified using “A Guide to Habitats in Ireland” (Fossitt, 2000). Birds, mammals, amphibians and reptiles were assessed in the course of the main habitat survey using a combination of direct sightings and observations of signs, tracks and droppings.

Bird Surveys

During the walkover survey all bird species heard or seen were recorded. Although some individual birds were visually recorded to verify the species present, the majority of registrations were based on calls alone. Evidence of breeding activity, such as singing or birds carrying food was also recorded. The area surrounding the proposed site was regularly scanned with binoculars to detect species of conservation concern in the vicinity of the site. Bird identification followed Mullarney et al. (1999).

Kerry Slug

The survey methodology for this species follows the National Roads Authority (NRA) guidelines on the Ecological surveying techniques of protected flora and fauna during the planning of national road schemes (NRA, 2008). Surveys were carried out within 20 meters of the Wind Farm development footprint and associated works. These guidelines recommend that fixed route transects should be walked at 20m intervals throughout oak woodland or bog habitat, ideally at night using torchlight, and a visual count made of the number of individuals observed within five metres of the transect. This will involve a careful search of features on which the animals are likely to be feeding, especially tree trunks, moss-covered timber close to water, and lichen covered boulders and outcrops. Transects should be covered over a fixed time period to provide indices of relative abundance and allow comparison between sites in those situations where such data would be useful.

Assuming there are no significant health and safety implications, surveys should be conducted at night, particularly during damp and humid conditions. Periods of excessive cold or drought should be avoided as survey efficiency during these periods is considerably reduced. Whilst surveys can be carried out on cloudy, damp days, the efficiency of these searches will be lower than for nocturnal surveys.

As this was in the first instance a presence/absence survey and due to health and safety concerns of surveying on upland areas with bog conditions, night surveys were not conducted, with surveys instead conducted until one hour past dusk.

The weather conditions were ideal for the day light surveys due to overcast conditions with high humidity and constant periodic rain and mist showers during both survey events. Each survey event was limited to 15 minutes per transect and involved fingertip searches through vegetation, particularly surrounding boulders or rock outcrops. Potential refuges were also inspected.

Hand searching during or after heavy rain or at dusk/dawn is also recommended as the most successful method for finding specimens by the Forestry Service (Forest Service Department of Agriculture, Fisheries and Food, 2009). The NPWS Threat Response Plan for Kerry Slug Geomalacus maculosus does not specifically refer to night surveys but notes that that survey results are likely to be meaningful only if conducted in roughly similar atmospheric conditions e.g. cloudy overcast, some rain. (NPWS, 2010).

Geyer's Whorl Snail

Surveys for this species were conducted within the wind farm site in May 2011, and though outside of the optimum survey timeframe of March to May, this is still an opportune time to survey for the species as they are more active in the summer months than the winter months. Surveys should not be undertaken during windy conditions when snails may seek shelter. Similarly, in wet conditions snails may be more difficult to release from vegetation or crawl lower down the leaves where the seeds and plant litter may coagulate (NRA 2008). The closest known location of this species is approximately 145km north in Co. Clare.

As Geyer's whorl snail tends to be found in the litter layer and amongst roots of sedges, a more appropriate method is to combine hand-searching with a technique in which a sample of the microhabitat (e.g. leaf litter or moss) is removed and taken to a laboratory where it is air-dried and sieved through a series of different mesh sizes. Molluscan shells can then be removed and identified under a microscope. This method has the advantage of including empty shells in the sample.

Fingertips searching for Geyer's whorl snail was also conducted. Vegetation samples were then taken from within, and around, the flushes found on site to be air-dried and sieved to locate any shells.

5.7 SITE EVALUATION

The nature conservation value of habitats and ecological sites occurring along the proposed route are based upon an established geographic hierarchy of importance as outlined by the National Roads Authority (NRA, 2009). The outline of this geographic hierarchy is provided below, and this has been used to determine ecological value in line with the ecological valuation examples provided by the NRA (see NRA, 2009). The geographic evaluation hierarchy is as follows:

- International Sites (Rating A);
- National Importance (Rating B);
- County Importance (Rating C);
- Local Importance (higher value) (Rating D); and
- Local Importance (lower value) (Rating E)

5.8 IMPACT ASSESSMENT METHODOLOGY

5.8.1 Impact Magnitude

Impact magnitude refers to changes in the extent and integrity of an ecological receptor. The IEEM (2006) defines integrity of designated conservation areas as "*the coherence of the ecological structure and function across the area, that enables it to sustain the complex of habitat and/or the levels of populations of the species for which it was classified*". For non-designated sites this can be amended to: "*the coherence of ecological structure and function, that enables it (the site or populations supported by the site) to be maintained in its present condition*". For the purposes of this assessment, the impact magnitude is influenced by the intensity, duration, frequency and reversibility of a potential impact and is categorised as follows:

- High magnitude impact: that which results in harmful effects to the conservation status of a site, habitat or species and is likely to threaten the long-term integrity of the system.
- Moderate magnitude impact: that which results in harmful effects to the conservation status of a site, habitat or species, but does not have an adverse impact on the integrity of the system.
- Low magnitude impact: that which has a noticeable effect but is either sufficiently small or of short duration to cause no harm to the conservation status of the site, habitat or species.
- Imperceptible: that which has no perceptible impact.
- Positive: that which has a net positive impact for the conservation status of a site, habitat or species.

5.8.2 Impact Significance

The significance of impacts is determined by evaluating the nature conservation value of the site, habitat or species concerned together with the magnitude of the impacts affecting the system. The more ecologically valuable a receptor and the greater the magnitude of the impact, the higher the significance of that impact is likely to be. *Table 5.1* outlines the levels of impact significance to be used during the assessment of impacts. The probability of an impact occurring will also be outlined when defining the significance of impacts.

Table 5.1: Impact Significance Criteria

Nature Conservation Value	Magnitude of Potential Impact			
	High	Moderate	Low	Imperceptible
International	Severe	Major	Moderate	Minor
National	Severe	Major	Moderate	Minor
County	Major	Moderate	Minor	Minor
Local (High)	Moderate	Minor	Minor	Negligible
Local (Low)	Minor	Negligible	Negligible	Negligible

5.9 CHARACTERISTICS OF THE DEVELOPMENT

The 14km, 20kV electricity cable will connect the permitted 7-turbine Derreenacrinnig West Wind Farm to the existing Ballylicky 110kV substation in County Cork (see **Figure.1 1**).

The project, which is the subject of this substitute consent application, involves the consenting of the grid connection cable between DWW and Ballylicky ESB sub-station.

The grid connection, which is partially constructed, is designed as part overhead line (OHL) and part underground cable (UGC), running in an east-west direction over a distance of approximately 13.916km from DWW to Ballylicky ESB sub-station.

The status of the grid connection which has been partially constructed is as follows:

- OHL already constructed comprises 9.537km
- OHL to be constructed comprising 1.201km
- UGC to be constructed comprising 3.178 km in 6 separate locations

The cable will consist of 10.738km of OHL and 3.178km of underground cable and comprise 154 standard 20kV single poles in total, with an average span distance of 85m. The total route of the grid connection is shown at Figure **1.1** Three electrical conductors will be supported by each structure. Stay wires, required for increased stability, will be attached to poles at locations where the line changes direction and where there are poor ground conditions.

Pole and line installation works will be standard for a 20kV OHL:

- Poles are carried from adjacent roadways to each erection site and placed into an excavated hole using a wheeled or tracked excavator fitted with a pole grab attachment. Poles are rested on the ground while the pole hole is excavated.
- The excavation for each pole is carried out using a wheeled or tracked excavator fitted with 12-inch bucket and to a depth of approximately 2m.
- Poles are lined up with excavated holes and the machine operator then drives forward while rotating the pole grab attachment until the pole is in a vertical position. The pole remains controlled by the pole grab attachment on the excavator until it is supported by the backfill material.
- The pole hole is manually backfilled and tamped down to a minimum depth of 1.0m until the backfill is capable of supporting the pole; the excavator then continues the backfilling and tamping.
- Where rock is encountered, the pole hole is formed using a hydraulic rock-breaker attachment mounted on the excavator.
- Where the line changes direction and at poleset locations with poor ground conditions, stay wires will be required. These wires are supported by means of stay blocks, which are made of wooden sleepers and are buried underground.
- Stringing of the conductor involves pulling out polypropylene rope along the route by hand, attaching the conductors and then pulling into position with a stringing machine. Conductor stringing would require a Manitou or other mobile elevated work platform (MEWP), following the same pole access routes as the excavator.

It is envisaged that access to pole locations in enclosed and improved agricultural areas will use existing farm access points. In the more upland areas along the eastern sector of the route, where open bog and heath habitats will be encountered, construction materials will be transported by means of tracked machinery along demarcated access routes, which will be defined in advance based on site-specific geotechnical and ecological surveys. Low ground pressure machinery will be used in peat areas and bog mat access routes will be installed in areas of particularly poor bearing. These bog mat routes will be removed on completion.

5.10 STUDY AREA DESCRIPTION

5.10.1 Grid Connection Route

Originating at the Derreenacrinnig West Wind Farm, the proposed OHL route travels uphill across an area of wet heath occurring on the south-facing slopes of the ridge at Derreenacrinnig West. Descending from the crest of the ridge, the route cuts through 300m of first and second rotation forestry before passing through an area dominated by rough unenclosed grazing and wet heath. The route then travels west along the Mealagh River valley, predominantly through areas of improved pasture and wet grassland. The route turns northwest at Glanareagh hill and crosses the Mealagh River 1km southeast of Ardrah Bridge, before rising up the north side of the valley to Ardrah townland. From here, the route turns southwest again and descends steadily towards Shandrum, crossing areas of improved and unimproved grassland with occasional areas of heath and mature coniferous forestry. Between Shandrum and Ballylickey substation, the route environs are dominated by improved grassland and grassy verge along the margins of the public road in which the underground section of the route will be laid.

5.10.2 Wind Farm Site

The consented wind farm site is located in the townland of Derreenacrinnig West and is situated in West Cork, approximately 5km north-west of Drimoleague. The total area of the site is 121 ha and is characterised by elevations varying from 200mOD to 400mOD. The site consists predominantly of exposed or thinly covered bedrock and upland blanket peat bog/heath. The majority of the study area is underlain by the Gun Point Formation of the Old Red Sandstone Magnafacies (Minerex 2010). Much of the site is grazed by sheep. Peat depth across the majority of the site is >0.5m deep in particular on the southern slope. Deep peat generally occurs only in pockets with the deepest measuring approx. 3m deep (Minerex 2010).

The northern part of the site drains via a tributary into the Mealagh River, which flows into the sea at Bantry. The southern part of the site is drained by a tributary of the Ilen River which flows into the sea to the west of Skibbereen. The River Ilen is an important salmonid river and contains stocks of salmon and sea trout.

Principle habitats in the area consist of a mosaic of wet heath/blanket bog, wet grassland and conifer plantations. Land use in the surrounding area is a mix of agriculture (mainly sheep and cattle grazing) and conifer plantation forestry. A forest access track runs from the public road through the conifer plantation in the north of the site. A private access track runs along part of the southern boundary of the site.

5.11 DESIGNATED NATURE CONSERVATION AREAS

Lands along the grid connection route and within and surrounding the consented Wind Farm are not subject to any nature conservation designations under national and European legislation. *Table 5.2* lists all designated nature conservation areas occurring within a 15km radius of the grid connection route and the consented Wind Farm along with the approximate distances to each of these designated conservation areas. These designated areas are illustrated on *Figures 5.1* to *5.3*.

<u>Table 5.2:</u> Designated Nature Conservation Areas within 10km of the proposed site

Name and Site Code	Site Code	Designation Type	Distance from Site
Derryclogher Bog	004193	SAC & pNHA	750m to the south.
Glengarriff Harbour	004032	SAC & pNHA	6.1km to the west
Caha Mountains	000665	SAC & pNHA	10.9km to the southwest
Bandon River	002171	SAC	11.7km to the east
Conigar Bog	002324	NHA	10.1km to the west
Leahill Bog	000383	NHA	12.9km to the west
Slaheny River Bog	002417	NHA	12.9km to the north
Lough Namaddra & Lough West	001069	pNHA	9.1km to the northwest
Lough Nagarriva	001369	pNHA	9.8km to the northwest
Cusroe, Whiddy Island	000110	pNHA	6.5km to the southwest
Rossnashunsoge	001537	pNHA	8.1km to the west
Domestic Building near Glengarriff	002049	pNHA	6.4km to the west, northwest
Loughavaul	000098	pNHA	9.8km to the west
Gusroe Whiddy Island	000110	pNHA	6.5km to the southwest
Carriganass Castle	002099	pNHA	3.2km to the north
Bandon River Valley, South of Dunmanway	001035	pNHA	11.6km to the east
Lough Allua	001065	pNHA	14.9km to the north
Sheelane Island	001977	pNHA	11.4km to the west
Gougainebarra Lake	001057	pNHA	11.4km to the north
Currakeal	001826	pNHA	8.1km to the northwest
Ballagh Bog	001886	pNHA	11.1km to the north

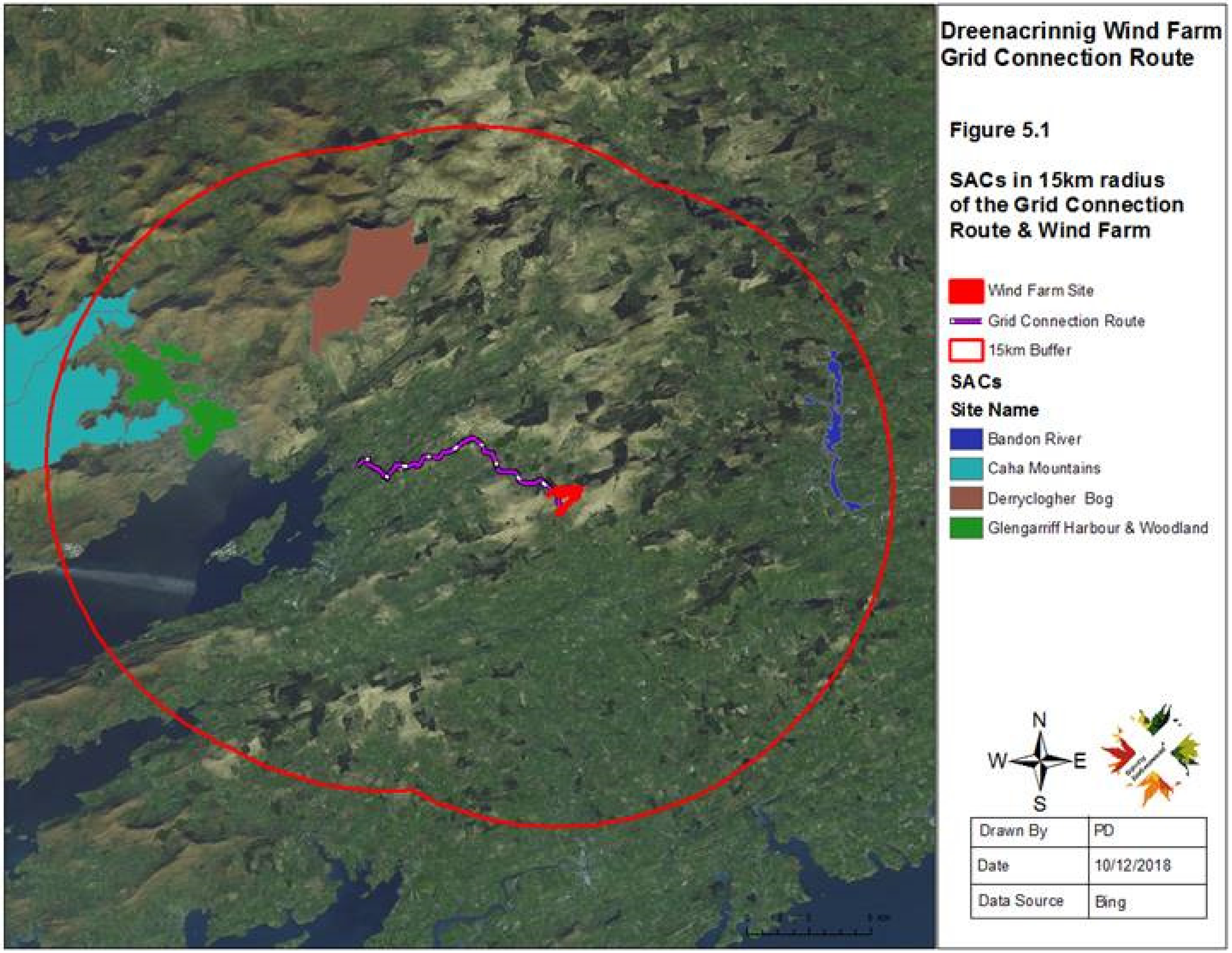

Dreenacrinnig Wind Farm
Grid Connection Route
Figure 5.1
SACs in 15km radius
of the Grid Connection
Route & Wind Farm
Wind Farm Site
Grid Connection Route
15km Buffer
SACs
Site Name
Bandon River
Caha Mountains
Derryclogher Bog
Glengarriff Harbour & Woodland
N
W
E
S
Drawn By
PD
Date
10/12/2018
Data Source
Bing

Figure 5.1

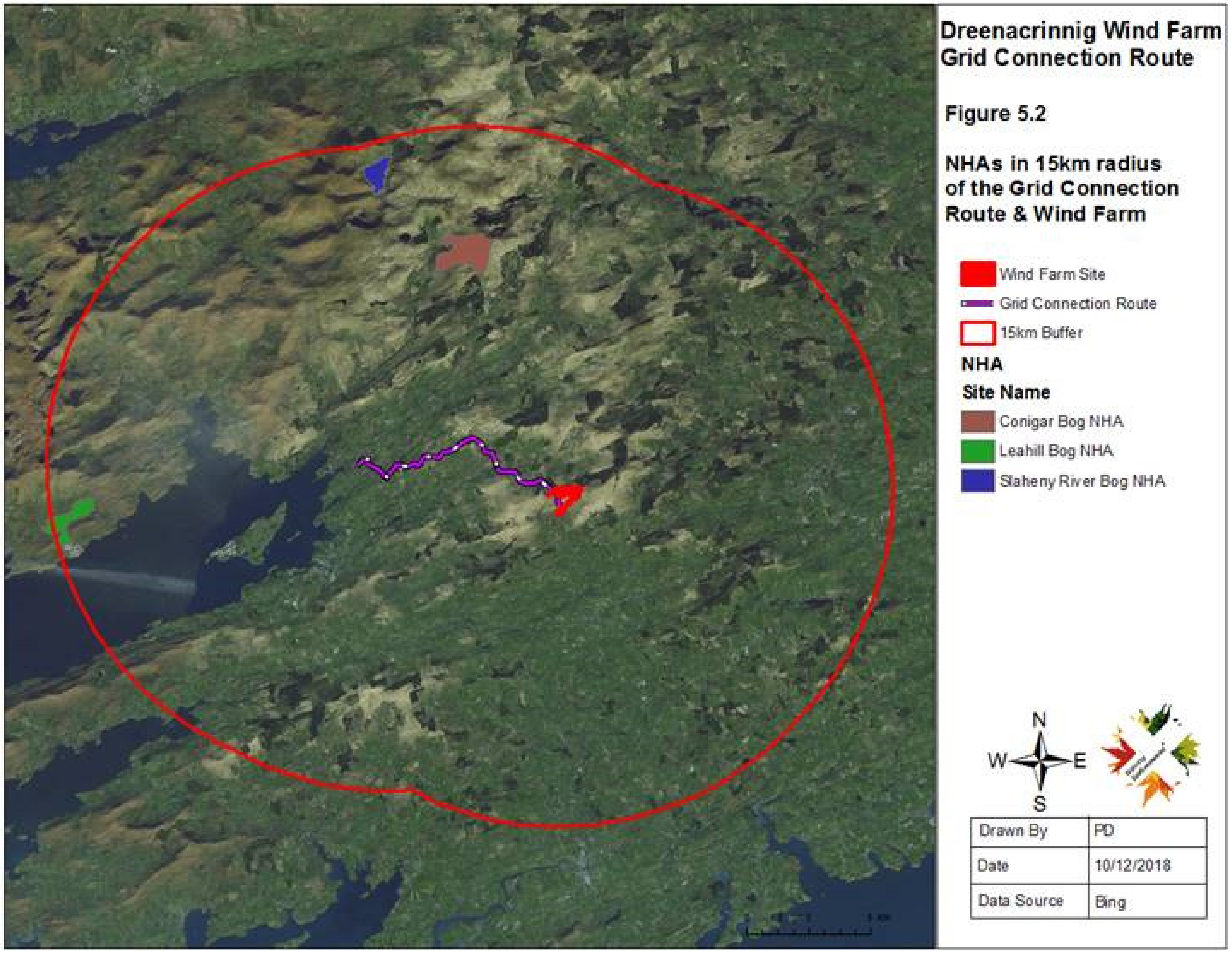

Dreenacrinnig Wind Farm
Grid Connection Route
Figure 5.2
NHAs in 15km radius
of the Grid Connection
Route & Wind Farm
Wind Farm Site
Grid Connection Route
15km Buffer
NHA
Site Name
Conigar Bog NHA
Leahill Bog NHA
Slaheny River Bog NHA
N
W
E
S
Drawn By
PD
Date
10/12/2018
Data Source
Bing

Figure 5.2

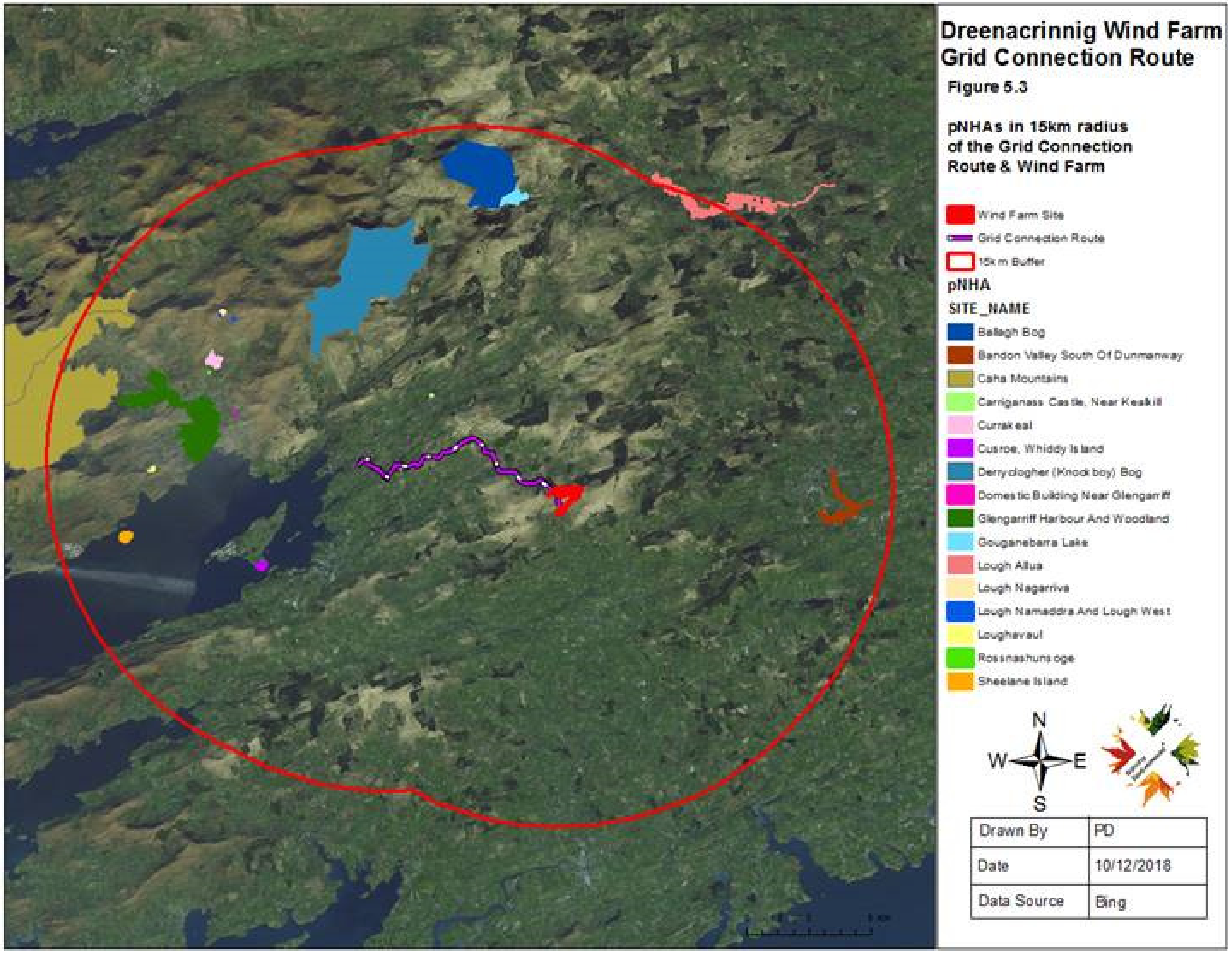

Dreenacrinnig Wind Farm Grid Connection Route
Figure 5.3
pNHAs in 15km radius of the Grid Connection Route & Wind Farm
Wind Farm Site
Grid Connection Route
15km Buffer
pNHA
SITE_NAME
Ballagh Bog
Bandon Valley South Of Dunmanway
Caha Mountains
Carriganass Castle, Near Kealkill
Currakeal
Cusroe, Whiddy Island
Derryclogher (Knockboy) Bog
Domestic Building Near Glengarriff
Glengarriff Harbour And Woodland
Gouganebarra Lake
Lough Allua
Lough Nagarriva
Lough Namaddra And Lough West
Loughavaul
Rossnashunsoge
Sheelane Island
N
W
E
S
Drawn By
PD
Date
10/12/2018
Data Source
Bing

Figure 5.3

5.11.1 Habitats Directive Assessment

Pursuant to Article 6(3) & (4) of the EU Habitats Directive and associated national legislation transposing this directive, an Appropriate Assessment is required where a plan or project has the potential to result in significant effects to the integrity of a Natura 2000 site.

Assessments under Article 6(3) of the Directive involves a number of stages that assess the likelihood of a plan or project to result in significant effects to European Sites. The initial Screening stage examines the likelihood of a project, either alone or in combination with other projects or plans, to result in significant effects to the integrity of European Sites. If the Screening concludes that significant effects are likely, an Appropriate Assessment is required. In effect, the Screening assesses the need for an Appropriate Assessment.

The Appropriate Assessment examines in detail how potential negative impacts associated with a project will affect the integrity of a European Site. Where such effects are considered likely to occur, mitigation measures are proposed so that such impacts are avoided.

A Screening Assessment of the proposed development, incorporating the electricity cable grid connection and the consented Wind Farm was carried out for the European Sites occurring within its zone of influence. It was concluded that the proposed development will not have the potential to result in likely significant effects to European Sites occurring within the wider zone of influence of the development. A copy of that Screening Report is set out at **Appendix C**. As such, an Appropriate Assessment was not required for the proposed development.

5.12 RARE & PROTECTED FAUNA

The spans the eight tetrads (i.e. 2km x 2km grid squares) W15A, W15B, W05W, W05R, W05S, W05L, W05G, W05B. A review of protected and rare species records for each of these tetrads held by Biodiversity Ireland (www.biodiversityireland.ie accessed on the 9th March 2017) was undertaken.

The protected, rare and/or sensitive species recorded within the eight tetrads surrounding the proposed grid connection route and wind farm are outlined in *Table 5.2.* As virtually all birds are protected in Ireland, only records for wetland or raptor species are detailed in ***Table 5.2***. A comment on the likelihood of each of these species occurring along the grid connection route and at or in the vicinity of the wind farm is provided in *Table 5.2*. This commentary is based upon the habitat occurring within the vicinity of the development and its suitability for supporting the species listed in *Table 5.2*.

Table 5.3: Protected and/or Rare Species occurring in the Eight Tetrads surrounding the Development

Common Name	Status	Likelihood of being supported by the project site
Sparrowhawk	Protected Species	Likely to be foraging throughout the study area.
Kestrel	Protected Species	Likely to be foraging throughout the study area.
Barn Owl	Protected Species	Likely to be foraging throughout the study area.
White-tailed Sea Eagle	Protected Species; EU Birds Directive Annex I	Recorded only from the tetrad W05B, at the western end of the route. Restricted to coastal areas. No suitable waterbodies occurring inland along the route.
Kingfisher	Protected Species; EU Birds Directive Annex I	Likely to be restricted to the west of the study area along the mature sections of the Owvane and Mealagh Rivers.

Common Name	Status	Likelihood of being supported by the project site
Wigeon	Protected Species	Recorded only from the tetrad W05B, at the western end of the route. Restricted to coastal areas. No suitable waterbodies occurring inland along the route.
Little Egret	Protected Species; EU Birds Directive Annex I	Recorded only from the tetrad W05B, at the western end of the route. Restricted to coastal areas. No suitable waterbodies occurring inland along the route.
Mallard	Protected Species	Recorded only from the tetrad W05B, at the western end of the route. Restricted to coastal areas. No suitable waterbodies occurring inland along the route.
Red-breasted Merganser	Protected Species	Recorded only from the tetrad W05B, at the western end of the route. Restricted to coastal areas. No suitable waterbodies occurring inland along the route.
Oystercatcher	Protected Species	Recorded only from the tetrad W05B, at the western end of the route. Restricted to coastal areas. No suitable waterbodies occurring inland along the route.
Curlew	Protected Species; EU Birds Directive Annex I	Recorded only from the tetrad W05B, at the western end of the route. Restricted to coastal areas. No suitable waterbodies occurring inland along the route.
Redshank	Protected Species	Recorded only from the tetrad W05B, at the western end of the route. Restricted to coastal areas. No suitable waterbodies occurring inland along the route.
Greenshank	Protected Species	Recorded only from the tetrad W05B, at the western end of the route. Restricted to coastal areas. No suitable waterbodies occurring inland along the route.

Common Name	Status	Likelihood of being supported by the project site
Great Northern Diver	Protected Species	Recorded only from the tetrad W05B, at the western end of the route. Restricted to coastal areas. No suitable waterbodies occurring inland along the route.
Cormorant	Protected Species	Recorded only from the tetrad W05B, at the western end of the route. Restricted to coastal areas. No suitable waterbodies occurring inland along the route.
Herring Gull	Protected Species	Recorded only from the tetrad W05B, at the western end of the route. Restricted to coastal areas. No suitable waterbodies occurring inland along the route.
Black-headed Gull	Protected Species	Recorded only from the tetrad W05B, at the western end of the route. Restricted to coastal areas. No suitable waterbodies occurring inland along the route.
Icelandic Gull	Protected Species	Recorded only from the tetrad W05B, at the western end of the route. Restricted to coastal areas. No suitable waterbodies occurring inland along the route.
Great-black backed Gull	Protected Species	Recorded only from the tetrad W05B, at the western end of the route. Restricted to coastal areas. No suitable waterbodies occurring inland along the route.
Red-billed Chough	Protected Species; EU Birds Directive Annex I	Recorded only from the tetrad W05B, at the western end of the route. Restricted to coastal areas. No suitable waterbodies occurring inland along the route.
Otter	Protected Species; EU Habitats Directive Annex II	Recorded only from the tetrad W05B but likely to be foraging along the Mealagh River.

Common Name	Status	Likelihood of being supported by the project site
Badger	Protected Species; EU Habitats Directive Annex IV	Likely to occur throughout all sections of the route at elevations below 150m.
Red Squirrel	Protected Species; EU Habitats Directive Annex IV	There is limited habitat along the route corridor to support red squirrel.
Irish Stoat	Protected Species; EU Habitats Directive Annex IV	Likely to occur throughout the route corridor at lower elevations, below 150m.
Irish Hare	Protected Species; EU Habitats Directive Annex IV	Likely to occur throughout the route corridor, but more likely to be associated with the eastern elevated sections of the route.
Lesser horseshoe Bat	Protected Species; EU Habitats Directive Annex II	This species was recorded from two tetrads, W05G and W05B through which the route corridor runs. Both tetrads are located towards the western end of the route corridor. This species is less likely to occur to the east of the route corridor due to the limited extent of favoured lesser horseshoe habitat occurring in this area.
Daubenton's Bat	Protected Species; EU Habitats Directive Annex IV	Recorded from the tetrad W05B at the western end of the route corridor. Likely to be associated with mature depositing rivers and coastal lakes.
Leisler's bat	Protected Species; EU Habitats Directive Annex IV	Recorded from the tetrad W05B at the western end of the route corridor. Habitat becomes less favourable to the east.
Soprano pipistrelle	Protected Species; EU Habitats	Recorded from the tetrad W05B at the western end of the route corridor. Habitat becomes less favourable to the east.

Common Name	Status	Likelihood of being supported by the project site
	Directive Annex IV	

5.13 HABITATS

5.13.1 Habitats Along the Grid Connection Route

The following sections provide a description of the habitats occurring within and immediately adjacent to the proposed grid connection route. The habitats occurring along the grid connection route corridor are illustrated in Appendix 1: Habitat Map Sheets 1 to 12.

Eroding Upland Watercourses (FW1)

The grid route passes through three separate surface water catchments, the Ilen River Catchment to the east of the alignment; the Mealagh River Catchment along the majority of the alignment and the Owvane River Catchment to the west of the alignment. Eroding upland (FW1) watercourses intersect the route corridor at various locations along the route. The route crosses the Mealagh River at one location in the townland of Ards Beg towards the east of the route corridor. Aside from this, only minor watercourses are crossed by the route corridor.

Drainage Ditches (FW4)

Numerous drainage ditches occur within the route corridor study area. The ditches occurring within the site are either bare, having been cut to bedrock level below the overlying peat deposit or have become colonised by a range of grasses and rushes such as *Deschampsia flexuosa, Agrostis capillaris, Agrostis caninia* and *Juncus effusus*.

Wet Willow Woodland (WN6)

Four examples of wet willow woodland occur within the route corridor. The first is located on the bankside of a meandering section of the Mealagh River in the townland of Ards Beg. The extent of this example of wet woodland is limited, being approximately 0.8 acres in size. Historical 6-inch and 25-inch maps of this area indicate the presence of wet pasture at this location. The meander of the Mealagh River has become more pronounced since the publication of these historical maps and it is likely that this wet woodland developed on the “tongue” of land between the meander.

The two other examples of wet woodland habitat occur in the townland of Drumloughlin towards the west of the route corridor. These two patches are separated by a small block of conifer plantation. They occur on sloping ground in a low depression. The 6-inch and 25-inch historical maps labelled the footprint of both patches of wet woodland as rough pasture, suggesting that this woodland is of recent origin. The combined extent of both patches occurring within the route corridor amounts to approximately 1 hectare.

The final example of this habitat occurs in the vicinity of the Ballylicky sub-station at the western end of the grid connection route.

Coniferous Plantation (WD4)

Commercially planted Sitka spruce (*Picea stitchensis*) occurs immediately to the north and west of the grid connection route. The block of forestry to the north of the wind farm site was planted prior to 1995, while the other two blocks to the west of the grid connection route are of older origin. The patches of forestry to the north of the wind farm site is representative of a first rotation, closed-canopy thicket (age-class 2 as per Coillte's age classification system for plantation forestry). Floral diversity within the conifer plantation is low with high levels of shading and acidic conditions arising from the slow decomposition of fallen needles limiting the potential for the ground layer to support a range of herb species.

Scrub (WS1)

The examples of scrub occurring along the route corridor are dominated by spreading patches of Ulex europeaus with Rubus fruticosus agg. Minor patches of immature willow (*Salix* sp.) scrub also occur. The examples of scrub habitat occur alongside watercourses, in marginal areas dominated by heavy, poorly drained soils or in association with unimproved wet heath habitat.

Recently Felled Woodland (WS5)

Recently felled conifer plantation occurs along the proposed route to the north of the wind farm site in the townland of Derreenacrinnig West. This habitat currently supports little vegetation with mosses such as *Rhytidiadelphus loreus, Hylocomium splendens, Pleurozium scheberi, Hypnum jutlandicum* and *Thuidium tamariscinum* dominating the cover.

Hedgerows & Treelines (WL1/2)

A network of hedgerows occurs throughout the lands along the grid connection route. The principal species occurring along hedgerows and treelines are *Fraxinus excelsior, Crategus monogyna, Prunus spinosa, Acer pseudoplatanus, Rosa canina, Sambuca nigra, Rubus fruticosus agg. and Ulex europeaus*.

Herbs occurring along hedgerows and treelines include *Urtica dioica, Galiium aparine*, *Heracleum sphondylium, Vicia cracca, Vicia sepium, Hypericum perforatum, Viola riviana, Geranium robertianum, Phyllitis scolopendrium, Polystichum setiferum, Ranunculus repens* and *Pteridium aquilinium.*

Improved agricultural grassland (GA1)

Improved agricultural grassland dominates the land cover at lower elevations throughout the route corridor. This habitat is intensively managed for cattle grazing and silage. Species indicative of high nutrient conditions in the habitat were noted throughout the land holding. These species include an abundance of *Lolium perenne, Holcus lanatus, Alopecurus pratensis, Ranunculus repens, R. acris, Trifolium repens, Trifolium pratense, Cirsium arvense, Cirsium vulgare* and *Urtica dioica*.

Overall, the improved agricultural grassland is species-poor and widespread on a local to national scale. This habitat plays a limited function in supporting wildlife although it does provide foraging and dispersal habitat for badgers and can support a limited range of invertebrates.

Amenity Grassland (GA2)

Examples of amenity grassland occurring within the route corridor are associated with domestic garden lawns. This is a species poor habitat likely to support a range of similar grass species such as *Festuca rubra, Agrostis stolonifera, Alopecurus pratensis* and *Holcus lanatus* and a limited range of herb species such as *Ranunculus repens, Ranunculus acris, Bellis perennis, Cerastium fontanum, Trifolium pratense, Trifolium repens* and *Taraxacum officinale agg*.

Humid Acid Grassland (GS3)

This unimproved grassland habitat occurs at higher elevations, generally above the 150m contour throughout the route corridor. It occurs in association with wet heath, which it frequently grades into. The dominant species of this habitat include *Agrostis stolonifera, Agrostis capillaris, Anthoxanthum odoratum, Nardus stricta, Deschampsia flexuosa* and *Festuca ovina*. Other species frequently occurring include *Juncus squarrosus, Carex panicea, Carex binervis, Carex echinata, Pedicularis sylvatica, Succisa pratensis, Potentilla erecta* and *Galium saxatile*. The bryophyte layer is dominated by Hylocomium splendens, Rhytidiadelphus squarrosus, Rhytidiadelphus loreus and Polytrichum commune. Sphagnum recurvum and Sphagnum tenellum are frequent in wetter depressions where this habitat grades into wet heath.

Wet Grassland (GS4)

Examples of wet grassland occur on poorly drained soils throughout the route corridor. Species poor examples of this habitat dominated by Juncus effusus are frequent on heavy waterlogged soils in more improved areas to the west of the corridor. Towards the east, and along the Mealagh River valley the wet grassland is dominated by a mix of Juncus acutiflorus and Juncus effusus. This wet grassland often grades into *Molinia caerulea* dominated wet heath. Other species occurring in association with the *Juncus acutiflorus* wet grassland include *Succisa pratensis, Deschampsia flexuosa, Deschampsia cespitosa, Hydrocotyle vulgaris, Galium palustre, Ranunculus flammula* and *Cardamine pratensis.*

Wet Heath (HH1)

Wet heath is the dominant peatland habitat occurring along the route corridor. Peats are thin throughout the route corridor at less than 0.5m in depth and exposed rock, indicating the shallow nature of the peat, is associated with all examples of wet heath habitat. The wet heath habitat occurring along the route corridor is generally restricted to elevated areas, above 150m. The exception to this is along the Mealagh River valley in the townland of Ards Beg. Throughout the route corridor this habitat is dominated by *Molinia caerulea* and occurs on thin peats at less than 0.5m in depth. To the east of the site in the vicinity of the wind farm the wet heath habitat is dominated by stands of species poor *Molinia caerulea*. Other species occurring in association with these species poor examples of wet heath include *Schoenus nigrans, Erica tetralix, Erica cinerea, Potentilla erecta and Calluna vulgaris*. The sward height consists of tall, tussocky *Molinia caerulea* to a height of greater than 25cm.

Other more species-rich examples of wet heath habitat occur along the route. Examples of this are in the townland of Ards Beg along the Mealagh River valley and the townlands of Laharanshermeen and Cappanaboul. Here the wet heath is again dominated by *Molinia caerulea,* but the sward heights are lower generally at 25cm or less. Signs of grazing were evident in these areas and it is likely that the low-level grazing occurring is restricting the dominance of *Molinia caerulea* and promoting diversity. *Succisa pratensis* is abundant in these areas along with *Trichophorum germanicum, Schoenus nigrans. Pedicularis palustre, Osmunda regalis, Potentilla erecta, Eriophorum angustifolium, Carex panicea, Carex echniata, Juncus squarrosus, Rhytidiadelphus loreus, Sphagnum capillifolium, Sphagnum papillosum, Sphagnum tenellum,* and *Breutilia chrysocoma* are all frequent in these areas of wet heath. *Erica tetralix* and *Calluna vulgaris* are occasional to rare.

Dry Heath (HH3)

Examples of dry heath are restricted to more elevated and/or exposed areas associated with exposed rock and very thin peat substrate. Two examples were noted during field surveys. These occur at the wind farm site in the townland of Derreenacrinnig to the east of the route corridor and also at an exposed location with rocky outcrops and thin peat in the townland of Derryarkane to the west of the route corridor. The dry heath is dominated by *Calluna vulgaris* and *Racomitrium lanuginosum*. Other species occurring frequently to abundantly include *Rhytidiadelphus loreus, Hypnum jutlandicum, Nardus stricta, Deschampsia flexuosa, Anthoxanthum odoratum* and *Juncus squarrosus*.

Dense Bracken (HD1)

Areas of dense bracken occur in association with previously felled conifer plantation. This habitat is comprised of mono-specific stands of *Pteridium aquilinium*.

Buildings & Artificial Surface (BL3)

Residential dwelling, farm buildings and paved surfaces make up the buildings and artificial habitats within the route corridor.

Habitats within the Wind Farm Site

The site consists predominantly of exposed or thinly covered bedrock and a mosaic of wet heath/upland blanket bog. Areas of dry heath are found on elevated areas with exposed rock. A large conifer plantation occurs in the northern part of the site. An elevated ridge runs across the centre of the site in a north-east to south-west direction. Below this ridge the site slopes off steeply to the south with more shallow peat soil. Vegetation along this slope indicates that there is a calcareous influence mostly likely due to the presence of glacial deposits. Peat depth across the majority of the site is >0.5m deep in particular on the southern slope. Blanket bog only occurs where the peat is >0.5m. This mostly confined to the northern half of the site where deep peat is found in pockets.

Wet heath HH3/upland blanket bog (PB2) mosaic

The majority of the site is characterised by wet heath habitat. Purple moor-grass (*Molinia caerulea*) is the dominant species with abundant Cotton grass (*Eriophorum vaginatum.*) also present. Stands of low-growing Western gorse (*Ulex gallii*), cross-leaved heather (*Erica tetralix*) and Ling (*Calluna vulgaris*) are also abundant in places. Moss cover is high in places and includes *Polytricum commune*, *Aulacomnium palustre* and *Sphagnum* species. Sedges including *Carex nigra* and *C. flacca* are also present. Other species include marsh lousewort (*Pedicularis palustris*), milkwort (*Polygala vulagris*). Stands of rushes (*Juncus effuses*) are also abundant throughout this habitat. On the southern slope black bog rush (*schoenus nigrans)* is abundant in places, indicating a calcareous influence. At the bottom of the slopes some localised areas of flush occur in wetter areas.

In parts of the site where peat depth is greater than 0.5m, wet heath grades into small pockets of habitat more characteristic of upland blanket bog (PB2). Vegetation is dominated by hares tail cotton grass, deergrass (*Scirpus cespitosus*) and ling. Cover of sphagnum mosses including *Sphagnum papillosum* and *S. capillifolium* is high in patches, particularly in a wet area.

Dry siliceous heath (HH1)

Wet heath grades to dry siliceous heath habitat on elevated parts of the site where exposed rock is present and peat soil is more free draining. The vegetation is dominated by ling (*Calluna vulgaris)* and bell heather (*Erica cinerea*) and grasses such as mat grass (*Nardus stricta*), sweet vernal (*Anthoxanthum odoratum*), couch grass (*Elymus sp*.) and meadow foxtail (*Alopecuris pratenis*),

Conifer plantation (WD4)

A large conifer plantation occurs in the northern part of the site. It is a commercial forest consisting mostly of mature Sitka spruce (*Picea sitchensis*).

Upland rivers (FW1)

Two upland streams (FW1) drain the site to the north and south. Both streams are characteristic of an upland eroding river channel with a substrate of bedrock and very little aquatic vegetation. These are described further under the **Section 5.3.6** Aquatic Environment and Fisheries.

5.14 FAUNA

5.14.1 Fauna along the Grid Connection Route

Non-volant Mammals

Otters (*Lutra lutra*) and their holts are protected under the EU Habitats Directive as well as under the Wildlife Act (as amended) 1976. Otters' Holts are generally established along riverbanks and these mammals are rarely found far away from aquatic habitats.

There are records of otters occurring along the Mealagh River to the east of the route corridor near Ballylicky and also in the vicinity of Ards Beg. This species forages widely throughout the Mealagh and Owvane river catchments.

Badgers, Irish Hare, Red Squirrel, Irish Stoat, Hedgehog and Pygmy Shrew have all been recorded in the vicinity of the route corridor. The six sections of proposed underground ducted line were surveyed in the field for signs indicating the presence of badgers. Particular attention was given to identifying the presence or otherwise of badgers along hedgerows and other field boundaries bisected by or running parallel to the proposed sections of ducted line. No badger setts were identified along the six sections of ducted line during the field survey on the 14th May 2017 and the 19th October 2018. No other field signs indicating the presence of badgers were recorded during the field survey.

Bats

The lesser horseshoe bat, an Annex II species has been recorded in the vicinity of the route corridor. Records for four other bat species (all Annex IV species) have also been identified. All bat records are associated with the lands at the eastern end of the route corridor.

Annex 1 /Sensitive Bird Species

Surveys for the presence of hen harrier were completed in 2015 for the national Hen Harrier census survey, within the 10km square hectad W15 in which the wind farm site and the eastern section of the route corridor occurs. No record of this species was recorded within this hectad during the 2015 surveys. The hectad W05 in which the eastern section of the route corridor occurs was not considered to support suitable habitat for hen harrier during the 2015 census survey. There are no records for the presence of hen harrier at this location. A possible breeding record for merlin was recorded within the hectad W05 during the 2007 to 2011 Bird Atlas. There are no breeding or winter records listed in the 2007 – 2011 Bird Atlas for Peregrine falcon in the two hectads W05 and W15.

Raptor species recorded in the vicinity of the route corridor include white-tailed sea eagle, sparrowhawk and kestrel. The white-tailed sea eagle is not likely to occur along the route corridor as no suitable habitat occurs for this species in the vicinity of the proposed overhead line. Both sparrowhawk and kestrel are likely to forage widely throughout the route corridor. There are records of Kingfisher along the sections of the Mealagh and Owvane Rivers crossed by the proposed route.

The route corridor, and lands to the north and south of it, do not support suitable habitat for supporting other sensitive species such as large wild fowl. There are no records of whooper swan, Bewicks swan or other geese species in the two hectads W05 and W15.

There are no recent records of curlew or golden plover breeding in the two hectads W05 and W15. Winter records of curlew are restricted to the coastal areas in the vicnity of Ballylicky. There are no winter records for golden plover within the two hecards W05 and W15.

There are no records noted in the 2007 – 2011 Bird Atlas of whooper swan, Greenland white-fronted geese, brent geese, greylag geese or other large wild fowl for the two hectads W05 and W15 through which the route passes.

Fish

The Mealagh and Owvane Rivers are both important salmon rivers providing suitable habitat for all age classes of Atlantic salmon. Tributaries of these rivers are also important for spawning and for juvenile fish. Good salmonid spawning habitat consists of a mix of cobbles, gravels and finer material, free of silt and detritus in fast flowing riffles to ensure that there is an adequate flow of water and oxygen through the substrate.

White-clawed Crayfish

There are no historical records for this species along the Ilen, Owvane or Mealagh Rivers.

Freshwater Pearl Mussel

The Ilen, and Mealagh River catchments, in which the route corridor occurs, are known to support populations of freshwater pearl mussels.

Kerry Slug

The rare and protected (Annex II and Annex IV EU Habitats Directive) Kerry slug (Geomalacus maculosus) has a distribution confined to the Old Red Sandstone geological zone of southwest Ireland. There is one historical record of this species from within the (W15) 10km square (DEHLG, 2010 and National Biodiversity Data Centre), however details on this location were not provided. Within its range in the southwest of Ireland it is found in three broad habitat types, oak dominated woodland, open situations of unimproved oligotrophic open moor or blanket bog and lake shores. The species is further restricted within these three broad habitat types and is absent unless sufficient sandstone outcrops and boulders, largely bare of vegetation except for lichens and mosses, are emergent within the area. For the majority of the grid connection route areas of suitable micro-habitat do not occur. Areas of boulder outcrops were restricted to two townland locations adjacent to the grid connection route at Cappanaboul and Laharanshermeen. However, no pole locations are situated within these micro-habitats.

Marsh Fritillary

There are records of marsh fritillary within the hectad W15. Suitable habitat for this species occurs along the route corridor (within the hectad W05). Areas of wet heath and humid acid grassland occurring along the route corridor within the hectad W05 support an abundance of Succisa pratensis in suitable short sward Molinia caerulea dominated wet heath.

Amphibians & Reptiles

The common frog (Rana temporaria) and smooth newt (Tristurus vulgaris) are both afforded protection under Annex V of the EU Habitats Directive and Wildlife Acts (as amended). No amphibians were noted during field survey. Drainage ditches and choked watercourses within the lands along the grid connection route provide suitable breeding habitat for frogs and newt.

5.14.2 Fauna within the Wind Farm Site

Mammals

No signs of badger (Meles meles) were recorded within the study site. Due to the exposed and wet habitats over much of the site, it is unsuitable for badger setts, however, badgers may occasionally use the area to forage. Badgers could be present within the coniferous plantation in the north of the site but due to the density of the woodland it was impossible to search for potential setts. Otter (Lutra lutra) is known to occur along both the Ilen and Mealagh Rivers and their tributaries. No otter signs were recorded within the site, but it is possible that they use the watercourses on site. Signs of fox (Vulpes) and rabbit (Oryctolagus cuniculus) were recorded in the general area. Other small mammals likely to occur include wood mouse (Apodemus sylvaticus) and pygmy shrew (Sorex minutus).

The exposed nature of the site, combined with the paucity of mature deciduous trees and suitable buildings, makes the site unsuitable for roosting bats. It is possible that bats may use the conifer plantation to the north of the site for foraging, but it is unlikely that they are commuting or foraging across the site due to the high elevation (400m).

Birds

Two species of bird typical of upland habitats were recorded in low densities during the walkover survey, skylark (Alauda arvensis) and meadow pipit (Anthus pratensis). Skylark is a species listed on the Amber list and of medium conservation concern in Ireland (Lynas et. al., 2007). Meadow pipits and skylark are ground nesting birds and are ubiquitous in peatland and upland habitats. Both of these species occupy a wide range of open habitats ranging from saltmarsh to peatland.

It is possible that snipe also occur, but none were recorded during survey. Snipe nest in dense vegetation separated by more open ground with low tussocks or clumps of sedges, rushes or coarse grasses. Snipe nest sites are always close to wet areas such as flushes and pool systems that are essential feeding areas for their insectivorous chicks.

Annex I bird species

There are records of Kingfisher along the Ilen and Mealagh Rivers. However, there are no records of bird species listed on Annex I of the EU Birds Directive for the area of the proposed wind farm and none were recorded during the field visits.

Hen harrier (Circus cyaneus) traditionally use open moorland for breeding in Britain and Ireland (Gibbon et al., 1993). However, there are no records for this species in this general area of West Cork (Barton et al. 2006, Nagle 2006).

There is no habitat within the study site suitable for use by nesting peregrines (Falco peregrinus) but they may occasionally use the site for foraging. The site is not within the known range of Merlin (Falco columbarius).

Consultations with local members of the Irish Raptor Study Group confirmed that there have been no recent records of Annex I bird species, raptors or owls in the area of the proposed wind farm.

Amphibians

Common frog and common lizard are likely to occur within the site due to the type of habitats present. In particular common lizard is found in areas with exposed rock, as they bask in the sunshine. No evidence of either of these two species was recorded during the present survey.

Molluscs

Kerry slug (Geomalacus maculosus)

Suitable habitat for supporting the Kerry Slug was identified within the Wind Farm site during surveys in 2010. Targeted surveys for Kerry Slug were completed in May 2011. During this survey suitable habitat was searched for the presence of Kerry Slug under suitable conditions. No record of this species was recorded within the Wind Farm site.

Geyer’s whorl snail (Vertigo geyeri)

Flush vegetation recorded in the southern parts of the site during habitat surveys in 2010 were identified as having the potential to support this species. A dedicated survey for the presence or otherwise of this species was completed in May 2011. The flush habitat was surveyed in detail for the presence of Geyer's whorl snail, but no record of this species was found to occur within the flush habitat in the Wind Farm site.

5.15 SITE EVALUATION OF THE GRID CONNECTION ROUTE

The proposed route corridor consists of a mosaic of peatland and grassland habitats with freshwater connections to the Mealagh, Ilen and Owvane Rivers, all of which are important salmonid rivers.

The peatland habitats are dominated by wet and dry heath. The more species rich examples of wet heath habitat such as that occurring along the Mealagh River valley at Ards Beg, at Laharansharmeen and at Cappanaboul have links to the Annex 1 habitat 'Molinia meadows on calcareous, peaty or clayey-silt-laden soils (6410)'. The examples of wet heath occurring within the route corridor are dominated throughout by *Molinia caerulea* with dwarf shrub heathers occurring only occasionally to frequently. As such they are not considered to be representative of the Annex habitat "Northern Atlantic wet heaths with *Erica tetralix* (4010)". The limited examples of dry heath, particularly those occurring on the ridgeline at Derreenacrinnig West has links to the Annex 1 habitat "European Dry heaths (4030).

The route corridor is not located within an important bird area and no Special Protection Areas occur within a 10km radius of the grid route. There are limited records of Annex 1 listed species occurring within the vicinity of the route: kingfisher is the only Annex 1 species likely to occur along the route corridor. No sensitive bird species are known to occur in the vicinity of the route corridor. All mammal species recorded within the study area are common and widespread.

The site is within the very limited geographical range of the Kerry slug, an Annex II and Annex IV species under the EU Habitats Directive.

Freshwater pearl mussel is known to occur within the Mealagh, Owvane and Ilen River. A tributary of the Ilen River runs along the southern boundary of the site. It is not known at present how high up the river system this species occurs. The presence of undesignated populations of this species in these watercourses is considered to be of national ecological value.

Overall, the lands occurring within the route corridor range from local (low value) to national ecological value. Habitats of national ecological value include the Mealagh River. Habitats of County Importance include the wet heath habitat, particularly the examples at Laharanshermeen, Cappanaboul and Ards Beg, the dry heath along the ridge line of

Derreenacrinnig West and the wet willow woodland. The humid acid grassland is considered to be of local (higher) value while other habitats such as gorse scrub, conifer plantation, recently felled woodland improved agricultural grassland, amenity grassland and built land are of local (lower) value.

5.16 WIND FARM SITE

The site of the proposed development consists of a mosaic of peatland habitats with freshwater connections to the Mealagh and Ilen Rivers, both of which are important salmonid rivers and are known to support undesignated populations of freshwater pearl mussels.

The peatland habitats consist of a mosaic of wet heath with pockets of blanket bog. These habitat types have links to habitats listed on Annex I of the EU Habitats Directive. Wet heath habitat corresponding to 'Northern Atlantic wet heaths with *Erica tetralix* (4010)' is listed on Annex I of the EU habitats Directive. Blanket bogs that are still capable of peat formation correspond to the priority habitat 'blanket bogs (*if active bog) (7130)' (Fossitt, 2000).

Bird species recorded within the site are of medium to low conservation concern. No birds listed on Annex I of the EU Birds Directive were recorded using the site during the present study. All mammal species recorded within the study area are common and widespread.

Overall the site is considered to have high ecological value.

5.17 CONSTRUCTION PHASE IMPACTS OF THE GRID CONNECTION OVERHEAD LINE

5.17.1 Designated Conservation Areas

There will be no impacts to any designated conservation areas as a result of the construction of the overhead line and the installation of the poles. No such sites occur within close proximity to the cable route and the pole locations and due to the distance of the route and pole locations from these sites it is highly unlikely that the construction operations associated with the pole installation and stringing of the electrical cable will have the potential to result in likely significant effects to these areas.

5.17.2 Habitats

As outlined in Section 3, the erection of poles will be required along the proposed overhead line. The footprint of the poles will result in a permanent land take along the route corridor. The working area required at the base of each pole will also result in temporary disturbance to habitats.

5.17.3 Watercourses

All watercourses will be oversailed by the overhead line and no poles will be places within 25m of any watercourse transected by the route. This approach will minimise the potential for negative impacts to watercourses and with its implementation no significant effects to watercourses are predicted.

5.17.4 Peatland

The excavation for poles will result in the disturbance to this habitat. A total of 35 poles are located within peatland habitats, with 33 located in wet heath and 2 located in dry heath. The excavation and installation of poles within this habitat will result in a temporary disturbance to $66m^2$ of wet heath habitat occurring along the grid connection route and a permanent loss of approximately $8.5m^2$ under the footprint of the poles. Over $233{,}000m^2$ of wet heath habitat has been mapped within the 100m grid connection route corridor. The temporary disturbance to this habitat arising from the installation of the poles and the permanent loss of habitat to the poles will represent a temporary disturbance to less than 0.03% and a permanent loss of less than 0.003% of this habitat occurring within the grid connection route study corridor.

Two poles are located within dry heath habitat, amounting to a total of $14m^2$ of temporary disturbance and $0.6m^2$ of permanent loss to the footprint of these poles. A total dry heath area of $14{,}900m^2$ has been mapped within the grid connection route study corridor. The installation of the poles will result in the temporary disturbance of approximately 0.025% and a permanent loss of less than 0.004% of this habitat. The areas of temporary wet heath and dry heath habitat loss are negligible and will have a low magnitude effect and an impact of minor negative significance.

The wet heath and dry heath habitats are underlain by thin peat generally at less than 0.5m in depth, with exposed rock occurring throughout the examples of wet heath crossed by the overhead line. Due to the thin peats present the excavations will not result in significant disturbance to the hydrology of the wet heath habitat and will not undermine the functioning of this habitat in areas surrounding the excavation locations. The excavations in heath habitats is predicted to have the potential to result in a low magnitude impact of minor significance.

The use of low ground bearing pressure tracked machinery to access pole locations within heath habitats will avoid any significant compaction or disruption to wet heath. The use of such machinery will represent a low magnitude effect and an impact of minor significance.

5.17.5 Humid Acid Grassland

The excavation for poles will result in the disturbance to this habitat. A total of 38 poles are located within this habitat and the excavation and installation of poles within this habitat will result in a temporary disturbance to 76m^2 and a permanent loss of approximately 11.4m^2 under the footprint of the poles. Over 270,000m^2 of humid acid grassland habitat has been mapped within the 100m grid connection route corridor. The temporary disturbance to this habitat arising from the installation of the poles and the permanent loss of habitat to the poles will represent a temporary disturbance to less than 0.03% and a permanent loss of less than 0.004% of this habitat occurring within the grid connection route study corridor.

The areas of temporary and permanent habitat disturbance and loss are negligible and will have a low magnitude effect and an impact of minor negative significance to this habitat.

The tracking of machinery to pole locations in this habitat will have a negligible disturbance impact to the grassland.

5.17.6 Improved agricultural grassland

The improved agricultural grassland occurring along the route corridor is of low nature conservation value. A total number of 62 poles will be situated in this habitat. The excavations for poles in this habitat will represent a low magnitude effect and an impact of negligible significance.

5.17.7 Scrub

The overhead line will over-sail the majority of areas supporting scrub along the route. Only one pole will be situated in this habitat. This temporary disturbance to this habitat as a result of the installation of this pole and the access of machinery to the pole location will represent a low magnitude effect to this habitat of local nature conservation value. Such an effect will represent an impact of low significance.

5.17.8 Wet Willow Woodland

The overhead line will over-sail the majority of areas supporting wet willow woodland along the route. Only one pole will be situated in this habitat. The total extent of this habitat within the grid connection route study corridor is 26,770m^2. The installation of this pole will result in the temporary loss of approximately 0.007% and a permanent loss of 0.001% of this habitat. This amount of temporary and permanent loss to this habitat represents an imperceptible effect and an impact of negligible significance. It is also noted that the pole is located at the edge of wet willow woodland habitat and the access to the pole location will not result in further temporary disturbance to this habitat.

5.17.9 Hedgerows

There will be no loss of linear hedgerows or treelines during the construction phase of the project. The overhead line will over-sail all linear habitats occurring along the route. Where taller treelines/hedgerows are intersected by the over-headline, the upper limbs will need to be pruned down below the line. There will be no loss in the extent of linear hedgerow/treeline habitat during pruning. As such this impact will represent an impact of imperceptible magnitude and negligible significance.

5.17.10 Birds

The minor nature of the works associated with the construction phase, along with the absence of any breeding of sensitive ground nesting bird species (such as curlew) from the wider surrounding area, and the avoidance of any loss of hedgerow, broadleaved woodland or scrub habitat will minimise impacts to birds during the construction phase to an impact of negligible significance.

5.17.11 Bats

No built structures or mature trees will be felled as a result of the overhead line. All linear habitats will be maintained during the construction phase and there will be no loss of potential foraging or commuting habitat for bat species. As such the construction phase will represent an impact of negligible significance to bats.

5.17.12 Badger

Much of the ground conditions along the route alignment are not suitable for supporting badgers. This species is more likely to be encountered to the east of the alignment. Badger setts are generally located along hedgerows or within woodland and scrub habitat. The avoidance of any excavation works in such habitats will further avoid is expected to minimise any potential disturbance to badgers.

5.17.13 Otter

Otters are known to be sensitive to construction activities and may abandon territories in the vicinity of such activity. The Mealagh River represents the only major watercourse to be crossed by the overhead line. It is likely that the local otter population rely mostly on this watercourse as opposed to other minor feeder streams. The buffering on any pole and associated works at minimum distance of 25m back from this and all other watercourses, coupled with the minor works associated with the individual pole and overhead line installation will minimise any potential impacts to an imperceptible level of low significance.

5.17.14 Freshwater pearl mussels

Freshwater pearl mussels or other aquatic invertebrates will not be affected by the construction of the proposed overhead line, due to the avoidance of physical contact of overhead lines with the water surface, and the distance of pole locations from watercourses that have the potential to support this or other aquatic invertebrate species. The impact significance on this species will be negligible.

5.18 CONSTRUCTION PHASE IMPACT OF THE GRID CONNECTION UNDERGROUND LINE

5.18.1 Designated Conservation Areas

There will be no impacts to any designated conservation areas as a result of the construction of the underground line and the installation of the electrical cables. No conservation areas occur within close proximity to the underground cable route locations and due to the distance of the route from these sites it is highly unlikely that the construction operations associated with the pole installation and stringing of the electrical cable will have the potential to result in likely significant effects to these areas.

5.18.2 Habitats

Six sections of underground line, amounting to approximately 3.178km are required for the grid connection route. The underground route will result in temporary disturbance to improved agricultural grassland and road verges. In addition, discrete sections of six hedgerows will be temporarily disturbed during the excavation of trenches to accommodate the underground trench.

The temporary disturbance to improved agricultural grassland and road verges during the construction of the underground line will result in an impact of imperceptible magnitude and will be of negligible significance. The temporary disturbance to hedgerows will be of a short-term nature, as all hedgerows will be reinstated following the installation and backfilling of the cable.

5.18.3 Birds

The underground line will result in the temporary disturbance to discrete areas of six hedgerows during the construction phase. The overall extent of hedgerow habitat loss will be negligible and is not predicted to have the potential to result in significant effects to the status of the local breeding bird population.

5.18.4 Bats

Bats are known to rely on hedgerows as commuting and foraging habitat. The temporary loss of discrete sections of hedgerows along the line of the underground route is not expected to result in the temporary fragmentation of any commuting or foraging routes. As such this element of the works will not result in significant effects to bats.

5.18.5 Badger

The excavations associated with the underground ducted line are not predicted to have the potential to negatively affect the badger population occurring in the surrounding area. Each section of the proposed ducted line was surveyed for the presence of badger setts and none were found during targeted field surveys. The absence of badger setts, tunnels and chambers in the vicinity of the ducted line will eliminate any risks posed by excavations associated with the grid connection route to badgers and their resting places.

5.18.6 Otter

The underline line will cross no watercourses. As such it will not result in any potential impacts to otters.

5.18.7 Freshwater pearl mussels

The underline line will cross no watercourses. As such it will not result in any potential impacts to freshwater pearl mussels or other aquatic invertebrates.

5.19 CONSTRUCTION PHASE IMPACTS OF THE WIND FARM

5.19.1 Designated Conservation Areas

There will be no impacts to any European Sites as none occur within 10km of the proposed site. The only designated site within a 10km range of the site is the pNHA Carriganass Castle, Near Kealkill, which has been designated due to a nationally important maternity colony of Daubenton’s bats. This roost is located approx. 7km from the proposed development site. Daubenton’s bats usually only forage 3km from the maternity roost (Altringham, 2003) and generally avoid watercourses devoid of overhanging vegetation (Russ and Montgomery, 2002).

Due to the distance of the proposed site from the pNHA and the nature of the watercourses on site it is highly unlikely that any bats from this roost are foraging on the proposed development site. Therefore, there will be no impacts direct or indirect to this pNHA.

5.19.2 Terrestrial Habitats

A direct loss of habitat will occur as a result of the construction of 7 turbine bases including hard standing (0.46 ha), new access roads (totalling 1.66 ha) and electrical compound, sub-station and car parking (0.15 ha). Excavation of peat will be required in some locations to provide hardstanding areas for turbine bases, sub-station and some access roads. Peat extraction has the potential to indirectly impact on surrounding wet heath/blanket bog habitat as a result of disruption to the natural hydrology.

Four of the proposed turbines (T3, T5, T6 and T7) will be located on existing exposed bedrock and will not require peat excavation. The other three (T1, T2 and T4) will be located on wet heath with peat depth less than 0.5m. Peat excavation will be required at these locations.

The new access road proposed along the southern part of the site (approx. 2km) will impact wet heath, flush habitat and where the peat is greater in depth than 0.5m blanket bog.

The majority of the remaining access track is situated on either exposed bedrock or peat <0.5m deep. Site surveys indicate that it is unlikely that the remainder of the track crosses peat >3m deep but this cannot be ruled out due to the localised variability in peat depth (Minerex 2010). Anywhere peat depth exceeds 0.5m there will be impacts to blanket bog habitat.

Layout and storage of surface vegetated scraghs/turves, for resodding bare areas, has the potential to impact on surrounding intact habitats. Mitigation measures will be implemented to ensure protection of surrounding habitats.

The loss of small areas of wet heath at turbines locations T1, T2 and T4 is not expected to have a significant impact on the functioning of this habitat within the site. Similarly, the loss of areas of exposed bedrock will not have a significant impact in terms of the functioning of this habitat. The loss of a small area of coniferous plantation woodland, a habitat considered to have low ecological value, will not have a significant impact.

There is, however, potential for significant impacts where the proposed access roads are located. This is particularly pertinent where the access road is proposed to be located along the south of the site. This section of road will cross a large area of wet heath/bog. Where there is excavation of peat there is always potential for direct and indirect hydrological impacts to surrounding habitats due to potential alteration of hydrological flows, which are essential for the functioning of peatland habitats.

Aquatic Habitats & Fisheries

Peat soil is highly erodible and can give rise to sedimentation. Surface run-off also tends to occur more frequently on impermeable soils such as peat especially during heavy rainfall. There is potential for impacts on surface water quality and fisheries as a result of increased suspended solids entering watercourses within and downstream of the site during construction.

There is potential for impacts on surface water quality due to increased surface water runoff generated on impermeable surfaces (access roads, turbine bases). Construction of access roads can cause preferential flow paths for surface waters, resulting in a significant increase in the amount of water entering local watercourses. This can lead to additional pressures on watercourses and interfere with the sustained flow of water particularly during dry weather.
There is potential for impacts on surface water quality due to leaks or spills of hydrocarbons or discharge of cement or concrete wash both during and post construction.

Disposal of waste material in particular peat soil has the potential to cause serious pollution to watercourses. Leachate from disturbed or stockpiled soils also poses a significant threat to the quality of water in receiving water bodies.

Birds

Some breeding birds recorded within the site will be impacted by a loss of feeding and nesting habitat, and by increased disturbance, particularly during construction of the proposed scheme. Overall, the area of permanent habitat loss is considered to be small and will not have a significant impact on local bird populations. Disturbance due to construction activities will be temporary to short-term in nature. A study in the UK (Pearce-Higgins *et al*., 2009) found no evidence of turbine avoidance by breeding passerines.

Mammals

There will be a loss of habitat for mammals as a result of the proposed development, however this loss will be small and will not have a significant impact on mammals using the site. Any impacts as a result of disturbance from construction activities will only be temporary and will not interfere with foraging behaviour which, for most mammals, is nocturnal.

Kerry slug (Geomalacus maculosus)

Due to the absence of this species within the Wind Farm site no impact is expected to occur to it.

Geyer's whorl snail (Vertigo geyeri)

Due to the absence of this species within the Wind Farm site no impact is expected to occur to it.

Aquatic Species

The southern part of the study site drains into a tributary of the Ilen River, therefore there is potential for the proposed development to indirectly impact freshwater pearl mussel and Atlantic Salmon which occur within the Ilen catchment. The access road proposed along the southern part of the site crosses two streams, which drain into this tributary. The road also runs parallel to this tributary for approx. 1.3km, however it is located outside of the 50m buffer zone surrounding this watercourse with the exception of the two stream crossings. Any increase in sediment within this watercourse could have potentially significant negative impacts on the two Annex II species freshwater pearl mussel and Atlantic salmon.

The northern part of the site drains into a tributary of the Mealagh River, therefore there is potential for the proposed development to indirectly impact Atlantic salmon, which occur within the Mealagh catchment. The existing borrow bit, which will be extended is located along an existing track within the area of coniferous plantation in the north of the site. Trackways can act like conduits especially if located on a gradient. Run-off from excavated peat stored in the borrow pit could potentially cause siltation in the Mealgh River which could adversely impact on salmonids.

5.20 OPERATION PHASE IMPACTS OF THE OVERHEAD LINE

5.20.1 Designated Conservation Areas

The operation phase of the overhead line will not present any potential impacts to designated conservation areas occurring in the wider surrounding area.

5.20.2 Habitats

There will be no additional impacts to habitats during the operational phase of the overhead power line.

5.20.3 Birds

New power line can pose a collision risk to birds in areas where sensitive bird species are present, such as the overwintering grounds of wildfowl species or the breeding territories of raptors, waders and wildfowl.

Existing baseline information indicates that the proposed grid connection route is not located within an important (or sensitive) bird area. There are no Special Areas of Protection occurring within over 10km of the proposed route. There are no records of breeding waders occurring within the vicinity of the route alignment or the Mealagh River Valley.

There is no record of sensitive raptor species (i.e. hen harrier, merlin) within the vicinity of the route, while white-tailed sea eagles, which have been recorded near the coast at Ballylicky are not expected to interact with route due to the absence of suitable habitat in its vicinity. However, kestrel and sparrowhawk have been recorded in the vicinity of the route. While population of raptors have not been recorded in abundance in the vicinity of the route the presence of a new power line will have potential to adversely affect individual birds. This is most likely in the non-breeding season, when breeding birds and their offspring may be more widely dispersed, and transient and migrant birds may also occur. The potential impact of the operational overhead line on breeding raptors is therefore assessed to be of low significance.

A review of baseline data indicates that the Mealagh River valley at the crossing point of the proposed overhead line is not likely to function as an established commuting route by swans and other vulnerable bird species.

5.20.4 Bats

The presence of the overhead power line will not have the potential to negatively affect bat species.

5.20.5 Badgers

The presence of the overhead power line will not have the potential to negatively affect badgers.

5.20.6 Otters

The presence of the overhead power line will not have the potential to negatively affect otters.

5.20.7 Freshwater pearl mussels

The presence of the overhead power line will not have the potential to negatively affect freshwater pearl mussels or other aquatic invertebrate species.

5.21 OPERATION PHASE IMPACTS OF THE GRID CONNECTION UNDERGROUND LINE

Designated Conservation Areas

The operation phase of the overhead line will not present any potential impacts to designated conservation areas occurring in the wider surrounding area.

Habitats

The operation phase of the underground line is not predicted to have the potential to result in significant effects to habitats.

Fauna

The operation phase of the underline will not have the potential to negatively fauna.

5.22 CUMULATIVE EFFECTS OF THE GRID CONNECTION ROUTE AND THE WIND FARM SITE

The grid connection route and the Wind Farm will not have the potential to combine to result in adverse effects to designated conservation areas. No such areas are located in close proximity to or downstream of both elements of the project and due to the distance between the development and these areas and the absence of potential impact pathways there will be no potential for both elements to combine to result in likely significant effects to these areas.

The wind farm and the pole locations of the overhead grid line will result in a cumulative loss of peatland habitats in the form of wet heath in the entire study area. However, the additional loss of this habitat arising from the grid connection route will be negligible, amounting to approximately 66m2 of temporary disturbance and 9.9m2 of permanent loss. This additional disturbance and loss of habitat will have an imperceptible cumulative effect on the effect the consent wind farm will have on wet heath habitat occurring at the wind farm site.

The construction phase of the wind farm and the grid connection route will not overlap and will not have the potential to combine to result in likely significant effects to the status of watercourse occurring downstream of both elements of the project.

The wind farm site will result in the loss of habitat for bird species but taking into consideration the small area of habitat that will be lost, in relation to the overall size of the study site, and the low density of species recorded, disturbance to breeding birds during the operation of the proposed wind farm is not expected to have a significant impact on the existing breeding bird population.

Similarly, the installation of the grid connection route is not predicted to result in the perceptible loss of habitat for birds occurring along the route.

Both the wind farm turbines and the overhead electrical cable have been assessed as being of low collision risk to bird species. This is due to the location of both elements of the development in an area where sensitive bird species are not known to occur and the distance of these elements from any such sensitive bird location in the wider surrounding area. Give the absence of such species the turbines and overhead cable will not have the potential to combine to result in likely significant cumulative effects to bird as a result of collision during the operation phase of the development. Given the assessment for both elements of the development it is considered that the combined impact of the operation phase of the wind farm and the grid connection route will not have the potential to result in significant cumulative effects to birds.

In terms of impacts to birds and mammals, the proposed cable route will not necessitate the removal of hedgerows and trees and so birds will not be impacted and no protected mammals were identified during the assessment so therefore there is no potential for interaction with the wind farm with respect to birds and mammals during the construction phase. Therefore, the cumulative impact will not be over and above the impact for the permitted wind farm development.

The operation phase of the grid connection and the wind farm will not have the potential to combine to result in likely significant cumulative effects to mammals or other fauna species occurring at or in the vicinity of both elements of the development.

5.23 CONSTRUCTION PHASE OF THE GRID CONNECTION ROUTE

Access roads should avoid crossing large areas of high value habitats such as wet heath and dry heath as these have links to Annex I habitats.

All construction works should be set back a minimum of 25m from watercourses. No poles or vehicles should be installed or operate within this buffer zone.

Construction works will be confined to the minimum area possible. Minimum removal of vegetation will take place at pole locations.

The footprints of all temporary access routes will be kept to the minimum compatible with sound engineering practice.

Construction traffic and machinery movement will be confined to specific roads and access routes. Construction vehicles to be used on peatland habitats should be of low ground bearing pressure.

Trampling and the use of machinery on saturated, quaking surfaces will be avoided. The locations of poles will be configured to minimise the number occurring within wet grassland and wet heath and the use of brash mats will be used if required.

The contractor will provide a method statement for working practices that will be designed to prevent adverse impacts on rivers and other watercourses. Working practices will include standard methods designed to minimise sedimentation and pollution.

A review of baseline data indicates that the Mealagh River valley at the crossing point of the proposed overhead line is not likely to function as an established commuting route by swans and other vulnerable bird species. However, it is possible that this river valley will be occasionally used by such species. Haas et al (2005) described general principles for protecting birds from collision with overhead lines, including routing of overhead lines as low as possible, for example behind buildings or rows of trees and attach clearly visible markers on the overhead lines posing a high collision risk.

5.24 CONSTRUCTION PHASE OF THE WIND FARM

Mitigation by Avoidance

<u>Habitats</u>

Access roads should avoid crossing large areas of intact peat habitats (wet heath/blanket bog) as these are Annex I habitats and in the case of blanket bog Annex I priority habitat. Where peat depths are greater than 0.5m excavations should be avoided in order to avoid impacts to blanket bog and to minimise hydrological impacts to surrounding peat habitats.

<u>Birds</u>

The Wildlife (Amendment) Act (2000) affords protection to breeding birds by prohibiting the clearance of vegetation during the period 1st March to the 31st of August inclusive except for the clearance of sites for development purposes. As the months of March to June are particularly important for breeding birds, where feasible best practice will be to avoid any clearance of vegetation during this period.

Watercourses

No turbines will be placed within 50m of any watercourses within the site to prevent any potential impacts on water quality during construction.

Roads on sloped ground will be positioned so as to cause minimal damage to the natural hydrology by following contours where possible (as opposed to running perpendicular to contours) and by frequent placing of drainage pipes to allow natural diffusion of water.

The use of sedimentary rocks, such as shale, in road construction should be avoided. This type of material has poor tensile strength and is liable to be crushed by heavy vehicles there by releasing fine sediment materials into the drainage system which are difficult to precipitate and may give rise to water pollution (Murphy, 2000).

The dispensing of fuel and oil tanks should be confined to one bunded location in order to minimise the risk of damage by spillage.

Mitigation by Reduction

Habitats

Construction works will be confined to the minimum area possible. Minimum removal of vegetation will take place so as to reduce the area of bare peat. When the foundations for turbines are being excavated, the surface vegetation will be removed in sods which can be stored (vegetation side up) and later replaced around the foundation platform where bare peat exists. This will ensure a more rapid re-vegetation of bare peat and will help reduce potential soil erosion which could lead to water pollution.

Excavated peat from turbine and road foundations will not be stored on areas of heath, bog or near streams or drains. The placing of soils on adjacent ground should not be permitted unless the area has been the subject of an in-depth risk assessment. Soil stockpiling operations will only be carried out in confined areas and soils should be vegetated with suitable plants in order to promote stability. If, during excavation, spoil is likely to fall on to adjacent habitats, shuttering boards or geotextile will be used to protect surface vegetation

Access track and drainage system construction will follow the Coford Forest Road Manual Guidelines 2004. Road width will be kept to the minimum compatible with sound engineering practice.

Construction traffic and machinery movement will be confined to the roads and tracks that are part of the long-term development in order to minimise unnecessary compaction and erosion of habitats and soil.

Watercourses

In the event of any watercourse crossing being in excess of 1ft in width Inland Fisheries Board (IFI) should be consulted prior to works commencing. Bridges are preferable to culverts. There will be no drainage or other physical interference with the bed or bank of any watercourse without prior consultation with IFI.

Sediment control measures will be implemented to prevent the transport of sediment (and other contaminants) into watercourses, by providing a physical barrier or by slowing down the flow rate sufficiently to encourage natural settling.

On-site attenuation ponds should allow for the settlement of fine/particulate materials. It is particularly important during the construction phase that sufficient retention time in the settlement pond is available to ensure no deleterious matter is discharged to any waters.

In constructing and designing silt traps particular attention should be paid to rainfall levels and intensity. The silt traps should be designed to minimise the movement of silt especially during intense precipitation events where the trap may be hydraulically overloaded. Silt traps should be located within easy access for monitoring and maintenance.

Leachate from stockpiles will be treated appropriately and will not drain directly into natural watercourses. Cement leachate, hydrocarbon oils and other toxic poisonous materials will require full containment and should not be permitted to discharge to any waters.

Aquatic Species

Any watercourses with connections to the Ilen River, which are to be crossed as a result of the proposed development, will be crossed via a free spanning bridge rather than culverted in order to prevent potential impacts to the freshwater pearl mussel. By bridging the watercourses no part of the stream bed or banks will be disturbed minimising the movement of suspended solids. Works in the vicinity of watercourses will be kept to a minimum and will be closely monitored.

5.25 OPERATION PHASE OF THE GRID CONNECTION ROUTE

5.26 OPERATION PHASE of the Wind Farm

Habitats

All vehicles accessing the site during the operational phase will be confined to the constructed roads and tracks in order to minimise unnecessary compaction and erosion of habitats and soil.

Watercourses

Settlement ponds will be maintained, where appropriate, during the operational phase to allow for the adequate settlement of suspended solids and sediments and prevent any deleterious matter from discharging into any natural waters. Periodic drain maintenance along access roads will likely be required.

5.27 MITIGATION BY REMEDIATION

Habitats

On site restoration following construction activities will include the following:

- Revegetation of areas disturbed during haulage and construction
- Re-grading access tracks and public roads (where necessary)
- Reinstatement of surface turves on areas of exposed peat.

5.28 RESIDUAL IMPACTS

The principal residual impacts of the development will be the permanent loss of approximately 1.7 ha of existing wet heath /blanket bog for roads, turbine bases, other ancillary development and poles associated with the grid connection route.

5.29 MONITORING

Monitoring of the mitigation measures will be undertaken by a qualified ecologist, to ensure that they are correctly implemented and to advise if any modifications are required.

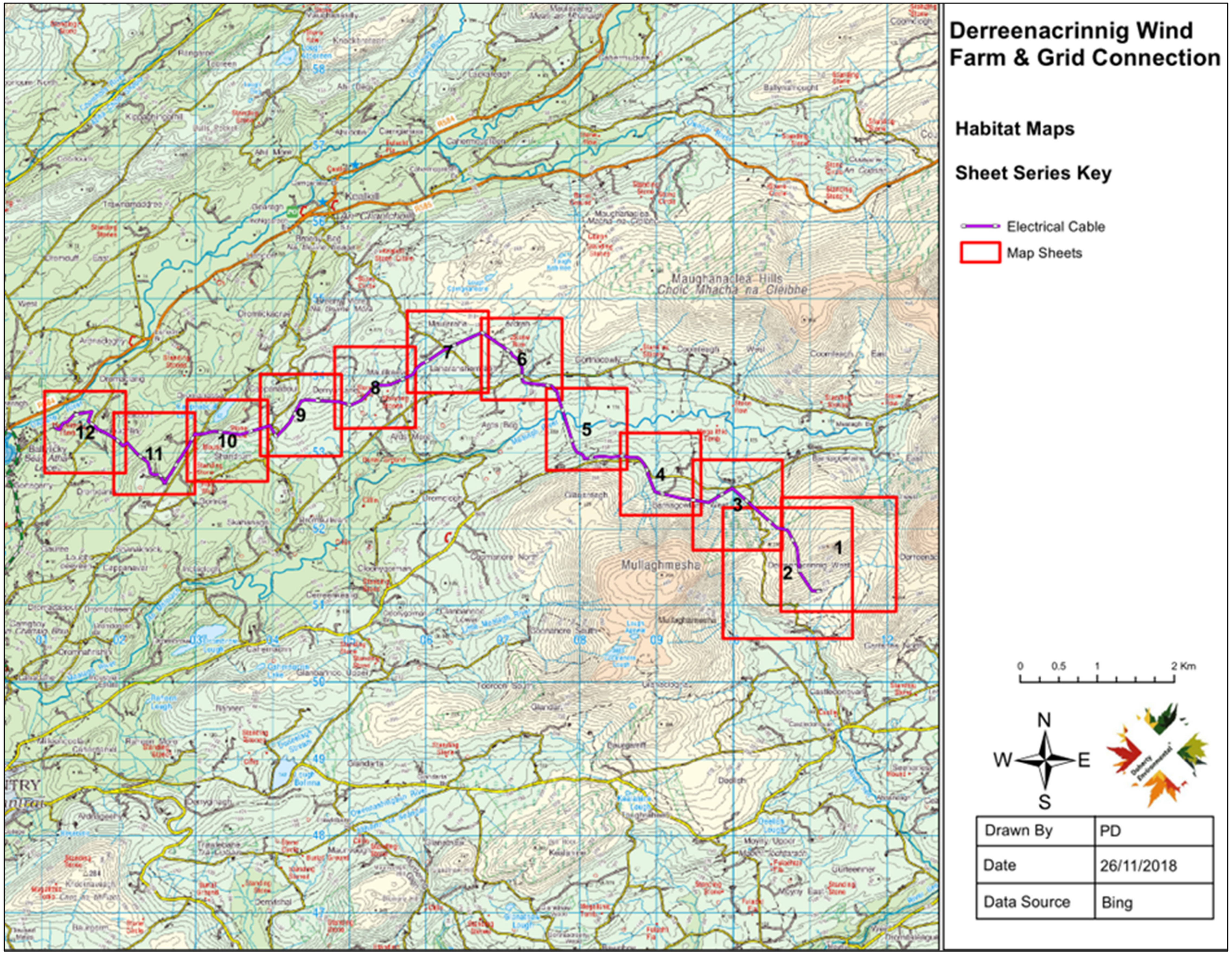

Derreenacrinnig Wind Farm & Grid Connection
Habitat Maps
Sheet Series Key
Electrical Cable
Map Sheets
1
2
3
4
5
6
7
8
9
10
11
12
Maughanaclea Hills
Mullaghmesha
0 0.5 1 2 Km
N
W
E
S
Drawn By
PD
Date
26/11/2018
Data Source
Bing

Figure 5.4

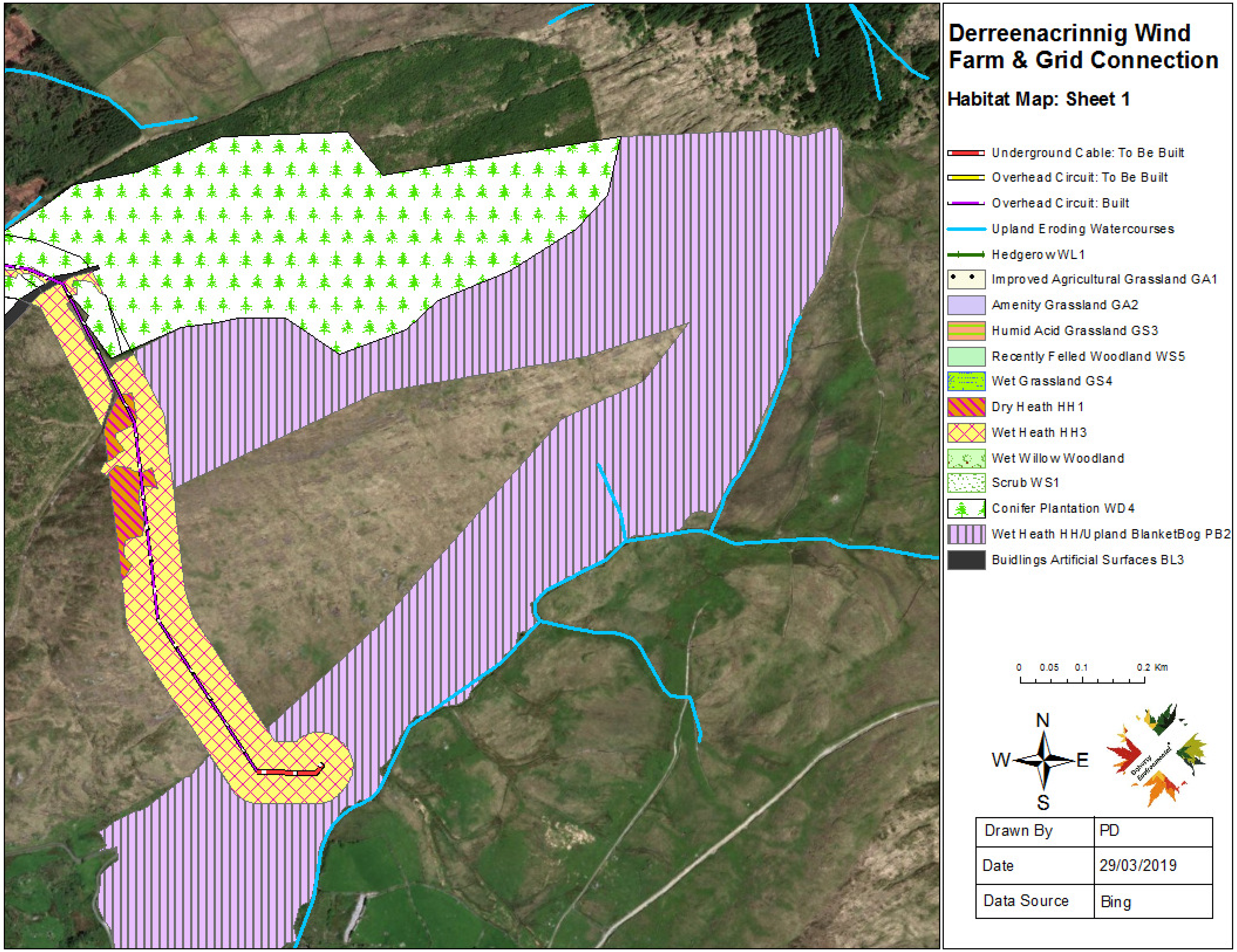
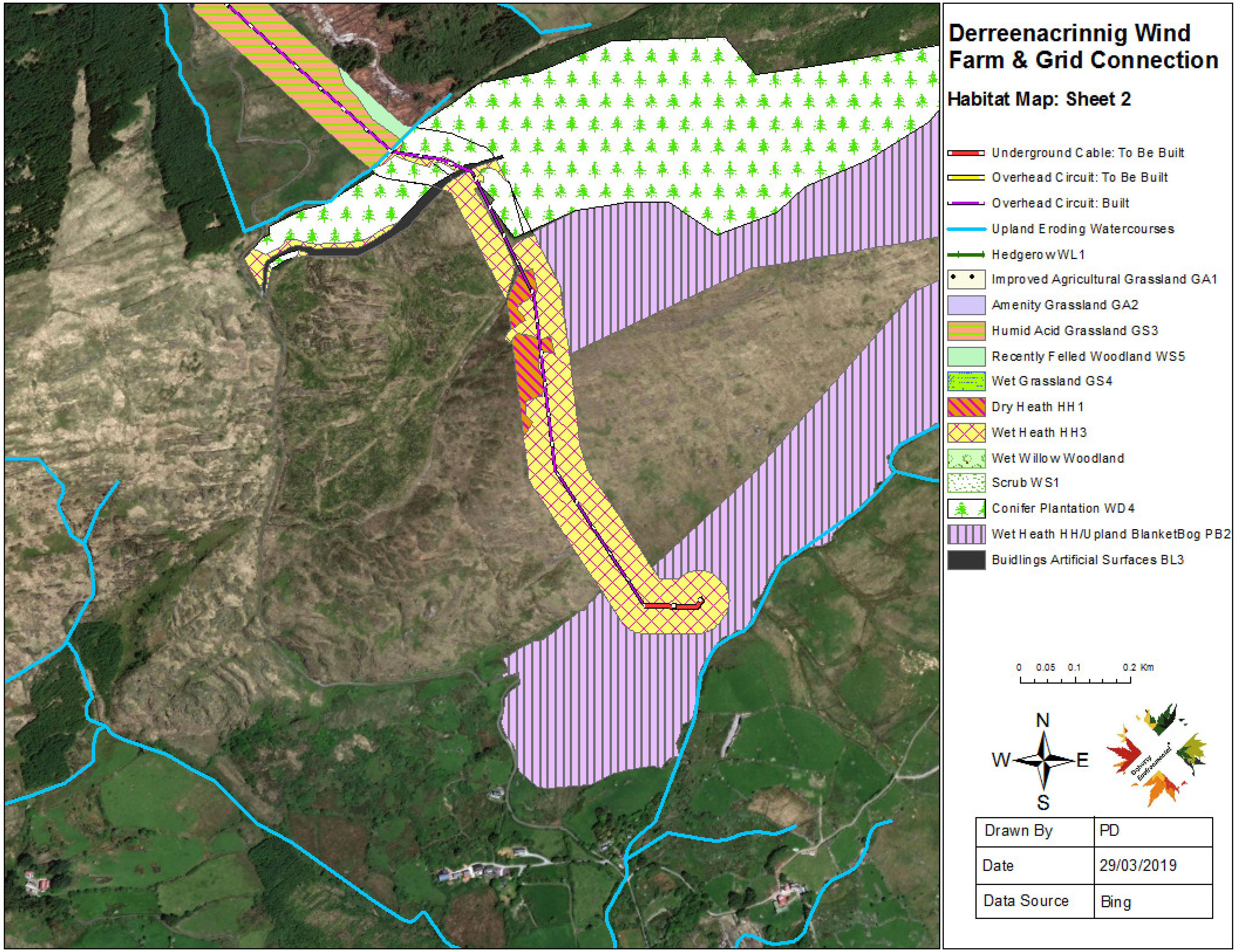

Derreenacrinnig Wind Farm & Grid Connection
Habitat Map: Sheet 1
Underground Cable: To Be Built
Overhead Circuit: To Be Built
Overhead Circuit: Built
Upland Eroding Watercourses
Hedgerow WL1
Improved Agricultural Grassland GA1
Amenity Grassland GA2
Humid Acid Grassland GS3
Recently Felled Woodland WS5
Wet Grassland GS4
Dry Heath HH1
Wet Heath HH3
Wet Willow Woodland
Scrub WS1
Conifer Plantation WD4
Wet Heath HH/Upland BlanketBog PB2
Buidlings Artificial Surfaces BL3
0 0.05 0.1 0.2 Km
N
W
E
S
Drawn By PD
Date 29/03/2019
Data Source Bing

Figure 5.5



Derreenacrinnig Wind Farm & Grid Connection
Habitat Map: Sheet 2
Underground Cable: To Be Built
Overhead Circuit: To Be Built
Overhead Circuit: Built
Upland Eroding Watercourses
Hedgerow WL1
Improved Agricultural Grassland GA1
Amenity Grassland GA2
Humid Acid Grassland GS3
Recently Felled Woodland WS5
Wet Grassland GS4
Dry Heath HH1
Wet Heath HH3
Wet Willow Woodland
Scrub WS1
Conifer Plantation WD4
Wet Heath HH/Upland BlanketBog PB2
Buidlings Artificial Surfaces BL3
0 0.05 0.1 0.2 Km
N
W
E
S
Drawn By
PD
Date
29/03/2019
Data Source
Bing

Figure 5.6

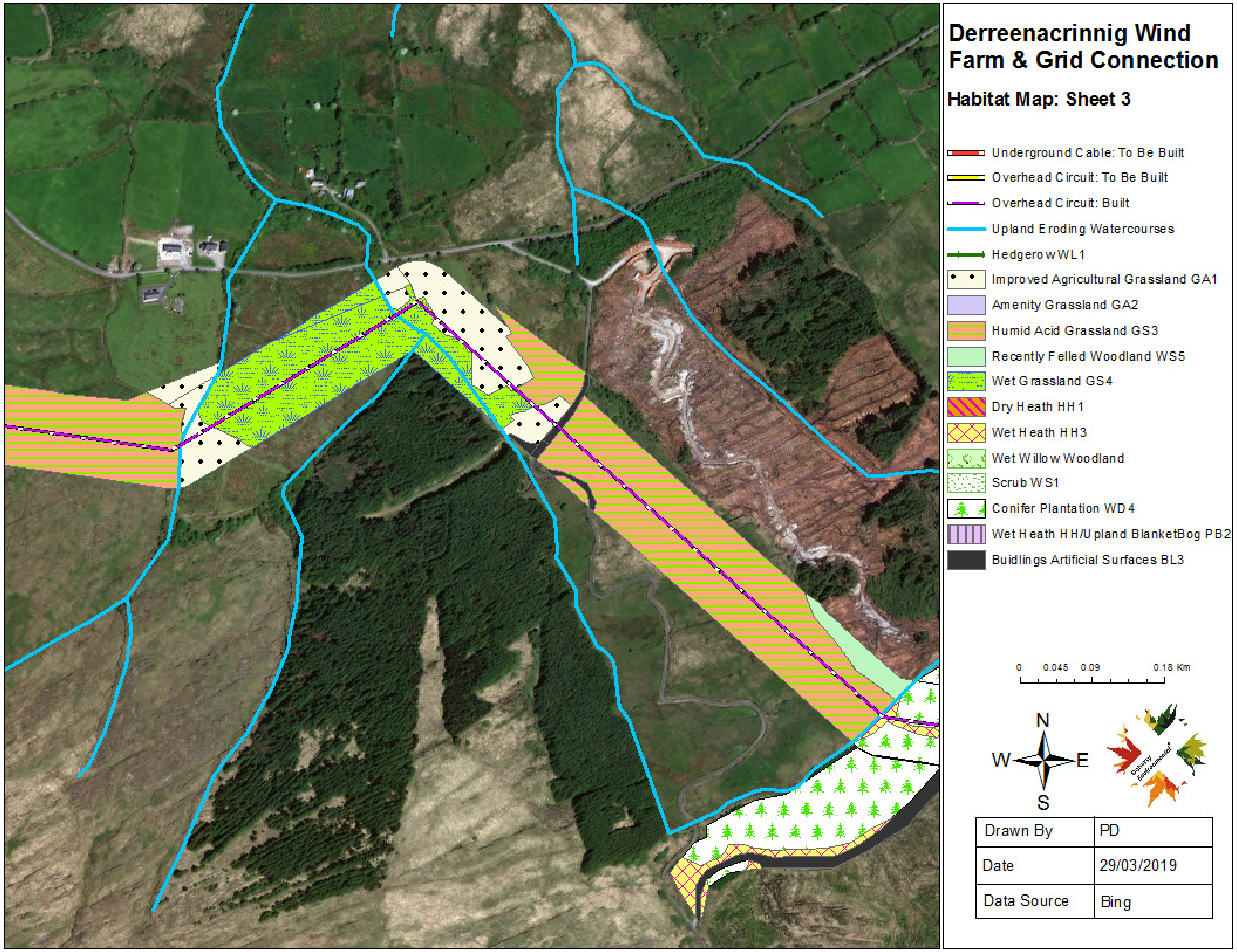

Derreenacrinnig Wind Farm & Grid Connection
Habitat Map: Sheet 3
Underground Cable: To Be Built
Overhead Circuit: To Be Built
Overhead Circuit: Built
Upland Eroding Watercourses
Hedgerow WL1
Improved Agricultural Grassland GA1
Amenity Grassland GA2
Humid Acid Grassland GS3
Recently Felled Woodland WS5
Wet Grassland GS4
Dry Heath HH1
Wet Heath HH3
Wet Willow Woodland
Scrub WS1
Conifer Plantation WD4
Wet Heath HH/Upland BlanketBog PB2
Buidlings Artificial Surfaces BL3
0 0.045 0.09 0.18 Km
N
W
E
S
Drawn By
PD
Date
29/03/2019
Data Source
Bing

Figure 5.7

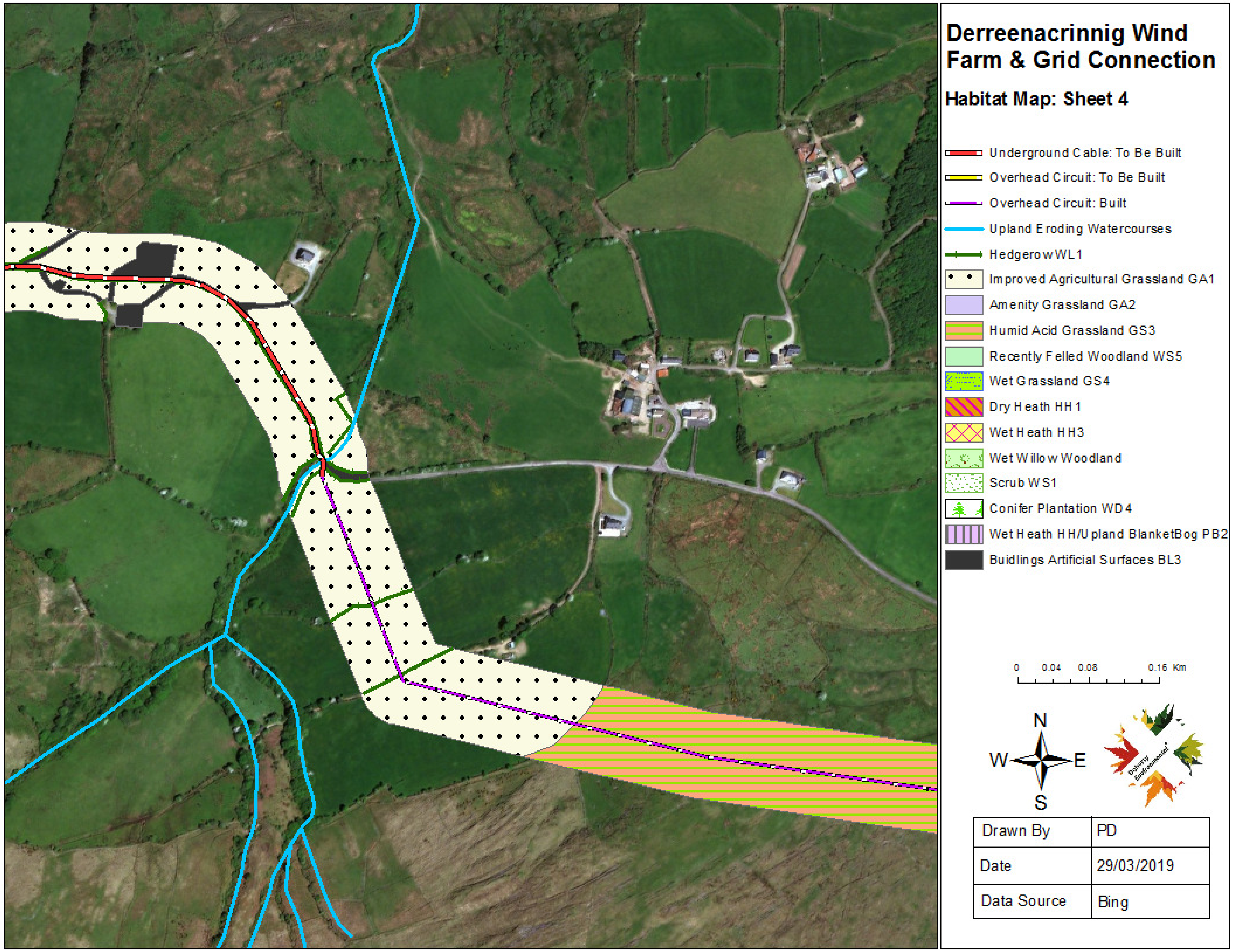

Derreenacrinnig Wind Farm & Grid Connection
Habitat Map: Sheet 4
Underground Cable: To Be Built
Overhead Circuit: To Be Built
Overhead Circuit: Built
Upland Eroding Watercourses
Hedgerow WL1
Improved Agricultural Grassland GA1
Amenity Grassland GA2
Humid Acid Grassland GS3
Recently Felled Woodland WS5
Wet Grassland GS4
Dry Heath HH1
Wet Heath HH3
Wet Willow Woodland
Scrub WS1
Conifer Plantation WD4
Wet Heath HH/Upland BlanketBog PB2
Buidlings Artificial Surfaces BL3
0 0.04 0.08 0.16 Km
N
W
E
S
Drawn By PD
Date 29/03/2019
Data Source Bing

Figure 5.8

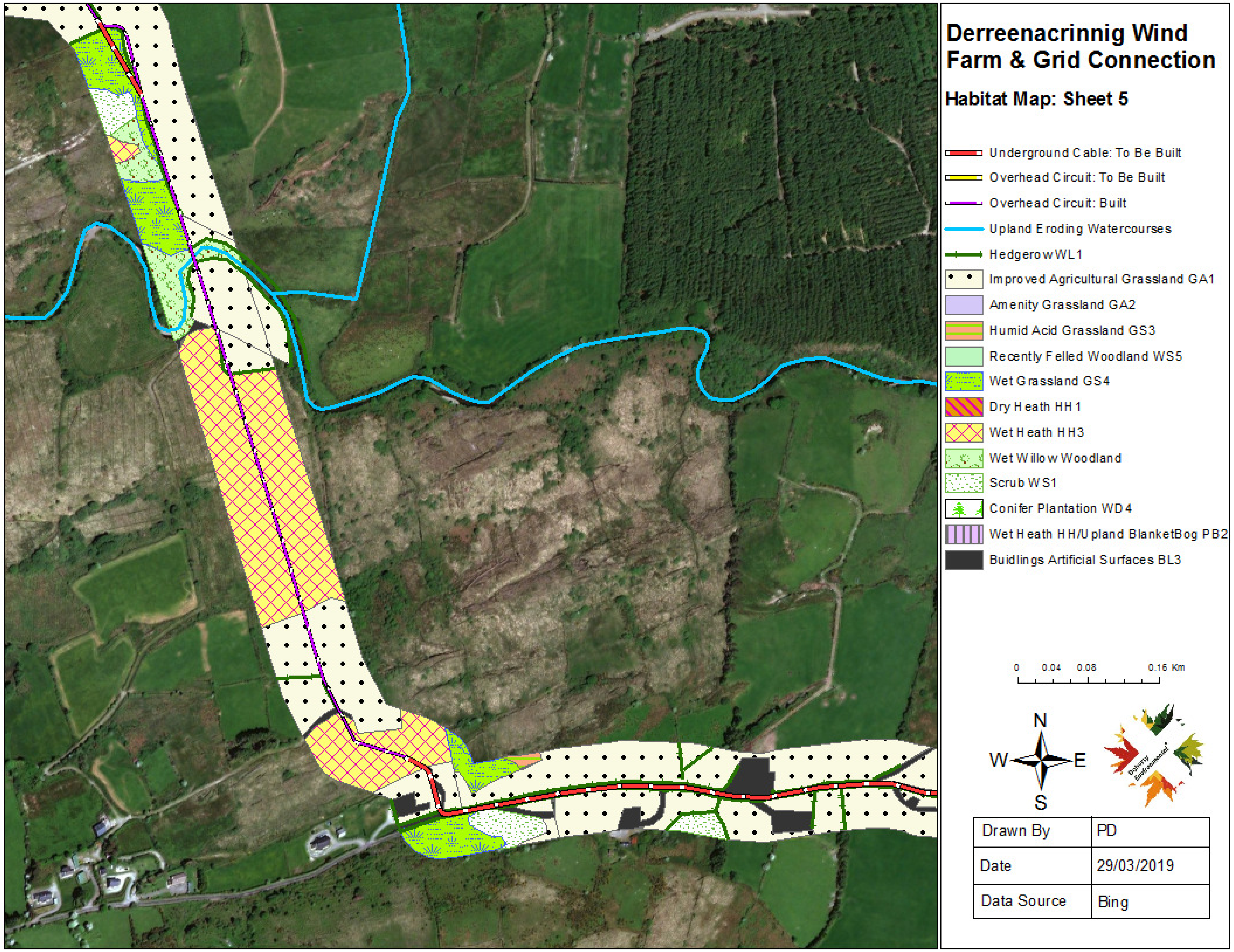
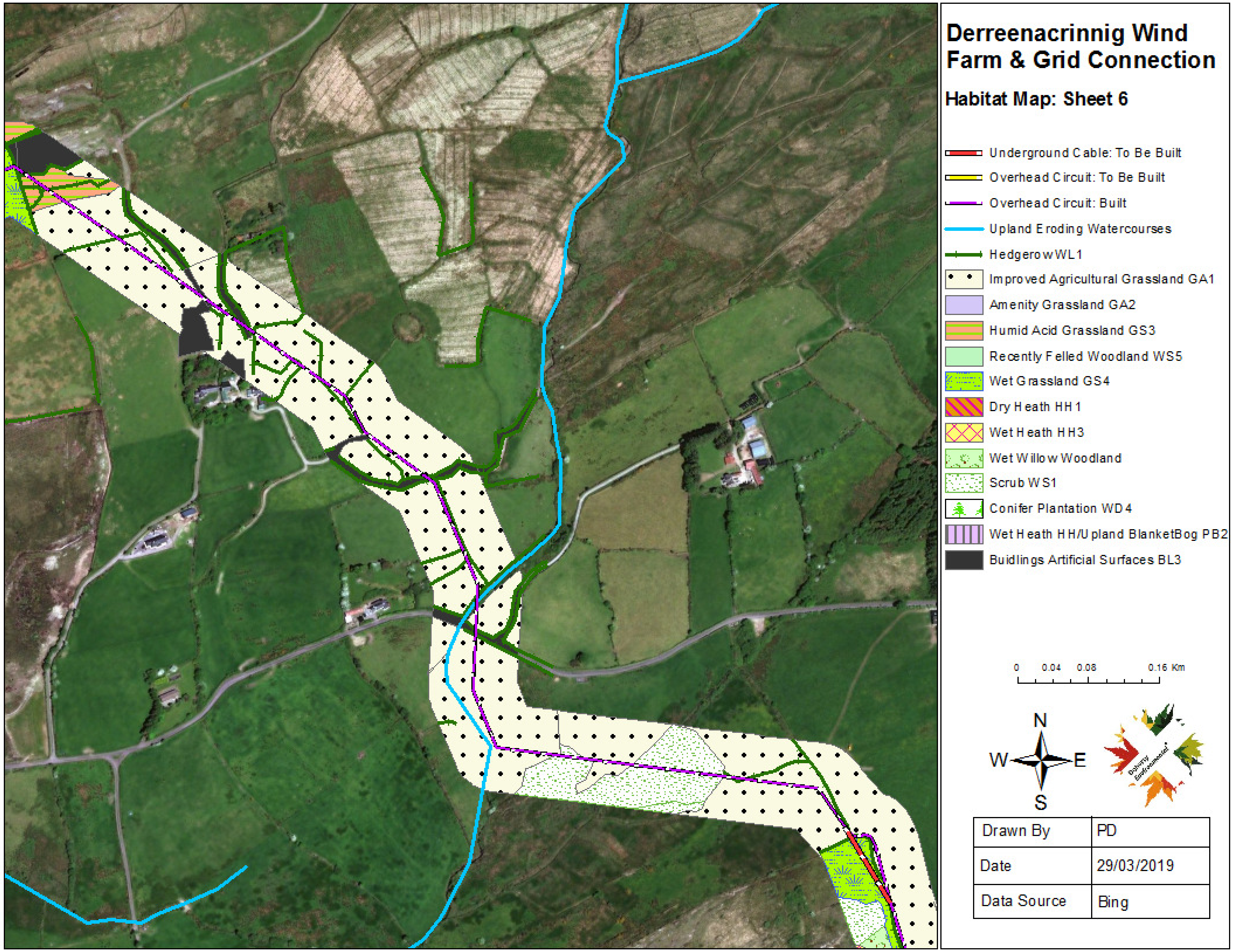

Derreenacrinnig Wind Farm & Grid Connection
Habitat Map: Sheet 5
Underground Cable: To Be Built
Overhead Circuit: To Be Built
Overhead Circuit: Built
Upland Eroding Watercourses
HedgerowWL1
Improved Agricultural Grassland GA1
Amenity Grassland GA2
Humid Acid Grassland GS3
Recently Felled Woodland WS5
Wet Grassland GS4
Dry Heath HH1
Wet Heath HH3
Wet Willow Woodland
Scrub WS1
Conifer Plantation WD4
Wet Heath HH/Upland BlanketBog PB2
Buidlings Artificial Surfaces BL3
0 0.04 0.08 0.16 Km
N
W
E
S
Drawn By PD
Date 29/03/2019
Data Source Bing

Figure 5.9



Derreenacrinnig Wind Farm & Grid Connection
Habitat Map: Sheet 6
Underground Cable: To Be Built
Overhead Circuit: To Be Built
Overhead Circuit: Built
Upland Eroding Watercourses
Hedgerow WL1
Improved Agricultural Grassland GA1
Amenity Grassland GA2
Humid Acid Grassland GS3
Recently Felled Woodland WS5
Wet Grassland GS4
Dry Heath HH1
Wet Heath HH3
Wet Willow Woodland
Scrub WS1
Conifer Plantation WD4
Wet Heath HH/Upland BlanketBog PB2
Buidlings Artificial Surfaces BL3
0 0.04 0.08 0.16 Km
N
W
E
S
Drawn By PD
Date 29/03/2019
Data Source Bing

Figure 5.10

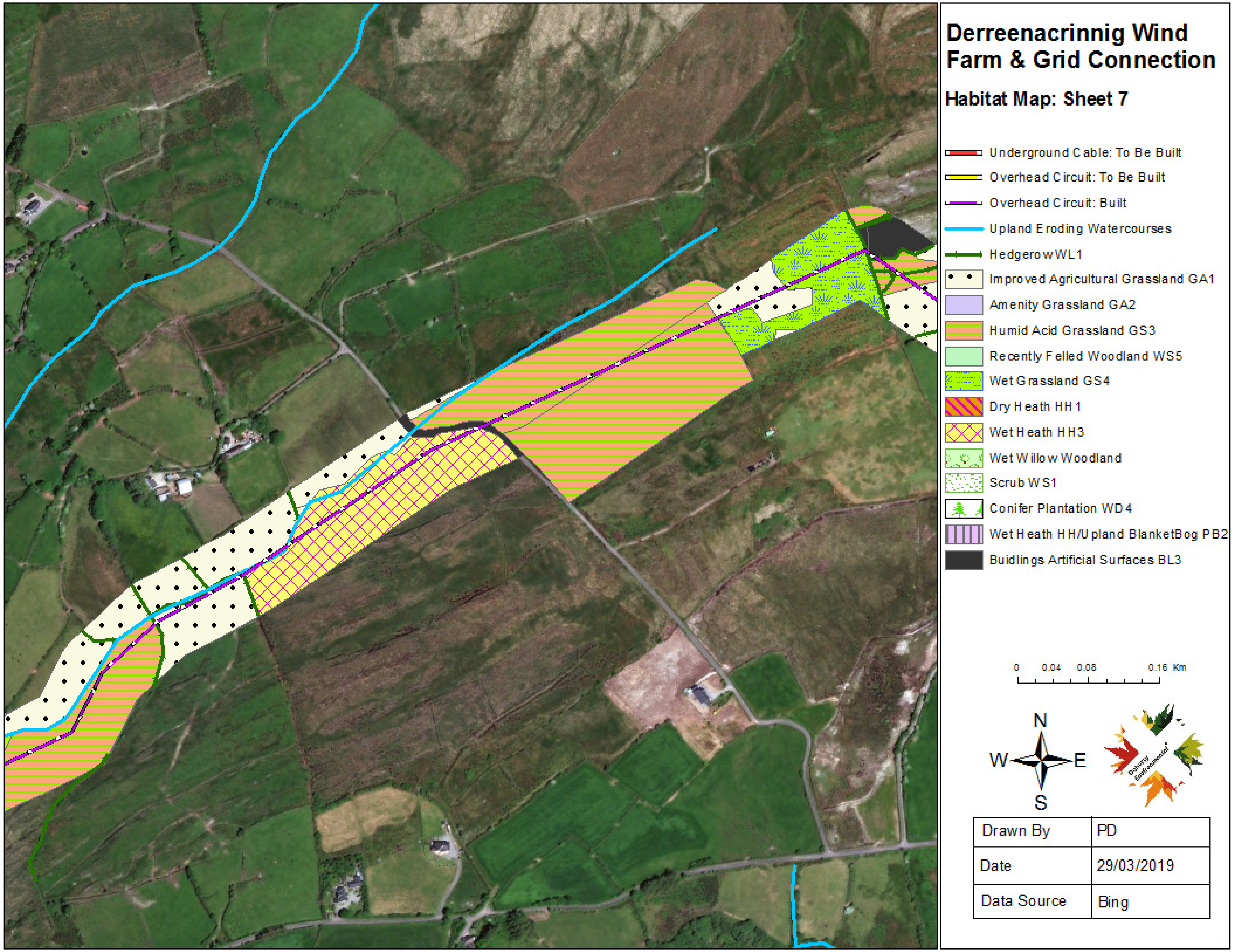

Derreenacrinnig Wind Farm & Grid Connection
Habitat Map: Sheet 7
Underground Cable: To Be Built
Overhead Circuit: To Be Built
Overhead Circuit: Built
Upland Eroding Watercourses
Hedgerow WL1
Improved Agricultural Grassland GA1
Amenity Grassland GA2
Humid Acid Grassland GS3
Recently Felled Woodland WS5
Wet Grassland GS4
Dry Heath HH1
Wet Heath HH3
Wet Willow Woodland
Scrub WS1
Conifer Plantation WD4
Wet Heath HH/Upland BlanketBog PB2
Buidlings Artificial Surfaces BL3
0 0.04 0.08 0.16 Km
N
W
E
S
Drawn By
PD
Date
29/03/2019
Data Source
Bing

Figure 5.11

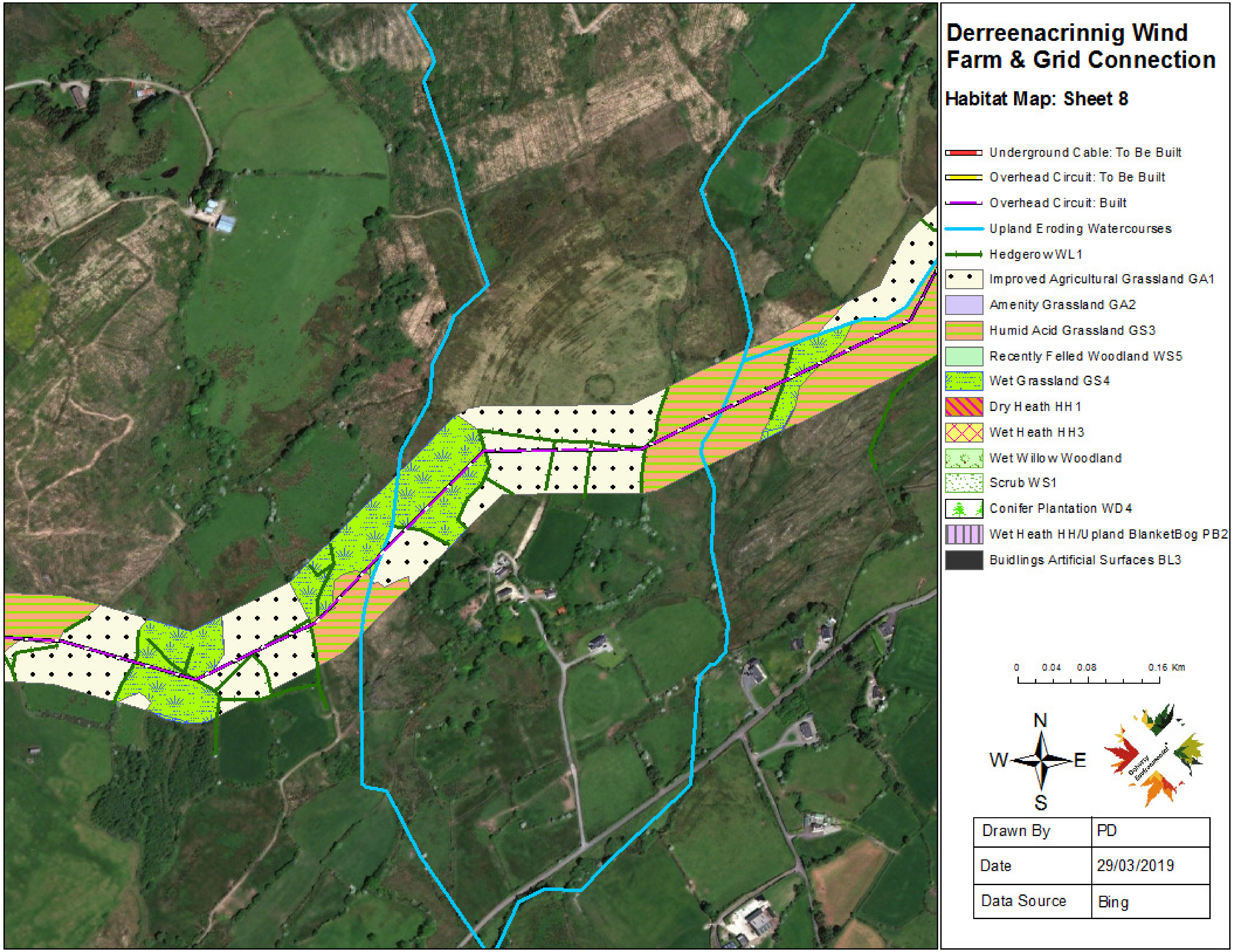

Derreenacrinnig Wind Farm & Grid Connection
Habitat Map: Sheet 8
Underground Cable: To Be Built
Overhead Circuit: To Be Built
Overhead Circuit: Built
Upland Eroding Watercourses
Hedgerow WL1
Improved Agricultural Grassland GA1
Amenity Grassland GA2
Humid Acid Grassland GS3
Recently Felled Woodland WS5
Wet Grassland GS4
Dry Heath HH1
Wet Heath HH3
Wet Willow Woodland
Scrub WS1
Conifer Plantation WD4
Wet Heath HH/Upland BlanketBog PB2
Buidlings Artificial Surfaces BL3
0 0.04 0.08 0.16 Km
N
W
E
S
Drawn By
PD
Date
29/03/2019
Data Source
Bing

Figure 5.12

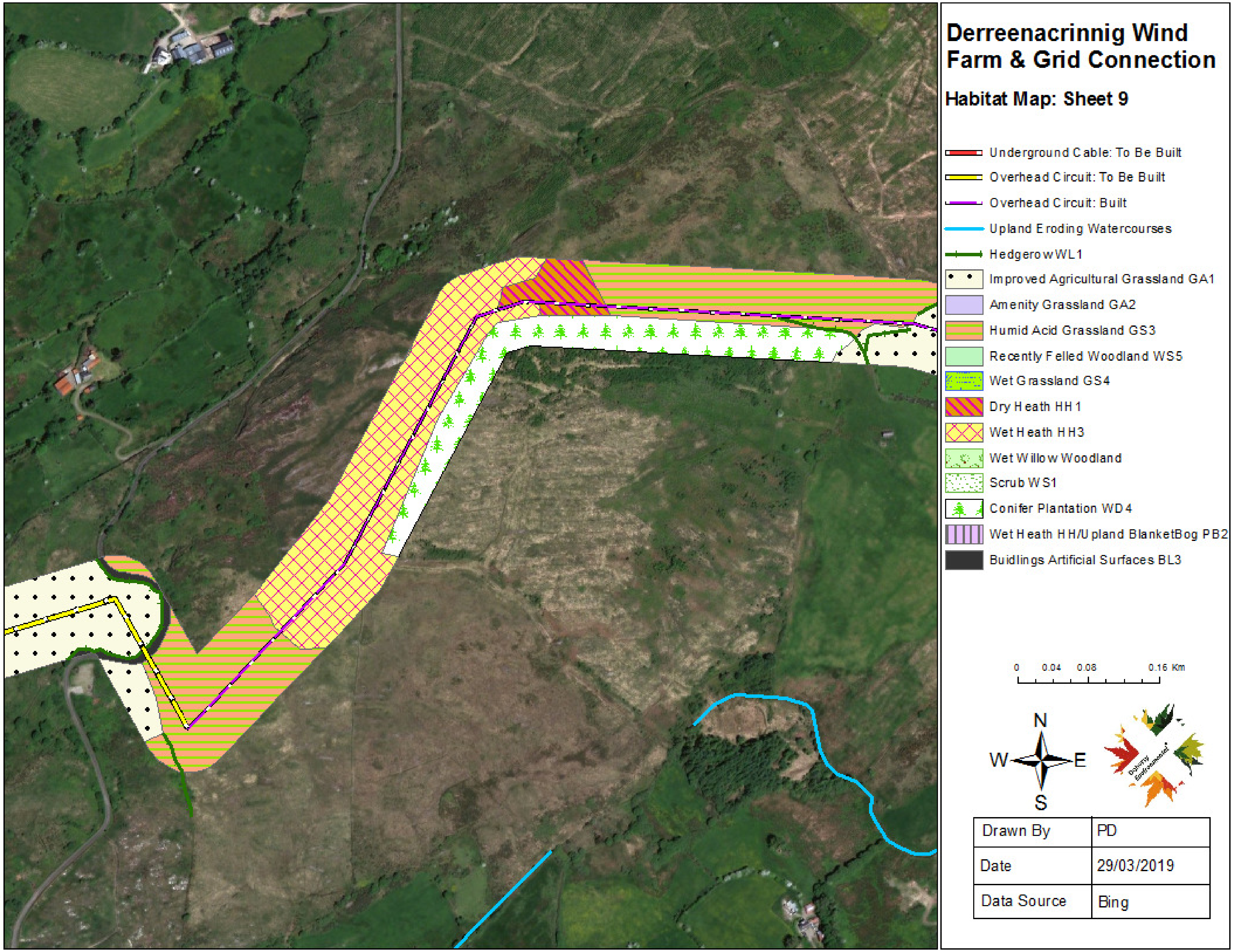
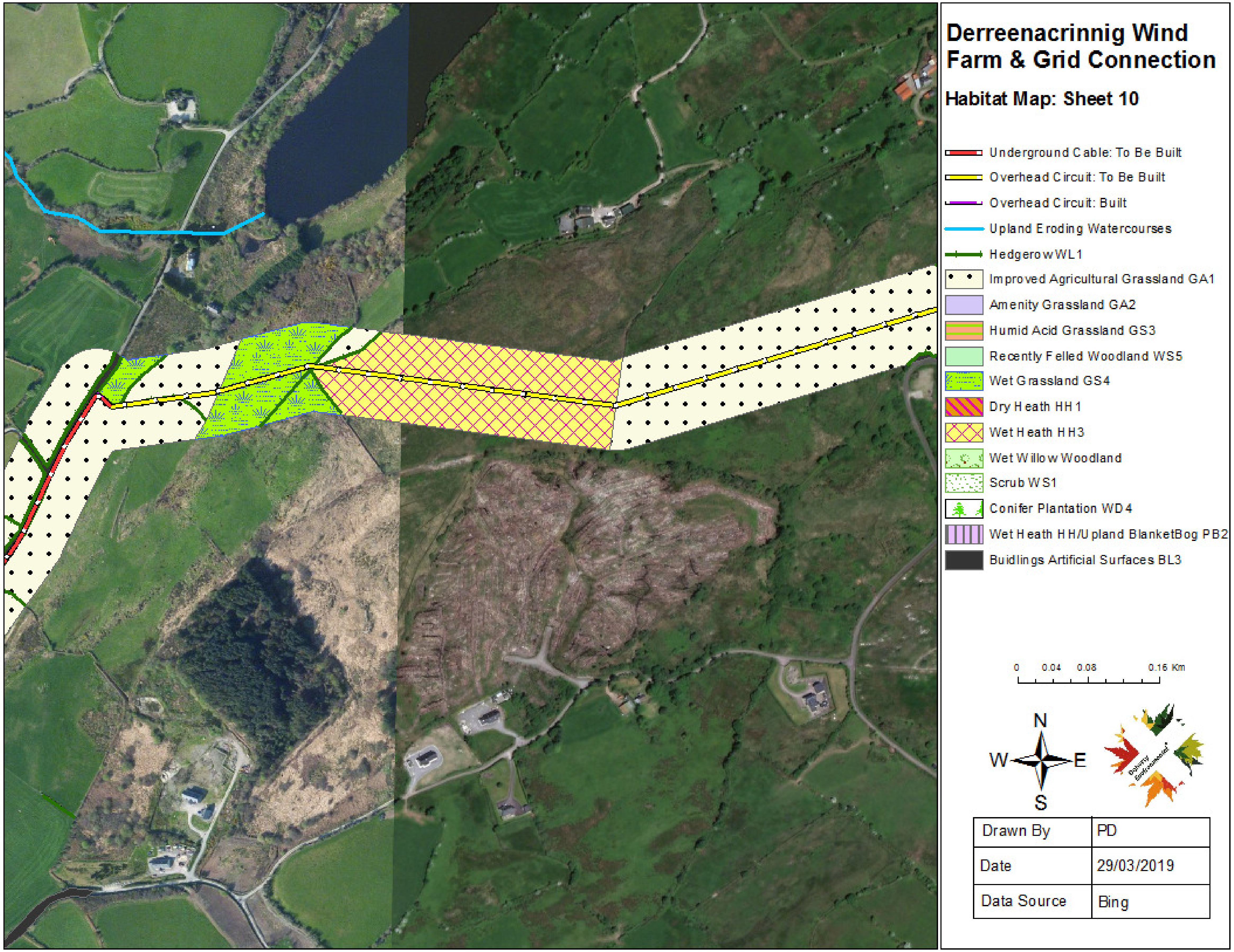

Derreenacrinnig Wind Farm & Grid Connection
Habitat Map: Sheet 9
Underground Cable: To Be Built
Overhead Circuit: To Be Built
Overhead Circuit: Built
Upland Eroding Watercourses
Hedgerow WL1
Improved Agricultural Grassland GA1
Amenity Grassland GA2
Humid Acid Grassland GS3
Recently Felled Woodland WS5
Wet Grassland GS4
Dry Heath HH1
Wet Heath HH3
Wet Willow Woodland
Scrub WS1
Conifer Plantation WD4
Wet Heath HH/Upland BlanketBog PB2
Buidlings Artificial Surfaces BL3
0 0.04 0.08 0.16 Km
N
W
E
S
Drawn By PD
Date 29/03/2019
Data Source Bing

Figure 5.13



Derreenacrinnig Wind Farm & Grid Connection
Habitat Map: Sheet 10
Underground Cable: To Be Built
Overhead Circuit: To Be Built
Overhead Circuit: Built
Upland Eroding Watercourses
Hedgerow WL1
Improved Agricultural Grassland GA1
Amenity Grassland GA2
Humid Acid Grassland GS3
Recently Felled Woodland WS5
Wet Grassland GS4
Dry Heath HH1
Wet Heath HH3
Wet Willow Woodland
Scrub WS1
Conifer Plantation WD4
Wet Heath HH/Upland BlanketBog PB2
Buidlings Artificial Surfaces BL3
0 0.04 0.08 0.16 Km
N
W
E
S
Drawn By PD
Date 29/03/2019
Data Source Bing

Figure 5.14

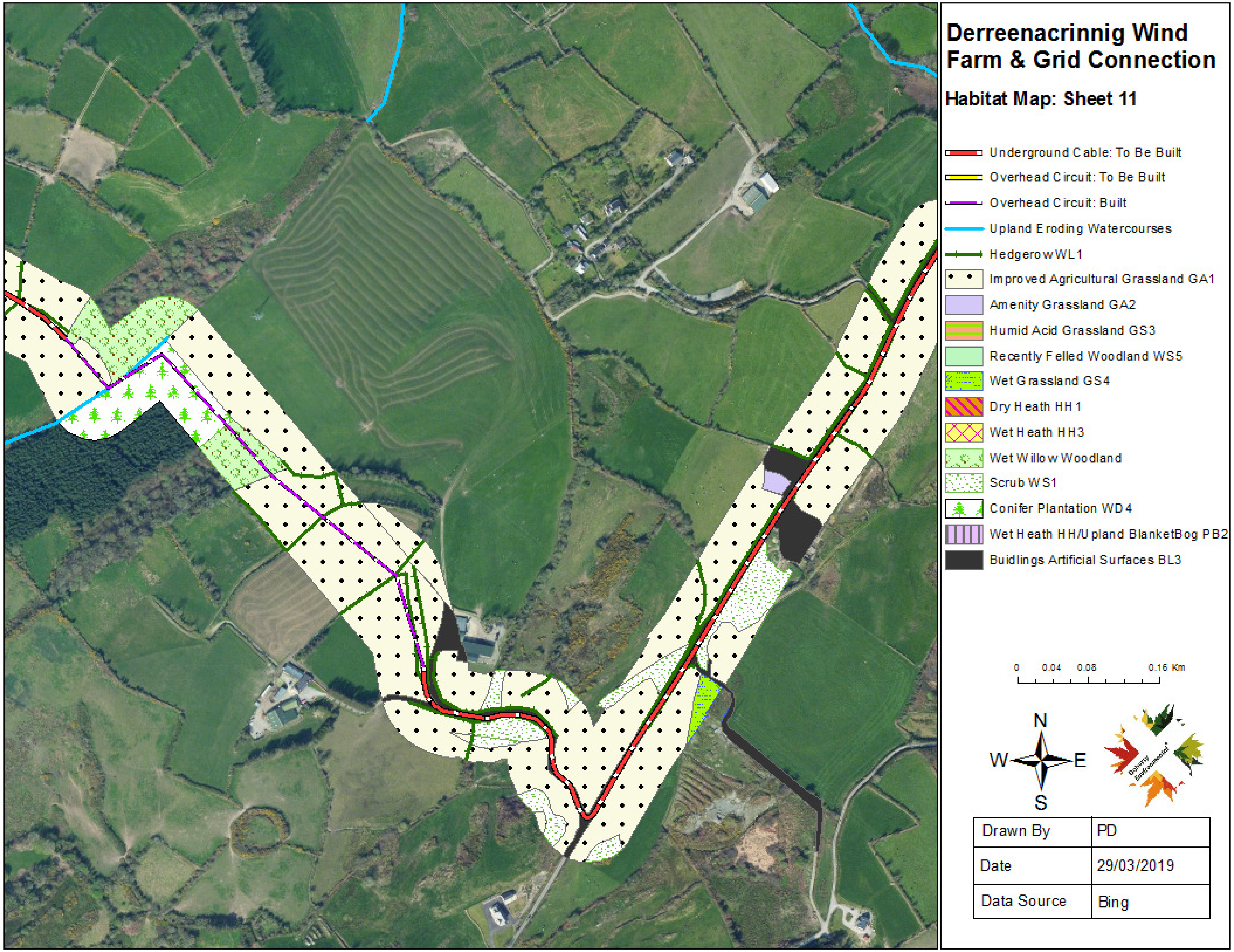

Derreenacrinnig Wind Farm & Grid Connection
Habitat Map: Sheet 11
Underground Cable: To Be Built
Overhead Circuit: To Be Built
Overhead Circuit: Built
Upland Eroding Watercourses
Hedgerow WL1
Improved Agricultural Grassland GA1
Amenity Grassland GA2
Humid Acid Grassland GS3
Recently Felled Woodland WS5
Wet Grassland GS4
Dry Heath HH1
Wet Heath HH3
Wet Willow Woodland
Scrub WS1
Conifer Plantation WD4
Wet Heath HH/Upland BlanketBog PB2
Buidlings Artificial Surfaces BL3
0 0.04 0.08 0.16 Km
N
W
E
S
Drawn By
PD
Date
29/03/2019
Data Source
Bing

Figure 5.15

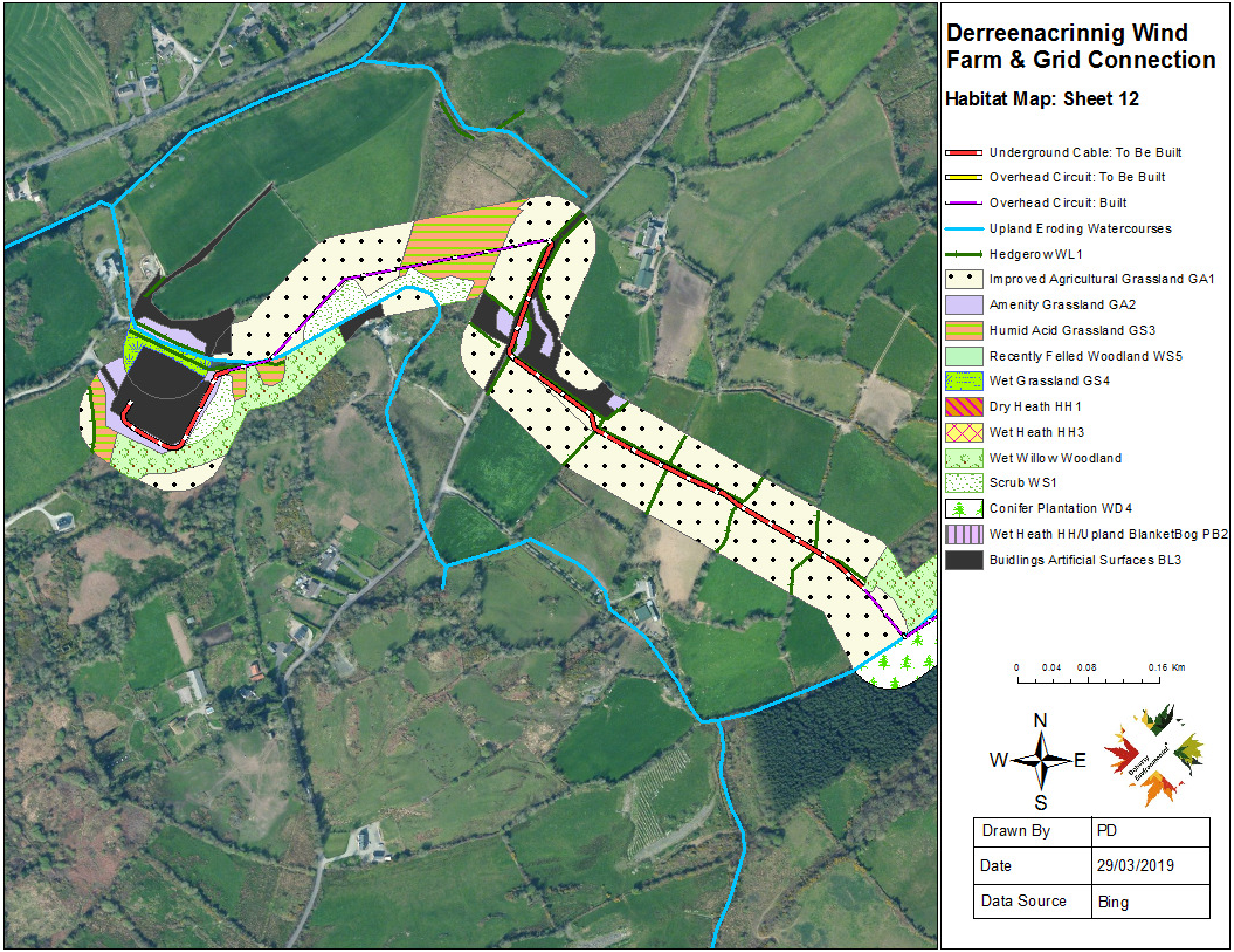

Derreenacrinnig Wind Farm & Grid Connection
Habitat Map: Sheet 12
Underground Cable: To Be Built
Overhead Circuit: To Be Built
Overhead Circuit: Built
Upland Eroding Watercourses
Hedgerow WL1
Improved Agricultural Grassland GA1
Amenity Grassland GA2
Humid Acid Grassland GS3
Recently Felled Woodland WS5
Wet Grassland GS4
Dry Heath HH1
Wet Heath HH3
Wet Willow Woodland
Scrub WS1
Conifer Plantation WD4
Wet Heath HH/Upland BlanketBog PB2
Buidlings Artificial Surfaces BL3
0 0.04 0.08 0.16 Km
N
W
E
S
Drawn By PD
Date 29/03/2019
Data Source Bing

Figure 5.16

5.30 REFERENCES

1. Haas D, Nipkow M, Fiedler G, Schneider R, Haas W, Schürenberg B. (2005). Protecting birds from powerlines. Convention on the Conservation of European Wildlife and Habitats (Bern Convention). Nature and environment, No 140. Council of Europe Publishing

2. IEEM (2006) Guidelines for Ecological Impact Assessment in the United Kingdom. Institute of Ecology and Environmental Management, Winchester.

3. NRA (2005). Guidelines for The Treatment of Badgers Prior To The Construction of National Road Schemes.

6 SOILS AND GEOLOGY

6.1 INTRODUCTION

6.1.1 Background and Objectives

Jennings O'Donovan & Partners Ltd. ("JOD"), have assessed the potential impacts of the proposed EIA Development on the soil and geological environment of the Proposed Development Site. Full details of the proposed EIA Development are provided in **Section 2: Project Description**.

This report provides a baseline assessment of the environmental setting of the Proposed Development Site in terms of soils and geology and assesses the potential impacts that the construction, operation and decommissioning phases that the proposed EIA Development will have. Where appropriate, mitigation measures to limit significant impacts to soils and geology are documented, and thereafter residual effects are identified and assessed.

The assessment also includes additional information as required by the Revised EIA Directive, where relevant to the proposed EIA Development ("*the importance of the sustainable use of soil, minimisation of land take, minimisation of erosion and organic matter loss, soil compaction, and soil sealing, subsurface and underground effects*").

6.1.2 Statement of Authority

JOD/Minerex Environmental Limited were commissioned to carry out an assessment of the soil and geology effects of EIA Development.

JOD has extensive experience in the development of wind farms from planning through to construction. JOD have been active in the wind energy market in Ireland since 1998 as engineering consultants for numerous completed wind farm projects varying from single wind turbine installations to large scale development which extends to over 2,000MW of power.

The JOD inputs been prepared by Mr. David Kiely of JOD, who has undertaken numerous EIS's for wind farms throughout Ireland. Mr. David Kiely has 35 years' experience in the civil engineering and environmental sector. He has obtained a bachelor's degree in Civil Engineering and a master's in environmental Protection, has overseen the construction of over 40 wind farms and has carried out numerous soils and geology assessments for EIS's.

Minerex Environmental Limited was established in 1994 and have carried out studies for a wide range of Clients and projects over the past 24 years. These include numerous wind farm projects.

THE CONSENTED 2012 DEREENACRINNIG WEST WIND FARM

Minerex Environmental Limited were commissioned by Jennings O'Donovan to undertake an impact assessment on the soils and geology aspects of the 2010 EIS. The extent of the site layout for the original study is shown in **Figure 6.1**. The purposed of the work was to:

1. Undertake a baseline study of soils, geology and ground stability conditions at the Derreenacrinnig West site.
2. Undertake a baseline study of water (groundwater and surface water) conditions at the Derreenacrinnig West site.
3. Identify the likely impacts of the proposed development upon these aspects of the environment.
4. Identify mitigation measures to avoid, remediate or reduce the impacts identified.
5. Identify residual impacts of the development after implementation of mitigation measures recommended.

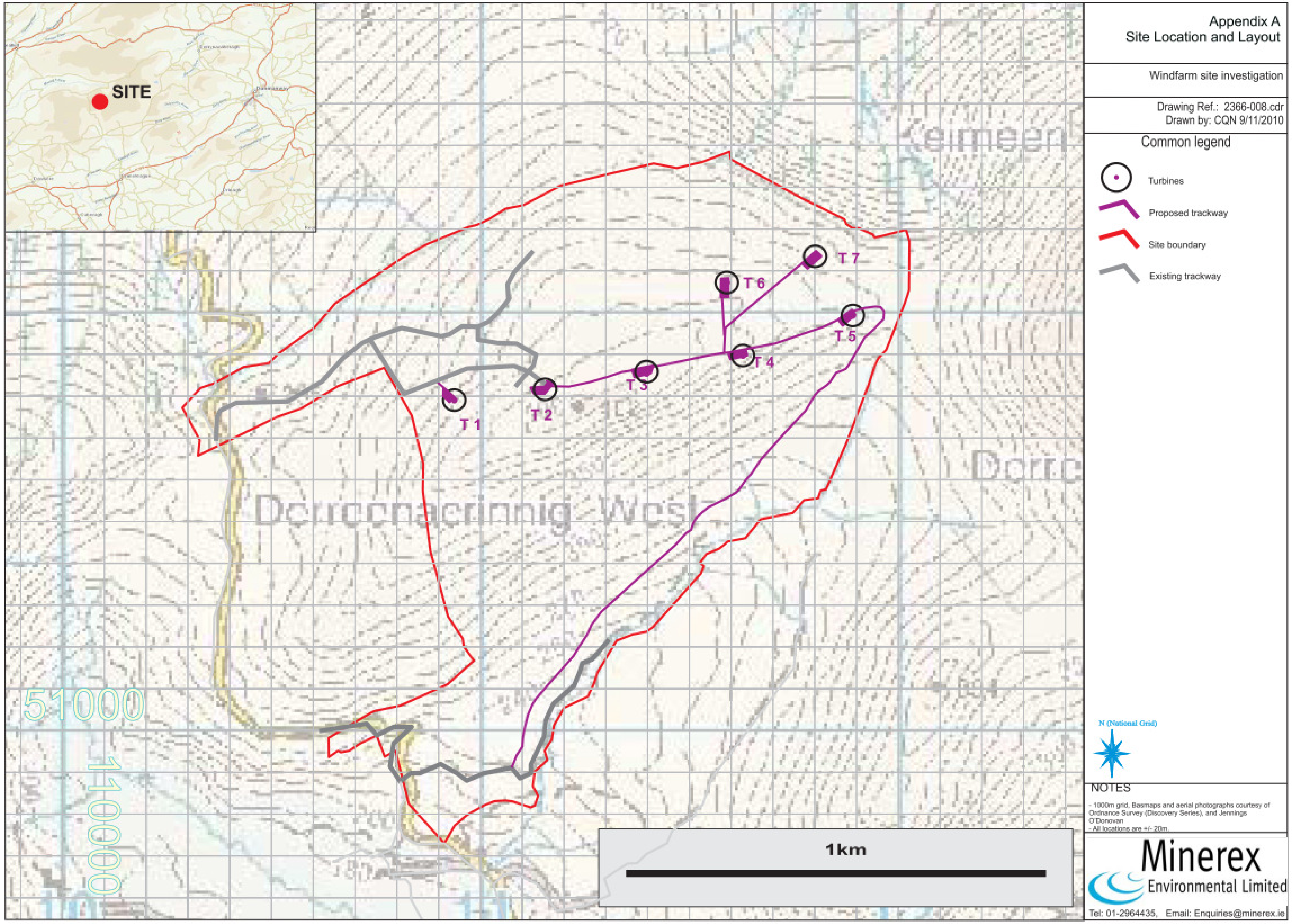

SITE
Keimeen
Dorroonacrinnig West
Dorr
51000
110000
T 1
T 2
T 3
T 4
T 5
T 6
T 7
1km
Appendix A
Site Location and Layout
Windfarm site investigation
Drawing Ref.: 2366-008.cdr
Drawn by: CQN 9/11/2010
Common legend
Turbines
Proposed trackway
Site boundary
Existing trackway
N (National Grid)
NOTES
- 1000m grid. Basmaps and aerial photographs courtesy of Ordnance Survey (Discovery Series), and Jennings O'Donovan
- All locations are +/- 20m.
Minerex
Environmental Limited
Tel: 01-2964435, Email: Enquiries@minerex.ie

Figure 6.1

6.1.3 Assessment Structure of Chapter 6

This Section contains the following sections:

- Assessment Methodology and Significance Criteria – a description of the methods used in baseline surveys and in the assessment of the significance of effects;
- Baseline Description - a description of the soils and geology of the Proposed Development Site based on the results of surveys, desk information and consultations, and a summary of any information required for the assessment that could not be obtained;
- Assessment of Potential Effects - identifying the ways in which soils and geological resources could be affected by the proposed EIA Development, including a summary of the measures taken during design of the EIA Development to minimise soils and geological effects;
- Mitigation Measures and Residual Effects - a description of measures recommended to off-set potential negative effects and a summary of the significance of the effects of the EIA Development after mitigation measures have been implemented;
- Cumulative Effects – identifying the potential for effects of the EIA Development to combine with those from other developments to affect soils and geological resources;
- Summary of Significant Effects;
- Statement of Significance; and
- Comparison with Derreenacrinnig West Wind Farm EIS, November 2010, prepared by Jennings O'Donovan Consulting Engineers ("the 2010 EIA") - commentary identifying any material variations in potential effects and levels of significance.

6.2 ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA

6.2.1 Assessment Methodology

This assessment has involved the following elements, further details of which are provided in the following sections:

- Legislation and guidance review;
- Desk study, including review of available maps and published information;
- Site walkover;
- Evaluation of potential effects;
- Evaluation of the significance of these effects; and
- Identification of measures to avoid and mitigate potential effects.

6.2.2 Relevant Legislation and Guidance

The soils and geology section of this EIAR is carried out in accordance with the following legislation:

- SI No. 349 of 1989: European Communities (Environmental Impact Assessment) Regulations, and subsequent Statutory Instruments (SI) amendments (SI No. 84 of 1995; S.I. No. 352 of 1998, SI No. 93 of 1999; SI No. 450 of 2000; and SI No. 538 of 2001).

The soils and geology section of this REIS / EIAR is carried out in accordance with guidance contained in the following documents:

- Environmental Protection Agency (September 2015): Draft - Advice Notes on Current Practice (in the preparation on Environmental Impact Statements);
- Environmental Protection Agency (September 2015): Draft – Revised Guidelines on the Information to be Contained in Environmental Impact Statements;
- Environmental Protection Agency (2003): Advice Notes on Current Practice (in the Preparation on Environmental Impact Statements);
- Environmental Protection Agency (2002): Guidelines on the Information to be Contained in Environmental Impact Statements;
- Institute of Geologists Ireland (2013): Guidelines for Preparation of Soils, Geology & Hydrogeology Chapters in Environmental Impact Statements; and,
- National Roads Authority (2009): Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes ("the NRA Guidance").

The Cork County Development Plan (2014-2020) ("the CDP") was also consulted as part of the EIA process. The CDP is described in more detail in **Section 3: Planning Policy**. **Table 6.1** shows those policies relating to soils and geology that are considered to be relevant to this assessment.

Table 6.1: Cork County Development Plan (2014-2020) Soils and Geology Policies and Objectives

Planning Policy / Objective	Assessed?	Comment
County Development Plan Objective HE 2-6: Geological Sites Maintain the conservation value of those features or areas of geological interest that are listed in Volume 2, Chapter 3 Nature Conservation Areas, of the plan, and to protect them from inappropriate development.	Yes	Table 5.1 lists all of the Designated sites within 10km of the proposed development including grid connection. Due to the distance the proposed site from the sites, there will be no impacts, direct or indirect.
County Development Plan Objective GI 9-1: Protection of Soils		
Ensure the protection and conservation of the soils in County Cork by encouraging sustainable management practices and the reuse of brownfield lands.	Yes	All excavated soils on the wind farm site will be re-used on site. The use of poles for some 78% of the grid connection consensus the integrity of soil as poles are minimally invasive. Much of the underground cable route is over public roads which has experienced disturbance of soil through construction of the roads.

6.2.3 Desk Study

Except in exceptional circumstances, impacts on soils and geology tend to be localised and therefore a 5km study area was considered appropriate for the Proposed Development Site. A desk study of the Proposed Development Site and the surrounding study area of 5km was largely completed in advance of undertaking the walkover survey. The desk study involved collecting all the relevant geological data for the Proposed Development Site and local study area. This included consultation with the following:

- Derreenacreenig West Wind Farm EIS, November 2010, prepared by Jennings O'Donovan[24] ("the 2010 EIA");
- Site Investigations Report, March 2017, prepared by Priority Geotechnical Limited ("the Investigations Report") (**Appendix F: Site Investigations Report**), which involved the following fieldwork:

[24] Fieldwork was undertaken on 18th and 19th February 2009 and the final assessment was presented in Section 3.4 of the 2009 EIA.

  - o Excavation of trial holes (undertaken at each of the proposed turbine locations and along proposed access roads to confirm subsoil lithology);
  - o Exploratory drill holes at turbine locations;
  - o Geophysical survey; and
  - o In-situ and laboratory testing;
- Environmental Protection Agency database (www.epa.ie);
- Geological Survey of Ireland - National Draft Bedrock Aquifer map;
- Geological Survey of Ireland - Groundwater Database (www.gsi.ie);
- Geological Survey of Ireland – 1:25,000 Field Mapping Sheets; and,
- General Soil Map of Ireland 2nd edition (www.epa.ie);

6.2.4 Field Work

MEL personnel visited the site on the 29th June and 4th November 2010 to undertake assessments of topography, geology and ground stability conditions at the site. A desk study to supplement the site assessment was undertaken and a report was issued to the client in November 2010.

JOD personnel visit the grid connection site on 1st August 2018.

6.2.5 Evaluation of Potential Effects

The baseline environment is assessed by characterising the site topographical, geological and geomorphologic regime from the data acquired.

Following on from the identification of the baseline environment, the available data is utilised to identify and categorise potential impacts likely to affect the soils and geological environment as a result of the proposed EIA Development. These are undertaken by:

- Undertaking preliminary materials budget calculations in terms of volumetric soil and subsoil excavation and reuse associated with development design
- Assessment of ground stability risks;
- Assessing the combined data acquired and evaluating any likely impacts on the soils, geology and ground stability; and
- Identifying impacts and considering measures that would mitigate or reduce the identified impact.

The statutory criteria (EPA, 2002; EPA, 2003) for the assessment of impacts require that likely impacts are described with respect to their extent, magnitude, type (i.e. negative, positive or neutral) probability, duration, frequency, reversibility, and transboundary nature (if applicable).

Impacts may be categorised as follows:

- Direct: where the existing soils and geological environment along, or in close proximity to, the proposed EIA Development is altered, in whole or in part;

- Indirect: where the soils and geological environment beyond the proposed EIA Development is altered by activities related to the construction or operation of the proposed EIA Development; and
- No Impact: where the proposed EIA Development has neither a negative nor a positive impact upon the soils and geological environment.

6.2.5.1 Sensitivity

The sensitivity of the soils and geological features of the Proposed Development Site have been identified utilising the criteria outlined within the NRA Guidance. These criteria are outlined within **Table 6.2** below.

Table 6.2: Criteria for Rating Site Attributes - Estimation of Importance of Soil and Geology Attributes

Importance	Criteria	Typical Examples
Very High	Attribute has a high quality, significance or value on a regional or national scale Degree or extent of soil contamination is significant on a national or regional scale Volume of peat and/or soft organic soil underlying route is significant on a national or regional scale	Geological feature rare on a regional or national scale ("NHA) Large existing quarry or pit Proven economically extractable mineral resource
High	Attribute has a high quality, significance or value on a local scale Degree or extent of soil contamination is significant on a local scale Volume of peat and/or soft organic soil underlying route is significant on a local scale	Contaminated soil on site with previous heavy industrial usage Large recent landfill site for mixed wastes Geological feature of high value on a local scale (County Geological Site) Well drained and/or high fertility soils Moderately sized existing quarry or pit Marginally economic extractable mineral resource

Importance	Criteria	Typical Examples
Medium	Attribute has a medium quality, significance or value on a local scale Degree or extent of soil contamination is moderate on a local scale Volume of peat and/or soft organic soil underlying route is moderate on a local scale	Contaminated soil on site with previous light industrial usage Small recent landfill site for mixed wastes Moderately drained and/or moderate fertility soils Small existing quarry or pit Sub-economic extractable mineral resource
Low	Attribute has a low quality, significance or value on a local scale Degree or extent of soil contamination is minor on a local scale Volume of peat and/or soft organic soil underlying route is small on a local scale	Large historical and/or recent site for construction and demolition wastes Small historical and/or recent landfill site for construction and demolition wastes Poorly drained and/or low fertility soils Uneconomically extractable mineral resource

6.2.5.2 Magnitude

The magnitude of potential impacts has been defined in accordance with the criteria provided in the 2002 EPA publication 'Guidelines on the information to be contained in Environmental Impact Statements' as outlined within **Table 6.3** below and the NRA Guidance, as outlined within **Table 6.4**.

<u>Table 6.3:</u> Impact Assessment Criteria

Magnitude of Impact	Description
Imperceptible	An impact capable of measurement but without noticeable consequences
Slight	An impact that alters the character of the environment without affecting its sensitivities
Moderate	An impact that alters the character of the environment in a manner that is consistent with existing or emerging trends
Significant	An impact, which by its character, magnitude, duration or intensity alters a sensitive aspect of the environment
Profound	An impact which obliterates all previous sensitive characteristics
Magnitude of Impact	Description

<u>Table 6.4:</u> Criteria for Rating Impact Significance - Estimation of Magnitude of Impact on Soil / Geology Attribute

Magnitude of Impact	Criteria	Typical Examples
Large Adverse	Results in loss of attribute	Loss of high proportion of future quarry or pit reserves Irreversible loss of high proportion of local high fertility soils Removal of entirety of geological heritage feature Requirement to excavate / remediate entire waste site Requirement to excavate and replace high proportion of peat, organic soils and/or soft mineral soils beneath alignment
Moderate Adverse	Results in impact on integrity of attribute or loss of part of attribute	Loss of moderate proportion of future quarry or pit reserves Removal of part of geological heritage feature Irreversible loss of moderate proportion of local high fertility soils Requirement to excavate / remediate significant proportion of waste site Requirement to excavate and replace moderate proportion of peat, organic soils and/or soft mineral soils beneath alignment

Magnitude of Impact	**Criteria**	**Typical Examples**
Small Adverse	Results in minor impact on integrity of attribute or loss of small part of attribute	Loss of small proportion of future quarry or pit reserves Removal of small part of geological heritage feature Irreversible loss of small proportion of local high fertility soils and/or high proportion of local low fertility soils Requirement to excavate / remediate small proportion of waste site Requirement to excavate and replace small proportion of peat, organic soils and/or soft mineral soils beneath alignment
Negligible	Results in an impact on attribute but of insufficient magnitude to affect either use or integrity	No measurable changes in attributes
Minor Beneficial	Results in minor improvement of attribute quality	Minor enhancement of geological heritage feature
Moderate Beneficial	Results in moderate improvement of attribute quality	Moderate enhancement of geological heritage feature
Major Beneficial	Results in major improvement of attribute quality	Major enhancement of geological heritage feature

6.2.5.3 Significance Criteria

The significance of the potential effects of the Development have been classified by taking into account the sensitivity of receptors and the magnitude of the potential effect on them, combined with the likelihood of an event occurring as defined in **Table 6.5**.

Table 6.5: Rating of Significant Environmental Impacts

	Magnitude of Impact				
Importance of Attribute		**Negligible**	**Small**	**Moderate**	**Large**
	Extremely High	Imperceptible	Significant	Profound	Profound
	Very High	Imperceptible	Significant/ Moderate	Profound/ Significant	Profound
	High	Imperceptible	Moderate/ Slight	Significant/ Moderate	Severe/ Significant
	Medium	Imperceptible	Slight	Moderate	Significant
	Low	Imperceptible	Imperceptible	Slight	Slight/ Moderate

6.3 BASELINE DESCRIPTION

6.3.1 Introduction

This section provides a description of the soils and geology of the Proposed Development Site based on the results of surveys and desk information, and a summary of any information required for the assessment that could not be obtained.

6.3.2 Site Description

The Proposed Development Site is described in full in **Section 2: Project Description** and is not repeated here.

6.3.3 Bedrock Geology

6.3.3.1 Wind Farm Site

The published bedrock geology mapping for the area is illustrated in Figure 6.2 - Bedrock geology, surface drainage and hydrochemistry. The majority of the wind farm study area is underlain by the Gun Point Formation of the Old Red Sandstone Magnafacies. This formation is dominated by green-grey sandstones and purple siltstones (Ref. 4). During the site visit this formation was observed to be well folded and generally steeply dipping across the site. The bedrock troughs created by differential erosion in the Gun Point Formation sandstone at Derreenacrinnig West function as basins for the accumulation of peat. The south of the site is underlain by the Castlehaven Formation, which is dominated by purple mudstone and siltstone (Ref. 4). The very north of the site is underlain by the Toe Head Formation which is dominated by cross-bedded sandstones and purple siltstones with some mudstones (Ref. 4).

There are two published bedrock faults within the site area. Both faults run in a generally northeast-southwest direction, one passing under the northern boundary of the site and one passing close to the southern boundary.

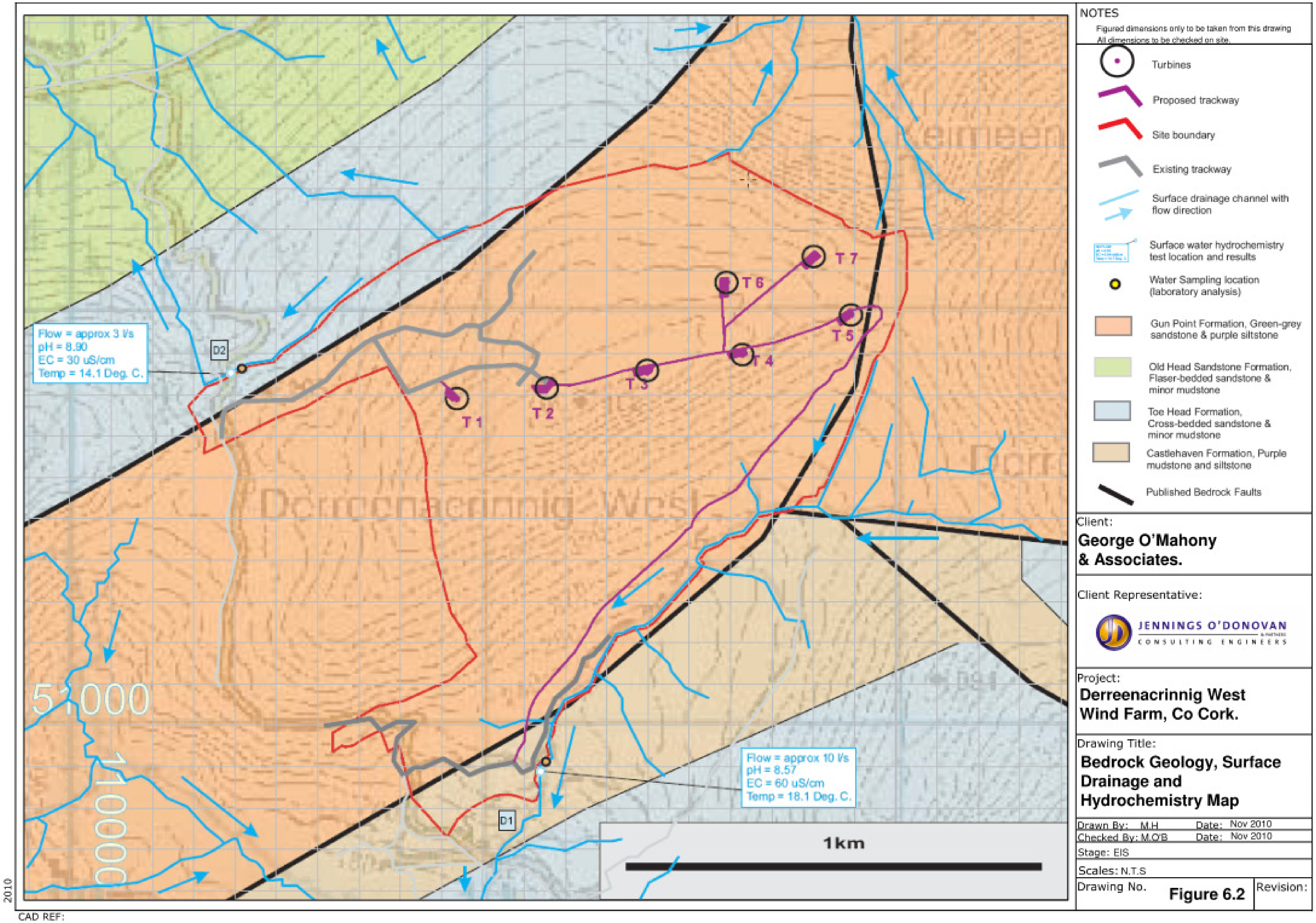

NOTES
Figured dimensions only to be taken from this drawing
All dimensions to be checked on site.
Turbines
Proposed trackway
Site boundary
Existing trackway
Surface drainage channel with flow direction
Surface water hydrochemistry test location and results
Water Sampling location (laboratory analysis)
Gun Point Formation, Green-grey sandstone & purple siltstone
Old Head Sandstone Formation, Flaser-bedded sandstone & minor mudstone
Toe Head Formation, Cross-bedded sandstone & minor mudstone
Castlehaven Formation, Purple mudstone and siltstone
Published Bedrock Faults
Client:
George O'Mahony & Associates.
Client Representative:
JENNINGS O'DONOVAN
CONSULTING ENGINEERS
Project:
Derreenacrinnig West Wind Farm, Co Cork.
Drawing Title:
Bedrock Geology, Surface Drainage and Hydrochemistry Map
Drawn By: M.H Date: Nov 2010
Checked By: M.O'B Date: Nov 2010
Stage: EIS
Scales: N.T.S
Drawing No. Figure 6.2
Revision:
Flow = approx 3 l/s
pH = 8.90
EC = 30 uS/cm
Temp = 14.1 Deg. C.
Flow = approx 10 l/s
pH = 8.57
EC = 60 uS/cm
Temp = 18.1 Deg. C.
D1
D2
T 1
T 2
T 3
T 4
T 5
T 6
T 7
Derreenacrinnig West
1km
51000
110000
2010
CAD REF:

Figure 6.2

Exposed bedrock was observed across the Derreenacrinnig West study site during the field investigations. This bedrock was observed to be consistent with the published information for the area.

As part of the Site Investigation carried out in 2016/2017, 4 rotaray cored boreholes were executed (turbine locations T01, T02, T03 and T04). Rock was encountered at the following depths:

Table 6.6: Rock Depths

Turbine Location	Depth to Rock	Type of Rock
T01	1.65m	Weak Grey Siltstone
T02	1.55m	Fine grained Sandstone
T03	1.55m	Purple red Siltstone overlying Sandstone at 4.55m
T04	1.60m	Weak purple grey Siltstone overlying Sandstone at 5.05m

From the above, it is evident that rock is typically encountered at 1.55-1.65 (average 1-60m) below ground level.

6.3.3.2 Grid Connection Route

The wind farm site substation is underlain by Gun Point Formation green grey sandstone and purple siltstone. As the grid connection route goes north-westwards, it encounters Toe Head Formation Cross-bedded Sandstone and minor mudstone. It then crosses: - Old Head Sandstone Formation wavy, bedded fine grained sandstone and minor mudstones.

- Ardaturrish Member black mudstones and silt-lensed Mudstones.
- Reenydonagan Formation medium to thin-bedded calcareous mudrock.
- Ardnamanegh Member dark-grey mudstones with thin laminae of black shade and siltstone en-route to Ballylickey substation towards the west.

Exposed bedrock was visible close to the wind farm site consistent with published information. However, much of the route was either grassland or forestry or roads with no rock visible.

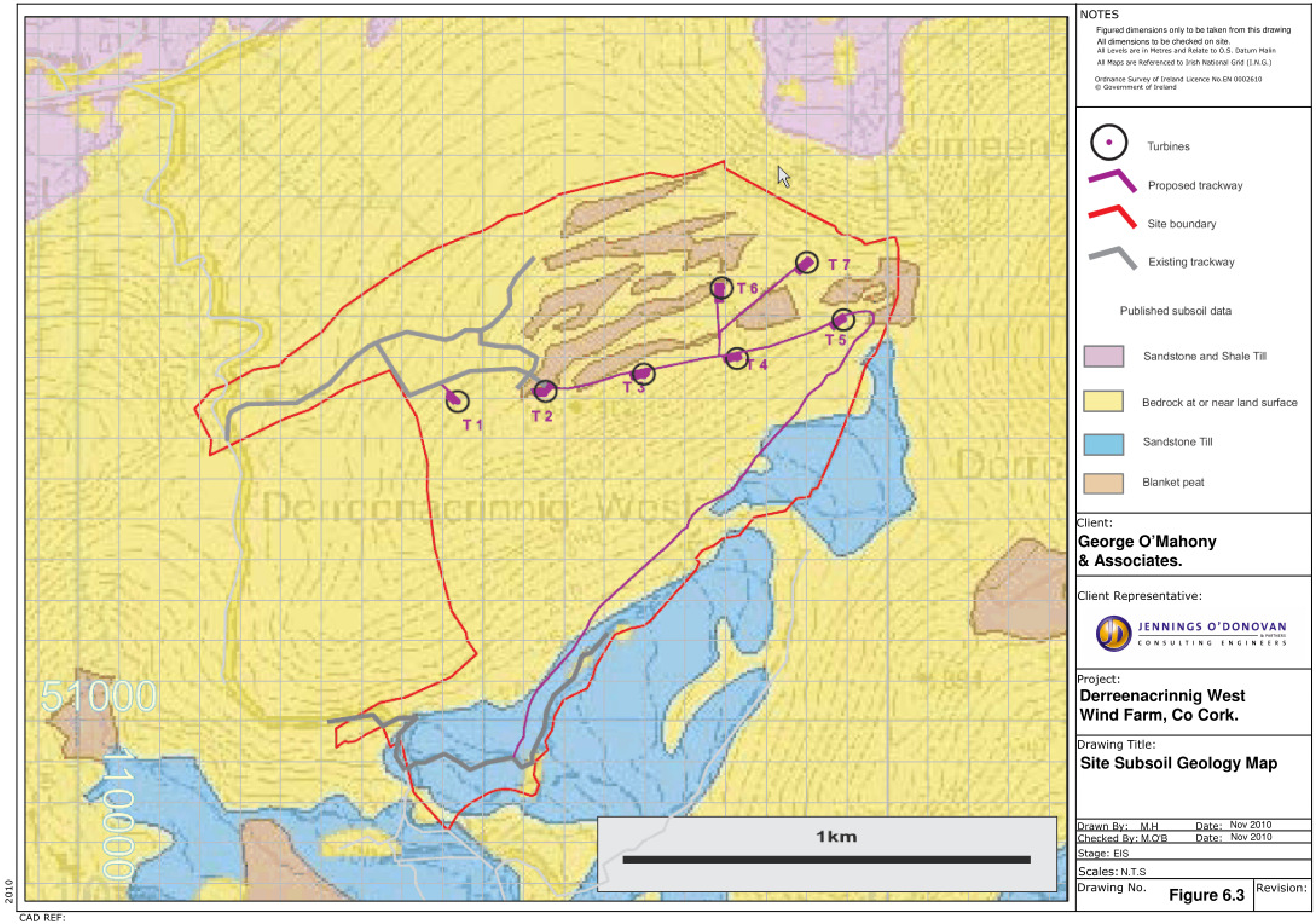
6.3.4 Soils and Subsoil Geology

Consultation with recent EPA and Teagasc mapping of soils and subsoil (Ref. 5) indicates that the majority of the wind farm site is characterised by exposed bedrock where overlying unconsolidated deposits are either thin or absent (Figure 6.3 - Site subsoil geology). The remaining ~ 10% of the site is overlain by upland blanket peat contained in east-west trending basins within bedrock depressions on the northern slopes of the hill (Appendix C, Site subsoil geology).

The field investigations undertaken by MEL in June 2010 generally confirm the published literature on soil and subsoil conditions at the wind farm site; in so much as, exposed or thinly covered bedrock and upland blanket peat bog are the dominant spatial coverage soil and subsoil units at the site.

Gouge coring was undertaken by MEL at 76 locations across the site (Appendix F Site Investigation database), at which preliminary geotechnical tests were undertaken on the soil and subsoil geology for the purpose of determining baseline slope potential for mass movement, peat substrate shear strength and overall stability of the ground under baseline conditions.

The composition and character of the peat, the spatial and depth distribution of the peat, the composition and character of the mineral subsoil, the spatial and depth distribution of the mineral subsoil and the relation of peat and mineral subsoil to the proposed infrastructure are summarised from the site surveys undertaken in June 2010, the detailed results are presented in Appendix F, these include site investigation database, gouge core locations and peat depth results, shear vane test results, and Von Post humification results. Results show c.0.5m of peat overlying c. link of sandy gravelly silt.



NOTES
Figured dimensions only to be taken from this drawing
All dimensions to be checked on site.
All Levels are in Metres and Relate to O.S. Datum Malin
All Maps are Referenced to Irish National Grid (I.N.G.)
Ordnance Survey of Ireland Licence No.EN 0002610
© Government of Ireland
Turbines
Proposed trackway
Site boundary
Existing trackway
Published subsoil data
Sandstone and Shale Till
Bedrock at or near land surface
Sandstone Till
Blanket peat
Client:
George O'Mahony & Associates.
Client Representative:
JENNINGS O'DONOVAN
CONSULTING ENGINEERS
Project:
Derreenacrinnig West Wind Farm, Co Cork.
Drawing Title:
Site Subsoil Geology Map
Drawn By: M.H Date: Nov 2010
Checked By: M.O'B Date: Nov 2010
Stage: EIS
Scales: N.T.S
Drawing No. Figure 6.3 Revision:
T 1
T 2
T 3
T 4
T 5
T 6
T 7
Derreenacrinnig West
51000
110000
1km
2010
CAD REF:

Figure 6.3

6.3.5 Composition and Character of PEAT

The peat in the study area can be described as 'Brown to Dark Brown, soft, moist to wet, fibrous to amorphous PEAT'. Results from the field investigation indicate low to mid to high humification values, ranging generally from H3 to H7, at peat depths between 0.15 and 3.1m (Appendix F (Von Post humification results). High humification values, ranging around H9 occur at peat depths greater than approximately 2m or in areas containing wet amorphous PEAT. Overall therefore, the study area is characterised by moderate humification rates at shallow peat depths and higher humification values at peat depths greater than approximately 2m.

6.3.6 Spatial and Depth Distribution of PEAT

The slopes of the southern part of the site are largely free from peat >0.5m deep. Approximately 50% of the north facing slopes on the site are also free from peat >0.5m deep. Were peat >0.5m deep does occur on the site it is deposited within northeast-southwest trending bedrock basins the location of which is controlled by the local geological structure. The deepest peat encountered in these peat deposits during the site survey was 3.15m deep. Pockets of such deep peat appear to be limited in their spatial extent with the peat at such areas becoming <2m and even <1m deep within 10m horizontal distance of the points where peat is 3m deep. This indicates that the depth of the peat deposits is highly variable over relatively short distances on the site. The majority of the access track is situated on either exposed bedrock or peat <0.5m deep. Site survey indicates that it is unlikely that the remainder of the track crosses peat >3m deep but this cannot be ruled out due to the localised variability in peat depth. Turbines 3, 5, 6, and 7 are sited on exposed bedrock while Turbines 1, 2, and 4 are sited on peat <0.5m deep. Existing borrow pits are located along the edge of the currently constructed forestry tracks in the northwest of the site. Peat cover in the vicinity of these borrow pits is generally <1m deep (Appendix E).

6.3.7 Composition and Character of MINERAL SUBSOILS

The mineral subsoil examined from exposures and from core samples was identified as beige to grey, firm to stiff, sandy, CLAY/SILT with some angular gravel and occasional cobbles which was interpreted as glacial till. An iron pan was observed in the mineral subsoil approximately 0.25m on average below the peat – mineral subsoil interface across the site.

6.3.8 Spatial and Depth Distribution of MINERAL SUBSOILS

The glacial tills identified around the footprint of the development are of sedimentary parent bedrock origin. The glacial tills are located under the peat across most of the site except where exposed bedrock is present. During the site surveys gouge cores that met refusal on rock commonly did not encounter till between the peat and underlying bedrock indicating that at least some of the peat developed on exposed bedrock.

6.3.9 Relation of Peat and Mineral SUBSOILS to Proposed Infrastructure

The infrastructure for the proposed development consists of seven (7) turbines, one (1) access road, one (1) ESB substation, and one (1) borrow pit. The borrow pit will be excavated by utilising the already existing borrow pits at the north western part of the site. These linear borrow pits are suitable for further development as they are relatively small at present, situated beside existing trackways, and do not have a covering of deep (>1m deep) peat in general. The relationship of the spatial positioning of this infrastructure (its footprint) relative to the existing geological environment is summarised in the following table:

6.3.10 Turbine Peat Depth (m) Dry/Moist/ Wet/Very Wet Peat Sub-Peat Geology Von Post Humification Shear Vane Test (kPa) Slope & Aspect

1	0.35	Moist	Rock	H3-H6	26	3º west
2	0.1	Moist	Rock	H3-H5	34	10º north
3	0.0	n/a	Rock	n/a	n/a	5º north
4	0.3	Moist	Rock	H3-H5	n/a	7º southeast
5	0.0	n/a	Rock	n/a	n/a	7º south
6	0.0	n/a	Rock	n/a	n/a	12º north
					(locally 5 ° -20 °)	
7	0.0	n/a	Rock	n/a	n/a	0º n/a

6.3.11 Von Post Humification

The Von Post Humification Scale (Ref. 2) is a 10-Point scale ranging from H1 unhumified plant remains to H10 totally humified plant remains or amorphous peat. The results of field investigations at the Derreenacrinnig West site indicate a humification range of H3 to H9 with the majority of values falling between H3 and H7. High H values (H8 to H9) were recorded at or near the bottom of cores in deep peat (>2m) this indicates that humification levels increase with depth across the site and that shallow peat here is likely to be less humified and contain more intact organic fibres than deeper peat which is generally more amorphous in character (Appendix E (Von Post humification results)).

6.3.12 Slope Measurements

Consultation with the GSI landslide database indicates that there is historic recorded evidence of two bog or landslide occurrences within 20km of the proposed development. One is located 17 km to the north at GRID REF. 101591, 67019 at Gortacreenteen in County Kerry where a *landslide from an embankment was recorded in 2004. The second is located 19.5 km to the north at GRID REF 113730, 72070 at Fuhiry in County Cork where a peat landslide from a mountain valley was recorded in 1997. There are no landslide events recorded within 17 km of the Derreenacrinnig West site (Ref. 6).*

Slopes in the Derreenacrinnig West site range from 0º-80º. The steeper slopes (>20 º) are largely confined to the southern side of the site uphill of the proposed access road with the northern side of the site exhibiting a series of steps or terraces, the location of which is controlled by local geological structure with steeper slopes found between flatter terraces. The turbines are situated on slopes of between 1º-12º, but the suitability of each site is dependent on not only the slope measurement of the site but the relationship between a number of factors including the presence or otherwise of unconsolidated deposits and the undrained shear strength and degree of peat humification in places where peat is present.

6.3.13 Shear Vane Tests

The Inspection Vane Tester is used primarily to measure the in situ undrained shear strength in peat. It is primarily intended for use in trenches and excavations at a depth not influenced by drying and excavation procedure. It should be noted that due to the fibrous nature of peat, measurement of shear strength can show elevated values due to the inherent strength of the fabric of the material, i.e. the roots and rootlets etc., as stated in BS 5930 and BS 1377-9 (Ref. 1 and 7). Results from testing in peat are used as indicative and relative values only and should not be used as absolute values. It is useful to illustrate shear strength in the depth profile and spatially with comparisons to peat depth and humification rates, as well as hydrological conditions such as proximity to drainage.

Shear Vane Tests (SVT's) were carried out at all turbine footprint locations where peat was present. Values over the site ranged from 18-34 kPa within the turbine footprint areas (Appendix E (Shear vane test results)). This range in data values suggests a relatively weak to moderately strong peat substrate at the Derreenacrinnig West site.

Most importantly, with respect to SVT data, is determining whether there is a relationship between peat shear strength and (a) peat depth, (b) slope measurements, and (c) von post humification. There is no clear relationship between changes in slope and changes in shear strength at the Derreenacrinnig West site. During fieldwork it was observed that the presence of fibres at depths where shear vane tests were carried out appeared to have a stronger influence on test results than other parameters such as slope, humification and whether the peat was classified as dry, moist or wet.

6.3.14 Ground Stability / Stress Indicators

The following observations were made on ground stability and stress indicators during the site walkover:

No ground disturbance or stress indicators were observed throughout the wind farm site, i.e. no fencing or trees showed any signs of ground movement, no fault scarps (a scarp is a steep slope created by a mass movement), tension cracks or steep slopes prone to slope stability problems were observed.

Existing cuttings and ditches showed no signs of slipping or potentially significant instability.

6.3.15 Soils – Grid Route

Peat is the dominant soil in the general area of the wind farm sub-station and going north-westwards for the first c.1km of the route.

The next main soil classification is Drimindy coarse loaming draft with Siliceous stones which then runs into Schull coarse loamy drift with siliceous stones near Ballylicky.

This, apart from the first c.1km which is in peat overlying siltstone/sandstone, the remining c.13km of route is expected to be within loaming soils with stones.[25]

6.4 DO NOTHING IMPACT

Site investigations of the baseline geological and geotechnical conditions at the Derreenacrinnig West site indicate that parts of the site have already experienced impacts to baseline conditions by commercial afforestation at the northern part of the site. In particular, access track construction for forestry planting has had the most severe impact on the local geological environment. There are no indications that the construction of this access track has had adverse impacts with regard to ground stability. The cumulative impacts of this access track construction appear to be the removal of peat around access track and quarrying or rock from borrow pits along the edge of the track route. This represents a slight, negative, permanent impact to the area.

Should the proposed development not proceed, the existing land-use practice of commercial forestry will continue with associated modification of the existing environment when forestry harvesting is eventually undertaken.

[25] www.gis.teagasc.ie/soils/map.php

6.5 POTENTIAL IMPACTS OF THE DEVELOPMENT

6.5.1 Construction Phase

6.5.2 Peat, Subsoil and Bedrock Removal

The removal of peat or mineral subsoil is a direct, permanent impact on the soils and geology aspect of the environment. However, much of the northern part of the site has already been impacted by access track construction and the site is not within a designated conservation area.

The removal of bedrock for turbine base construction is a direct, permanent and potentially significant negative impact for this development. Table 6.7 below presents a summary of indicative design depths for turbine foundations.

Table 6.7: Turbine Foundation/Formation Summary

Turbine Location	Foundation Option	Expected depth below existing ground level to suitable bearing stratum	Expected Bearing Stratum
T1	Non-buoyant Gravity base	2.0m	Bedrock
T2	Non-buoyant Gravity base	1.70m	Bedrock
T3	Non-buoyant Gravity base	1.70m	Bedrock
T4	Non-buoyant Gravity base	1.70m	Bedrock
T5	Non-buoyant Gravity base	1.70m	Bedrock
T6	Non-buoyant Gravity base	1.70m	Bedrock
T7	Non-buoyant Gravity base	1.70m	Bedrock

The turbine foundations are anticipated to be 14.5m in diameter, 2.1m thick. Assuming an overbreak of 0.1m to accommodate a concrete blinding layer, the depth to formation will be at c.1.8m below ground level. If rock is encountered at c.1.6m below ground level, then a 0.2m depths of rock will need to be excavated at each of the seven turbine bases. The volume of rock to be excavated will be c.33m^3 per turbine. However, a trench for ducting will need to be excavated under part of each foundation such that the total volume of rock excavation will be total volume of rock excavation will be c.37m^3 per turbine or c.259m3 in total. However, additional rock will be excavated at T5, T6 and T7 which will add a further c.780m^3.

Approx. 20m^3 of rock is estimated to be removed for sub-station foundations. Thus, the total volume of rock to be excavated for foundations is estimated at 1,059m^3.

Some 16,000m^3 of rock from a site borrow pit are required to construct site track, hardstands and site compound in addition to the rock excavated from foundations.

Some 4,150m of site track are to be constructed at 4m wide and assuming 1.6m depth of peat, the volume of peat to be excavated for the site tracks us estimated at 8,300m^3 while the volume of silty soil is estimated at 18,260m^3.

Seven crane hardstands are to be constructed having a cumulative area of 0.46ha. Assuming 1.6m depth of peat the volume of peat to be excavated for hardstands is estimated at 2,300m^3 while the volume of silts sub-soil is estimated at 5,060m^3.

For site cabling, some 3km of trenching 0.6m wide, 1.2m deep will be required. Approximately 50%of the peat can be reinstated in the trench giving a nett excavated volume of 1,080m3 which will be silts sub-soil.

The volume of peat required to be excavated for the site compound and site substation is estimated at 375m^3 while the volume of subsoil is estimated at 750m^3. The total volume of peat to be excavated is estimated at 10,975m^3 while the total volume of silt to be excavated is estimated at 25, 490m^3.

Mitigation and reductive measures with regard to materials budget handling and potential indirect impact on water quality from subsoil and bedrock excavation activities are outlined in the mitigation section of this report.

6.5.3 Vehicular Movement

During the construction phase of the proposed development, vehicles will cross over or excavate into areas of bog in order to construct the access roads and gain access to the proposed development areas. This is considered to be a short-term, direct impact on the peat and in-situ earth materials, but it is not considered to be a potentially significant negative impact of the proposed development, especially as this type of vehicular impact has already occurred on the site during afforestation works.

6.5.4 Excavation Works

The approach and methodology in which excavation of in-situ peat and earth materials is undertaken is very important for ground stability in blanket bog environments. Peat is 80-90% water and if it is not sufficiently drained prior to excavation or alternatively supported during excavation works (where high slope exists), excavation has the potential to cause potential slippage or mass failure under the right prevailing geotechnical and hydrological conditions (Ref. 8).

6.5.5 Storage and Stockpiles

Of significance during the construction phase of the project is the excavated materials handling, storage and re-use. There is potential for direct and indirect negative impacts on ground stability and water quality, for example slope failure due to excessive loading (surcharge) and the release of peat washings and suspended solids to the surface water system. This potential impact by construction works activity on water quality impact is discussed in the Chapter 7 - Water.

6.5.6 Ground / Peat Stability

Mass movements in peat can take the form of either bog burst or bog slide. Historical evidence suggests that raised bogs are more prone to bog bursts while bog slides are more common on blanket bogs. Bog slides are prone to occur in certain upland locations due to their peculiar topography, ground composition and hydrology. When a slide occurs, it acts as a safety valve to restore equilibrium (Ref. 9). Peat slides generally occur either during or immediately after periods of heavy rainfall. Failures are especially likely to occur where there is a break of slope at the edge of an upland plateau of peat. Records indicate that bog bursts naturally occur on shallow slope angles varying between 3° and 6° while bog slides appear to occur on slopes that are steeper than 6o. The most destructive bog slides involve the combination of slide materials with floodwaters, diluting the peat and mud in waterways and accelerating the velocity of the debris flow.

Following well documented bog slides on the slopes of Dooncarton and Barnachuille mountains, Co. Mayo in September 2003 (Ref. 10) and more significantly at Derrybrien, Co. Galway in October 2003 (Ref. 11), the potential for bog failure has come to the fore in consideration of planning for wind farm developments on blanket and raised bogs. The following causal factors for bog failure are identified following research and assessment of recent slides and from historical evidence over the last 200 years in Ireland (Ref. 9).

Research into the history of bog slide occurrence indicates that the majority of bog slides have occurred on the blanket bogs in the west of Ireland where rainfall is highest. Here, bog slides tend to be more frequent during the autumn and winter months.

The following criteria are considered to be the main causal or contributory factors to bog slide occurrence:

Slope is the single most important factor for blanket and raised bogs. Bog slides are especially likely to occur where there is a break in slope at the edge of an upland plateau of blanket peat, providing a line of weakness. While initial failure is likely to be slippage (translational or rotational faults), semi-fluid to fully fluid behaviour is the main movement mechanism downslope. Slope gradient imparts kinetic energy to the sliding material.

The depth of peat and its relationship to humification (the degree to which the fibre structure of the peat has decayed), pore water pressure, shear vane strength and other parameters generally indicates that the deeper the peat profile the more unstable it is, if external controls such as slope, drainage, removal of adjoining earth materials are changed. Exact depth threshold of stability is not applicable due to the variability of peat environments (raised bog, blanket bog or fen habitats) and their site-specific conditions. However, as a rule of thumb peat of depths greater than >2m is significantly more vulnerable to instability than shallower peat at <1m depth, and in particular the top-layer of acrotelm (living) peat at <0.2m.

The bedrock relief can play an important role in both the location of deeper peat zones within an upland blanket bog complex, as well as the stability of the overlying peat unit. Upland bedrock geology is usually ancient and has experienced a long history of tectonic folding, faulting and weathering. This usually means that the “rockhead” or surface of the bedrock is irregular and contains depressions or localised “basins” into which peat accumulates over time. In cross section, these deep peat pockets are characterised by an ellipsoidal shape, with the surface of the peat doming upwards illustrating characteristics of a “raised bog” microcosm. These peat pockets are usually highly saturated with water with no outlet for ‘basin’ drainage; hence they are characterised by high pore water pressure. They usually coincide with “quaking bog” ecological zonations. In terms of ground stability, the deep peat is supported by the underlying geology and relief morphology (basin walls) for slope stability, and if these walls are undermined by interference there is a high risk of causing a peat slide at these locations.
The pattern of recent precipitation such as intense localised rainfall (or melting snow) is an important trigger mechanism.

Antecedent weather conditions such as drought conditions are identified as a contributing factor. In the case of the landslides at Dooncarton and Barnachuille in September 2003 and at Derrybrien October 2003, short intense periods of heavy rainfall followed an exceptionally dry late summer. Historically, the Owenmore bog slide in Erris, Co. Mayo (1819) was also preceded by two months of drought. Sustained dry conditions leads to high soil moisture deficit (SMD). This dries the blanket peat, causing shrinkage and desiccation cracks which in turn can provide pathways for lubrication of solid mass when precipitation subsequently occurs.

The presence of impermeable material at the base of the peat causes water to accumulate at the base of the peat after recent rainfall and may lubricate a slip layer of humified peat near the base. Elevated pore pressure provides buoyancy forces, which accompanied by gravitational force can cause the bog slide. In many cases an iron or mineral pan is identified within the upper mineral subsoil or weathered bedrock. This pan impedes downward migration of groundwater and a plane of seepage forms above the pan.

Some bog slides are caused by excessive interference e.g. opening of turf banks, opening deep drains on a bog. All drains should be perpendicular or oblique to slope contour not parallel to it.

Site specific assessment of the potential for bog failure at the Derreenacrinnig West site indicates the following:

Much of the site is underlain by peat between 0.5 and 2-3 meters deep. Turbines 3, 5, 6, and 7 are underlain by exposed bedrock while turbines 1, 2, and 4 are underlain by peat <0.5m deep. A hard pan was identified from available substrate exposures and from site investigation results at the site. This hardpan was usually located in the mineral subsoil approximately 0.25m beneath the peat – mineral subsoil interface.

Site investigations reveal that either bedrock or a firm to stiff, beige to grey, sandy CLAY/SILT material interpreted as glacial till underlies most of the Derreenacrinnig West site. This material is probably a lodgement till of Quaternary age.

Slopes at the Derreenacrinnig West site range from 0º-80º with all the planned turbines on slopes of <15º.

Shear vane test results indicate a relatively weak to moderately strong peat at the Derreenacrinnig West site. Geotechnical assessment of the proposed turbine locations indicates stable baseline peat / ground conditions at these locations.

In constructing the access road through the proposed site of development, if peat depths exceed 1.0m in depth, specific geotechnical ground testing and preparation (where necessary), excavation supervision and management is required.

There are historical records of two land / peat-slide events within 20km of the study area. There are no visual indicators of significant slope instability at the site, such as concentric cuts, healed tension cracks or leaning fence lines.

At the Derreenacrinnig West site, while published records and field investigations indicate baseline geotechnical stability, there is still a risk of peat instability and a resultant peat slide occurring, particularly during the construction phase of the development. This low risk or probability is a function of the introduced variables involved in the construction phase of the project (e.g. excavation type and methodology, drainage during earthworks, inappropriate stockpiling) and to a lesser degree during the operational phase of the project (poor constructed drainage design). As a result, using the precautionary principle, mitigation measures are required for this potential risk / impact.

6.5.7 Waste Generation / Management

Construction generates waste as a by-product of development. In the case of this site, solid waste will be generated by the excavation of unsuitable earth materials, i.e. peat. This excavated peat has the potential to have significant, direct impacts on ground stability and the baseline geochemical environment and indirectly on the site's hydrology.

Waste can also be generated as a function of introduced construction materials (e.g. cementitious materials) that are subsequently not used or not exhausted during the construction phase. Depending on how inert these different materials are compared to the existing environment, they can cause local change in geochemical chemistry which in turn can impact hydrochemistry and thus ecology.

6.5.8 Operational Phase

No new impacts are anticipated to arise during the operation phase of the project on the geological, geomorphological and geotechnical environment.

6.6 MITIGATION MEASURES

A constraints map identifying geotechnical exclusion zones can be viewed in Figure 6.3 Geotechnical and hydrological constraints map. Recommended mitigation measures for each of the impacts are outlined below.

6.6.1 Mitigation by Avoidance

A process of "mitigation by avoidance" was undertaken by the EIA team during the design of the turbine and associated infrastructure layout. Arising from the results of this study, a constraints map was produced that identifies areas where geotechnical constraints make parts of the site unsuitable for development. These geotechnical constraints map is illustrated in Figure 6.3 - Geotechnical and hydrological constraints map.

Ideally, peat depth buffer or constraint zones >2.0m peat depth should be avoided for the turbine development footprint. However, it is possible to excavate turbine bases in areas containing peat >2.0m deep if construction is appropriately planned, carried out and supervised by suitably qualified contractors. The location of the access roads and turbine bases in peat depths greater than 2.0m was avoided by the EIA team, the spatial distribution of peat and exposed bedrock across the site, as well as other constraint issues such as drainage, buffer zones, has allowed for this Figure 6.3 - Geotechnical and hydrological constraints map. Borrow pits which may be required for construction purposes should utilise existing linear borrow pits in the north western part of the site along existing trackways. The peat cover is suitable here (<1m deep) and borrow pits already exist here, thus, situating any other required borrow pits in these locations would avoid the need for new borrow pit excavations in other parts of the site.

MEL, in consultation with the design team has reviewed this layout plan and has identified it as the best layout design available for protecting the sites existing geotechnical (and hydrological) regime, while at the same time incorporating and overlaying engineering and other environmental constraints as detailed in this EIS.

6.6.2 Construction Phase

Peat, Subsoil and Bedrock Removal

The removal of peat and mineral subsoil / bedrock is an unavoidable impact of the development, but every effort should be made to ensure that the amount of earth materials excavated is kept to a minimum in order to limit the impact on the geotechnical and hydrological balance of the site.

The mass balance of materials required for construction and the earth materials excavated from the site should be kept as numerically equivalent as possible to avoid any excess storage, disposal (waste) or importation of foreign materials to the site. The latter is particularly important in terms of maintaining the existing environment’s geo- and hydrochemistry. For example, limestone (alkaline) based materials should not be imported into the site for construction of access roads. Priority should be given to the recycling and use of excavated materials within the site OR if necessary, imported materials should be acquired locally from similar geological formations (similar geochemical signature e.g. schist which is slightly acidic) for all construction works.

Vehicular Movement

Vehicular movements should be restricted to the footprint of the proposed development, particularly with respect to the newly constructed access road. This implies that machinery must be kept on roads and, aside from advancing excavations, should not move onto bog that is not proposed for the development (Ref. 12). Floating trackways may be installed across sections of deep peat in order to avoid unnecessary peat extraction.

Excavation Works

Excavation of peat in areas >1.0m in peat depth should follow appropriate engineering controls such as the drainage of the peat along the proposed access road in advance of excavation activity (1 month in advance where possible) so as to reduce pore water content and thus instability of the peat substrate prior to excavation. Such drains should be positioned at an oblique angle to slope contours to ensure ground stability. Drains should never be positioned parallel to slope contours. Drainage must be attenuated prior to outfall.

In those parts of the site where excavation will intercept peat that is >1.0m depth, a geotechnical engineer/engineering geologist should be on site to supervise and manage the excavation works and confirm the necessity for supporting newly excavated peat exposures or redirect construction phase drainage to maintain ground stability. Further geotechnical investigations should be undertaken on the relationship between the deeper peat areas and the location of the proposed access road, with the view to planning in advance to either drain the peat pocket or support it during and post road construction.

It is strongly recommended that a geotechnical engineer/engineering geologists (a) approve the methodology of construction (contract of works) and (b) supervise all excavations during the construction phase of the project. This would involve direct monitoring and management of operations, preventing unauthorised excavations and stopping approved excavations on first signs of ground stressing or release of uncontrolled water and suspended solids load.

Storage and Stockpiles

All excavated materials from the site or introduced materials for construction must be either used or removed from the site. No permanent spoil or stockpiles should be left on site.

If peat is required for reinstatement, then acrotelm peat (<0.3m shallow, living layer) should be stripped off the development footprint (prior to main excavation) and either placed carefully at the margins of the development (adjacent to road and turbine platforms) or transported to a temporary storage zone, where the peat is laid out like topsoil sod on flat terrain. This acrotelm "strip" of peat should be no thicker than 0.3m on excavation and should be re-deposited at <0.3m thick at any point on the development site (avoid surcharge). This c.0.3m top layer of peat is held together by dense vegetation roots and as such will retain its structural integrity when excavated and transported. It is a useful resource as once laid on disturbed peat ground, the vegetation in the sod will begin to grow again (once it is moist) and assist in the stabilisation of loose material.

Catotelm peat is the layer of peat below the vegetated acrotelm layer (i.e. >0.3m depth). Once this material is excavated and disturbed its fragile structure is destroyed and the material behaves like a fluid in terms of its geotechnical properties. As a result, Catotelm peat should be treated with caution and greatest care in terms of its potential instability and potential to pollute waterways if not controlled by interceptor drainage. On a temporary basis, Catotelm peat should be moved to a lower elevation part of the site that is characterised by near-horizontal slopes, is >100m away from any significant break of slope and is >100m away from drains and streams.

6.6.3 Ground / Peat Stability

Geotechnical investigations at the Derreenacrinnig West site indicate that the site is a low to medium risk / probability to slope failure or peat slides. There is historic recorded evidence of two bog or landslide occurrences within 20km of the proposed development. One is located 17 km to the north at GRID REF. 101591, 67019 at Gortacreenteen in County Kerry where a landslide from an embankment was recorded in 2004. The second is located 19.5 km to the north at GRID REF 113730, 72070 at Fuhiry in County Cork where a peat landslide from a mountain valley was recorded in 1997. There are no landslide events recorded within 17 km of the Derreenacrinnig West site. Applying the precautionary principle however, the following procedures are recommended as best-practise mitigation measures to avoid slope instability at wind farm sites. These are as follows:

All site excavations and construction should be supervised by a geotechnical engineer/engineering geologist. The contractor's methodology statement should be reviewed and approved by a suitably qualified geotechnical engineer/engineering geologist prior to site operations. Particular attention and pre-construction assessment and mitigation planning should be given to the proposed access road.

Any excavations that may tend to undermine the up-slope component of a peat and / or unstable subsoil slope should be sufficiently supported by buttress, frame or rampart to resist lateral slippage. To this end, all turbine foundation locations should be supported by a restraining / support wall during the construction phase.

In such excavations, pore water pressure should be kept low at all times and careful attention should be given to the existing drainage and how structures might affect it. In particular, ponding of water should not be allowed to occur in recent excavations, particularly where slopes are >10° and where peat is >1.5m. All deliberate or incidental sumps must be drained to carry water away from the sump following rainfall. Otherwise, this water will increase hydraulic heads locally, increase pore water pressure and can potentially lead to instability.

Prior to excavation, drains should be established to effectively drain grounds prior to earthworks. Such drains should be positioned at an oblique angle to slope contours to ensure ground stability. Drains on areas of the site with minimal risk of bog failure as identified by site investigations can be positioned at a more acute angle to the slope contour in order to reduce the velocity of surface water drainage.

Due to peat's fluid-like properties, all peat excavated should be immediately removed from sloping area. If peat is required for reinstatement, then acrotelm peat (<0.3m shallow, living layer) should be stripped off the surface of the bog and placed carefully at the margins of the development along the access road and hardstand margins that are characterised by near-horizontal slopes (<6°), are >100m away from any significant break of slope and are >100m away from drains and streams.

The development of a borrow pit by blasting of bedrock as opposed to manual breakout of rock is not recommended in a blanket bog environment.

Where possible, construction activities should be undertaken during the drier months of the year (typically the summer months of May to August). During this period, rainfall is expected to be low and pore water pressures should be stable. Ultimately however, considering currently changing patterns of rainfall intensity within and between seasons, once the mitigation measures outlined above are complied with, construction work can be undertaken throughout the year. If construction is undertaken during the traditionally wetter months of the year (October to March), Minerex recommends that a geotechnical monitoring programme is undertaken during this period to monitor and report on site conditions on at least a weekly basis. From examination of factual evidence to date, the majority of landslides occur after an intense period of rainfall. It is recommended that an emergency response system be developed for the construction phase of the project, particularly during the early excavation phase. This at the minimum should involve 24 hours advance meteorological forecasting (Met Eireann download) linked to a trigger-response system. When a pre-determined rainfall trigger level is exceeded (e.g. 1 in 100-year storm event or very heavy rainfall at >25mm/hr), planned responses are undertaken. These responses should include cessation of construction until the storm event including storm runoff has passed over and where excavation is progressing in peat >1.0m depth, slope support structures are put in place until the storm runoff event passes.

6.6.4 Waste Generation / Management

All excavated earth materials must either be re-used in an environmentally appropriate and safe manner e.g. landscaping and bog restoration OR removed from the development site at the end of the construction phase. No permanent stockpiles above existing ground level are recommended at the site.

Consideration should be given to infilling any borrow pits created within the boundary of the site with inert non-peat material (similar geology of exposure), such as excavated and unusable bedrock and glacial till and peat as a secondary material. The capacity of the borrow pits previously excavated for forest roads are estimated at c.13,000m^3. If a further 16,000m^3 will be excavated so as to construct site track, hardstands etc, then the borrow pit capacity to accommodate excavated silty sub-soil (glacial tall) will be c.28,000m^3. Thus, the potential capacity of the borrow pit is greater than the volume of subsoil spoil for disposal and as such, all of the excavated sub-soil can be disposed of to the borrow pit. If used for this purpose, the re-distribution of materials to this location must be geotechnically stable, capped with surrounding substrate type and must be drained to the constructed attenuation network before discharge from the site. Infilling of historically created depressions (peat cutting, gullying) and “exposures” is beneficial for restoring and / or improving the bog environment and indirectly the hydrological and hydrogeological system.

Any excess introduced semi-natural (road building materials) or artificial (PVC piping, cement materials, electrical wiring etc) must be taken off site at the end of the construction phase. Any accidental spillage of solid state introduced materials must be removed from the site.

In addition, a construction phase environmental management plan should be in operation to check equipment, materials storage and transfer areas, drainage structures and their attenuation ability on a regular basis during the construction phase of the project. The purpose of this management control is to ensure that the measures in place are operating effectively, prevent accidental leakages, and identify potential breaches in the protective retention and attenuation network during earthworks operations.

6.6.5 Spoil Management – Underground Cable Grid Connection

For general trenching operations it is estimated that for each 100m section of duct, 90m3 of sub-soils will be excavated. The material will be stored adjacent to the trench with 30m3 of this material being reinstated in the trench. The remaining 60m3 will be transported to a licenced facility for disposal. For 3,178m of underground duct, the volume to be disposed of will be c.1,910m3.

6.6.6 Spoil Management – Overhead Line Grid Connection

In total, 164 poles are required for the project. Assuming 0.21m average diameter and that each pole is 2.2m into the ground, then the volume of spoil per pole is estimated at 0.076m^3 and the total is estimated at 12.5m^3. This will be transported to a licenced facility for disposal.

6.6.7 Operation Phase

No new impacts are anticipated during the operation phase of the project on the geological, geomorphological and geotechnical environment; therefore, no mitigation is required.

6.7 RESDUAL IMPACTS OF THE DEVELOPMENT

6.7.1 Construction Phase

The residual impact on the soils and geology environment during the construction phase of the development is that there will be a change in ground conditions at the site with the replacement of natural materials such as peat, subsoil and bedrock by concrete, subgrade and surfacing materials. This is a negative, slight, direct permanent change to the materials composition at the site.

6.7.2 Operational Phase

The residual impact on the soils and geological environment during the operation phase of the development is that there will be a permanent change in ground surfacing including areas of new hardstands that will indirectly impact on the ecology and hydrology of the site. Careful design of this drainage will be undertaken to reduce the impact and mimic natural conditions where possible along the development sections of the site. The residual impacts of the Derreenacrinnig West development will be negative and permanent but slight in terms of their overall effect on the local environment.

6.8 MONITORING

In relation to the geological and geotechnical impacts identified the following recommendations are made in terms of site monitoring:

MEL's preliminary field investigations at the Derreenacrinnig West site suggest that the site is not naturally at risk (low risk) to slope failure or mass movements. However, the construction contractor selected for the detailed design phase should provide details of environmental safety methodology outlining best practice procedures to manage construction activities. This methodology statement should be reviewed and critiqued by a qualified geotechnical engineer/engineering geologist.

An independent, qualified geotechnical engineer/engineering geologist should be contracted for the detailed design stage of the project and geotechnical services should be retained throughout the construction phase, including monitoring and supervision of construction activities on a regular frequency.

6.9 CONCLUSIONS

If the mitigation measures outlined for the geological and geotechnical aspects of the site are implemented as described in this report, the resultant predicted impact of the development is that there will be a change in ground conditions with the replacement of a small area of natural materials with concrete, and road construction sands and gravels. To ensure that the mitigation and control structures operate to stated purpose and comply with licence requirements, monitoring of ground conditions at an agreed frequency during the operation phase is recommended. If the guidelines outlined in this report are adhered to during construction and operation of the proposed wind farm the predicted overall impact of the development on the soils and geology of the site is slight, negative, and permanent.

6.10 MITIGATION MEASURES AND RESIDUAL EFFECTS

This section provides a description of measures recommended to mitigate potential negative effects and a summary of the significance of the effects of the proposed EIA Development after mitigation measures have been implemented.

6.10.1 Construction Phase

6.10.1.1 Subsoil and Bedrock Removal

6.10.1.1.1 Mitigation by Avoidance

The following mitigation measures are proposed:

- The design of the proposed EIA Development has followed closely the design of the 2010 Permission which took into account the existing geotechnical and hydrological baseline and incorporated the engineering and environmental constraints of the Proposed Development Site at that time. Any variations from the existing design to accommodate the revised turbine dimensions have reflected this, in an updated baseline assessment.
- The peat which will be removed during the construction phase will be mounded local to the turbine location and site tracks;
- No turbines or related infrastructure will be constructed in any designated sites such as NHAs or SACs or Features of Geological Significance and such areas have been avoided in the selection of the Haul Route Options; and
- Construction of settlement/attenuation ponds will be volume neutral, and all excess material will be used locally to form pond bunds/walls. These ponds will be retained post construction, i.e. throughout the operational phase to maintain greenfield runoff rates.

6.10.1.1.2 Mitigation by Reduction

The following mitigation measures are proposed:

- The excavation of materials should be minimised as far as possible on-site during the construction phase;
- Spoil removed from turbine locations and access roads will be used to reinstate the borrow pit;
- Any excess temporary mounded peat/topsoil in storage for long periods will be covered by a polyethylene sheet or seeded at the earliest opportunity. This will prevent erosion of soil. Silt fences will be installed around stockpiles to limit movement of entrained sediment in surface water runoff. The use of bunds around earthworks and mounds will prevent egress of water from the works;

- In order to minimise erosion of mineral subsoils and loss of organic matter, stripping of topsoil will not take place during extremely wet periods (to prevent increased silt rich runoff). Temporary drainage systems will be required to limit runoff impacts during the construction phase;
- Bog mats will be used to support vehicles on soft ground, reducing soil erosion and avoiding the formation of rutted areas, in which surface water ponding can occur; and

6.10.1.1.3 Mitigation by Remediation

Provided the measures above are adhered to, there will be no need for any remediation mitigation measures on the Proposed Development Site or the Haul Route Options.

6.10.1.2 Subsoil and Bedrock Removal

6.10.1.2.1 Mitigation by Avoidance

The following mitigation measures are proposed:

- Apart from designated spoil deposition areas which will be graded, covered in topsoil, and landscaped, there will be no permanent stockpiles of excavated materials left on-site following completion of the EIA Development. Materials will be reused for backfill within the borrow pit or for landscaping purposes, for example at turbine bases, hardstands and along the edges of access tracks.
- There will not be any permanent stockpiles of excavated materials following completion of the grid connection widening works.

6.10.1.2.2 Mitigation by Reduction

The following mitigation measures are proposed for the Proposed Development Site and the Grid Connection works.

- Spoil will be removed as it is executed either to the onsite borrow pit or in the case of the grid connection directly to a licenced facility.
- In order to minimise erosion of mineral subsoils, stripping of peat topsoil will not take place during extremely wet periods (to prevent increased silt rich runoff). Temporary drainage systems will be required to limit runoff impacts during the construction phase.

6.10.1.2.3 Mitigation by Remediation

Provided the measures above are adhered to, there should be no need for any remediation mitigation measures.

6.10.1.3 Vehicular Movements

6.10.1.3.1 Mitigation by Avoidance

The following mitigation measures are proposed for the Proposed Development Site and the Grid Connection:

- Plant and machinery should be restricted to movements within the delineated development footprint.
- In order to minimise erosion of mineral subsoils stripping of peat topsoil will not take place during extremely wet periods (to prevent increased silt rich runoff). Temporary drainage systems will be required to limit runoff impacts during the construction phase.

6.10.1.3.2 Mitigation by Reduction

On the Proposed Development Site and in areas of works on the grid connection route, only plant and machinery selected specifically for construction of the works will be used. Once tasks are completed, plant will be removed from site.

6.10.1.3.3 Mitigation by Remediation

Provided the measures above are adhered to, there will be no need for any remediation mitigation measures on the Proposed Development Site or on the grid connection route.

6.10.1.4 Ground Stability

6.10.1.4.1 Mitigation by Avoidance

Mitigation measures proposed for the Proposed Development Site and the grid connection route will involve a geotechnical engineer visiting the sites of works (Proposed Development Site and works on Haul Route) to supervise excavations and who will also review and approve the appointed contractor's method statement.

6.10.1.4.2 Mitigation by Reduction

The following mitigation measures are proposed for the Proposed Development Site and the grid connection route:

- Any excavations on identified unstable subsoils (very low likelihood) which could weaken the upslope area of the soil should be supported by a structure such as a buttress, frame or rampart to prevent lateral slippage;
- In any excavations on unstable soil, the pore water pressure should be low at all times. Excessive ponding of water should not be permitted in newly excavated areas and following rainfall events, sumps should be drained to carry water away, thus preventing a build-up of pore water pressure which could potentially lead to instability of the soils; and

- Heavy rainfall events are a catalyst for landslides. Therefore, an emergency response system should be developed for the construction phase. This could involve 24-hour meteorological forecasting where the likelihood of an extreme rainfall event such as a 1:100-year rainfall event, responses such as cessation of construction activity on site until such a time as the runoff has flowed away from the excavations. It is recommended that an automatic rainfall gauge be provided on site for the construction phase.

6.10.1.4.3 Mitigation by Remediation

Provided the measures above are adhered to, there will be no need for any remediation mitigation measures on the Proposed Development Site or on the grid connection route.

6.10.1.5 Soil Contamination

6.10.1.5.1 Mitigation by Avoidance

The following mitigation measures are proposed for the Proposed Development Site and the Haul Route Options:

- All construction materials imported to site during the construction period, for example, rock, cement, ducting or cables etc., will be removed from site following completion;
- As far as possible, a balance should be maintained between materials excavated and those brought to site for construction to reduce the need for storage and disposal of waste, particularly foreign materials which may have a different geochemistry or hydrochemistry. Recycling and reuse of materials on-site will be carried out as much as possible. It is envisaged that rock will be sourced from the adjacent quarries to be compatible with the local geochemistry; and
- The appointed contractor will develop a Construction Environmental Management Plan (CEMP) which will specify the maintenance of plant and equipment, materials storage areas and drainage infrastructure for the duration of the construction phase. The plan will see that the designed measures are operating effectively, outline measures to prevent leakages of substances such as oils, identify issues with the drainage regime, and see that a record is kept of all actions/measures undertaken in the plan for management and audit purposes.
- Hardcore material for use on works along the grid connection route will be sourced from a suitable supplier where the material has a similar geochemistry or hydrochemistry to the area where the works are to take place.

6.10.1.5.2 Mitigation by Reduction

The following mitigation measures are proposed for the Proposed Development Site and the grid connection route:

- Minimal refuelling or maintenance of construction vehicles or plant will take place on site. Off-site refuelling will occur at controlled fuelling station(s);
- On-site re-fuelling will be undertaken using a double skinned bowser with spill kits on the ready for accidental leakages or spillages;
- Fuels volumes stored on site will be minimised. Storage areas where required will be bunded appropriately for the fuel storage volume for the time period of the construction and fitted with a storm drainage system and an appropriate oil interceptor;
- The plant used during construction will be regularly inspected for leaks and fitness for purpose; and,
- An emergency plan for the construction phase to deal with accidental spillages will be contained within the Construction Environmental Management Plan. Spill kits will be available to deal with and accidental spillage in and outside the re-fuelling area.

6.10.1.5.3 Mitigation by Remediation

Provided the measures above are adhered to, there should be no need for any remediation mitigation measures.

6.10.1.6 Construction Phase Residual Impacts

The replacement of natural materials namely soils and rock, with gravels, concrete and timber poles will result in a change in ground conditions within the Proposed Development Site and grid connection route. Overall, this change is slight direct, permanent negative impact.

6.10.2 Operational Phase

No new impacts (i.e. beyond those identified during the construction phase) are predicted during the operational phase of the EIA Development on the geological, geomorphological and geotechnical environment within the Proposed Development Site, therefore no mitigation is required.

For the grid connection, no new impacts are envisaged (i.e. beyond those identified during the construction phase) during the operational phase. The road trenching works will have been reinstated to the requirements of the Road Opening Licence.

6.10.2.1 Construction Phase Residual Impacts

There will be a long-term change to the geological character of the Proposed Development Site and grid connection with soils and rock being replaced by areas of hardstanding such as tracks, turbine and hardstands, cable ducts and the substation made up of concrete and gravels. The drainage design for the site will be designed to maintain greenfield runoff rates as far as possible in line with SuDS principles. This will have a direct, long-term, small negative impact on the hydrological regime of the site and on-site ecology.

6.10.3 Decommissioning Phase

No new impacts are predicted during the decommissioning phase of the EIA Development on the geological, geomorphological and geotechnical environment; therefore, no mitigation is required beyond normal best practice construction methods such as water, silt and hydrocarbon management.

6.10.3.1 Decommissioning Phase Residual Impacts

There will be a long-term change to the geological character of the Proposed Development Site with soils and rock being replaced by areas of hardstanding made up of concrete and gravels. This will have a slight, negative a direct, long-term, impact on the Proposed Development Site.

6.10.4 Cumulative Effects

Cumulative effects from the EIA Development and other developments in the area will only occur during the construction and decommissioning phases of the Development as wind farms do not have an effect on soils and geology during operation.

6.11 SUMMARY OF SIGNIFICANT EFFECTS

This assessment has identified no potentially significant residual effects on either the Proposed Development Site or the Grid Connection.

6.12 STATEMENT OF SIGNIFICANCE

This Section has assessed the significance of potential effects of the proposed EIA Development on the soil and geology resource of the Proposed Development Site and the grid connection route. The proposed EIA Development has generally been assessed as having the potential to result in effects of a negative, slight/moderate, direct, high probability, permanent impact or lower.

Given that only effects of significant impact or greater are considered “significant” in terms of the EIA Regulations, the potential effects of the EIA Development on the soils and geology resources are considered to be not significant.

7. WATER

7.1 INTRODUCTION

An Application for Substitute Consent is sought for the construction of a Grid Connection to connect the previously consented Derreenacrinnig West Wind Farm to the National Grid at the existing 110kV Ballylicky ESB substation. A detailed description of the project proposals is set out in Chapter 2. The applicant is seeking substitute consent for the existing Overhead Grid Connection works as shown in **Figure 1.2.**

Study Area

The study area comprises the wind farm site and the grid connection route which extends from the Ballylicky Substation to consented Derreenacrinnig West Substation. The Grid Connection route comprises some 13.178 km and traverses' agricultural fields and an element of public road as show on **Figure 7.1**.

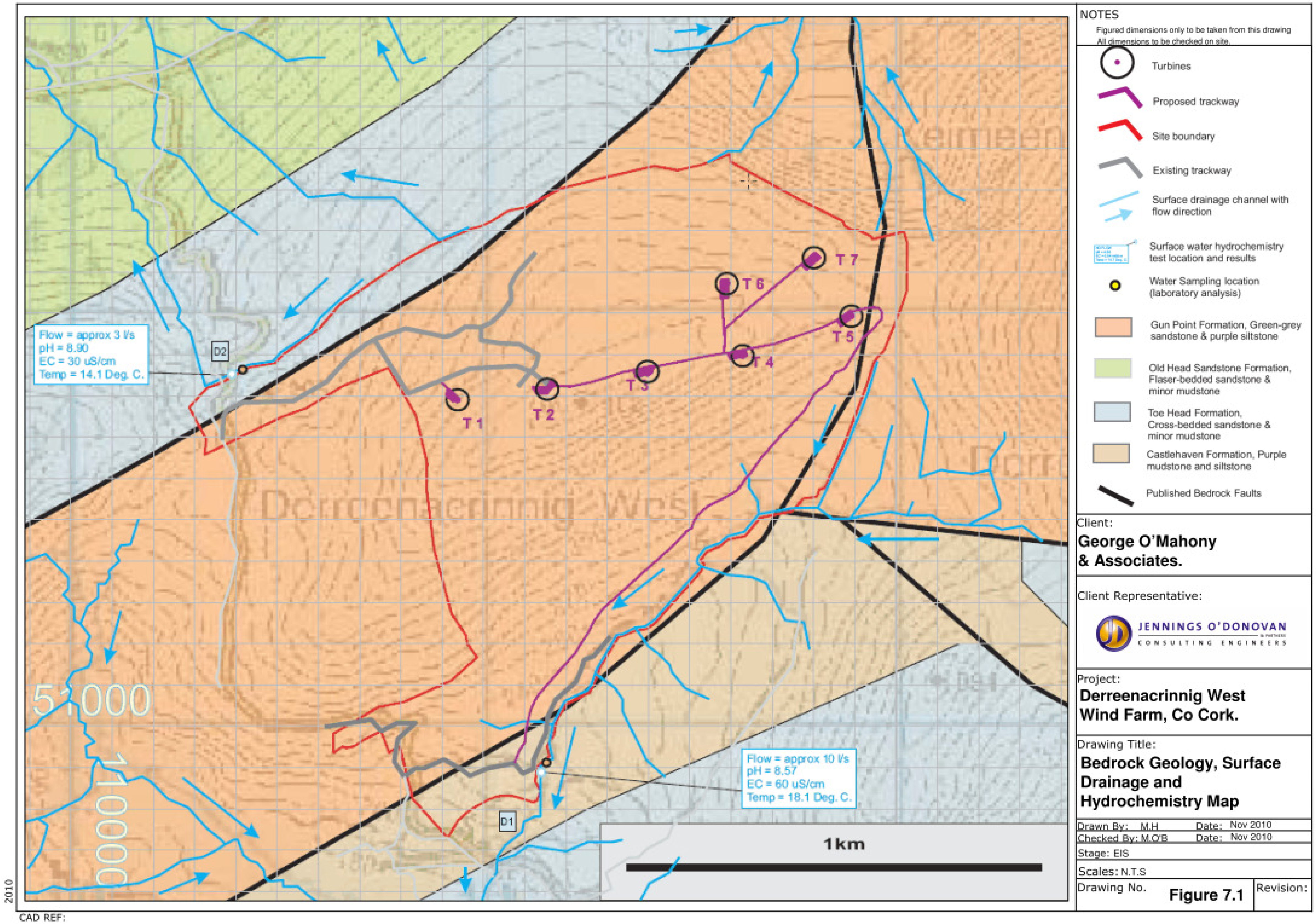

NOTES
Figured dimensions only to be taken from this drawing
All dimensions to be checked on site.
Turbines
Proposed trackway
Site boundary
Existing trackway
Surface drainage channel with flow direction
Surface water hydrochemistry test location and results
Water Sampling location (laboratory analysis)
Gun Point Formation, Green-grey sandstone & purple siltstone
Old Head Sandstone Formation, Flaser-bedded sandstone & minor mudstone
Toe Head Formation, Cross-bedded sandstone & minor mudstone
Castlehaven Formation, Purple mudstone and siltstone
Published Bedrock Faults
Client:
George O'Mahony & Associates.
Client Representative:
JENNINGS O'DONOVAN
CONSULTING ENGINEERS
Project:
Derreenacrinnig West Wind Farm, Co Cork.
Drawing Title:
Bedrock Geology, Surface Drainage and Hydrochemistry Map
Drawn By: M.H Date: Nov 2010
Checked By: M.O'B Date: Nov 2010
Stage: EIS
Scales: N.T.S
Drawing No. Figure 7.1
Revision:
Flow = approx 3 l/s
pH = 8.90
EC = 30 uS/cm
Temp = 14.1 Deg. C.
Flow = approx 10 l/s
pH = 8.57
EC = 60 uS/cm
Temp = 18.1 Deg. C.
D1
D2
T 1
T 2
T 3
T 4
T 5
T 6
T 7
Derreenacrinnig West
1km
2010
CAD REF:

Figure 7.1

7.2 METHODOLOGY

The following sources of information were considered in the preparation of this chapter:

- The proposed Grid Connection Route and the previously consented Derreenacrinnig West Wind Farm.
- Relevant Guidance and Legislation
- A Desk Based Study of the surface water hydrology and water quality in the catchments relevant to the Grid Connection.

7.2.1 Relevant Guidance and Legislation

The European Union (EU) has set requirements for Member States relating to the planning and consent stage of proposed developments i.e. requirements on the assessment of the effects of certain public and private projects on the environment. Environmental Impact Assessment (EIA) requirements are imposed through Council Directive 85/337/EEC (as amended by Directives 97/11/EC, 2003/35/EC and 2009/31/EC) and as codified and replaced by Directive 2011/92/EU of the European Parliament and the Council on the assessment of the effects of certain public and private projects on the environment (and as amended in turn by Directive 2014/52/EU).

The EU directives on EIA were transposed into Irish legislation through SI No. 349 of 1989: European Communities (Environmental Impact Assessment) Regulations, and subsequent Statutory Instruments (SI) amendments (SI No. 84 of 1994; SI No. 93 of 1999; SI No. 450 of 2000 and SI No. 538 of 2001), and the latest subsequent SI (SI No. 296 of 2018) which transposes finally the latest EU Directive (2014/52/EU).

Part 10 (Environmental Impact Assessment) of the Planning and Development Regulations 2001 – 2018 (Unofficial Consolidation) prepared by the Department of Housing, Planning and Local Government, updated 8th October 2018. The document is an unofficial consolidation of the Planning and Development Regulations 2001 to 2018, comprising the Planning and Development Regulations 2001 (S.I. No. 600 of 2001), as amended, i.e. the aforementioned SIs deriving from the aforementioned EU Directives. However, it should be noted that the document was prepared for ease of reference and is not a legal document.

The EPA provided a draft guidance document entitled Guidelines on the information to be contained in Environmental Impact Assessment Reports (EIAR) in August 2017 (Ref 1). This guidance document replaces an older version in light of the latest EU Directive (2014/52/EU) and is aimed to provide assistance to practitioners during the transition to new regulations. Such regulations have now been transposed (SI 296/2018), however for the purposes of drafting this report and in the absence of a reviewed and finalised version at present, the August 2017 Draft version has been consulted and requirements set therewith adhered to.

In addition to this planning legislation and guidance, other environmental legislation and guidance relevant to hydrological and hydrogeological aspects of the environment were referred to as follows:

1. Environmental Protection Agency (EPA) (2015) Advice Notes for Preparing Environmental Impact Statements – DRAFT September 2015 (Supersedes 2003 version) (Ref. 2)
2. Parameters of Water Quality – Interpretation and Standards (EPA, 2001) (Ref. 3) which consolidates provisions of EU Directives including;
    a. Surface Water Directive (75/440 EEC)
    b. Bathing Water Directive (76/160/EEC)
    c. Dangerous Substances Directive (76/464/EEC)
    d. Freshwater Fish Directive (78/659/EEC)
    e. Shellfish Directive (79/923/EEC)
    f. Ground Water Directive (80/68/EEC)
    g. Drinking Water Directive (80/778/EEC)
    h. Drinking Water Directive (98/83/EC)

This document also sites World Health Organisation (WHO) Guidelines for Drinking Water Quality; the latest edition at present is the Fourth Edition, including the first addendum.

1. Legislation transposing directives listed above, and other directives such as;
    a. SI 81/1988, as amended, transposing Directive 80/778/EEC on the Quality of Water Intended for Human Consumption.
    b. SI No. 278/2007 Drinking Water Regulations, as amended, transposing the Directive 98/83/EC on the Quality of Water Intended for Human Consumption.
2. SI No. 294 of 1989, as amended, transposing Directive 75/440/EEC on the Quality Required of Surface Water Intended for Abstraction of Drinking Water.
3. SI No. 272 of 2009 European Communities Environmental Objectives (Surface Waters) Regulations 2009, as amended, transposing multiple Directives including, inter alia;

Directive 2006/11/EC1 of the European Parliament and of the Council of 15 February 2006 on pollution caused by certain dangerous substances discharged into the aquatic environment of the Community, Directive 2000/60/EC2 of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy

4. Dangerous Substances Directive (76/464/EEC) and resultant SI No. 12 of 2001: Water Quality (Dangerous Substances) Regulations; and SI No. 258 of 1998: Water Quality (Phosphorous Regulations).
5. Quality of Fresh Waters Needing Protection or Improvement in order to Support Fish Life (78/659/EEC) and resultant SI No. 293 of 1988: Quality of Salmonid Waters Regulations.
6. The Water Framework Directive (WFD) (2000/60/EC) (Ref. 4), which was passed by the EU in 2000, and came into legal effect in December 2015. The WFD is a wide-reaching legislation which replaces a number of other water quality directives (or example, those on Water Abstraction) while implementation of others (for example, The Integrated Pollution Prevention and Control, and Habitats Directives) will form part of the "basic measures" for the WFD. The fundamental objective of the WFD aims at maintaining "high status" of waters where it exists, preventing any deterioration in the existing status of waters and achieving at least "good status" in relation to waters by 2015.
7. River Basin Management Plan 2018-2021, prepared by the Department of Housing, Planning and Local Government, and a requirement under the WFD, sets out the actions that Ireland will take to improve water quality and achieve "good" ecological status in water bodies by 2027. The document is a far-reaching action and policy plan but also includes sections on addressing pressures on waters including, inter alia; Section 7.3 Addressing Pressures from Forestry, Section 7.4 Addressing Pressures from Peat Harvesting, and Section 7.7 Addressing Abstraction Pressures. (Ref. 5)
8. The Cork County Development Plan 2014-2020 prepared by Cork County Council includes a Strategic Environmental Assessment (SEA) as a requirement under EU Directive 2001/42/EC, and includes details on environmental status and pressures, and also sets Strategic Environmental Objectives including for Water Quality i.e. W1 (Protect the quality of surface and ground waters as sources of drinking water and as valuable assets for amenity and recreation.) and W2 (Achieve and maintain required water quality standards and reduce discharges of pollutants or contaminants to waters), and also identifies how such objectives are interlinked with other Strategic Goals such as supporting energy generation from renewable resources, and ensuring adequate supply of energy, including renewable energy. (Ref. 6)

9. This study has been prepared using, inter alia, the following guidance documents;

    a. Institute of Geologists of Ireland (IGI) (2002) Geology in Environmental Impact Statements – A guide (Ref. 7)

    b. IGI (2013) Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements (Ref. 8)

    c. Irish Wind Energy Association (IWEA) (2012) Best Practice Guidelines for the Irish Wind Energy Industry (Ref. 9)

    d. National Roads Authority (NRA) (2008) Guidelines on Procedures for the Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes (Ref. 10)

    e. NRA (2008) Environmental Impact Assessment of National Road Schemes – A Practical Guide – Rev 1 (Ref. 11)

    f. CIRIA (2006) Control of Water Pollution from Linear Construction Projects – Technical Guidance (Ref. 12)

    g. NRA (2008) Guidelines for the Crossing of Watercourses During the Construction of National Road Schemes (Ref. 13)

    h. Inland Fisheries Ireland (IFI) (2016) Guidelines on the Protection of Fisheries During Construction Works in and Adjacent to Waters (Ref. 14)

    i. IFI (2015) Environmental Character – Assessing the Effects of Certain Plans and Programmes on the Environment (Ref. 15)

    j. Office of Public Works (OPW) (2013) Construction, Replacement or Alteration of Bridges and Culverts (Ref. 16)

    k. Scottish Environment Protection Agency (SEPA) (2010) Engineering in the water environment: good practice guide – River Crossings (Ref. 17).

10. This study has been prepared using, inter alia, the following websites and/or map viewer;

    a. EPA Maps (Ref. 18)

    b. National Parks and Wildlife Services (NPWS) Map Viewer (Ref. 19)

c. Geological Survey Ireland (GSI) Groundwater Data Viewer (Ref. 20)

d. GSI Geotechnical Public Viewer (Ref. 21)

e. EPA Catchments (Ref. 22)

f. WFD Ireland Water Maps Map Viewer (Ref. 23)

g. Ordinance Survey Ireland (OSI) GeoHive (Ref. 24)

h. OPW Flood Maps (Ref. 25)

i. Met Eireann – Historical Data (Ref. 26)

7.2.2 Previously Consented Derreenacrinnig West Planning Application

Minerex Environmental Limited (MEL) were commissioned by Jennings O'Donovan & Partners (JOD) on behalf of George O'Mahony and Associates in May 2010 to undertake an impact assessment on the water aspects of the environment by the proposed Wind Farm at Derreenacrinnig West, County Cork. The purpose of this work was to:

1. Undertake a baseline study of water (groundwater and surface water) conditions at the Derreenacrinnig site.
2. Identify the likely impacts of the proposed development upon these aspects of the environment.
3. Identify mitigation measures to avoid, remediate or reduce the impacts identified.
4. Identify any residual impacts of the development after implementation of mitigation measures recommended.

7.2.3 Schedule of Works for Previously Consented Derreenacrinnig West Wind Farm

The hydrological and hydrogeological assessment was authorised on the 16th June 2010. MEL personnel visited the site on the 29th June and 4th November 2010 to undertake assessments of topography, geology, surface water and groundwater conditions at the site.

7.3 METHODOLOGY

7.3.1 Desk Study

MEL undertook a desk study assessment of the water aspects of the proposed development site in June 2010 before and after field investigations. This involved the following components:

1. Acquire and compile all maps of the proposed wind farm development.

2. Study and assess the proposed locations of turbines, access roads, anemometer and substation relative to available data on site hydrology and hydrogeology.

3. Overlay Ordnance Survey of Ireland (OSI) 1:250,000, 1:50,000 and 1:10,560 (6”) maps with AutoCAD plan drawings.

4. Overlay Geological Survey of Ireland (GSI) Geology maps (1:100,000) to determine site bedrock geology and the presence of any major faults or other anomalies.

5. Overlay Environmental Protection Agency (EPA) / Teagasc (Agricultural Agriculture & Food Authority) Soils and Subsoil maps (1:50,000) to determine categories of soils and subsoil and indirectly geochemical origin for the study area.

6. Consultation with the GSI databases, publications and website in relation to well database records and hydrogeological resources of Co. Cork.

7. Consultation with National Parks and Wildlife Service in relation to designated sites of Co. Cork.

8. Consultation with Met Éireann for meteorological service records for the period 1961 to 1990 of the closest pertaining synoptic and rain gauge sites.

7.3.2 Site Investigations

MEL carried out field investigations at the site of the proposed development on the 29th June and 4th November 2010. These works consisted of the following:

1. Drainage distribution and catchment mapping.

2. Field hydrochemistry of the drainage network (electrical conductivity, pH and temperature).

3. Recording of GPS co-ordinates for all investigation and monitoring points in the study.

4. Digital photography of significant features.

7.3.3 Impact Assessment Methodology

From the desk and field data acquired, the following calculations and assessments were undertaken in order to evaluate the potential impacts of the proposed development on water aspects of the environment at the Derreenacrinnig West site:

1. Characterise the sites current hydrological / hydrogeological regime from the topographical, geological and geomorphological data acquired.

2. Undertake catchment calculations at and near the proposed development site.

3. Undertake preliminary water balance calculations in relation to estimated artificial surface development, storm runoff and required drainage and attenuation mechanisms for the proposed development.

4. Consider water quality changes as a result of the proposed development.

5. Assess the combined data acquired and evaluate any likely impacts on the water aspects of the environment.

6. If impacts are identified, consider measures that would mitigate or reduce the identified impact.

7. Present and report these findings in a clear and logical format that complies with EIS reporting requirements (Ref. 1).

7.3.4 Characteristics of the Previously Consented Derreenacrinnig West Wind Farm Development

The proposed development site is characterised by elevations between 200 m OD and 400 m OD at Malin Head and a spatial area of approximately 1 km². The proposed development is characterised by the following changes to the site:

1. Erection of 7 wind turbines.
2. Upgrading of 1.26 km of existing access track.
3. Construction of 3.05 km new access track.
4. Construction of an electrical compound and sub-station

7.4 RECEIVING ENVIRONMENT

7.4.1 Surface Water

7.4.1.1 Surface Water Drainage – Wind Farm Site

The following table summarises the observed channels and flows in the surface water drainage.

Table 7.1: Observed surface water drainage channels and flows at Wind Farm Site

Channel ID	Type of channel	Flow (l/s)	Relationship to proposed development
D1	stream	10	Flows southwest along southern boundary of the site alongside the proposed access road
D2	stream	3	Flows west along northern boundary of the site before turning north and flowing to the Mealagh River

7.4.1.2 Surface water runoff – Wind Farm Site

The northern part of the site drains via a tributary into the Mealagh River, which flows into the sea at Bantry. The southern part of the site is drained by a tributary of the Ilen River which flows into the sea to the west of Skibbereen. The River Ilen is an important salmonid river and contains stocks of salmon and sea trout.

The significance and impact of baseline surface water runoff at the Derreenacrinnig West site following sustained rainfall is that upland blanket bog and exposed bedrock environments experience rapid runoff discharge compared to mineral soil environments. This is due to the inherent water saturation of the peat substrate, combined with poor infiltration capability of both the peat and exposed bedrock. The result is a relatively high rate of overland flow during heavy precipitation events. The rate and amount of surface water runoff from the site will increase as a function of the replacement of vegetation, peat and subsoil cover (which absorb rainfall) in parts of the site with a concrete hardstand at turbine and substation building locations, and aggregate mix for road widening and substation compound.

7.4.1.3 Grid Connection

The proposed grid route passes through three separate water catchments, the Ilen River Catchment to the east of the alignment; the Mealagh River Catchment along the majority of the alignment and the Owvane River Catchment to the west of the alignment. Eroding upland watercourses intersect the route corridor at various locations along the route. The route crosses the Mealagh River at one location in the townland of Ards Beg towards the east of the route corridor. Aside from this, only minor watercourses are crossed by the route corridor.

Numerous drainage ditches occur within the route corridor study area. The ditches occurring within the site are either bare, having been cut to bedrock level below the overlying peat deposit or have become colonised by a range of grasses and rushes.

7.4.1.4 Surface Water Quality

Field testing of physiochemical parameters and general observations on surface waters were undertaken in D1 and D2 at the Derreenacrinnig West site on the 29th June 2010. The results of these preliminary measurements are given in **Figure 7.1- Bedrock geology, surface drainage and hydrochemistry.**

Table 7.2 summarises the field hydro chemical measurements for each of the significant streams / drains at the site. These values are in-line with expected values for unpolluted water in this region and environmental setting.

Table 7.2: Watercourse field hydro chemical measurements

Sampling site	Channel ID	EC (µScm)	pH	Temperature (ºC)
D1	D1	60	8.57	18.1
D2	D2	30	8.90	14.1

Water samples were taken from D1 and D2 at the Derreenacrinnig West site on the 29th June 2010 and sent for laboratory analysis. The results of these analytical results are presented in Table 7.3 below. These values are in-line with expected values for unpolluted water in this region and upland environmental setting.

Table 7.3: Watercourse laboratory hydro chemical measurements

Parameter	D1 S1	D2 S1
Alkalinity, Bicarbonate	15.5	11
Sulphate	3.6	<3
Chloride	8.3	9.1
Calcium	2.92	1.68
Sodium	6.59	6.44
Magnesium	0.66	0.517
Potassium	<2.34	<2.34

7.4.1.5 Groundwater

7.4.1.5.1 Aquifer Classification

Consultation of the Geological Survey of Ireland’s National Bedrock Aquifer Classification Map (Ref. 3) indicates that the site is underlain by a Locally Important Aquifer, which is generally productive only in local zones (LI). There are no significant sand and gravel aquifers recorded at or near the Derreenacrinnig West site. Groundwater flow direction in an elevated site such as this is likely to generally conform to the direction of land surface slope.

7.4.1.5.2 Vulnerability Assessment

The GSI has produced guidelines on groundwater vulnerability mapping that aim to represent the intrinsic geological and hydrogeological characteristics that determine how easily groundwater may be contaminated by human activities. Vulnerability depends on the quantity of contaminants that can reach the groundwater, the time taken by water to infiltrate to the water table and the attenuating capacity of the geological deposits through which the water travels. These factors are controlled by the types of subsoil that overlie the groundwater, the way in which the contaminants recharge the geological deposits (point or diffuse source) and the unsaturated thickness of geological deposits from the point of contaminant discharge (Ref. 4).

Where low permeability subsoil overlies the bedrock, it is the thickness of subsoil between the release point of contaminants and bedrock that is considered when assessing vulnerability of bedrock aquifers, regardless of whether the low permeability materials are saturated or not. The GSI vulnerability mapping guidelines allow for the assignment of vulnerability ratings from "extreme" to "low", depending upon the subsoil type and thickness. With regard to sites where low permeability subsoil is present, the following thicknesses of unsaturated zone are specified (Ref. 4):

Vulnerability Rating	Thickness of unsaturated zone (m)
Extreme	0 to 3
High	3 to 5
Moderate	5 to 10
Low	>10

On the basis of these GSI recommendations and field investigation data, an Extreme (E) vulnerability is assigned across the Derreenacrinnig West Wind Farm site where there is a thickness of peat and/or unconsolidated sediments of <3m overlying the bedrock.

By reference to the GSI Groundwater Data Viewer, there is confirmation of 'Extreme' at and close to the wind farm site and start of grid connection due to rock at or near the surface.

As the grid connection route proceeds westwards, the vulnerability reduces alternative 'High' and 'Extreme' areas.[26]

7.4.1.5.3 Groundwater Usage

Consultation of the national well database compiled by the GSI indicates that there are no known wells recorded within 2 km of the proposed wind farm site of development.

[26] www.dcenr.maps.arcgis.com/apps/webappviewer

7.4.1.5.4 Groundwater Quality

Due to the absence of any recorded groundwater quality data within or proximal to the study area, no published data on groundwater quality is available.

7.4.1.4.5 Designated Areas

The proposed wind farm site is neither contained within nor bordered by any designated areas for nature conservation. The proposed development is >7km from any proposed or designated areas for nature conservation.

Freshwater pearl mussel is known to occur within the Mealagh, Owvane and Ilen River. A tributary of the Ilen River runs along the southern boundary of the site. It is not known at present how high up the river system this species occurs. The presence of undesignated populations of this species in these watercourses is considered to be of national ecological value.

The lands occurring within the grid connection route corridor range from local (low value) to national ecological value. Habitats of national ecological value include the Mealagh River. Habitats of County Importance include the wet heath habitat, particularly the examples at Laharanshermeen, Cappanaboul and Ards Beg, the dry heath along the ridge line of Derreenacrinnig West and the wet willow woodland. The humid acid grassland is considered to be of local (higher) value while other habitats such as gorse scrub, conifer plantation, recently felled woodland improved agricultural grassland, amenity grassland and built land are of local (lower) value.

7.5 DO NOTHING IMPACT

Site investigations of the baseline geological and geotechnical conditions at the Derreenacrinnig West wind farm site indicate that parts of the site have already experienced impacts to baseline conditions through the planting of commercial forestry and construction of associated access tracks to the north of the site. There are no indications that the construction of the access track has had adverse impacts with regard to the hydrology or hydrogeology of the site.

Should the proposed development not proceed, the existing land-use practice of commercial afforestation and associated access track construction will possibly continue with associated alteration of the existing environment.

7.6 POTENTIAL IMPACTS OF THE DEVELOPMENT

7.6.1 Construction Phase

7.6.1.1 Surface Water Runoff

7.6.1.1.1 Increased runoff

The proposed development has the potential to result in increased volumes of runoff during the construction phase of the project relative to baseline conditions. This is a function of the progressive excavation and removal of vegetation cover along the proposed development footprint and thus removing the hydraulic absorption / buffer control from this part of the site. Table 7.4 summarises a preliminary water balance analysis for the Derreenacrinnig West site. The Meteorological Service records for the period 1961 to 1990 (Ref. 5) show that the highest monthly rainfall average recorded at Drimoleague (Garda Station) is in the month of January, and the lowest evapotranspiration at Valentia Synoptic Station is in the month of December. As this data represents the worst-case scenario, it has been used to estimate runoff volumes from the Derreenacrinnig West site for both (a) baseline (in-situ vegetation) conditions and (b) operation phase (changed ground conditions on footprint). Worst case scenario baseline calculations indicate that this would amount to a runoff from developed areas (assuming impermeable grounds) of approximately $39m^3$/day that would need to be controlled and attenuated before release to natural drainage.

Further analysis indicates that the proposed infrastructure would lead to increased runoff of $1,156m^3$ in a worst-case scenario. In reality therefore, the change in runoff as a function of the proposed development will result in a net increase of $39m^3$/day during the wettest month(s) of the year. The significance of this increased runoff as a function of the proposed development is discussed in Table 7.4.

Table 7.4: Surface Water Runoff Calculations

Baseline / Development	Parameter	Value
Baseline	Average January rainfall (R) Month with highest rainfall based on 30 years data from Drimoleague (Garda Station) rain gauge	0.1970m
Baseline	Average December potential evapotranspiration (PE) Month with lowest PE based on 30 years data from Valentia Synoptic Station	0.0087m
Baseline	Average December actual evapotranspiration (AE) (PE x 0.92)	0.0080m

Baseline / Development	Parameter	Value
Baseline	Effective Rainfall under highest rainfall & lowest PE conditions (ER = R – AE)	0.1890m
Baseline	Area of subject site	1,221,633m^2
Baseline	**Total Effective Rainfall** received over site area	230,888m^3
Baseline	**Baseline Site Runoff** (approximately 80% of total effective rainfall)	184,710m^3
Development	Proposed Area of Impermeable Surfaces – based on areal calculations supplied by Jennings O'Donovan	30,568m^2
Development	**Total Site Runoff** from impermeable areas (100% of total effective precipitation) in worst case month	5,777m^3
Comparison	**Baseline Runoff** from Proposed Area of Impermeable Surfaces under highest rainfall & lowest PE conditions	4,621m^3
Comparison	**Worst Case Net Increase in Runoff** in one month from Site as a function of Development	1,156m^3

Increased volumetric runoff has been provisionally calculated as contributing a net increase of +39m^3/day during the wettest months of the year from the proposed footprint area. This is a direct permanent impact, but it is not considered to be a potentially significant negative impact given that only a small proportion of the study site is to be developed. Hence the magnitude of the proposed change to the hydrological runoff regime is considered minor relative to the total water balance for the site.

7.6.1.1.2 Increased Hydraulic Loading

The proposed development has the potential to result in increased rates of runoff during the construction phase of the project relative to baseline conditions. Increased surface water runoff from the construction footprint has the potential to result in increased hydraulic loading to the receiving drainage network. However, because the footprint area is small at c.30,568m^2 and preliminary estimates of increased runoff are c.+39m^3/day during the wettest months of the year, any potential increase in hydraulic loading to the existing drainage network is considered to be an insignificant impact as a function of this particular development.

Dewatering / Diversion of Drainage

The proposed development has the potential to result in diversion of the existing drainage network during the construction and operation phases of the project relative to baseline conditions. The drainage network at and around the proposed development site has been mapped in **Figure 7.2 - Site subsoil geology**. The southern access road of the proposed development will cross two streams that are tributaries of D1 at the Derreenacrinnig West site. Provided that appropriate remedial actions are implemented, it is unlikely that the functioning of this drain will be impacted by the development. There should be no interception, diversion, infilling or dewatering of water in any drains at the site by the proposed development.

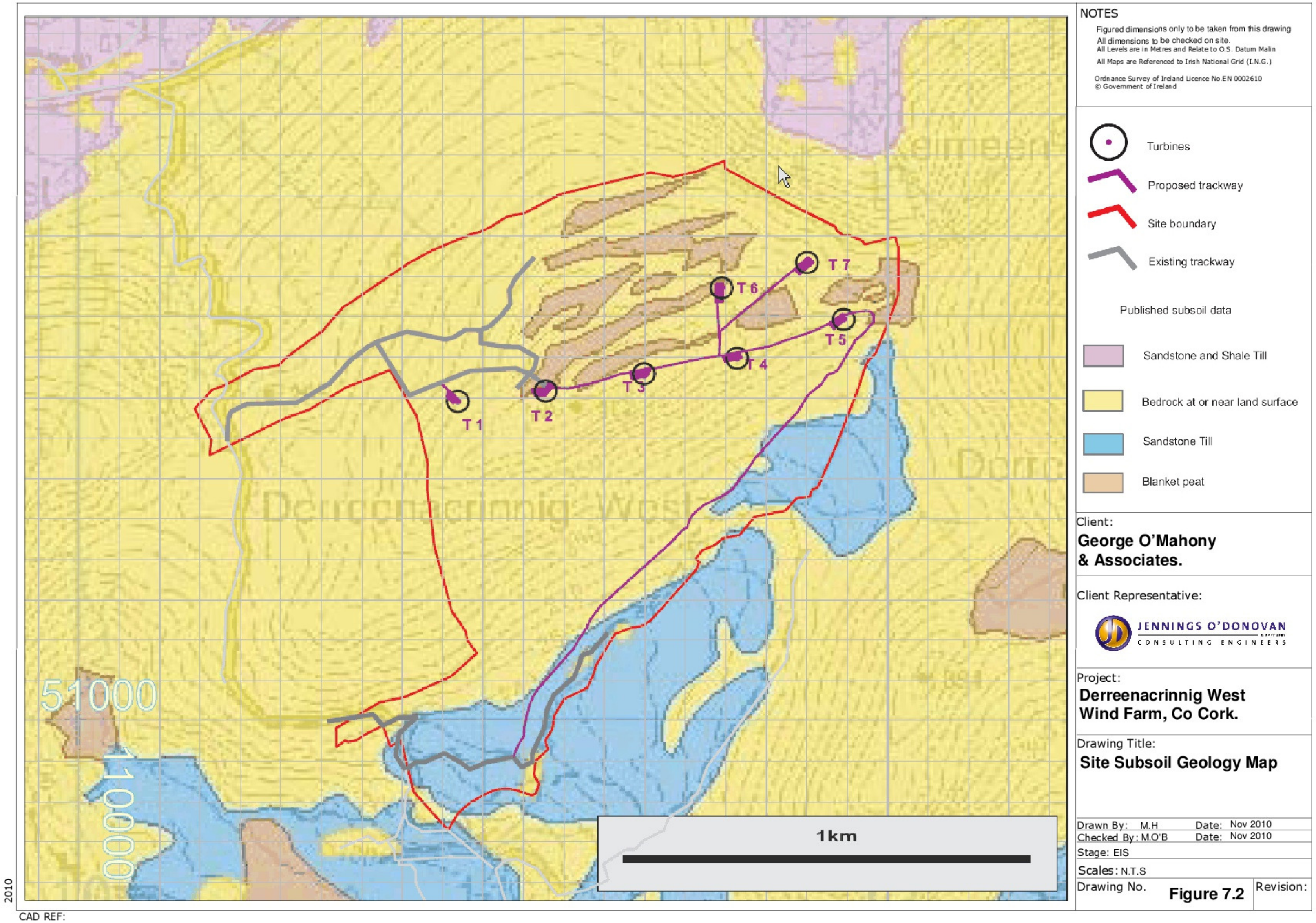


Figure 7.2: Site Subsoil Geology Map

7.6.1.2 Surface Water Quality

Release of Suspended Solids

The proposed development has the potential to result in the release of suspended solids during the construction phase of the project relative to baseline conditions. This is particularly likely as a result of the excavation of in-situ peat, and where necessary, the underlying mineral subsoil. Runoff of suspended solids can add turbidity to the surface water which can clog fish gills, smother spawning grounds, reduce light penetration for flora growth, and add bacteria and algae to the water. Nutrients that are associated with the solids (inorganic nutrients such as phosphorus and organic such as hydrocarbons, sewage if present) can lead to eutrophication of the water environment and eventually to fish-kills due to lowering of oxygen supply.

During the excavation, storage and re-use of materials, it is likely that a high content of suspended solids will be entrained by sustained rainfall and surface water runoff. The most vulnerable areas to surface water quality deterioration are (a) access road crossings of existing streams and (b) turbine hardstand and infrastructure development at moderate to high gradient slopes to existing waterways. This is considered to be a short-term, temporary but potentially significant negative impact. However, with appropriate environmental engineering controls and measures, this impact can be reduced to within water quality regulatory limits (Ref. 9, 10, 11, and 12).

Risk of Pollution from Hydrocarbons Leakage

The proposed development has the potential to result in the accidental leakage of hydrocarbons into the drainage network during the construction phase of the project. The plant equipment to be used during the construction stage is run on hydrocarbons. This implies that mobile equipment will require regular refuelling from a fuelling station, which is likely to be stored on site OR will be supplied by a truck / tanker that will be scheduled to re-fuel the plant directly. This poses the potential for spillage and leakage of hydrocarbons from plant equipment and associated transfer stations during the construction phase of this project.

Hydrocarbon is a pollutant risk due to its toxicity to all flora and fauna organisms. Hydrocarbons chemically repel water and sparingly dissolve in water. The majority of hydrocarbons are light non-aqueous phase liquids (L-NAPL's) which means that they are less dense than water and therefore float on the water's surface (whether surface water or groundwater). Hydrocarbons absorb (stick) onto the majority of natural solid objects it encounters, such as vegetation, animals, earth materials. It burns most living organic tissue, such as vegetation, due its volatile chemistry. It is also a nutrient supply for adapted micro-organisms, which can deplete dissolved oxygen at a rapid rate and thus kill off water based vertebrate and invertebrate life. An accidental hydrocarbon spillage would have a severe, medium term, negative impact on surface water quality in the Mealagh and Ilen Rivers, to the north and south of the site respectively. The Mealagh River has to be crossed by the overhead line grid connection. However, with appropriate environmental engineering controls and measures, this potential risk can be reduced.

Wastewater Sanitation

The proposed development has the potential to result in the accidental leakage of wastewater into the drainage network during the construction phase of the project. A temporary site office, service area and sanitation will be required for the construction stage of the development. Associated with this facility is the potential risk of water and soil contamination by wastewater release or chemical contamination of water and soil from temporary sanitation facilities. The level of risk posed is dependent on the type of facilities that are put in place and therefore can range from potentially significant to insignificant impact in direct correlation to the type of sanitation used (e.g. septic tank versus portaloo).

Mobile Portaloos will be used for grid connection works as the works will be transient.

Other Potential Pollutants

Other potential pollutants that may impact on surface water quality as a function of excavation works and associated with entrained suspended solids from peat, mineral subsoil and bedrock (dust) are:

- Inorganic nutrients such as nitrogen and phosphorus compounds (if present in excavated sediment).

- Bacteriological contamination arising from availability of organic nutrients (e.g. livestock waste on acrotelm peat).

7.6.1.3 Groundwater Flow

Excavation Seepage / Inflows

Peat is essentially an aquitard, characterised by low permeability but high porosity (like a sponge that holds water). Peat should not contribute any significant seepage or inflows to excavations during the construction phase of the project. However, some seepage is expected to occur at and along the contact of the base of the peat with underlying glacial till (present throughout the site) or more importantly from the fractured / weathered bedrock (if present).

From the recovered mineral subsoil within the site, the glacial sediments (where present) are characterised by SILT or CLAY matrix which is unlikely to contribute significant groundwater inflow during excavation as the sediments were observed to be dry during the site visit. However limited and discontinuous seepage / inflow might be expected from the back-wall excavations for the turbine pads. The time of year for excavation will be a significant control in how much inflow / seepage is expected, however overall in the context of the site geology and its high elevation within the catchment, any seepage that does occur is likely to be low in volume and is likely to be short-lived. Excavation seepage / inflow is a low magnitude, short-term negative impact that can be easily controlled by appropriate interceptor drainage and in the case of turbine bases by pumps.

Lowering of Water Table

While locally there may be some 'perched' water in the upper bedrock along more permeable or fractured zones, regionally the water table is likely to be below the deepest excavation by the proposed development as the site is located on high ground relative to the surrounding countryside. No impact is anticipated on the water table as a function of the proposed development.

Dewatering of Wells

No wells were identified at or within 2 km of the proposed development; therefore, no impact is anticipated for dewatering or hydraulic impact on groundwater supply.

7.6.1.4 Groundwater Quality

Groundwater Contamination

The bedrock aquifer that underlies the development footprint is classified as a Locally Important Aquifer (LI) and due to incoming WFD requirements with respect to the protection of all groundwater quality (Ref. 2), the groundwater beneath the site requires preventative mitigation measures for potentially polluting activities, of which hydrocarbons release is the main threat to groundwater quality.

The vast majority of groundwater eventually discharges to the surface water network in the form of baseflow or spring seepage mechanisms. This implies that if groundwater is contaminated locally, it has the potential to contaminate drains, streams, rivers and lakes that are located down-gradient of the groundwater body, thus highlighting the inter-connectivity of groundwater and surface water in the hydrological cycle.

The potential threats to groundwater contamination are essentially the same for surface water and include the same potential sources. These are:

1. Hydrocarbons from introduced plant equipment / fuel stations.

2. Wastewater and chemical treatment compounds from sanitation facilities.

3. Inorganic nutrients such as nitrogen and phosphorus compounds (if present in excavated sediment).

4. Bacteriological contamination arising from availability of nutrients (e.g. sanitation, livestock etc).

5. Trace metals that may naturally be present and therefore potentially released from bedrock.

Unlike surface water, suspended solids or turbidity is not generally a problem for groundwater due to the filtering ability of the granular mineral subsoil that overly the bedrock and / or the small aperture size of the fractures of the Sedimentary bedrock, which also provide attenuation of suspended solids / turbidity. Under steady flow conditions, by the time the groundwater discharges there is generally very little turbidity present.

While groundwater through-flow has a greater ability to attenuate potential pollutants compared to the surface water system, there is still a potential negative, short to medium term impact on groundwater quality as a function of the proposed development.

7.6.1.5 Operational Phase

7.6.1.5.1 Surface Water

Surface Water Flow

The design of the proposed constructed drainage utilises a number of methodologies to reduce and attenuate runoff and surface water discharge arising from the replacement of baseline vegetation with impermeable (concrete bases, substation) and semi-permeable (roads, hardstands) materials. There is potential during the lifetime of the project that the measures put in place to control volumetric discharge can be damaged, blocked or fail to function to required specification for a number of reasons. In some cases, some engineering adjustments to the drainage design may be required pending an evaluation of the drainage performance during the early stages of high runoff conditions during the operation phase.

Surface Water Quality

While the main threat to water quality, in particular surface water quality arises during the construction phase of the project due to earthworks activity, there is also a risk of pollution during the operation phase of the project that is associated with drainage runoff and attenuation of suspended solids. Mitigation measures to avoid and reduce impacts on surface water quality arising during the lifetime of the project are outlined in Section 7.6.

7.6.1.5.2 Groundwater

Groundwater Flow

During the construction phase of the project, groundwater seepage, water ponding and wetting of previously dry spots may occur around the development footprint. It is possible that water ingress may be encountered in the upper weathered zone of the bedrock during the construction phase.

Groundwater Quality

There is a potential risk of groundwater contamination during the operation phase of the project, however this risk is low and largely a function of the legacy of introduced services during the construction phase of the project. Using the precautionary principle however, mitigation measures to prevent, identify and remediate any potential groundwater contamination must be adhered to.

7.7 MIITGATION MEASURES

Figure 7.3 - Geotechnical and hydrological constraints map identifies hydrological constraint zones. Recommended mitigation measures for each of the impacts identified are outlined in this Section. A process of "mitigation by avoidance" was undertaken by the EIA team during the design of the turbine and associated infrastructure layout. Arising from the results of this study, a constraints map was produced that identifies areas where hydrological constraints make parts of the site unsuitable for development. This hydrological constraint map is illustrated in **Figure 7.3 - Geotechnical and hydrological constraints map.**

7.7.1 Construction Phase Mitigation

7.7.1.1 Constructed Drainage

Potential impacts on site hydrology, surface water course hydrology and associated ecologies during construction and operational phases are mitigated by designing a system which causes minimal disturbance to the current hydrological regime and which minimises suspended sediment loading. Reduction of sediment loading is important since the main watercourses drain into the Mealagh River to the north, and the Ilen River to the south which is an important salmonid river. Mitigation measures are required to protect against suspended solid loading of headwater drainage during the construction stage of the project. This is to be achieved by including the following features:

a. Drainage outfall is via indirect buffered outfalls to surface watercourses or onto the bog surface. The drains end by fanning out onto the surrounding vegetation via tapering drains. The tapering drain end should contain hard core material (of local baseline geochemistry) to entrap suspended sediment. In addition, these outfalls promote sediment percolation through vegetation in the buffer zone, reducing sediment loading to any adjacent water courses and avoiding direct discharge to the watercourse. A minimum buffer width of 50 m should be imposed between the end of the drain fan and water courses. Buffer widths should be designed in line with Forestry Commission Guidelines (Ref. 13, 15) on protection of water courses during forestry operations and management. This method buffers the larger volumes of run-off discharging from the drainage system during periods of high precipitation, reducing the hydraulic loading to water courses and reducing suspended sediment load to surface water courses. Note that any imported hard core or drain material should be of a comparable geochemistry to that at the site, to minimise changes in hydrochemistry.

b. Stilling ponds should buffer the larger volumes of run-off discharging from the drainage system during periods of high precipitation, by retaining water, thus reducing the hydraulic loading to watercourses. Stilling ponds should be designed to reduce flow velocity to 0.3 m/s at which velocity silt settlement generally occurs. This reduces the suspended sediment and associated nutrient loading to surface water courses and mitigates potential impacts on plant and animal ecologies.

c. There are a large number of drainage outfalls, discharging either indirectly to surface watercourses or into appropriate wetland habitats via stilling ponds and buffered fanned drains. Discharging at regular intervals mimics the natural hydrology by encouraging percolation and by decreasing individual hydraulic loadings from discharge points.

d. Drainage and associated pollution control measures shall be implemented on site before the main body of construction activity commences. Where possible drainage control should be installed during seasonally dry ground conditions.

e. Grid Connection crossings of watercourses should be via overhead line with poles at least 25m away from streams.

7.7.1.2 Surface Water Flow

<u>Increased Runoff</u>

Additional surface water runoff emanating from the construction phase of the development requires hydraulic runoff buffering. The main reason for concern for additional site runoff is that during the construction phase, surface water drainage is at risk to water quality deterioration. It is essential therefore that an environmental management programme that checks, audits and facilitates repair and in places improvement of the constructed drainage scheme is undertaken as part of mitigation measures for surface water runoff during the operation phase. The following mitigation measures are recommended to protect surface water quality:

a. The site drainage and attenuation system should be installed prior to the main construction activities to control increased runoff in discharging waters from the development areas. This involves the construction of drainage ditches and the installation of settlement ponds and soakaways.

b. A site-specific drainage scheme is required to attenuate hydraulically (flow) and hydro chemically (pollutants) the projected increase in runoff of c.39 m^3/day (worst-case scenario) that would arise from the hardstands created by the proposed development.

c. Exit discharge points from the site should be characterised by stage-discharge curves to provide a baseline reference (at least 12 months) on the range of flows expected from the site. This can be calibrated against rainfall data (site rainfall gauge) for water balance calculations.

d. Surface water flows in all waterways and drainage should not be impeded in any way by the proposed development. Access tracks that intercept existing waterways should have suitably designed culverts installed to maintain baseline flows, large enough to accommodate peak flow in a 50-year return period.

<u>Hydraulic Loading</u>

Hydraulic loading of the existing drainage network by increased runoff discharge from the site will be mitigated by the following:

a. Indirect buffered outfalls to surface watercourses or onto the bog surface. This will reduce individual discharge contributions to the existing drainage network, as well as allow for some percolation of discharge before entering the receptor drainage.

b. Stilling ponds will buffer the larger volumes of run-off discharging from the drainage system during periods of high precipitation, by retaining water until the storm hydrograph has receded, thus reducing the hydraulic loading to watercourses.

c. At the access road crossings, culverts / stream crossings that is modelled to take the capacity of a 1 in 50-year storm event with a minimum diameter of 0.9 m should be installed to ensure no blockage or build-up of discharge underneath the road crossings.

Dewatering / Diversion of Drainage

There will be no interception, diversion, infilling or dewatering of water drainage channels by the proposed development; therefore, no mitigation is required.

7.7.1.3 Surface Water Quality

Release of Suspended Solids

In order to mitigate the impact posed by release of suspended solids to the surface water environment, the following mitigation measures are recommended:

a. Protection of riparian zones around drainage by restricting construction disturbance to outside of 50 m buffer zones from streams and drains. This will protect what vegetation that is in place and provides some filtering of runoff erosion from the site.

b. Buffered drainage outfalls should contain hard core material of similar or identical geology to the bedrock at the site to entrap suspended sediment. In addition, these outfalls promote sediment percolation through vegetation in the buffer zone, reducing sediment loading to any adjacent watercourses and avoiding direct discharge to the watercourse.

c. Stilling ponds will buffer the larger volumes of run-off discharging from the drainage system during periods of high precipitation, by retaining water, thus reducing the hydraulic loading to watercourses. Stilling ponds are designed to reduce flow velocity to 0.3 m/s at which velocity silt settlement generally occurs. This reduces the suspended sediment and associated nutrient loading to surface water courses and mitigates potential impacts on plant and animal ecologies.

d. The drainage and attenuation system should be installed prior to the main construction activities to control increased runoff and associated suspended solids loads in discharging waters from the development areas. This involves the construction of drainage ditches, the installation of silt traps, stilling ponds and the implementation of prescribed buffer zones. Where possible drainage control should be installed during seasonally dry ground conditions.

e. Monitoring of drainage discharge during the construction stage, particularly at all upstream and downstream stream / drain sections relative to stilling ponds is recommended. Monitoring should be undertaken during and immediately following high rainfall events. As part of the construction phase environmental management plan regular checking and maintenance of pollution control measures are required, with an immediate plan for repair or backup if any breaches of design occur.

Risk of Pollution from Hydrocarbons Leakage

To control and contain any potential hydrocarbon and other harmful substances spillage by vehicles during construction, it is recommended where possible to refuel plant equipment off the development site or grid connection route, thus mitigating this potential impact by avoidance.

If fuelling must occur on site, then a discrete "fuel station" should be designated for the purpose of safe fuel storage and fuel transfer to vehicles. This fuel station should be bunded to 110% volume capacity of fuels stored at the site. The bunded area should be drained by an oil interceptor and this drainage will be controlled by a pent stock valve that will be opened to discharge storm water from the bund. A suitably qualified management company will take responsibility for management and maintenance of the oil interceptor and associated drainage on a regular basis, including decommissioning.

There is also the risk of leakage from vehicles and plant equipment during construction activity, as opposed to refuelling. The plant equipment used on site will require regular mechanical checks and audits to prevent spillage of hydrocarbons on the exposed ground (during construction). This should be part of the site environmental management system (EMS).

Waste Water Sanitation

During the construction phase, a self-contained port-a-loo with an integrated waste holding tank should be used on site for toilet facilities. This should be maintained by the service contractor on a regular basis and removed from the site on completion of the construction phase. In relation to a water supply for the site office and service area, a drum of fresh water should be brought to the site each day and disposed from the site to a suitable wastewater drainage system. In summary, wastewater of all kinds should be taken off site for disposal / treatment to controlled facilities.

7.7.1.4 Groundwater Flow

Excavation Seepage / Inflows

During the construction phase of the project, the development areas should be monitored daily for evidence of groundwater seepage, water ponding and wetting of previously dry spots. Any water ingress that may be encountered in the upper weathered zone of the bedrock during the construction phase should be intercepted by a toe drain and diverted after attenuation, to an existing artificial drainage channel or a natural watercourse. The design of the drainage must take into account factors of slope stability and where possible, should be impermeable and closed at the base. Any water ingress that may be encountered in the weathered bedrock / mineral subsoil during the construction phase should be intercepted by an interceptor drain and diverted to the constructed drainage system for pollution control attenuation prior to discharge. This diversion of seepage is likely to be sufficient for most parts of the construction activity. In the case of the turbine bases, some pumping out of the base sumps may be required. All pumped water must be captured and directed to constructed drainage for attenuation. No freshly pumped water must enter the existing drainage network directly or be pumped out onto the adjacent blanket bog habitat.

The above mitigation measures highlight the need to have constructed drainage installed prior to the main construction activity of the project.

Lowering of Water Table

No impact is anticipated on the regional water table as a function of the proposed development; therefore, no mitigation is required.

Dewatering of Wells

There will be no dewatering or hydraulic impact on groundwater supply as a function of the elevated position of the site and absence of wells from within 2 km of the proposed development. No mitigation is required.

7.7.1.5 Groundwater Quality

Groundwater Contamination

The main threat to groundwater quality is the introduction of hydrocarbons to the site. In order to mitigate groundwater contamination by hydrocarbons in particular, the following are strongly recommended:

a. No fuel storage should occur on site and that re-fuelling of plant equipment should occur off-site at a controlled fuelling station.

b. If fuelling must occur on site due to logistical reasons, then a discrete "fuel station" should be designated for the purpose of safe fuel storage and fuel transfer to vehicles. This fuel station should be bunded to 110% volume capacity of fuels stored at the site. The bunded area should be drained by an oil interceptor and this drainage will be controlled by a pent stock valve that will be opened to discharge storm water from the bund. A suitably qualified management company will manage and maintain the oil interceptor and associated drainage on a regular basis.

c. A construction phase environmental management plan should be in operation to check equipment, materials storage and transfer areas (where applicable), drainage structures and their attenuation ability on a regular basis.

d. If a significant hydrocarbon spillage does occur, the contractor on behalf of the developer must have an approved and certified clean-up consultancy available on 24-hour notice to contain and clean-up the spill. The faster the containment or clean-up starts, the greater the success rate, the lower the damage caused and the lower the cost for the clean-up.

The following mitigation measures are recommended in relation to non-hydrocarbon potential contamination:

a Wastewater from sanitation facilities will be mitigated by use of temporary and portable sanitary facilities that are self-contained. These facilities will not interact with the existing hydrological environment in any way and they will be maintained, serviced and removed from site at the end of the construction phase.

b Inorganic nutrients such as nitrogen and phosphorus compounds (if present in excavated sediment) will be controlled by attenuation of the suspended solids to which they adsorb to and by retention of discharge waters within stilling ponds to allow peak runoff to recede prior to discharge. It is noted that the baseline surface water chemistry (under low flow regime) indicates low total nitrogen and low, albeit trace concentrations of phosphorus. It is expected overall, that the site is a low nutrient environment; therefore, nutrient loading should not pose a major threat to the site’s hydrology or hydrogeology.

c Bacteriological contamination arising from availability of nutrients (e.g. sanitation, livestock etc) will be mitigated by appropriate self-contained sanitation facilities (above) and livestock grazing control on the site overall, but particularly on areas zoned for excavation and development.

d There is low risk of mobilising trace metals that may naturally be present. The potential impact may arise from introduced water percolation with excavated bedrock substrate. Concentrations of trace metals are usually low in the natural environment; however, water quality should be checked for metals concentration before, during and after the construction phase (e.g. S.I. No. 12 of 2001; Ref. 14).

Pollution of Groundwater Supply

Due to the absence of recorded wells proximal to the site, specific measures for resource protection are not required, outside of preventing any deterioration in the existing groundwater body as per requirements of the Water Framework Directive (Ref. 2).

7.7.1.6 Operational Phase Mitigation

7.7.1.6.1 Surface Water

Surface Water Flow

To ensure that there is no adverse impact on surface water flow, runoff and discharge from the site during the operation phase of the project, a regular programme of environmental audit and site maintenance for constructed drainage, attenuation structures (e.g. stilling ponds, buffered outfalls etc) and drainage crossings is required to ensure attenuation performance to regulatory standards at the site.

Some changes in the drainage network may be required as a result of unanticipated changes in the hydrological regime during the operation phase of the project.

Surface Water Quality

An environmental management programme is required to monitor, maintain and possibly change underperforming aspects of the constructed drainage network during the operation phase of the project.

7.7.1.6.2 Groundwater Flow

There is no anticipated impact on groundwater flow during the operation phase of the development and therefore no requirement for mitigation.

7.7.1.6.3 Groundwater Quality

In addition to the surface water mitigation measures outlined for the operation phase of the project, on completion of the construction phase, if fuelling has occurred on site, the fuel tanks and oil interceptor used at the fuel transfer area should be removed by a suitably qualified contractor. An audit of ground and water conditions immediately under and around the transfer area is recommended to investigate whether any leakage has occurred to the hydrogeological system and whether some clean-up measures are required.

7.8 RESIDUAL IMPACTS OF THE DEVELOPMENT

7.8.1 Construction Phase

The residual impact on the water environment during the construction phase of the development is anticipated to be a limited temporary decrease in water quality within the site likely to arise from the release of suspended solids and sediments during the excavation and construction process, particularly following rainfall events after a sustained dry period. This local deterioration in water quality is likely to be reduced naturally by dilution and managed by mitigation prior to exiting from the site boundary to main catchments of the streams in question. Thus, this impact overall is anticipated to be slight, and temporary.

7.8.2 Operational Phase

The residual impact on the water environment during the operation phase of the development is anticipated to be increased runoff of rainwater and increased drainage discharge as a result of changes in ground surfacing including areas of new hardstands. Different parts of the site may experience a net change in 'wetting' and 'drying' as a function of the constructed drainage design.

7.9 MONITORING

The following recommendations are made for site monitoring in relation to the hydrological and hydrogeological impacts:

a During the construction phase of the project, water quality in the streams and outflow from end points from the drainage and attenuation system should be monitored, field-tested and laboratory tested on a regular basis during different weather conditions. This monitoring along with the visual monitoring outlined below will help to ensure that the mitigation measures that are in place to protect water quality are working.

b During the construction phase of the project, the development areas should be monitored daily for evidence of groundwater seepage, water ponding and wetting of previously dry spots, and visual monitoring of the effectiveness of the constructed drainage and attenuation system to ensure it does not become blocked, eroded or damaged during the construction process.

7.10 SUMMARY OF SIGNIFICANT EFFECTS

This assessment has identified no potentially significant residual effects on either the Proposed Development Site or the Haul Route Options, given the mitigation embedded in the design and recommended for the implementation of the proposed EIA Development, and the recommendations of the OCEMP.

7.11 STATEMENT OF SIGNIFICANCE

This Section has assessed the significance of potential effects of the EIA Development on water receptors and resources. The EIA Development has been assessed as having the potential to result in effects of a negative, minor, long-term, reversible impact or lower.

Potential cumulative effects were assessed as being negligible in terms of other developments near the proposed EIA Development and a slight positive, short-term impact in terms of the haul route.

Given that only effects of significant impact or greater are considered “significant” in terms of the EIA Regulations, the potential effects of the EIA Development on water receptors and resources are considered to be not significant.

7.12 CONCLUSION

If the mitigation measures outlined for the surface water and groundwater aspects of the site are implemented as described in this report, the resultant predicted impact of the development is that there will be some local changes to how water flows at the site. There is likely to be some short-term deterioration of the quality of runoff waters within the site. Monitoring of water discharge and water quality during the construction phase and regular monitoring at an agreed frequency during the operation phase is recommended. Thus, it is anticipated that the hydrological impacts of the development will be negative, slight and temporary overall, with increased runoff being a negative, slight and permanent impact.

7.13 REFERENCES

No.	*Description*
1.	Environmental Protection Agency (2002) “Guidelines on the information to be contained in Environmental Impact Statements”.
2.	European Union (2000) “Water Framework Directive (2000/60/EC)”
3.	Geological Survey of Ireland (July 2010) “Consultation with www.gsi.ie for National Draft Bedrock Aquifer Classification for Co. Cork”.
4.	Geological Survey of Ireland (July 2010) “Consultation with www.gsi.ie for National Draft Aquifer Vulnerability Classification for Co. Cork.
5.	Met Éireann (1994) "Meteorological Service Records for period 1961-1990".
6.	Hunter-Williams, N. (2004) “The calcareous / non calcareous ("siliceous") classification of bedrock aquifers in the Republic of Ireland”.
7.	Hem. J. D. (1989) “Study and Interpretation of the Chemical Characteristics of Natural Water”. US Geological Survey.

No.	*Description*
8.	Schouten, M. G. C. Ed. (2002) "Conservation and Restoration of Raised Bogs, Geological, Hydrological and Ecological Studies". Duchas, Staatsbosbeheer, GSI, Dublin.
9.	European Economic Union (1978) "78/659/EEC: Council Directive on the Quality of Fresh Waters to Support Fish Life".
10.	DoE-LG (1988) "S.I. No. 293 of 1988: European Communities (Quality of Salmon Waters) Regulations".
11.	European Economic Union (1975) "75/440/EEC: Council Directive on the Quality of Surface Water for Human Consumption".
12.	DoE-LG (1989) "S.I. No. 294 of 1989: European Communities (Quality of Surface Water intended for the abstraction of Drinking Water) Regulations".
13.	Forestry Commission (2004). "Forests and Water Guidelines". 4th Edition. Forestry Commission, Edinburgh, Scotland.
14.	DoE-LG (2001) "S.I. No. 12 of 2001: Water Quality (Dangerous Substances) Regulations".
15.	DoM-NR, Coillte (2000) "Forestry and Water Quality Guidelines''.

8. AIR AND CLIMATE

8.1 INTRODUCTION

Air quality issues associated with wind farms generally relate to dust and vehicle exhaust emissions during construction and decommissioning. A wind farm has little potential for impact on air quality when operational, the main potential effect is generally dust emissions from access tracks being the main factor. The potential for impacts therefore comes during the construction and decommissioning phases and the significance of the impact is influenced by its proximity to any sensitive receivers.

In terms of climate, the main potential effects are positive, in terms of reduced CO_2 emissions during the operational phase.

8.1.1 Background and Objectives

Despite the ongoing deterioration in air quality on a national level due to the reliance on fossil fuel generated energy, transportation, and heating, Ireland as a whole is relatively free of air pollution, when compared with other more industrialised EU countries. The combustion of fossil fuels for energy results in the release of several gases which contribute to climate change and acid rain, including carbon dioxide (CO_2), sulphur dioxide (SO_2) and nitrogen oxides (NOx), and Particulate Matter (PM_{10} and $PM_{2.5}$).

Climate change has begun to manifest itself in Ireland, as it has globally in recent years, with increased air temperatures and changes in precipitation patterns. In 2005, emissions data estimated that Ireland was 25.4% above the level for 1990. Emissions data from 2007 show that Ireland was 24.6% above the level for 1990 (the base year for Kyoto targets). By 2013, total emission levels in Ireland had dropped back almost to 1990 levels, largely as a result of the economic downturn, with indications that individual households had reduced their emissions (EPA, 2014)[27]. No levels above the EU limit were recorded at any of the ambient air quality network monitoring sites in Ireland in 2015 (EPA, 2015[28]).

The EU Commission has also imposed targets on Ireland’s emissions. These require Ireland to reduce its greenhouse gas emissions by 20% by 2020, using 2005 figures as a baseline. It is now estimated that non-Emission Trading Scheme sector emissions are projected to be 9% - 14% below 2005 levels by 2020. This compares to the target of 20% below 2005 levels by

[27] Environmental Protection Agency “Air Quality in Ireland 2014 - Key Indicators of Ambient Air Quality” www.epa.ie
[28] http://www.epa.ie/pubs/reports/air/quality/Air%20Quality%20Report%202015.pdf

2020. However, post-2020 targets will pose serious compliance challenges in the subsequent years[29].

This section assesses the air quality environment of the area of the Proposed Development Site and the potential effects of the proposed EIA Development on air quality during the construction, operation and decommissioning phases of the wind farm. Mitigation measures are then recommended which can reduce effects and residual effects are then assessed. This section also quantifies the emissions avoidance levels of the EIA Development.

8.1.2 Statement of Authority

Jennings O'Donovan and Partners Limited Consulting Engineers ("JOD") were commissioned on behalf ESB Networks to carry out an assessment of the air quality effects and climate effects of the EIA Development on relevant receptors.

JOD has extensive experience in the development of wind farms from planning through to construction. JOD have been active in the wind energy market in Ireland since 1998 as engineering consultants for numerous completed wind farm projects varying from single wind turbine installations to large scale development which extends to over 2,000MW of power.

8.1.3 Assessment Structure

This Section contains the following sections:

- Assessment Methodology and Significance Criteria – a description of the methods used in baseline surveys and in the assessment of the significance of effects;
- Baseline Description - a description of the soils and geology of the Proposed Development Site based on the results of surveys, desk information and consultations, and a summary of any information required for the assessment that could not be obtained;
- Assessment of Potential Effects - identifying the ways in which soils and geological resources could be affected by the proposed EIA Development, including a summary of the measures taken during design of the EIA Development to minimise soils and geological effects;
- Mitigation Measures and Residual Effects - a description of measures recommended to off-set potential negative effects and a summary of the significance of the effects of the EIA Development after mitigation measures have been implemented;
- Cumulative Effects – identifying the potential for effects of the EIA Development to combine with those from other developments to affect soils and geological resources;

[29] Ireland's Greenhouse Gas Emission Projections: 2014-2035, (2015), EPA, http://www.epa.ie/pubs/reports/air/airemissions/EPA%202015%20GHG%20Projections%20Publication%20Final.pdf

- Summary of Significant Effects;
- Statement of Significance;

8.2 ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA

8.2.1 Assessment Methodology

This assessment of air quality and climate involved the following:

- A desk study of the air quality / climate baseline in the area of the Proposed Development Site area and nationally;
- Evaluation of potential effects;
- Evaluation of the significance of effects; and
- Identification of measures to avoid and mitigate potential effects.

8.2.2 Relevant Legislation and Policy

There are various regulatory measures in force for the prevention or control of air pollution, adopted both nationally and by the EC. The Air Quality Framework Directive (96/62/EC) sets out the principles of ambient air quality monitoring, assessment and management and was followed by four daughter directives.

- Air quality 1st Daughter Directive (99/30/EC) deals with sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead;
- Air quality 2nd Daughter Directive (2000/69/EC) deals with carbon monoxide and benzene;
- Air quality 3rd Daughter Directive (2002/3/EC) deals with monitoring of ozone levels; and
- Air quality 4th Daughter Directive (2004/107/EC) covers polyaromatic hydrocarbons, arsenic, nickel, cadmium and mercury in ambient air.

In May 2008, the new Directive on ambient Air Quality and Cleaner Air for Europe (Directive 2008/50/EC) was adopted. This Directive was transposed into Irish Law as The Air Quality Standards Regulations (S.I. No. 180 of 2011) and replaces the Air Quality Standards Regulations 2002 (S.I. NO. 271 of 2002), the Ozone in Ambient Air Regulations 2004 (S.I. No. 53 of 2004) and The Ambient Air Quality Assessment and Management Regulations 1999 (S.I. No. 33 of 1999). This merges the former framework Directive and the first three Daughter Directives into a single Directive with no change to existing air quality objectives for the protection of human health and vegetation. It also introduces new air quality objectives for PM2.5 (fine particles) including a limit value and exposure related objectives – exposure concentration obligation and exposure reduction target.

In 2005, the black smoke standards were replaced by PM monitoring requirements based on Directive 1999/30/EC (CEC, 1999). This Directive established limit values for PM_{10} mass concentration levels. The PM_{10} daily mean limit of 50µg/m^3 should not be exceeded more than 35 times per calendar year. The annual mean PM^{10} limit value is 40µg/m^3.

The Cork County Development Plan 2014 – 2020 contains the following policies in relation to air and climate:

County Development Plan Objective

-GI 12-1: Air Quality: *"Monitor air quality and air quality trends in accordance with EU policy directives and take appropriate action where required including the provision of additional air quality monitoring infrastructure."*

13.12.1 "*Air quality is generally good in the County as it is located in an area with a relatively mild climate and has an almost continuous movement of clean air. It is now evident that, due mainly to the very significant increase of vehicles on the public roads, the biggest threat now facing air quality is emissions from road traffic."*

13.12.2 "*Air quality monitoring is undertaken to assess compliance with national air quality standards and to implement EU Directives on Air Quality. Air quality monitoring and assessments are undertaken at 5 locations within Cork County, of which 3 are located within Cork City Council area and 2 locations are within the administrative area of Cork County Council. Air quality is monitored and assessed in Cork County at Glashaboy and Cork Harbour at Passage West and consideration should be given to further provision of air quality monitoring infrastructure in County Cork."*

Climate policy has been set out previously in **Section 3** of this EIAR and is not repeated here.

8.2.3 Evaluation of Potential Effects

Following on from the identification of the baseline environment, the available data is utilised to identify and categorise potential impacts likely to affect air quality and environment as a result of the EIA Development.

The statutory criteria (EPA, 2002; EPA, 2003) for the assessment of impacts require that likely impacts are described with respect to their extent, magnitude, type (i.e. negative, positive or neutral) probability, duration, frequency, reversibility, and transboundary nature (if applicable). The descriptors used in this REIS / EIAR are those set out in EPA (2002) 'Glossary of Impacts'. Impacts may be categorised as follows:

- Direct: where the existing air quality environment along or in close proximity to the EIA Development is altered, in whole or in part.
- Indirect: where the air quality environment beyond the EIA Development is altered by activities related to the construction or operation of the EIA Development.
- No Impact: where the EIA Development has neither a negative nor a positive impact upon the air quality environment.

8.2.4 Sensitivity

The NRA Guidance[30] states that "*In terms of significance criteria, all sensitive locations for human exposure and for ecosystems are judged to be of 'high sensitivity'*".

8.2.5 Magnitude

The magnitude of potential impacts has been defined in accordance with the criteria provided in the 2002 EPA publication 'Guidelines on the information to be contained in Environmental Impact Statements' as outlined within **Table 8.1** below.

<u>Table 8.1:</u> Impact Assessment Criteria

Magnitude of Impact	Description
Imperceptible	An impact capable of measurement but without noticeable consequences
Slight	An impact that alters the character of the environment without affecting its sensitivities
Moderate	An impact that alters the character of the environment in a manner that is consistent with existing or emerging trends
Significant	An impact, which by its character, magnitude, duration or intensity alters a sensitive aspect of the environment
Profound	An impact which obliterates all previous sensitive characteristics

8.2.6 Significance Criteria

The significance of the potential effects of the EIA Development have been classified by taking into account the sensitivity of receptors and the magnitude of the potential effect on them, combined with the likelihood of an event occurring as defined in **Table 8.2**.

[30] http://www.tii.ie/technical-services/environment/planning/Guidelines-for-the-Treatment-of-Air-Quality-during-the-Planning-and-Construction-of-National-Road-Schemes.pdf

Table 8.2: Rating of Significant Environmental Impacts

	Magnitude of Impact				
Importance of Attribute		**Negligible**	**Small**	**Moderate**	**Large**
	Extremely High	Imperceptible	Significant	Profound	Profound
	Very High	Imperceptible	Significant/ Moderate	Profound/ Significant	Profound
	High	Imperceptible	Moderate/ Slight	Significant/ Moderate	Severe/ Significant
	Medium	Imperceptible	Slight	Moderate	Significant
	Low	Imperceptible	Imperceptible	Slight	Slight/ Moderate

8.3 RECEIVING ENVIRONMENT

8.3.1 Introduction

Air quality in Ireland is regarded as good, particularly in rural areas such as the site of the proposed development. Air quality is monitored by EPA stations nationwide. The closest air monitoring station to the proposed Derreenacrinnig West Wind Farm is located approximately 60km east of Derreenacrinnig West at Heatherton Park in the suburbs of Cork City. The ambient air-modelling programme in Cork City currently monitors air quality; this monitoring is being carried out by Cork City Council.

Monitoring is done using continuous monitors for sulphur dioxide, nitrogen oxides, carbon monoxide and ozone. Continuous samples are also taken for particulates (PM_{10}), benzene and lead.

Hourly averages were produced for the gases while the particulate and lead samples were taken away for laboratory analysis every three weeks. Results are compared with the assessment thresholds in the Air Quality Regulations to determine the type of monitoring required long term.

There have been four exceedances of the PM_{10} daily mean limit of 50 $\mu g/m^3$ so far this year at Heatherton Park. No other limit values have been exceeded at Hetherton Park during the ambient air modelling programme. Concentrations of Carbon Monoxide, Sulphur Dioxide, Nitrogen Dioxide, Benzene, PM_{10} and lead are currently below their respective lower assessment thresholds. The air quality is consistently classified as “Good”.

Particulate Matter (PM) less than ten micrometres in size (PM_{10}) can penetrate deep into the respiratory system increasing the risk of respiratory and cardiovascular disorders. PM_{10} arises from direct emissions of primary particulate such as black smoke and formation of secondary PM in the atmosphere by reactions of gases such as sulphur dioxide and ammonia. The main sources of primary PM_{10} are incomplete burning of fossil fuels such as coal, oil and peat and emissions from road traffic, in particular diesel engines. Other sources of particulates include re-suspended dust from roads. Natural PM includes sea-salt and organic materials such as pollens. The diverse sources and impacts of PM make it one of the most challenging issues to address.

In 2005, the black smoke standards were replaced by PM monitoring requirements based on Directive 1999/30/EC (CEC, 1999). This Directive established limit values for PM_{10} mass concentration levels. The PM_{10} daily mean limit of 50 $\mu g/m^3$ should not be exceeded more than 35 times per calendar year. The annual mean PM_{10} limit value is 40 $\mu g/m^3$. Particulate matter (PM_{10}) concentrations in Ireland in 2008 were all compliant with the standards introduced in 2005. All stations were compliant with the standard introduced for 2005 which permits no more than 35 daily values greater than the limit value of 50$\mu g/m^3$. Levels were highest in traffic influenced sites in the cities and large urban areas. In 2009, the highest number of exceedances occurred at Heatherton Park, where 10 values greater than 50$\mu g/m^3$ were recorded and no exceedances were recorded at Ringsend, Phoenix Park, Ballyfermot and Newbridge (EPA, 2009).

Nitrogen oxides (NOx), includes the two pollutants, nitric oxide (NO) and nitrogen dioxide (NO_2). Power-generation plants and motor vehicles are the principal sources of NOx, through high temperature combustion. NOx contributes to the formation of acid rain and is also a recognised ozone precursor. Short-term exposure to NO_2 is associated with reduced lung function and airway responsiveness, and increased reactivity to natural allergens. Long-term exposure is associated with increased risk of respiratory infection in children.

Nitrogen Dioxide (NO_2) concentrations measured in Ireland in 2008 were compliant with all Directive 1999/30/EC (CEC, 1999) limit values. The highest annual mean value of 36$\mu g/m^3$ recorded at Coleraine Street in Dublin was below the limit value of 40$\mu g/m^3$. Navan and Blanchardstown monitoring stations both recorded one exceedance of the hourly limit value of 200$\mu g/m^3$; no more than 18 exceedances greater than 200$\mu g/m^3$ in a calendar year will be permitted from 2010 onwards (EPA, 2007).

The proposed Derreenacrinnig West Wind Farm site, like most areas in the southwest of Ireland, experiences regular Atlantic weather flows which have the effect of replenishing the air regularly. The prevailing wind directions are from the southwest and west and the site experiences significantly high levels of rainfall (1,207 mm/year), (Cork Airport Synoptic station, 1962-1991) when compared with annual average rainfall in the east of Ireland (732 mm/year) (Dublin Airport, 1961-1990) (Met Éireann 2010).

The energy industry was responsible for over 21.8% of all greenhouse gas emissions in Ireland in 2008. This is an improvement from the position in the late 1990's when it contributed over 30% to the emission load. This improvement is largely as a result of switching to cleaner and emission free fuels such as natural gas and renewables (EPA, 2009).

8.3.2 Existing Climate

Ireland does not experience a great range of temperatures throughout the year. The mean temperature is generally between 9 and 11 degrees.

8.3.3 Existing Air Quality Conditions

Generally, Ireland is recognised as having some of the best air quality in Europe. However, from time to time, and under certain weather conditions, it is possible to experience some air pollution in the larger towns and cities.

Ireland is required under EU legislation to monitor air quality in large urban areas to ensure that the health of the population is not put at risk.

The main sources of air pollution are from motor vehicles, fuel usage in heating systems, such as coal, oil, wood, turf etc., and from industrial processes.

The EPA's report 'Air Quality in Ireland 2015, Key Indicators of Ambient Air Quality' outlined key findings from monitoring during 2015, as follows:

- No levels above the EU limit value were recorded at any of the ambient air quality network monitoring sites in Ireland in 2015;
- WHO guideline values were exceeded as follows:
    - Ozone at 7 monitoring sites;
    - Particulate Matter PM_{10} at 16 monitoring sites (24hr WHO Guideline);
    - Particulate Matter $PM_{2.5}$ at 8 monitoring sites (24hr WHO Guideline);
    - Particulate Matter $PM_{2.5}$ at 1 monitoring sites (annual WHO Guideline);
- EEA reference levels were exceeded as follows:

  - Polycyclic Aromatic Hydrocarbon (PAH) at 4 monitoring sites; and
- The dioxin survey 2015 shows levels recorded are similar or lower than those from previous surveys and from studies undertaken in other EU countries.

Air quality in Ireland is regarded as '2 - Good', particularly in rural areas such as the site of the EIA Development.

The energy industry was responsible for over 19.7% of all greenhouse gas emissions in Ireland in 2015. This is an improvement from the position in 1990 when it contributed 20.4% to the emissions load when the economy was much smaller. This improvement is largely as a result of switching to cleaner and emission free fuels such as natural gas and renewables (EPA, 2017)[31].

Emissions in the energy industry showed an increase of 5.4% in 2015 which is attributable to an increase in coal and peat use for electricity generation and decrease in natural gas by -5.5%. renewables accounted for 27% of electricity generation in 2015 which was an increase of 4% on 2014 levels (EPA, 2017).

The actual amount of carbon dioxide (CO2) released through electricity generation in Ireland relates directly to the generating plant in use at any given time. This mix changes on a daily basis and will change in the future as generating plant is replaced and fuel costs change, therefore as a consequence it is not possible to predict exactly how much CO2 release the windfarm will prevent over its lifetime. However, the Sustainable Energy Authority of Ireland ("SEAI") states that, in 2013, 457 tonnes of CO2 ("tCO2") were released each GigaWatt hour (GWh)[32].

The carbon footprint of fossil fuelled power plants is dominated by emissions during their operation. In contrast electricity from wind energy has one of the lowest carbon footprints, with nearly all the emissions arising during the manufacturing and construction phases, such as from the production of steel for the tower and concrete for the foundations, which account for 98 % of the total life cycle CO2 emissions. Emissions generated during the operation of wind turbines arise from routine maintenance inspection trips and the assessment includes the use of lubricants and transport. The carbon footprint for onshore wind energy in the UK is only 4.64

[32] Sustainable Energy Authority of Ireland (2013) Energy in the Residential Sector 2013 Report. Dublin: Sustainable Energy Authority of Ireland. Page 48 notes "*The carbon intensity of electricity fell by 49% since 1990 to a new low of 457 g CO2/kWh in 2014*" and "*The efficiency of electricity supply increased to 49.1% in 2014 while emissions from electricity generation fell to a record low of 457 g CO2/kWh*".

gCO2eq/kWh[33] (equivalent figures for Ireland are not currently available, but UK figures are representative). This figure was estimated through a Life Cycle Assessment and includes the cumulative environmental impacts of the windfarm through all the stages of its life. The footprint of the EIA Development will be minimised through the use of local materials and labour wherever possible. Where materials or specialist labour cannot be sourced locally efforts will be made to limit the transport/freight miles to the Development. When appointing organisations to work on the Development, consideration will also be given to their environmental credentials.

8.4 DO NOTHING IMPACT

If the proposed EIA Development was not to proceed then it is anticipated that the 2012 Permission would not be implemented.

8.5 POTENTIAL IMPACTS OF THE PROPOSED DEVELOPMENT

8.5.1 Construction Phase

8.5.1.1 Dust Emissions

The main potential source of impacts on air quality during construction is dust. There is potential for the generation of dust from excavations and from construction of access tracks and hardstands and the trench for the cable ducting for the grid connection. The potential nuisance issues arising from this are dependent on the terrain, weather conditions (i.e. dry and windy conditions) and the proximity of receptors. Dust from cement can cause ecological damage if allowed to migrate to water courses, though it is proposed that ready-mix concrete will be used with no on-site batching taking place, and therefore this will not be a potential source of emissions. Potentially dust generating activities are as follows:

- Earth moving and excavation plant and equipment for handling and storage of soils and subsoils;
- Transport and unloading of stone materials for access track construction;
- Rock will be extracted from turbine foundation construction and this will be used for subsequent use in construction of tracks and hardstands as needed; and
- Vehicle movements over dry surfaces such as access tracks.

The potential impact from dust becoming friable and being a nuisance to workers, residents and local road users is considered, a slight, negative, short-term, direct impact during the construction phase.

[33] Parliamentary Office of Science and Technology (2006). Available at: http://www.parliament.uk/documents/post/postpn268.pdf

8.5.1.2 Sensitive Receptors

Friable dust cannot remain airborne for a very long time. The distance it can travel depends on the particle sizes, disturbance activities and weather conditions. Larger dust particles tend to travel shorter distances than smaller particles. Particle sizes greater than 30µm will generally deposit within approximately 100m of its source, while particles between 10-30µm travel up to approximately 250-500m and particle sizes of less than 10µm can travel up to approximately 1km[34].

Generally (depending on the conditions outlined), dust nuisance is most likely to occur at sensitive receptors within approximately 100m of the source of the dust. There are no properties within 100m of the proposed EIA Development. In addition, vegetation such as trees and hedgerows will help to mitigate any airborne dust migrating off site. Any effects of dust on vegetation will be confined to the construction and possibly the decommissioning phases and be short-term in duration.

Any impact from dust deposition at sensitive receptors would give rise to nuisance issues for residents of those properties. However, given the distances from the site to those properties, this would be predicted to be a slight to moderate, temporary adverse type impact.

8.5.1.3 Exhaust Emissions

Emissions from plant and machinery, including trucks, during the construction of the proposed Derreenacrinnig West Wind Farm and Proposed Grid Connection are a potential impact. The engines of these machines produce emissions such as carbon dioxide (CO_2), carbon monoxide (CO), Nitrogen Oxide (NOx), and Particulate Matter (PM_{10} and $PM_{2.5}$).

Particulate Matter (“PM”) less than ten micrometres in size (PM_{10}) can penetrate deep into the respiratory system increasing the risk of respiratory and cardiovascular disorders. PM_{10} arises from direct emissions of primary particulate such as black smoke and formation of secondary PM in the atmosphere by reactions of gases such as sulphur dioxide and ammonia. The main sources of primary PM_{10} are incomplete burning of fossil fuels such as coal, oil and peat and emissions from road traffic, in particular diesel engines. Other sources of particulates include re-suspended dust from roads. Natural PM includes sea-salt and organic materials such as pollens. The diverse sources and impacts of PM make it one of the most challenging issues to address.

[34] http://www.dustscan.co.uk/Dust-Info/Definitions

Nitrogen oxides (NOx), includes the two pollutants, nitric oxide (NO) and nitrogen dioxide (NO_2). Power-generation plants and motor vehicles are the principal sources of NOx, through high temperature combustion. NOx contributes to the formation of acid rain and is also a recognised ozone precursor. Short-term exposure to NO_2 is associated with reduced lung function and airway responsiveness, and increased reactivity to natural allergens. Long-term exposure is associated with increased risk of respiratory infection in children.

The construction phase is likely to lead to small localised increases in these emission levels which is likely to lead to a temporary imperceptible effect.

8.5.1.4 Construction Carbon Footprint

The CO_2 "payback time", which is the period of windfarm operation required until there is a net saving of CO_2 (until achieved savings equal whole-lifetime emissions), can be calculated as the total CO_2 offset associated with the EIA Development divided by the carbon footprint of the EIA Development. The time it would take to displace emissions equivalent to those used in manufacture and construction of the EIA Development is within three to four months[35].

8.5.2 Operational Phase

8.5.2.1 Dust Emissions

There will be a small number of light vehicles accessing the site during the operational phase and this could lead to some localised dust being generated though this will be small and sporadic as only approximately one to two site visits per week will occur at the EIA Development. This will be an imperceptible negative impact.

8.5.2.2 Reduction in Climate Change Emissions

The proposed EIA Development does not contain any element, which will produce greenhouse gaseous emissions or odorous emissions. Indeed, the EIA Development will contribute to a net national reduction in the emissions of greenhouse and other gases resulting from the combustion of fossil fuels. The gases of main concern are those that contribute to an increase of the Greenhouse Effect (Carbon dioxide, Methane, Nitrous oxide and other Nitrogen oxides) and those that contribute to Acid Rain (principally Sulphur dioxide). The degree to which wind energy reduces levels of emissions depends on the method of electricity generation which it is replacing.

[35] Based on the Parliamentary Office of Science and Technology (2006) carbon footprint estimate of 4.64 gCO2eq/kWh and the generation of 38.684GWh / year, the EIA Development will have a carbon footprint of between approximately 4,487 tCO_2eq/GWh over its 25 year lifetime. The annual CO_2 offset of the EIA Development is estimated to be between 16,453 and 24,680 tCO2/yr meaning that the Development must operate for almost 4 months to payback the CO_2 used in manufacturing and construction.

No appreciable effect on the air quality in the immediate environs of the Proposed Development is expected from the construction and operation of the EIA Development. However, the relative reductions in greenhouse gas emissions in the energy sector will serve to reduce the effects of climate change on a national and global level, albeit at a moderate scale. This will be a small positive impact in the medium term in helping Ireland reduce its greenhouse gas emissions and meet its international obligations.

8.5.3 Decommissioning Phase

Impacts during the decommissioning phase of the EIA Development are anticipated to be similar to those arising during the construction phase depending on the scenario chosen. The turbines will be dismantled and removed from site and the access tracks and hardstands will be covered in topsoil and revegetated. The decommissioning phase could be expected to last approximately 4 weeks in this case. The effect in this case is predicted to be imperceptible. It is considered that leaving the access tracks in-situ for the continued use of the landowners will have less potential environmental effects than removal.

8.6 MITIGATION MEASURES AND RESIDUAL EFFECTS

8.6.1 Construction Phase Mitigation

The main potential impact during the construction phase of the EIA Development will be from dust nuisance at sensitive receptors close to the site. Good practice site procedures will be followed by the appointed contractor to prevent dirt and dust being transported onto the local road network. Good practice site control measures are likely to include the following:

- Approach roads and construction areas will be cleaned on a regular basis to prevent mud built-up and from migrating around the site and off-site;
- Wheel cleaning facilities will be provided near the site compound to prevent mud/dirt being transferred from the site to the public road network;
- ‘Damping down’ will be used if dust becomes an issue on any part of the site;
- Vehicles delivering materials to the site will be covered appropriately when transporting materials that could result in dust, e.g. crushed rock or sand;
- Ready-mix concrete will be delivered to site and it is envisaged that no batching of concrete will take place on site;
- Speed restrictions on access tracks will be implemented to reduce the likelihood to dust becoming airborne;
- Public roads along the construction haul route will be inspected regularly and if dirt/mud is identified that could result in dust generation then the road will be cleaned as necessary;

- Weather will be monitored so that during periods of dry weather when dust is likely to become airborne, sporadic damping down of access tracks (and other surfaces as necessary) will be undertaken;
- Stockpiling of materials will be carried out in such a way as to minimise their exposure to wind where possible and damping down will be carried out where needed; and
- A complaints procedure will be implemented on site where complaints will be reported to the site manager, logged and appropriate action taken.

8.6.2 Operational Phase Mitigation

A net benefit in terms of the reduction of greenhouse gas emissions in the energy sector has been noted and therefore, no mitigation is proposed for the operational phase.

8.6.3 Decommissioning Phase Mitigation

Mitigation measures during the decommissioning phase will be similar to those employed during the construction phase as outlined above.

8.6.4 Cumulative Effects

There is the potential for cumulative impacts with other proposed ddevelopments in the area,

8.7 RESIDUAL IMPACTS OF THE EIA DEVELOPMENT

The use of plant and machinery will have an effect on air quality in the area, both in terms of dust generation and exhaust emissions. Overall this impact is assessed as slight/imperceptible, negative, direct and temporary/short-term in nature.

The appointed contractor responsible for the detailed design of the project will provide details to the planning authority for agreement in writing prior to the commencement of development of environmental safety methodology including best practice procedures to manage construction activities. It is recommended that the methodology statement should be signed off by a suitably qualified geotechnical engineer/engineering geologist. An independent, qualified geotechnical engineer/engineering geologist should be contracted for the detailed design stage of the project and geotechnical services should be retained throughout the construction phase, including monitoring and supervision of construction activities on a regular basis.

During the operational phase of the EIA Development the effects are assessed as being slight, positive and long-term in nature with helping to reduce greenhouse gas emissions in Ireland. This is in line with the objectives in The National Climate Change Strategy and promoting renewable energy.

8.8 SUMMARY OF SIGNIFICANT EFFECTS

This assessment has identified no potentially significant effects, given the mitigation measures embedded in the design and recommended for the implementation of the EIA Development.

8.9 STATEMENT OF SIGNIFICANCE

This Section has assessed the significance of potential effects of the EIA Development on air quality. The proposed EIA Development has been assessed as having the potential to result in effects of slight, negative, temporary/short-term effect during construction. There will be a slight, positive, long-term effect in terms of helping Ireland meet its international obligations to reduce greenhouse gas emissions.

Potential cumulative effects were assessed as being of a slight, negative, short-term impact. Given that only effects of significant impact or greater are considered "significant" in terms of the EIA Regulations, the potential effects of the EIA Development Farm on air quality and climate are considered not significant.

8.10 CUMULATIVE AND IN COMBINATION EFFECTS

The proposed development of the wind farm and grid connection has the potential to cause negative effects in combination with other plans and projects during the construction phase should they be constructed at the same time. Increased amounts of dust could become friable and increased traffic could lead to increased emissions in the local area. However, given the short-term nature of the proposals any effects would be minor in nature.

8.11 CONCLUSION

In conclusion, the proposed development may have a localised negative impact on air quality in the area during construction but will contribute to a long-term positive impact in terms of air quality and climate on a national level by facilitating development of wind energy and the move to a lower carbon economy.

9 NOISE

9.1 STATEMENT OF AUTHORITY

This Section has been prepared by Mr Brendan O'Reilly of Noise and Vibration Consultants Ltd. Mr. O'Reilly has a Masters degree on noise and vibration from Liverpool University and has over 30 years' experience in noise and vibration control (and many years' experience in preparation of noise impact statements) and is a member of a number of professional organisations (including the Society of French Acoustics and European Association of Acoustics). Mr. O'Reilly was an author and project partner (as a senior noise consultant) in '*ENVIRONMENTAL QUALITY OBJECTIVES Noise in Quiet Areas*' administered by the Environmental Protection Agency on behalf of the Department of the Environment, Heritage and Local Government (as a first step towards implementation of the EC Directive relating to the Assessment and Management of Environmental Noise (EU, 2002).

Noise & Vibration Consultants have considerable experience in the assessment of noise impact and have compiled studies for in excess of 50 planned wind farm developments throughout Ireland ranging in size from 1 to 20 turbines.

9.2 INTRODUCTION AND METHODOLOGY

Planning permission was originally granted for development for a seven-turbine wind farm at Derreenacrinnig West, Drimoleague, Co. Cork. The 2010 EIS submitted as part of that application assessed the existing background noise levels at some of the dwelling locations closest to the proposed turbines. The potential impact on residential amenity at these Noise Sensitive Locations (NSLs) were assessed by comparing predicted noise levels from the wind turbines at the NSLs with existing background noise levels and extrapolated noise limits as recommended by the Wind Energy Development Guidelines 2006[36]. The background noise levels being the noise level equalled or exceeded for 90% of the monitoring interval.

Representative locations north and south of the site were identified and existing background noise levels at these locations were recorded continuously over a fifteen-day period from the 30th July to 13th of August 2010. The background survey is undertaken to assess the natural conditions close to groups of residents around the site i.e. devoid from the noises of everyday human activity where possible.

[36]. The Department of Environment, Heritage and local Government has recently published 'Wind Energy Development Guidelines'- Guidelines for Planning Authorities June, 2006

The baseline noise monitoring was carried out in accordance with *ISO 1996 Part 1 (Description and Measurement of Environmental Noise - Part 1: Basic Quantities and Procedures)* while the impact statement was compiled according to the *Department of Environment, Heritage and Local Government 'Wind Energy Development Guidelines 2006'*.
The Wind Energy Development Guidelines state that *"noise is unlikely to be a problem where the distance from the nearest property is more than 500 metres"*. The nearest house (H1) to the proposed Derreenacrinnig West Wind Farm is 884 m north of the site.

The Proposed Grid Connection Route
The proposed development works have been assessed using a desktop assessment on the possible noise issues which could arise as a result of the proposed underground cable grid connection works.

The proposed grid connection works have the potential to generate noise impacts in the surrounding area during the construction phase. There will be no noise impacts generally during the operational phase due to the nature of the proposed development. There could however be noise impacts if any maintenance is required on the cable and this impact would be of a similar nature to that of construction. Therefore, this assessment will primarily focus on the construction phase.

9.3 ACOUSTIC TERMONOLOGY

Sound is simply the pressure oscillations that reach our ears. These are characterised by their amplitude, measured in decibels (dB), and their frequency, measured in Hertz (Hz). Noise is unwanted or undesirable sound; it does not accumulate in the environment and is normally localised. Environmental noise is normally assessed in terms of A-weighted decibels, dB (A), when the 'A weighted' filter in the measuring device elicits a response which provides a good correlation with the human ear. The criteria for environmental noise control are of annoyance or nuisance rather than damage. In general, a noise level is liable to provoke a complaint whenever its level exceeds by a certain margin the pre-existing noise level or when it attains an absolute level. A change in noise level of 3 dB (A) is 'barely perceptible'; while an increase in noise level of 10 dB (A) is perceived as a twofold increase in loudness. A noise level in excess of 85 dB (A) gives a significant risk of hearing damage.

Construction and industrial noise sources are normally assessed and expressed using equivalent continuous levels, L_{Aeq}[37]. Road traffic noise is normally assessed using L_{10} dB (A)[38] or L_{Aeq}.

In keeping with the requirements of the *Wind Energy Development Guidelines* the background noise level and the noise level due to wind turbines are expressed using the A weighted sound pressure level that is equalled or exceeded for 90% of a 10-minute measurement interval, $L_{A90,10min}$

9.4 EXISTING ENVIRONMENT

9.4.1 Noise Sensitive Locations

The nearest dwellings within 1.5km to the proposed wind turbine development have been identified and are shown in **Figure 9.1- House Location Map.** As can be seen from the drawing the sample houses chosen are representative of the nearer local residences. **Table 9.1** gives the distances from each house within 1.5 km to the nearest proposed turbine location.

Table 9.1: Noise Sensitive Location / Turbine Separation

House ID	Nearest Turbine	Distance to Turbine (m)
H1	7	884
H2	7	905
H3	1	1014
H4	6	1038
H5	1	1073
H6	1	1112
H7	1	1126
H8	1	1128
H9	7	1175
H10	6	1212
H11	1	1216
H12	1	1310
H13	7	1365
H14	1	1381
H15	1	1451

[37] L_{Aeq} is defined as being the A-weighted equivalent continuous steady sound level during the sample period and effectively represents an average value.

[38] The value of the L_{10} hourly dB(A) is the noise level equalled or exceeded for just 10% of the time over a period of one hour

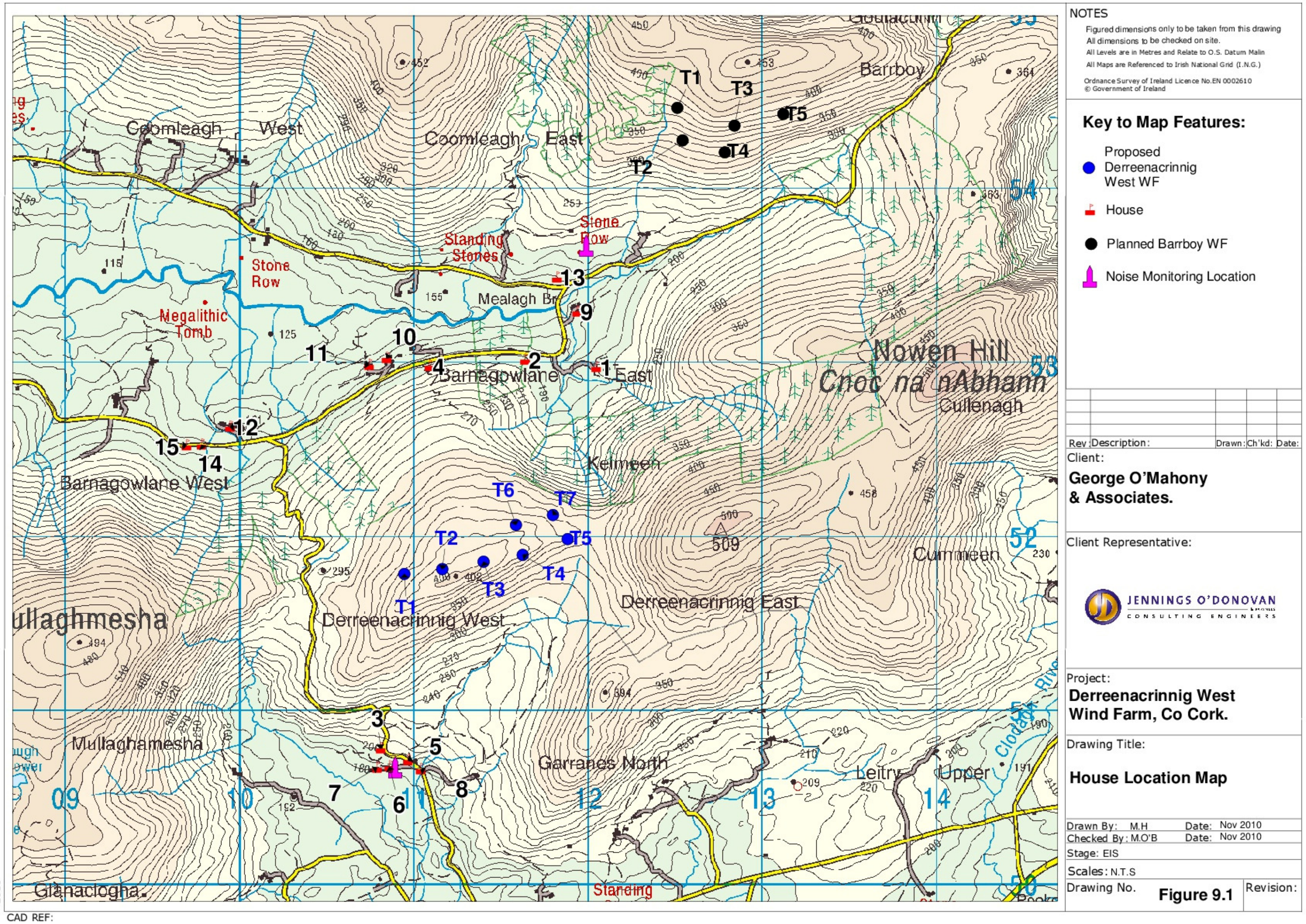


Figure 9.1: House Location Map

9.4.2 Baseline Noise Survey

Baseline noise monitoring was carried out at two locations (H6, and H13) to represent areas in which the nearest NSL's are situated. The weather conditions during the monitoring period were varied with short periods of rain but mainly dry. The average wind speeds ranged between 1 and 7.2 m/s (calculated to 10m measurement height). The detailed numerical dataset is presented in **Appendix F.**

9.4.3 Baseline Noise Methodology

Continuous monitoring was undertaken from 30th July to 13th August 2010. The following conditions were adhered to in undertaking the survey:

- Measurement of ambient noise levels was undertaken during varied wind speeds using Type 1 instruments.
- Concurrent measurements of wind speed / direction and noise levels were recorded.
- Monitoring locations were selected as close to noise sensitive locations as possible.
- Survey carried out according to ISO 1996 Part 1 (Description and Measurement of Environmental Noise - Part 1: Basic Quantities and Procedures)
- Recording was conducted during quiet day time and night time periods including a weekend period.

9.4.4 Instrumentation Used

The following instrumentation was used in the baseline survey measurements:

- Two Larson Davis 870 Precision Integrating Sound Level Analyser/Data logger with 900B 3876 Pre-amplifier and 1/2" Condenser Microphone Type 2542 and Rainhat.
- Wind Shields Type: Larson Davis 2120 Windscreen.
- Wind Monitor Type: Young Model 05103.
- Calibration Type: Larson Davis Precision Acoustic Calibrator Model CA250.

Wind speed was recorded on site at 2.5m height above ground level (and converted to 10m height) as recommended in *Guidelines for Planning Authorities 2006.*

9.4.5 Measurement Procedure

Continuous noise monitoring was carried out at 2 locations which represent the houses located north and south of the site (please refer to house location map, **Figure 9.1**) over a 15-day period using environmental noise analysers with data logging facilities set on real time. The microphones were positioned on a tripod 1.2m above ground level and more than 3m from any reflecting façade. The logged data was later downloaded to a personal computer. All acoustic instrumentation was calibrated before and after each survey and no drift of calibration was observed. The measurement locations were selected on the basis of their location relative to wind turbines and the location of the most sensitive properties. The noise survey locations were representative of the houses North and South of the proposed wind farm.

Table 9.2: Noise Monitoring Details

Monitoring Location	Description
H6 (south of site)	Microphone at 1.2m height, 30m from house
H13 (north of site)	Microphone at 1.2m height, 250m north east of house

Following the wind energy development guidelines, the measured noise data would generally be divided into subsets:

Day time hours 08.00 – 20.00 hrs every day

Night-time hours 20.00 – 08.00 hrs every day

9.4.6 Noise Survey Results and Analysis of Data

This local environment is predominately controlled by the noise generated from agriculture activity, road traffic on the local road network and wind influence on vegetation. The variation in background noise level with wind speed is determined by correlating the $L_{A90(10min)}$ noise measurements taken during the survey with the average wind speeds recorded over the same 10-minute periods. Prior to analysis, the acoustic data were filtered, and instances of unexpected peaks removed. These may have been caused by infrequent human activities or intermittent operation of farm machinery. A scatter chart for each location illustrating the collected data points was produced. The calculated best fit curve for each data set provides a representative existing noise level across the band of wind speeds for which measurements were taken. The best-fit data from the baseline survey is presented in Figure 9.2 to Figure 9.5. The complete dataset of results obtained in the noise survey are also contained in **Appendix H**.

9.5 NOISE IMPACT

9.5.1 Characteristics of Proposal

There are two quite distinct types of noise sources within a turbine. The mechanical noise produced by the gearbox, generator and other parts of the drive train; and the aerodynamic noise produced by the passage of the rotor blades through the air.

Over the last few years there has been a significant reduction in the mechanical noise generated by wind turbines, and it is now generally less than the aerodynamic noise. Aerodynamic noise from wind turbines is generally unobtrusive; it is broadband in nature and in this respect is similar to the noise of wind in the trees.

The main noise source emissions from turbines are those associated with aerodynamic noise, however with continuing improvements in design, lower rotational speeds produce higher rated outputs. Low rotational speeds reduce the probability of any audible tonal or impulsive components.

Level for level, wind turbine generated noise is less objectionable than industrial or road traffic noise. The audibility of noise from wind turbines will be greatest at lower wind speeds, less than 6 m/s. At average wind speeds of around 7 m/s and above, it generally becomes quite an abstruse issue to discuss sound emissions from modern wind turbines since background noise (wind on vegetation / objects) will generally mask any turbine noise completely.

9.5.1.1 Target Criterion and Noise Limits

The noise limits suggested by the *Wind Energy Development Guidelines* have been derived with reference to the following, and other, points:

- Existing standards and guidance relating to noise emissions
- Society's need for renewable energy sources to reduce harmful greenhouse gas emissions in pursuance of government energy policy
- The ability of manufacturers and developers to meet these noise limits
- The research of Noise Working Groups in the UK, Denmark, Holland and Germany.

The following are a number of key extracts from the *Wind Energy Development Guidelines* in relation to noise impact:

9.5.2 General Noise Impact

"*Noise impact should be assessed by reference to the nature and character of noise sensitive locations*."

"*Separate noise limits should apply for day-time and for night-time*"

"Noise limits should be applied to external locations and should reflect the variation in both turbine source noise and background noise with wind speed."

9.5.3 Measurement Units

"The descriptor [$L_{A90\ 10min}$] which allows reliable measurements to be made without corruption from relatively loud transitory noise events from other sources, should be used for assessing both wind energy development noise and background noise."

9.5.4 Specific Noise Limits

'Noise limits should be applied to external locations and should reflect the variation in both turbine source noise and background noise with wind speed.'

"In general, a lower fixed limit of 45dB(A) or a maximum increase of 5dB(A) above background noise at nearby noise sensitive locations is considered appropriate to provide protection to wind energy development neighbours. However, in very quiet areas, the use of the margin of 5dB(A) above the background noise at nearby noise sensitive properties is not necessary to offer a reasonable degree of protection and may unduly restrict wind energy developments. Instead in low noise environments where background noise is less than 30 dB(A), it is recommended that the daytime level of $L_{A90,10min}$ of the wind energy development noise should be limited to an absolute level within the range 35-40dB(A)". In this instance absolute level of 40 dB (A) is being used.

"During the night the protection of external amenity becomes less important and the emphasis should be on preventing sleep disturbance. A fixed limit of 43dB (A) $L_{A90,10min}$ which will protect sleep inside properties during the night"

9.5.4.1 Predicted Wind Turbine Noise

Windfarm, V 3.1.2.5 (developed by Resoft Ltd) software package was used to determine the noise impact at the prediction locations. Noise levels are calculated using a simple point source spherical spreading algorithm. The attenuation due to spherical spreading is given by;

$$Lp = Lw - 20 \log R - 8$$

Where:

Lp = sound pressure level

Lw = sound power level

R = distance from source to receiver

In the predictions a conservative figure of 3 dBA attenuation has been allowed for by way of ground absorption, reflection, diffraction and vegetation.

The prediction model is calculated as a worst-case scenario. As such, it has been shown by measurement–based studies (conducted by this author) that this model, like others, tend to over-estimate the noise levels at nearby dwellings by more than 4 dB(A) (the author's own studies of recent constructed wind farms throughout Ireland verifies this).

The turbine model to be used at the wind farm site will, most likely, be either Enercon E44/E48 or Vestas V52. The hub height will be up to 55 m and the rotor diameter will be up to 52 m. Noise levels used in this report were based on the Vestas V52 wind turbine which has a base to blade tip of 81m. Noise levels were calculated using the data supplied by the turbine manufacturer Vestas for the V52-850 kW OptiSpeed, wind turbine. The turbine has a cut-in speed of 4 m/s and a cut-out speed of 24 m/s. The sound power levels of the 0.85 MW turbine at varying wind speeds at 10m height wind speeds for a hub height of 55m is given in **Table 9.3.a.** This is the worst-case scenario as the sound power levels associated with the Enercon turbine models are lower (see comparison in Table 9.3.b).

Table 9.3.a: Sound power levels for the Vestas V52, 0.85 MW turbine

V wind In 10m Height	Sound Power Level L_{WA} [dB(A)]
<4	<94.0
4	<94.0
5	97.2
6	101.7
7	103.8
8	104.2
9	104.2
10	103.3

Table 9.3.b: Comparative Turbine Models – Sound Power Levels

	Vestas V52	Enercon E44	Enercon E48
Wind Speed (Vs) in 10m Height	**Sound Power Level [dB(A)]**	**Sound Power Level [dB(A)]**	**Sound Power Level [dB(A)]**
4	94.0	91.1	89.2
5	97.2	94.1	93.7
6	101.7	99.7	97.9
7	103.8	101.1	100.7
8	104.2	102.6	101.7
9	104.2	103.0	102.5
10	103.3	103.0	102.5

It has been quoted in documentation (ETSU-R-97), that $L_{A90,10min}$ (background) values from the wind farm are likely to be 1.5 – 2.5 dB(A) less than the L_{Aeq}. To account for this an allowance of 2 dB(A) has been subtracted for the use of the L_{A90} values rather than the L_{Aeq} values. **Table**

9.4 gives the predicted noise levels at varying wind speed at the nearest houses expressed as L_{A90} values. The predicted noise levels are the cumulative levels for the seven turbines.

Recent noise measurements by this author recorded from a number of recently constructed wind farms throughout Ireland suggest that the difference between the L_{Aeq} and L_{A90} values can be greater than that given in the ETSU –R-97[39] document, at 2.5 - 3.5 dB(A).

Figures 9.2 to 9.5 inclusive gives a graphical presentation of the daytime and night time derived limits plotted against the predicted wind turbine noise at varying wind speed at houses H2 and H6. The noise data from the baseline survey location H13 was used for the derived plot for H2. Noise levels were calculated using the data supplied from the turbine manufacturer for the Vestas V52-850 kW class wind turbine.

Table 9.4: Predicted noise levels at houses within 1.5km expressed as $L_{90,\ 10\ min}$

House id	Distance to nearest turbine (m)	Predicted Noise Level (L_{A90}) at Varying Wind Speed (m/s)						
		4	5	6	7	8	9	10
H1	884	22.4	25.6	30.1	32.6	33.2	33.2	31.3
H2	905	23.1	26.3	30.8	32.9	33.5	33.5	32.6
H3	1014	20.8	24.0	28.5	30.6	31.2	31.2	30.3
H4	1038	22.2	25.4	29.9	32.0	32.6	32.6	31.7
H5	1073	20.6	23.8	28.3	30.4	31.0	31.0	29.1
H6	1112	19.9	23.1	27.6	29.7	30.3	30.3	29.5
H7	1126	19.5	22.7	27.2	29.3	29.9	29.9	29.0
H8	1128	20.2	23.4	27.9	30.0	30.6	30.6	29.8
H9	1175	19.6	22.8	27.1	29.2	29.8	29.8	28.9
H10	1212	20.5	23.7	28.2	30.3	30.9	30.9	30.0
H11	1216	20.2	23.5	28.0	30.1	30.7	30.7	29.8
H12	1310	16.8	20.0	24.6	26.7	27.3	27.3	26.6
H13	1365	17.5	20.7	25.2	27.3	27.9	27.9	27.0
H14	1381	15.9	19.1	23.6	25.7	26.3	26.3	25.4
H15	1451	15.1	18.3	22.8	24.9	25.5	25.5	24.6

[39] *ETSU-R-97, The Assessment & Rating of Noise from Wind Farms,* which was published in September 1996 by the 'Working Group on Noise from Wind Turbines, UK.

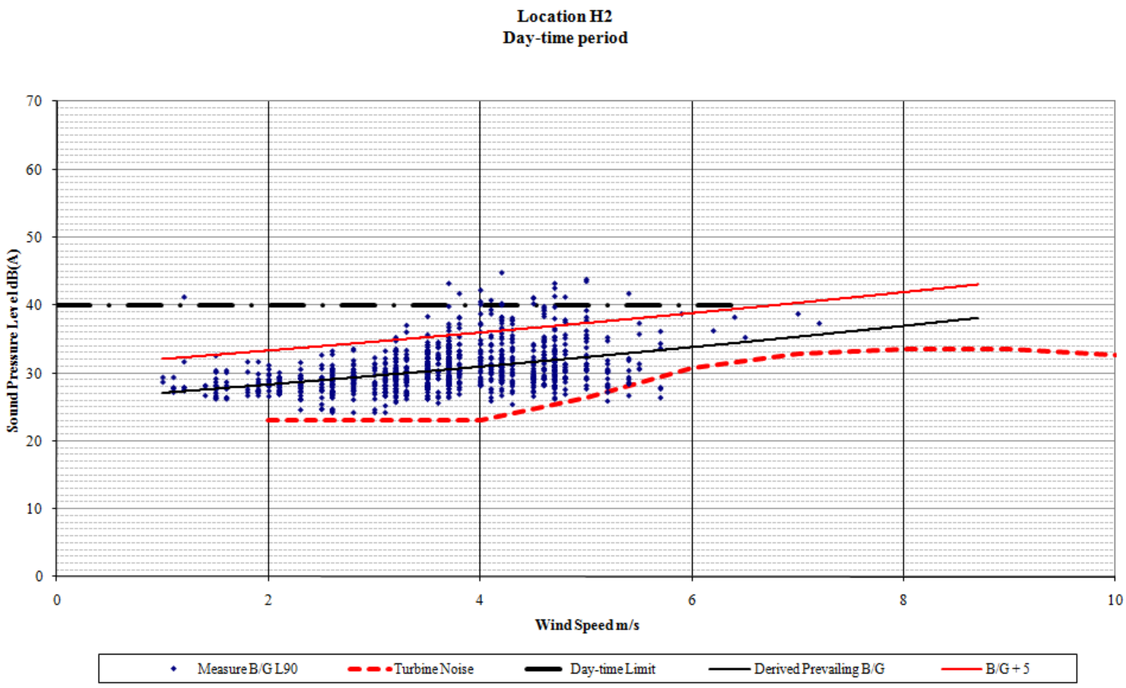


Figure 9.2: Graphical representation of $L_{A90,10\,min}$ versus wind speed and $L_{A90,10\,min}$ + 5dB and daytime criterion versus predicted turbine noise at House id H2

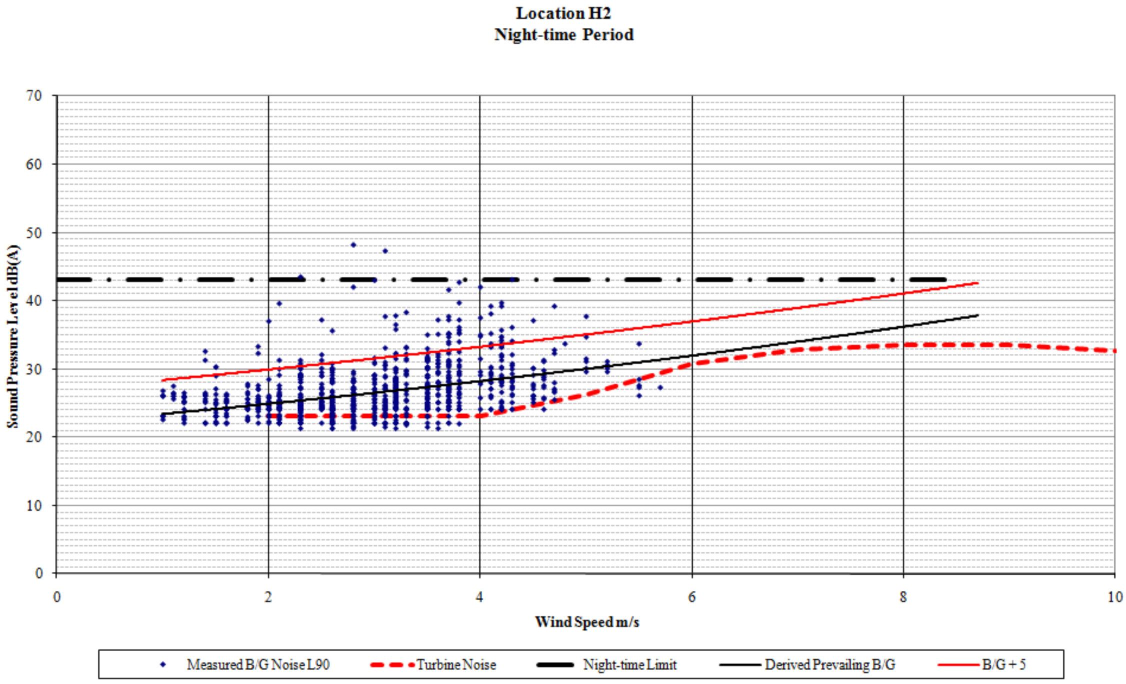


Figure 9.3: Graphical representation of $L_{A90,10\,min}$ versus wind speed and $L_{A90,10\,min}$ + 5dB and night-time criterion versus predicted turbine noise at House id H2

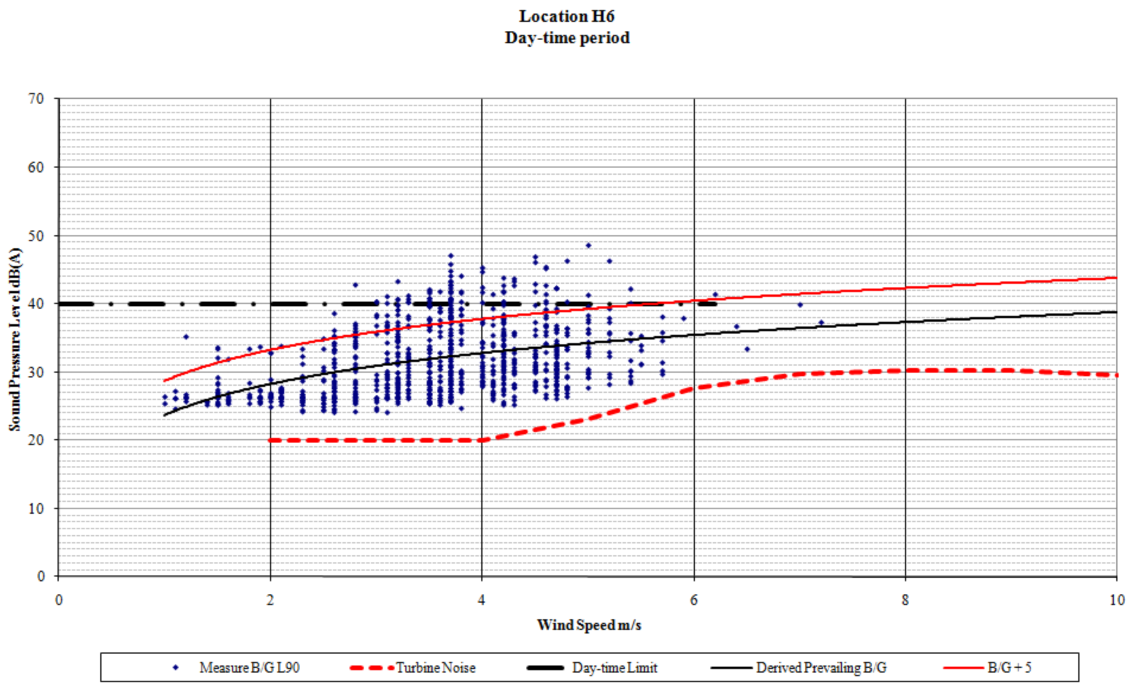


Figure 9.4: Graphical representation of $L_{A90,10\,min}$ versus wind speed and $L_{A90,10\,min}$ + 5dB and daytime criterion versus predicted turbine noise at House id 6

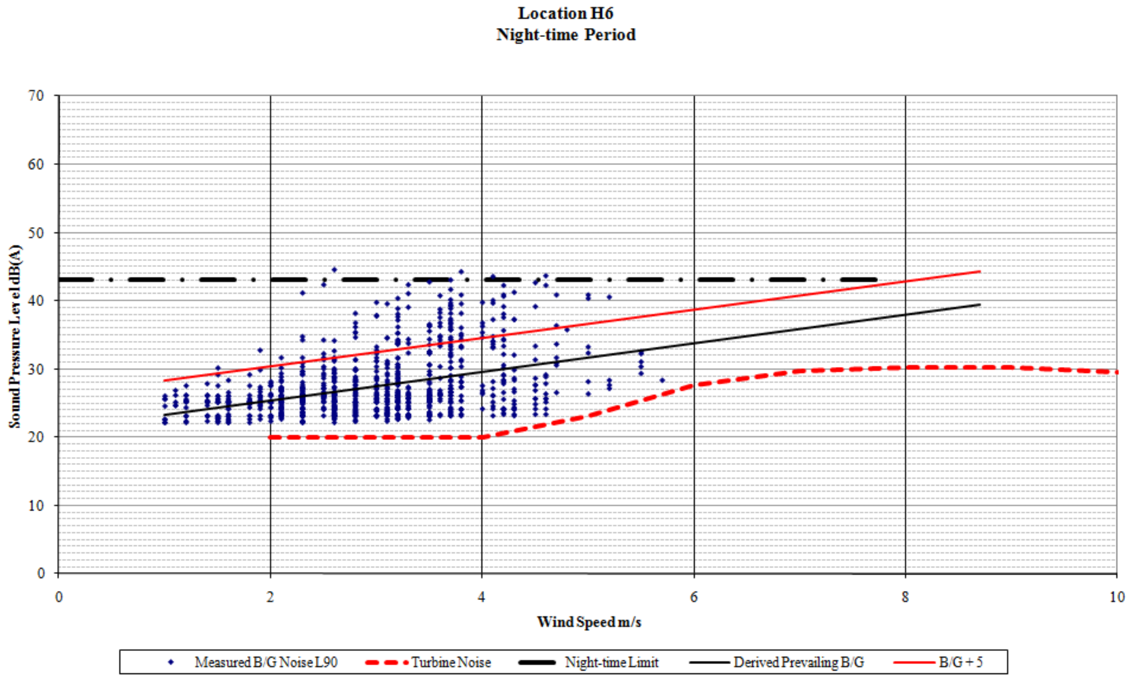


Figure 9.5: Graphical representation of $L_{A90,10\,min}$ versus wind speed and $L_{A90,10min}$ + 5 dB and night time criterion versus predicted turbine noise at House id H6

9.5.4.2 Noise Assessment

Table 9.5 and **9.6** gives a comparison of the predicted noise levels with the derived daytime and night time noise limits for example locations H2 and H6. The term ΔL is used to denote the difference between the predicted wind farm noise level and the recommended derived limit. A negative value indicates that the predicted noise level is within the limit. These tables are presented by way of example to demonstrate compliance with the limits (with the highest predicted noise level at resident H2).

A comparison of the predicted turbine noise levels at two residences H2 and H6 shows very good compliance with the daytime and night time noise limits, as recommended in the *Wind Energy Development Guidelines*. The predicted noise level is below the background + 5dBA derived limit, the 40 dBA daytime and the 43 dBA night time limit for low wind speeds.

Table 9.6: Comparison of predicted noise levels ($L_{A90,10min}$) and the noise criterion values that have been derived from a graphical representation of the background noise levels best-fit curve (daytime and night time) for H2

	Reference Wind Speed (V_{10}/m/s)				
	2	**4**	**6**	**8**	**10**
House id H2, Day Time					
Noise Limit, dB(A)	40.0	40.0	40.0	42.0	45.0
Predicted Wind Turbine Noise level, dB(A)	23.1	23.1	30.8	33.5	32.6
ΔL, dB(A)	-16.9	-16.9	-9.8	-8.5	-12.4
House id H2, Night Time					
Noise Limit, dB(A	43.0	43.0	43.0	43.0	46.0
Predicted Wind Turbine Noise, dB(A)	23.1	23.1	30.8	33.5	32.6
ΔL, dB(A)	-19.9	-19.9	-12.8	-9.5	-13.4

Table 9.7: Comparison of predicted noise levels ($L_{A90,10min}$) and the noise criterion values that have been derived from a graphical representation of the background noise levels best-fit curve (daytime and night time) for H6

	Reference Wind Speed (V_{10}/m/s)				
	2	**4**	**6**	**8**	**10**
House id H6, Day Time					
Noise Limit, dB(A)	40.0	40.0	40.0	42.0	44.0
Predicted Wind Turbine Noise level, dB(A)	19.9	19.9	27.6	30.3	21.5

	Reference Wind Speed (V_{10}/m/s)				
	2	**4**	**6**	**8**	**10**
ΔL, dB(A)	-20.1	-20.1	-32.4	-11.7	-22.5
House id H6, Night-time					
Noise Limit, dB(A)	43.0	43.0	43.0	43.0	47
Predicted Wind Turbine Noise level, dB(A)	19.9	19.9	27.6	30.3	29.5
ΔL, dB(A)	-23.1	-23.1	-15.4	-12.7	-17.5

A noise contour map for the proposed Derreenacrinnig West Wind Farm at a 10m height and a wind speed of 8m/s with the L_{90} dBA descriptor being used for the noise level is given in **Figure 9.6**. Such maps are useful for evaluating the noise *footprint* of a given development.

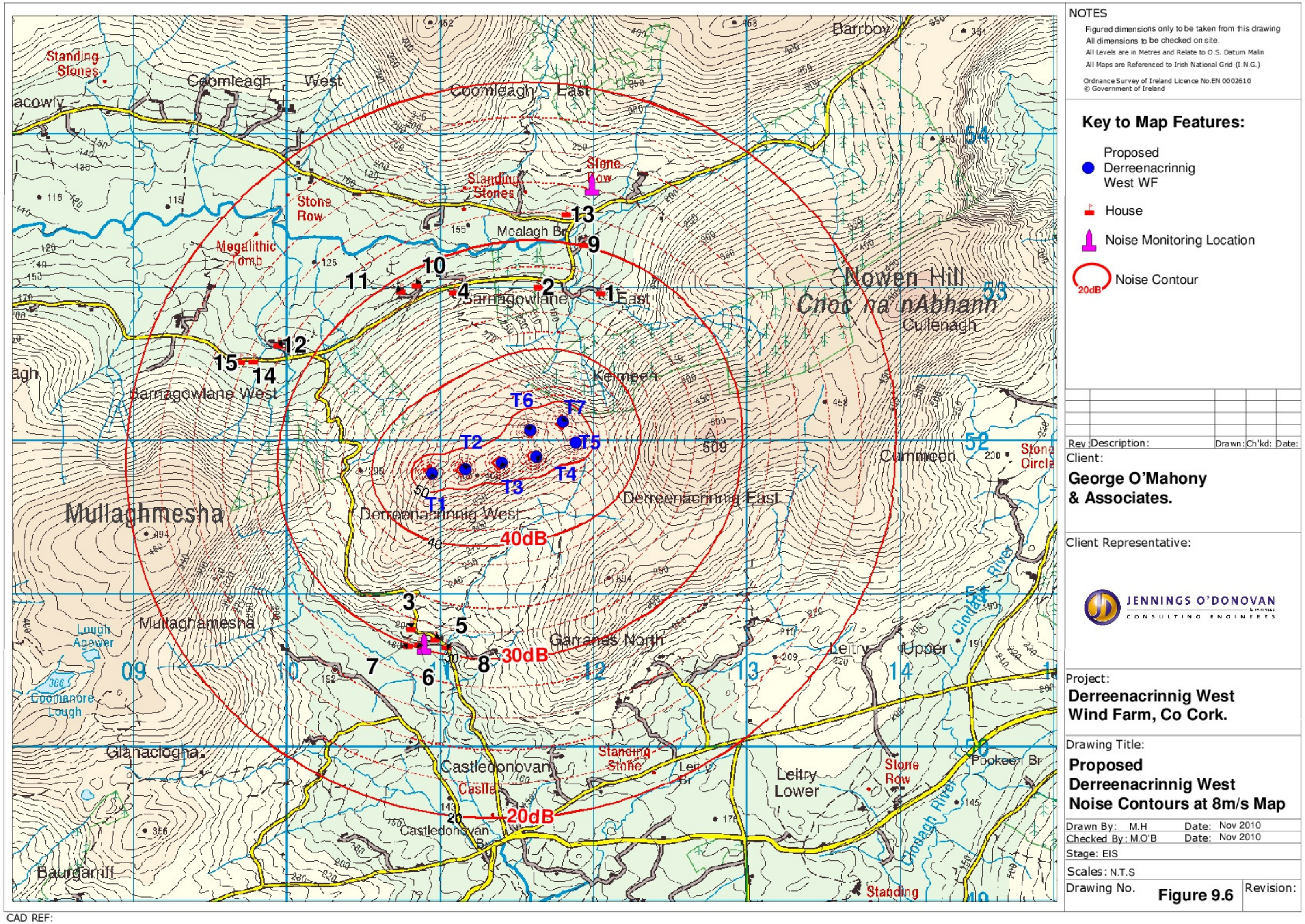


Figure 9.6: Proposed Derreenacrinnig West Noise Contours at 8m/s Map

Since the grant of planning in December 2012, an immaterial deviation was submitted to Cork Council for alternate wind turbine models which will result in a noise reduction from the previously consented wind turbine models. For ease of reference a table setting out the comparisons between the models is shown in **Table 9.7a.**

Table 9.7a: Comparative Turbine Models – Sound Power Levels

	Vestas V52	Enercon E44	Enercon E48
Wind Speed (Vs) in 10m Height	Sound Power Level [dB(A)]	Sound Power Level [dB(A)]	Sound Power Level [dB(A)]
4	94.0	*	89.2
5	97.2	*	93.7
6	101.7	*	97.9
7	103.8	101.1	100.7
8	104.2	102.6	101.7
9	104.2	103.0	102.5
10	103.3	103.0	102.5

*Sound power levels below 7m/s are not available for this turbine model.

Table 9.7b: Comparative Turbine Models – Sound Power Levels

	Vestas V52	Enercon E44	Enercon E48
Wind Speed (Vs) in 10m Height	Sound Power Level [dB(A)]	Sound Power Level [dB(A)]	Sound Power Level [dB(A)]
4	94.0	91.1	89.2
5	97.2	94.1	93.7
6	101.7	99.7	97.9
7	103.8	101.1	100.7

	Vestas V52	Enercon E44	Enercon E48
8	104.2	102.6	101.7
9	104.2	103.0	102.5
10	103.3	103.0	102.5

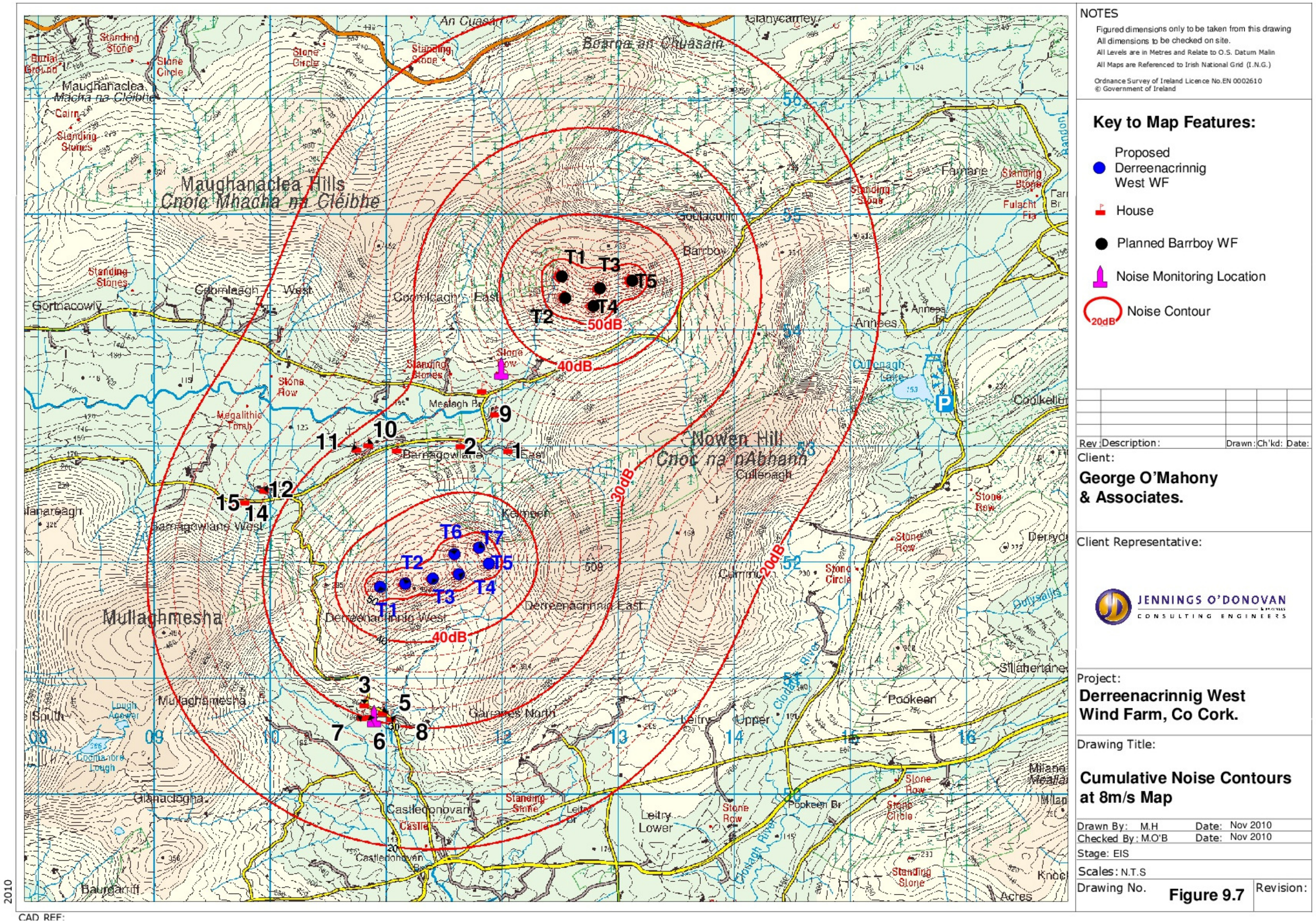


Figure 9.7: Cumulative Noise Contours at 8m/s Map

9.5.4.3 *Cumulative Wind Farm Effects*

The turbines to be installed in the permitted 5 turbine Barryboy Wind Farm 2.2 km to the north west of the site are Siemens SWT 1.3MW with a sound power level L_{WA} of 106db. The cumulative effects of all turbines (proposed and permitted) have been predicted using the Windfarm software. The predicted cumulative noise levels at the nearest houses are less than 1.5 dBA. **Table 9.8** gives the cumulative noise levels at a wind speed of 8 m/s expressed as $L_{90,\ 10\ min}$.

A noise contour map for the site for the site giving the cumulative noise effect (proposed Derreenacrinnig West Wind farm and the planned Barrboy Wind Farm) at a 10m height wind speed of 8m/s with the L_{90} dBA descriptor being used for the noise level is given in **Figure 9.7.**

Table 9.8: Predicted cumulative noise levels at a wind speed of 8 m/s expressed as $L_{90,\ 10\ min}$

House id	Predicted noise level at 8m/s wind speed	House id	Predicted noise level at 8m/s wind speed
H1	34.4	H9	33.5
H2	34.3	H10	31.3
H3	31.2	H11	31.1
H4	33.0	H12	27.4
H5	31.0	H13	33.4
H6	30.3	H14	26.4
H7	29.9	H15	25.6
H8	30.6		

9.5.4.4 *Assessment of Cumulative Effects*

The cumulative effects of the planned Barrboy Wind Farm will have no more than a marginal to negligible impact at all residences. The impact was assessed using a ‘worst case’ scenario where the predictions from both wind farms were made assuming downwind conditions. In practice for this assumption to be true (downwind at both wind farms) the wind direction would have to be in two different directions at the same time.

9.5.4.5 *Construction Noise*

Typical Construction Noise Levels

It is not possible to specify the precise noise levels emissions from the construction equipment until such time as a contractor is chosen and construction plant has been selected however, **Table 9.9** indicates typical construction related noise levels for this type of activity.

Table 9.9: Typical noise levels from construction works

Activity	L_{Aeq} at 10m
General Construction	70-84 dBA
Tracked excavator removing topsoil, subsoil for foundation	up to 87 dBA
Vibrating rollers	76-86 dBA

The construction activity at 900m from the operating point with attenuation by distance, ground absorption and air attenuation will result in typical noise levels of between 40 and 44 dB L_{Aeq} with maximum levels of 48 dB L_{Aeq} during intensive activity. The maximum levels will pertain for no longer than 2 weeks-equivalent at the nearest residence.

Maximum Permissible Construction Noise Levels

There are no national guidelines for construction noise, however limits for construction noise are generally set below 65 dB $L_{Aeq,1h}$ with no Sunday operations. The noise from the construction site will be kept well below the aforementioned targets.

Mitigation Measures for Construction Noise

All construction will be carried out in accordance with BS 5228-1: 2009 Code of Practice for Noise and Vibration Control on Construction and Open Sites: Noise. Accordingly, all construction traffic to be used on site should have effective well-maintained silencers. Operators of all mobile equipment will be instructed to avoid unnecessary revving of machinery. Where possible the contractor will be instructed to use the least noisy equipment. With efficient use of well-maintained mobile equipment, considerably lower noise levels than those predicted can be attained. The Project Engineer will closely supervise all construction activity. Construction activity due to its nature is a temporary activity and thus any impacts will be short term. All construction works will be carried out during the day-time period. Construction plant will be throttled down or turned off when not in productive use.

9.6 COMMENTARY

Examination of the results presented in **Table 9.5** and **9.6** reveal very good compliance with the limits as derived from the Wind Energy Development Guidelines. Furthermore, it has been the experience of this Consultant (from the monitoring of new constructed wind farms) that the measured noise levels are more than 4 dBA below predicted values.

9.7 MONITORING

When the wind turbine is commissioned a monitoring programme can be put in place to demonstrate compliance with the predicted values and limits specified.

9.8 LOW FREQUENCY NOISE AND VIBRATION

There is always low frequency noise present in an ambient quiet background. It is generated by natural sources such as wind, water flow in streams and rivers. There are also low frequency emissions from many sources found in modern life, such as household appliances (e.g washing machines), water flowing through pipes within your home and in water flow from municipal water supply. Vibration of elements of structures (low frequency) can be generated by local activity in one’s home by way of normal routine activity, like climbing stairs, closing doors etc.

The frequency range of audible noise is in the range of 20 to 20,000Hz and low frequency noise is generally from about 2 to 200Hz. Researchers such as Leventhall have studied low frequency noise, however, most of the research carried out in low frequency noise (and not alluded to by Leventhall) has been in the area of blasting (air overpressure) which falls into the same frequency range, although with considerable higher magnitude. There appears to be little or no agreement about the biological effects of low frequency noise on human health and there is evidence to suggest that there are no serious consequences to people health from infrasound exposure.

A study of low frequency noise (infrasound) and vibration around a modern wind farm was carried out for ETSU and reported in ETSU W/13/00392/REP – ‘*Low Frequency Noise and Vibration Measurements at a Modern Wind Farm’*. The results showed levels of infrasound to be below accepted thresholds of perception even on the wind farm site. Furthermore, a document prepared for the World Health Organisation, states that; *‘there is no reliable evidence that infrasound below the hearing threshold produce physiological or psychological effects.*

9.9 POTENTIAL IMPACTS OF THE PROPOSED GRID CONNECTION

The proposed development has the potential to cause noise nuisance issues at the residential dwellings along the proposed route. This effect will only occur during the estimated 4 to 6-month construction phase unless maintenance is required on sections of the cable during operation.

The construction phase has the greatest potential to cause noise nuisance to residents in the area along the underground cable route, both along the route itself and in the surrounding area. However, these will be of short duration. Noise will emanate from the transport of materials to and from progressing works as well as from plant and equipment excavating and laying the cable.

It is estimated that 2,325 trucks will travel to the works over the 4 to 6-month construction period. This equates to 15 trucks per day in a 7-month construction period. The plant to be used for the various planned works is outlined in the dedicated CMS in Appendix G but will generally consist of 1 no. tracked excavator and 1 no. tracked dumper or tractor and trailer per gang, with two separate gangs. The exact specifications of these are not yet known so the precise noise levels are not known.

Based on BS 5228 Noise control on construction and open sites, construction activities are likely to give rise to noise levels in excess of 45dB(A) up to 200 m from the works. Mitigation measures will be put in place to minimise nuisance to the residents in the area as necessary. It should be noted that any nuisance will be very short-term in nature as the works will progress along the route in 100m sections over the 4 to 6-month construction period.

Operational Phase

There will be no noise emitted from the operation of the cable. In the event that any maintenance or replacement of cable is required during operation then the effects will be short-term and similar to those of the construction phase.

Impacts from Vibration

There will be no blasting during the construction phase of the development. Some rock breaking activity may be required to install the cable ducts. Any rock breaking activity will be carried out in accordance with BS 5228 Noise Control on Construction and Open Sites and monitored to BS 7385 Evaluation and Measurement for Vibration in Buildings. Any rock breaking will be short-term in duration and will be limited to 8 mm/s peak particle velocity at occupied dwellings.

9.10 MITIGATION MEASURES

9.10.1 Construction Phase

Mitigation by Avoidance

No blasting will be carried out during construction. Heavy construction works such as excavation, rock breaking (if required), use of heavy machinery etc. will be carried out between 08:00 and 18:00 Monday to Friday and on Saturday between 08:00 and 13:00. Heavy construction will not take place on Sundays or Bank Holidays.

Mitigation by Reduction

Noise levels will be controlled in accordance with the principles of BS 5228:1984 Noise Control on Construction and Open Sites. Construction equipment will be maintained in accordance with the EC (Construction Plant and Equipment) (Permissible Noise Levels) Regulations 1988, SI 320 of 1988. Heavy equipment will be, where possible, enclosed, located away from sensitive sites and shut down when not in use.

Mitigation by Remediation

A documented complaints procedure will be put in place prior to commencement of works on site. If noise complaints arise, appropriate corrective action will be taken, and Cork County Council advised. Works will also be supervised by a Project Engineer in line with that specified for the Derreenacrinnig West Wind Farm.

Operational Phase Mitigation

There will be no noise impacts from the underground cable unless any maintenance and/or cable replacement works are needed. In this case, the same mitigation measures as outlined above for the construction phase will be implemented.

9.11 RESIDUAL IMPACTS OF THE DEVELOPMENT

With the implementation of the measures outlined it is unlikely there will be any significant negative effects from the proposed underground cable development. If any effects arise then they will be short-term as the works move progressively along the route.

9.12 CUMULATIVE AND IN-COMBINATION IMPACTS

There is potential for cumulative impacts with the Derreenacrinnig West Wind Farm during the construction phase if the works are undertaken at the same time in the area at the wind farm substation. However, any effect would be temporary in nature as the works on the proposed underground cable grid connection will move progressively over a distance of 13.178km from the consented Derreenacrinnig West Wind Farm substation to the Ballylicky 110kV substation.

There could also be an in-combination impact along sections of the route if any of the planned developments take place at the same time, though these will also be temporary in nature and unlikely to give rise to significant effects given the nature of the planned developments being mostly for dwelling house construction and extension etc.

The noise assessment undertaken for the EIS in 2010 stated that construction is short term and works will be carried out in daytime hours only and under the supervision of the Project Engineer. The operational noise assessment concluded that the 6 turbines would not exceed the criteria and all dwellings in the area are well below recommended levels.

9.13 CONCLUSION

The impact of the proposed wind turbines on the local environment has been assessed in line with the recommendations documented in the Department of the Environment, Heritage and Local Government recently published '*Wind Energy Development Guidelines'- Guidelines for Planning Authorities June 2006*. Noise levels have been predicted at the nearest residences and, at all of these, the predicted noise levels meet the requirements of the Wind Energy Development Guidelines for noise for both day and night-time. The noise impact at all residence should be negligible.

The cumulative effect of the permitted Barrboy wind farm [permission has now lapsed] should at maximum be no more than negligible to marginal and well within the requirements of the Wind Energy Development Guidelines for noise for both day and night-time.

The low frequency noise and vibration from the proposed wind farm operation is predicted to have a negligible impact on residents and on local properties.

With implementation of the mitigation measures outlined above (and additional mitigation as needed) it is unlikely that the proposed Grid Connection will have any significant effects in terms of noise and vibration.

10. SHADOW FLICKER & ELECTROMAGNETIC INTERFERENCE

10.1 INTRODUCTION

Jennings O'Donovan and Partners were commissioned on behalf of George O'Mahony and Associates, to carry out an assessment of shadow flicker effects of the proposed seven turbine Derreenacrinnig West Wind Farm on surrounding dwellings. This assessment addresses the potential cumulative impacts of the proposed Derreenacrinnig West Wind Farm and the planned Barrboy five turbine Wind Farm on the surrounding dwellings in terms of:

- Predicting and assessing the extent of shadow flicker experienced by all houses within 500m of the proposed turbines as recommended by the Wind Farm Planning Guidelines 2006. There are no houses within 500m of any of the proposed Derreenacrinnig West wind turbine and therefore the assessment range was increased to 2km. According to the Danish Wind Industry Association – "*If you are farther away from a wind turbine rotor than about 500-1000 meters, the rotor of a wind turbine will not appear to be chopping the light, but the turbine will be regarded as an object with the sun behind it. Therefore, it is generally not necessary to consider shadow casting at such distances*".

- Specifying mitigation measures, where deemed necessary.

Henceforth for the purposes of this chapter, the cumulative shadow flicker impacts of the above-mentioned wind farms will be referred to as "*the cumulative overall wind farm development*"

10.2 SHADOW FLICKER

Wind turbines, like other tall structures will cast a shadow on the neighbouring area when the sun is visible. Shadow flicker occurs under a special set of conditions when the sun passes behind the hub of a wind turbine and casts a shadow over neighbouring properties. When the blades rotate, shadows pass over the same point causing an effect called 'shadow flicker'. Shadow flicker effects occur in various situations: travelling by road through a tunnel or under overhanging trees (dappled shadow effects) or standing within the shadowed area of wind turbine blades.

Currently, only Germany has detailed guidelines on limits and conditions for shadow impact posed by wind farms. According to the German guidelines, the limit of the shadow is set by two factors:

- The angle of the sun over the horizon must be at least 3 degrees.

- The blade of the wind turbine must cover at least 20 % of the sun.

The maximum shadow impact permitted for a dwelling within ten rotor blade diameters of a wind farm according to the German guidelines is 30 hours per year of astronomical maximum shadow (worst case).

The proposed turbines for the site at Derreenacrinnig West will have a hub height of up to 55 m and a rotor diameter of up to 52 m, the turbine model to be used at the site has not been selected. The shadow flicker calculation in this report was based on the Vestas V52 wind turbine which has a hub height of 55m, a rotor blade diameter of 52m and an overall height of 81m. There are no houses within ten rotor (520m based on Vestas V52) diameters of the proposed Derreenacrinnig West Wind Farm and therefore it is expected that no shadow flicker of a significant nature will be caused on dwellings in the vicinity of Derreenacrinnig West Wind Farm. The closest house to the proposed Derreenacrinnig West Wind Farm is House 1 which is located 884 m north east of turbine 7.

Although there is no agreed standard for shadow flicker impact in Ireland, the Department of Environment, Heritage and Local Government in its Wind farm Planning Guidelines for Local Authorities considers shadow flicker not to be an issue beyond ten rotor diameters from a property. It is to be noted that there are no properties within ten rotor diameters (520 m) of any one of the proposed Derreenacrinnig West Wind Farm turbines. Considering this, the assessment range was increased to 1.5km in order to asses any minor shadow flicker effects experienced by houses. However, beyond ten rotor diameters (520m) effects are expected to be insignificant.

Shadow flicker within a house occurs if a wind turbine is close enough and of a specific orientation with the house. It will not happen where there is vegetation or other obstructions between the turbines and the house. It will not happen if windows facing a turbine are fitted with blinds or shutters. It will not happen if the sun is not shining brightly enough to cause shadows from a turbine. Shadow flicker is more often experienced as a minor short-term nuisance than as a health and safety issue.

The shadow-flicker frequency is related to the rotor speed and number of blades on the rotor. Most turbines operate at a rotor speed of between 10 – 25 revolutions per minute (RPM), which translates to a blade pass frequency of less than 1 Hz (less than 1 alternation per second). The turbine model selected for this shadow flicker analysis for the proposed Derreenacrinnig West Wind Farm operates at a rotor speed of 14-31.5 RPM. Health wise, such low frequencies are harmless. Frequencies higher than 3 Hz but below 10 Hz are widely used in discotheques and the Epilepsy Foundation has made a statement that frequencies below 10 Hz are not likely to trigger epilepsy seizures.

The distance and direction between the turbine and habitation or observer is of great significance because:

The duration of the shadow will be shorter the greater the distance. The shadow flicker effect will be reduced the further a dwelling is from an operating turbine. Shadow flicker effects may be experienced within ten blade diameters distance from the nearest turbine (i.e. within 520 m). Beyond this shadow flicker effects will not be significant.

The shadow flicker is more likely to occur on sunny winter days, when the sun is lower in the sky and shadows are then cast over a larger distance. Shadow flicker is more likely to take place where turbines are sited to the east, south east, west or south west of dwellings. The proposed Derreenacrinnig West Wind Farm turbines are sited to the south of eleven dwellings and to the north of four dwellings located within 1.5 km. These dwellings are likely to experience shadow flicker effects from the proposed Derreenacrinnig West Wind Farm because of their location in relation to the wind turbines.

Shadow flicker is generally not regulated explicitly by planning authorities. The Cork County Council Development Plan 2009 does not make any recommendations regarding limits in relation to shadow flicker. The Wind Farm Planning Guidelines 2006, requests that shadow flicker is taken into account when designing or selecting a wind farm site and that calculations to quantify the effect should be provided. Please see **Table 10.2: Shadow Flicker Calculations.**

10.1.1 Methodology

This assessment was based on the cumulative overall wind farm development which comprises the proposed Derreenacrinnig West Wind Farm and the planned Barrrboy Wind Farm. The seasonal timing and duration of this effect has been accurately calculated from the geometry of each machine, its orientation relative to nearby houses and the latitude of the potential site, using Windfarm© computer software. Any properties, which may potentially be affected, can be identified and the risk calculated.

The computerised model calculates a worst case scenario, providing the highest possible shadow flicker for each house in a situation where the sun is shining all day from sunrise to sunset, the turbines are always moving, the wind direction is always perpendicular to the line from the turbine to the sun, a person is always home to view the moving turbines, and there are no vegetation or structures in between the moving turbines blades and the receptor.

The shadow flicker analysis was completed for the cumulative overall wind farm development using Windfarm © software as outlined above. Co-ordinates taken in relation to the houses were taken approximately in the middle of the houses within 1.5 km of the proposed Derreenacrinnig West Wind Farm. The ground contours, the coordinates of the wind turbines, latitude, and seasonal fluctuation of daylight/night time, rotor diameter, and hub height of the cumulative overall wind farm development were input, and the calculations were run by the computer.

The software determines the times of year when the sun will be in line with the rotational components of the turbine, thereby casting intermittent shadows. The software outputs details of potential shadow flicker, in this case by day in the month, sun rise and sun set.

10.1.2 Shadow Flicker Analysis

As already outlined, fifteen shadow flicker receptors/houses were identified to be within 1.5 km of the nearest proposed turbine. All shadow flicker receptors were in closer proximity to the proposed Derreenacrinnig West turbines than the planned Barrboy Wind Farm. House locations are set out in **Table 10.1** and displayed in **Figure 10.1 – Shadow Flicker Receptors Map.**

Table 10.1: House Locations

House No.	Easting	Northing	Nearest Turbine	Distance to Turbine(m)
1	112048	52969	T7, Derreenacrinnig West Wind Turbine	884
2	111639	53011	T7, Derreenacrinnig West Wind Turbine	905
3	110810	50777	T1, Derreenacrinnig West Wind Turbine	1014
4	111089	52975	T6, Derreenacrinnig West Wind Turbine	1038
5	110966	50709	T1, Derreenacrinnig West Wind Turbine	1073
6	110860	50673	T1, Derreenacrinnig West Wind Turbine	1112
7	110789	50666	T1, Derreenacrinnig West Wind Turbine	1126
8	111039	50657	T1, Derreenacrinnig West Wind Turbine	1128

House No.	Easting	Northing	Nearest Turbine	Distance to Turbine(m)
9	111938	53287	T7, Derreenacrinnig West Wind Turbine	1175
10	110843	53021	T6, Derreenacrinnig West Wind Turbine	1212
11	110743	52981	T1, Derreenacrinnig West Wind Turbine	1216
12	109944	52626	T1, Derreenacrinnig West Wind Turbine	1310
13	111822	53485	T7, Derreenacrinnig West Wind Turbine	1365
14	109780	52523	T1, Derreenacrinnig West Wind Turbine	1381
15	109695	52519	T1, Derreenacrinnig West Wind Turbine	1451

Of the fifteen houses assessed for the impacts of shadow flicker only one house (H1) experiences over 30 hours per year of shadow flicker. However, because of the distance between the turbines and the house (over 520m), turbines will not appear to be chopping the light and will merely appear as an object with the sun behind it. The Danish Wind Industry Association states that "*If you are farther away from a wind turbine rotor than about 500-1000 meters, the rotor of a wind turbine will not appear to be chopping the light, but the turbine will be regarded as an object with the sun behind it. Therefore, it is generally not necessary to consider shadow casting at such distances*". Because of the insignificant effects of shadow flicker on the remaining fourteen houses only house 1 shadow flicker times have been considered in detail in this assessment. Detailed shadow flicker times of all the remaining houses can be viewed in **Appendix G.**

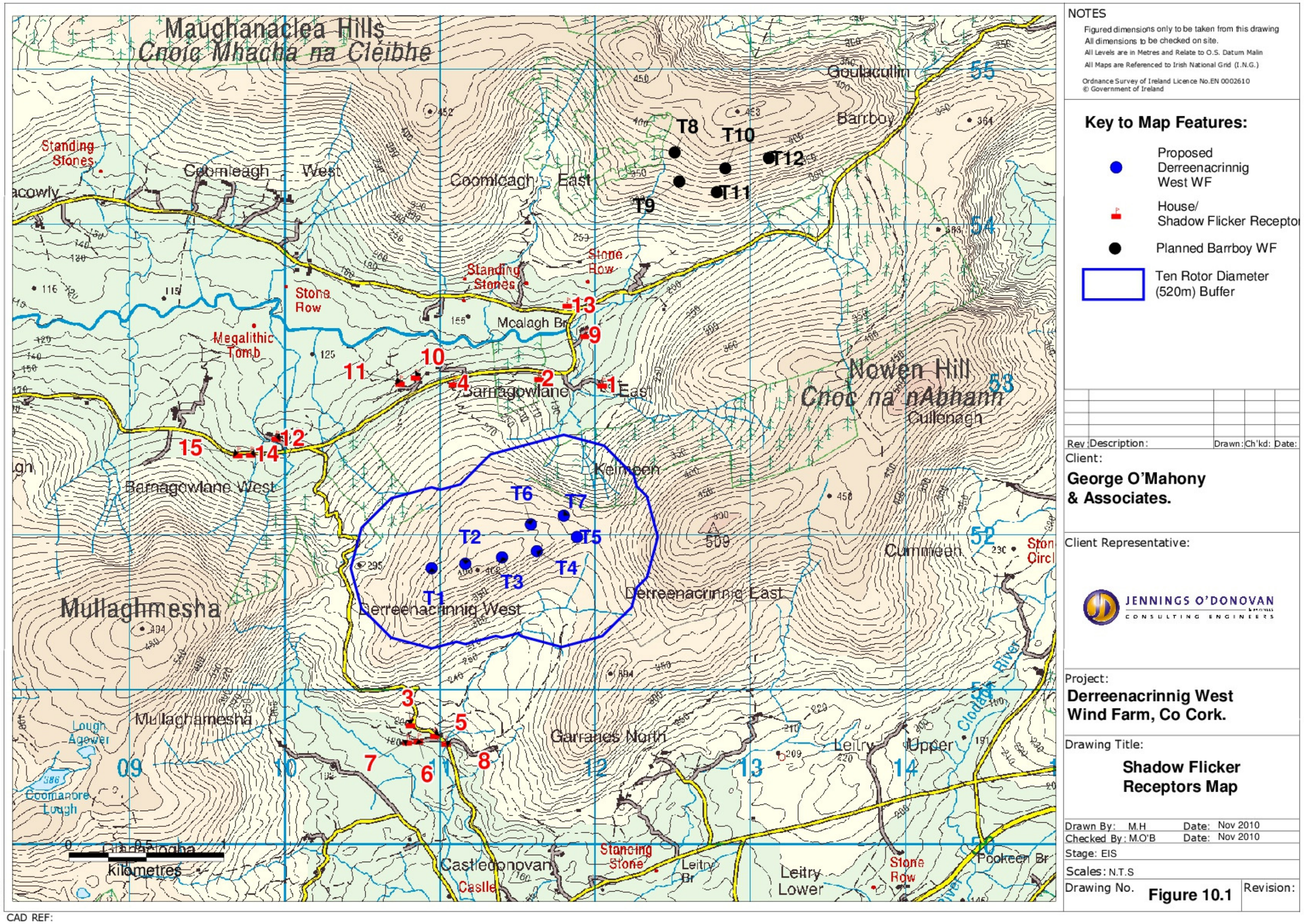


Figure 10.1: Shadow Flicker Receptors Map

10.1.3 Seasonal and Hourly Variation

Full details of the cumulative shadow flicker for each location can be found in **Appendix G**. A summary of these results is set out in **Table 10.2.** This table provides details on the maximum hours per day, the shadow days per year and the total hours per year in constant sunlight that shadow flicker is predicted to occur.

The times shown here do not include data on regional weather and are thus representative of a situation in which the sun is always shining (at every occurrence during these dates and times).

Table 10.2: Cumulative Shadow Flicker results for the overall cumulative wind farm development

House	Window	Description	Turbine	Days per year of Shadow Flicker	Max. Hours per day of Shadow Flicker	Mean Hours per day of Shadow Flicker	Total Hours Per Year	Ave Time Occurrence	Ave Month Occurrence
1	1	North Facing	-	0	0	0	0	-	-
1	2	East Facing		0	0	0	0	-	-
1	3	South Facing	1,2,3,4,6 & 7	69	0.64	0.50	34.2	15.30-15.35	Dec-Jan
1	4	West Facing	1,2,3,4,6 & 7	69	0.63	0.49	34.1	15.30-15.35	Dec-Jan

(Turbines 1-7 indicate Derreenacrinnig West Wind Farm and turbines 8-12 indicate Barrboy Wind Farm).

10.1.4 Mitigation Measures

The Shadow Flicker analysis presented is an indicative computer analysis that provides a measure of potential shadow flicker for the overall cumulative wind farm development. If the proposed Derreenacrinnig West Wind Farm is constructed and shadow flicker occurs in such a way that it is deemed to have an impact on the health and safety of nearby residents, mitigation measures could be put in place. To limit these effects, the developer would be responsible for implementing these mitigation measures, upon agreement with the landowners and/or house occupiers. This would involve pre-programming the turbine with dates and times when shadow flicker would cause a nuisance. A photo sensor cell would be used to monitor sunlight. The turbine would then be shut down, when the strength of the sun, wind speed and the angle and position of the sun combines to cause a flicker nuisance.

The proposed Derreenacrinnig West Wind Farm affects eight out of the fifteen houses within 1.5km of the proposed wind farm site. Barrboy Wind Farm site does not contribute to the shadow flicker hours experienced by houses within 1.5km of the proposed Derreenacrinnig

West Wind Farm site. Each of the houses experiences an average of 10 hours of shadow flicker from the Derreenacrinnig West Wind Farm development in a year. The overall cumulative shadow flicker effects account for 0.2% of the total hours of sunlight in a year (4439 hours).

10.2 ELECTROMAGNETIC INTERFERENCE

Jennings O’Donovan and Partners Consulting Engineers were commissioned on behalf of George O’Mahony & Associates to assess the potential effect of the proposed Derreenacrinnig West Wind Farm on electromagnetic transmissions in the area. Radio and television signals are the most likely to be affected and mobile telephone signals are also considered.

10.2.1 Existing Environment

RTÉ and UPC were consulted during the early stages of the EIA. UPC advised that they have no records of underground cable at or near the Derreenacrinnig West Wind Farm site. No response was issued by RTE.

Mobile phone operators Meteor, Vodafone and O2 were also canvassed for their opinions on the potential impact of wind turbines on the transmission of their signals in the area. No response was issued by Meteor or Vodafone. O2 did not predict any impact on their services from the proposed development. There is an existing telecommunications mast (ID:311) on the nearby Nowen Hill. The nearest turbine to the telecommunications tower is approximately 700m. This tower is operated by O2 and after consultation with O2 they have stated that this development should not have any negative impact on the mast or signals. No impact on the transmission network is predicted. (Reference **Appendix A.)**

10.2.2 Possible Sources of Electromagnetic Emissions from the Proposed Development

During the construction phase, there are likely to be several sources of electromagnetic emissions. Chief among these will be electrical power tools and electrical generators which may be brought on site before mains electricity is provided.

All these devices are required by Irish and European law to comply with the EMC Directive 89/336/EEC. Compliance with this directive will mean that the electromagnetic emissions from these devices will not cause interference to other equipment.

During the operation phase, there will be several sources of electromagnetic emissions. The generators themselves will produce 50Hz fields, but there is no reason to assume the levels of these (50Hz) fields will be excessively destructive.

The control electronics will be typical of any circuits used by industry or a conventional generating station. As with the construction phase, all electrical components, equipment, apparatus and systems are required by Irish and European law to comply with the EMC Directive 2004/108/EC. Compliance with this directive will mean that the electromagnetic emissions from these devices will not cause interference to other equipment.

10.2.3 Possible Impact of Electromagnetic Emissions on the Existing Environment

There are no sources of electromagnetic emissions of sufficient strength to have any impact on the environment during the construction phase.

The levels likely to be generated during the construction phase are well below those specified in the ICNIRP 1998 Guidelines on the limit of exposure to radio frequency electromagnetic fields and electric and magnetic fields at 50/60Hz and in the EU Council Recommendation 1999/519/EC.

As with the construction phase, during the operation phase all electrical components, equipment, apparatus and systems are required by Irish and European law to comply with the EMC Directive 2004/108/EC. Compliance with this directive will mean that the levels of electromagnetic emissions from these devices will be well below those specified in the ICNIRP 1998 Guidelines and in the EU Council Recommendation 1999/519/EC.

During the operation phase the proposed Derreenacrinnig West Wind Farm is not expected to cause any electromagnetic interference on the existing environment.

10.3 MITIGATION MEASURES

The proposed development should have only a minor negative effect on the existing electromagnetic conditions in the locality, therefore no mitigation measures have been identified.

10.4 CONCLUSIONS

The shadow flicker assessment found that the proposed Derreenacrinnig West Wind Farm will cause a flickering effect on all eight of fifteen houses assessed. These houses are expected to experience on average 10 hours a year of shadow flicker. House No.1 (Reference **Table 10.2**) experiences the most hours of Shadow Flicker (34.2hrs). House No. 1 is over 884 m from the proposed development; this is seventeen times the rotor diameter of the proposed turbines. According to the Wind Farm Planning Guidelines 2006 shadow flicker will not be an issue at more than ten times the rotor diameter of the turbines. This means that shadow flicker from the proposed Derreenacrinnig West Wind Turbines will have minimal effect on House No. 1.

As the analysis for the Derreenacrinnig West Wind Farm shows, shadow flicker typically occurs for a small period of time each day on houses 1,2,9,10,11,12,14 and 15. The given data provided a computerised worst-case estimate of shadow flicker, but is restricted in accuracy due to the following factors:

- The houses predicted to experience shadow flicker have outbuildings, landscaping or other intervening structures between the wind turbines and the house. This analysis has not taken any of these possible obstructions into account.
- Window orientations are likely to differ from the generic windows used in this analysis, which would be the main factor responsible for actual shadow flicker differing from that predicted in this analysis.
- The Danish Wind Energy Association has determined that actual shadow flicker is reduced by, on average, 63% of the worst-case results. This was estimated by taking into account the fact that the sun is not always shining, that the turbines are not always rotating and that there could be intervening structures or vegetation. Therefore, House 1, which has the highest predicted total hours per year, at 34.2 total hours per year, would in reality produce a shadow flicker of 12.6 total hours per year. This figure is below the recommended limit of 30 hours per year. This calculation does not take into account the hours when people are asleep or out of the house.

If the proposed Derreenacrinnig West Wind Farm is constructed and shadow flicker occurs in such a way as to be deemed an impact on health and safety, the developer would be responsible for pre-programming the turbine to shut down during the specific dates and times when shadow flicker would cause a nuisance.

During the operation phase the proposed Derreenacrinnig West Wind Farm is not expected to cause any electromagnetic interference on the existing environment. It is concluded that the proposed development will cause no major long-term negative impacts relating to Shadow Flicker or Electromagnetic Emissions.

11. LANDSCAPE AND VISUAL

11.1 INTRODUCTION

11.1.1 Background and Objectives

This section of the EIAR is concerned with the assessment of the Landscape and Visual effects of the proposed EIA Development. Planning permission is sought for the construction of a Grid Connection to connect the previously consented wind farm at Derreenacrinnig West Wind Farm to Ballylicky Substation. A full project description is set out in **Chapter 2 of this EIAR**.

This section of the EIAR sets out the potential Landscape and Visuals impact from the Gird Connection and the potential cumulative impact of the proposed development with the already consented wind farm project including all associated infrastructure. As well as this, the in-combination impacts of the project with other projects will also be assessed.

Extent of the Project Area

The project area comprises the extent of the proposed Grid Connection Route. The Grid Connection comprises 13.916 km. Substitute Consent is sought for 9.537 km of Overhead Lines as set out on Drawing No 4636-P-GCR-000-1 as shown in **Figure 1.2.**

Permitted Derreenacrinnig West Wind Farm

The study area of the consented Derreenacreenig West Wind Farm site is set out in the 2010 EIS and includes a radius of 15km from the consented wind farm sites.

11.2 METHODOLOGY FOR THE CONSENTED DERREENACRINNING WEST WIND FARM

The Landscape and Visual Assessment (LVA) as part of the 2010 EIS explores the potential effects of siting the proposed seven wind turbines at Derreenacrinnig West in County Cork. This Assessment takes into consideration the character and features of the landscape and concomitant views/viewers. Impacts are assessed under various headings. Full details and explanation of the methodology applied, and sources consulted for this assessment are described herein.

The proposed turbines for the site at Derreenacrinnig West will have a hub height of up to 81m and a rotor diameter of up to 52 m. While the likely turbine model to be used at the site will be Enercon E44/E48 which have height to blade top of up to 79.6m. The visual assessment was based on the Vestas V52 wind turbine which has a hub height of 55m, a rotor blade diameter of 52m and an overall height of 81m i.e. greater dimensions then the turbines. Accordingly, the worst-case scenario is considered.

There are unavoidable visual and landscape impacts associated with the proposed seven wind turbines at Derreenacrinnig West. Wind farms, of necessity, have visual effects on the landscape by virtue of the height and prominence of the turbines and their location in exposed and elevated locations. The form and characteristics of the existing landscape, the existing skyline, layout, design, number, and the size and colour of turbines all influence the visual impact of a wind farm. The visual impact in turn can affect the (character of the) landscape. The 2010 assessment for the wind farm was carried out using photomontages, wireframes and zones of theoretical visibility maps, which were prepared by Jennings O'Donovan & Partners Consulting Engineers. The assessment adopted the following methodology:

- *Compilation of data into map form and assessing plans, maps and topography*
- *Identification of key views of the site*
- *Production of topographical 3-dimension computer generated virtual wire frames for each selected viewpoint*
- *Field surveys and the collection of digital photographic images from selected viewpoints, located using a Geographical Positioning System (GPS) and compass*
- *Production of photomontages of the proposed wind farm for each selected viewpoint*
- *Generation of computer visuals to produce the Zones of Theoretical Visibility Maps (ZTVs)*
- *Background research including review of relevant landscape studies including Wind*
- *Farm Planning Guidelines, 2006 and the Cork County Development Plan 2009*
- *Delineation of landscape character, value and sensitivity, as referenced from the Cork County Development Plan 2009*
- *Collection of relevant data on all surrounding planned and operational wind farms in the area*

Estimation of visual and landscape impact is determined using both quantitative and qualitative factors. It comprises classifications of sensitivity of the landscape/receptor (including location and distance from the proposal); the visual presence of the turbines in the landscape; and then a determined overall landscape and visual significance impact.

Planning Policy Framework

Chapter 13 of the Cork County Development Plan 2014-2020 sets out details relating to Landscape views. There are a number of specific planning policies relating to landscape and visual impact. Further consideration is given to those landscape policies below.

Draft Landscape Strategy 2007

The Draft Landscape Strategy 2007 forms part of the Cork County Development Plan. The Landscape Character Assessment for County Cork was based on the methodology principles outlined by the 'The Landscape and Landscape Assessment Draft Guidelines for Planning Authorities', which was published by the Department of the Environment in 2000.

The 2006 Wind Energy Guidelines state that Landscape and Landscape Sensitivity is the key consideration in evaluating areas suitable for large scale windfarm developments. Therefore, in the preparation of this study, the Council utilised an evaluation of the landscape and its sensitivity for wind energy developments taking account of the Draft Landscape Strategy. Factors that can inform landscape sensitivity to wind energy development, include scenic quality, rarity, uniqueness and natural and cultural heritage considerations.

The Landscape Character Assessment describes in broad terms the 16 different Landscape Character Types identified for the County. Each of the 16 landscape types include an assessment methodology with three main stages/concepts: Landscape Character, Landscape Value and Landscape Sensitivity, see Maps 3-6 in Appendix 3.

Landscape and Visual Impacts; Scenic Routes and Scenic Landscapes

Certain parts of the County are designated as Scenic Landscapes and Scenic Routes in the Cork County Development Plan, 2014 -2020 as varied. Any wind farm development must have regard to the impact on same.

The DoEHLG (2006) 'Planning Guidelines for Wind Energy Development for Planning Authorities' (page 15) state that such designations: *"...would not automatically preclude an area from future wind energy development but the inclusion of such objectives in a development plan is a material factor that will be taken into consideration in the assessment of a planning application"*

<u>Landscape Analysis of the Consented Derreenacrinnig West Wind Farm site</u>

The Landscape and Visual Assessment carried out as part of the 2010 EIS was carried out in June 2010 through consultation with the Cork County Development Plan 2009 and having regard to the preservation of scenic routes and views

"Wind turbines are large machines and cannot be hidden in the landscape, but most parts of the countryside are managed and forever changing. Human activity has shaped the countryside for thousands of years. Wind farms can be designed to fit harmoniously into different types of landscape" Sustainable Energy Ireland.

Due to the nature of wind energy developments, there is potential for visual impact over a wide area. Visual impacts incorporate the extent of visibility, the distance of the view, the sensitivity of the viewers affected, the degree of visual impact and the effect on the character and quality of the views.

Scope of Study for Consented Derreenacrinnig West Wind Farm

The scope of the original study This Landscape and Visual Assessment explores the potential effects of siting a seven-turbine wind farm in the townland of Derreenacrinnig West, approximately 11 km west of Dunmanway, County Cork in regard to the character and features of the landscape and concomitant views/viewers. The assessment also takes into consideration the planned five turbine Barrboy Wind Farm, the existing ten turbine Kealkill Wind Farm, the existing five turbine Milane Hill Wind Farm, the existing five turbine Lahanaght Hill Wind Farm, the existing Currabwee Wind Farm, the existing four turbine Coomatallin Wind Farm and the existing thirteen turbine Ballybane Wind Farm.

In the original 2010 report, the baseline, (i.e. existing), quality of the receiving landscape is described in terms of its designated character, visual and scenic quality. Landscape character and sensitivity are appraised, and sensitive receptors and view shed reference points are identified, thirteen in total. Comment is made on the visual presence of the proposed development and the anticipated aesthetic impact on its landscape context. Consideration is given to reducing the significance of any predicted impacts and mitigation measures are considered accordingly.

The photomontages and wireframes were produced to provide indicative views of the existing and proposed development. A study area, measuring 15 km radius, centred on the location of the proposed development is predicted to be the area most affected by visual impacts from the wind farm was selected. Visual impacts received by receptors beyond 15 km from the development are not considered to be of significance.

Reference to this receiving environment aids judgment of the likely landscape and visual effects of the proposed Derreenacrinnig West Wind Farm on the surrounding area.

It is noted that visibility of turbines, although a visual impact, is not necessary an impact on landscape character. It is noted that visual impacts can be present without to the Landscape Character. This would be the case where turbines do not dominate the landscape or in the case where views in the direction of the turbines are not an important part of the landscape character.

ZTVs cannot give an accurate representation of the extent to which turbines will dominate the character of the landscape.

This analysis is computer-generated using Ordinance Survey Ireland digital mapping data, with grid points interpolated at 10 m intervals. Variations in landform, such as small hills less than 10 m wide, are also not accounted for. In reality, the actual views of the wind farm would be much more limited than the zone of theoretical visibility portrays. The assessment uses a range of 15 km radius from the wind farm centre.

Wind turbine dimensions used for the production of the Photomontages and Wireframe analysis from each view point were based on the maximum height above ground level of the wind turbines and with their rotor blades fully extended vertically, referred to as “blade tip height” (in this case 81m).

The photomontages and wireframes indicate a worst-case illustration of potential visual impacts. For example, where a turbine blade could potentially be visible, it may not be perceptible to the human eye due to distance, visual obstructions in the landscape or blend effects, existing man-made structures and changes in vegetation and screening over time. Comments are made in this text on visibility at each of the Viewshed Reference Points.

General Comments

The Irish landscape is a living and evolving environment, that has thus far accommodated the physical and spiritual needs of inhabitants, with the needs of nature, in a harmonious manner. There is interdependence between people and their landscape. Humans can harness the landscape for economic benefit with awareness of the contribution of that landscape to their quality of life. The Government has recognised this with the encouragement of the natural growth and development of rural communities. Decisions that affect landscape must be taken from an informed basis with comprehensive assessment landscape and visual impacts.

Landscape Description of Consented Wind Farm

The site is situated in the townland of Derreenacrinnig West, approximately 11km west of Dunmanway and approximately 5km north of Drimoleague. Please refer to Figure 2.1 - Site Location. The site ranges in elevations between 210 and 402 m OD (Malin Head) and is irregular in outline. The total area of the site is 123.1 hectares. The site is located in a mountainous area of predominantly exposed bedrock and upland blanket bog. Land uses at the site consist of grazing and forestry.

The DoEHLG Wind Farm Planning Guidelines 2006

The proposed Derreenacrinnig West Wind Farm in located in a landscape type that is classified as mountain moorland according to the Windfarm Planning Guidelines 2006. These landscapes are characterised by peaked ridged or rolling mountains and upland areas with steep sides.

Location: According to the Wind farm Planning Guidelines 2006. The proposed Derreenacrinnig West Wind Farm is located in a landscape defined as mountain moorland. The Guidelines state that it is "acceptable to locate wind energy developments on ridges and peaks". Turbine three is the most elevated of the seven proposed turbines for Derreenacrinnig West Wind Farm and is located at 398mOD. The most elevated peak at the site is 402 MOD.

Cumulative Effect: The Windfarm Planning Guidelines state that "the open expanse of such landscapes can absorb a number of wind energy developments" The Wind Farm Planning Guidelines say of varied and undulating landscapes such as the one of the proposed wind farm development that they have a "greater ability to absorb and screen wind energy developments. The aesthetic effect of wind energy developments in these landscapes is acceptable where each one is discrete, standing in relative isolation". Barryboy Wind Farm, Kealkill Wind Farm, Milane Hill Wind Farm, Lahanaght Hill Wind Farm, Currabwee Wind Farm, Coomatllin Wind Farm and Ballybane Wind Farm are all located 2km -14km form the proposed Derreenacrinnig West Wind Farm and stand in isolation from one another and from the proposed Derreenacrinnig West Wind Farm.

Landscape Character Assessment - Scenic Routes and Scenic Landscapes in County Cork

Cork County Council has designated areas of the county their unique scenic quality. These areas include scenic routes and scenic landscapes.

There are 118 designated scenic routes in County Cork. There are three scenic routes in the vicinity of the proposed S30 Scenic Route. The S30 scenic route is the closest of these routes and is located 2.4 km south of the nearest proposed Derreenacrinnig West wind turbine. Viewpoint 4 and Viewpoint 6 demonstrate how the proposed Derreenacrinnig West Wind Farm would appear from this route. The proposed wind farm is only visible from 3.4 km of this 34 km scenic route.

Road between Dunmanway and Coolkellure, Castledonovan and Bantry

This scenic route encompasses local roads between Dunmanway and Coolkellure, Castledonovan and Bantry and takes in views of hills, mountains, the Rivers Clodagh, Derreenacrinnig West Wind Farm, namely the S29, S30 and the S111.

Scenic Landscapes

Scenic Landscapes are areas of natural beauty identified by Cork County Council as having visual and scenic amenities. There are two scenic landscapes in the vicinity of the proposed wind farm site. The closest of which is located 3.6 km north of the proposed Derreenacrinnig West Wind Farm site. The S29 scenic route passes through this designated scenic landscape. This scenic landscape is designated for views of the Maughanaclea Hills and surrounding peaks as one passes through Cousane Gap. The second scenic landscape is located 4.7 km south of the proposed Derreenacrinnig West Wind Farm site. The River Ruagagh passes through this scenic landscape. The proposed Derreenacrinnig West Wind Farm is not visible from either of these scenic

As can be seen from the Zone of Theoretical Visibility Map in the accompanying "Landscape and Visual Assessment Figures", [**Appendix K**] that the site is visible from a number of areas within 15 km. Views towards the site were selected from a variety of directions to give a representative picture of how the proposed development may will appear from locations within the surrounding landscape. This assessment aimed to produce a mix of short- and long-range views.

11.3 THE PROPOSED GRID CONNECTION

11.3.1 Landscape Baseline

The proposed Grid Connection is shown on **Figure 11.1 - Site Location. The Grid Connection.** The proposed grid route from the wind farm is located for approximately 300m in the Broad Marginal Middleground and Lowland Basin Landscape Character Type (LCT) area, it then travels north for approximately 5.7km in the Ridged and Peaked Upland LCT and then turns east for approximately 7.1km within the Rugged Ridge Peninsulas LCT. Approximately 7km of the western section of the route from Ardrah to Ballylicky is within an area of 'High Value Landscape. [See **Figure 11.3**]. The existing Ballylicky Substation is approximately 680m East of the S111scenic route along the N71 from Glengariff to Ballylicky and on to Bantry Bay. The nature and scale of the grid connection works proposed is such that it can be accommodated in a landscape where there are existing overhead electricity lines, housing and forestry. This landscape is a working landscape capable of accommodating change.

The overhead grid connection is located within a Type Four Landscape Area which is classified as a "Rugged Ridge Peninsulas –Type 4.' In terms of visual impact, this is the only element of the planning application proposals which will have an impact in visual terms and this impact will be limited. The balance of the proposed Grid Connection is underground cables, located within the carriageway which will have an imperceptible impact on the landscape.

11.4 THE EXISTING GRID CONNECTION

An aerial overview of the existing grid connection is set out at Figure **11.1**. The grid connection traverses several different landscape character areas as shown in **Figures 11.**

Figure 11.1: Aerial photograph showing the landscape context of the Proposed Development Site and its immediate surrounds (Bing maps)

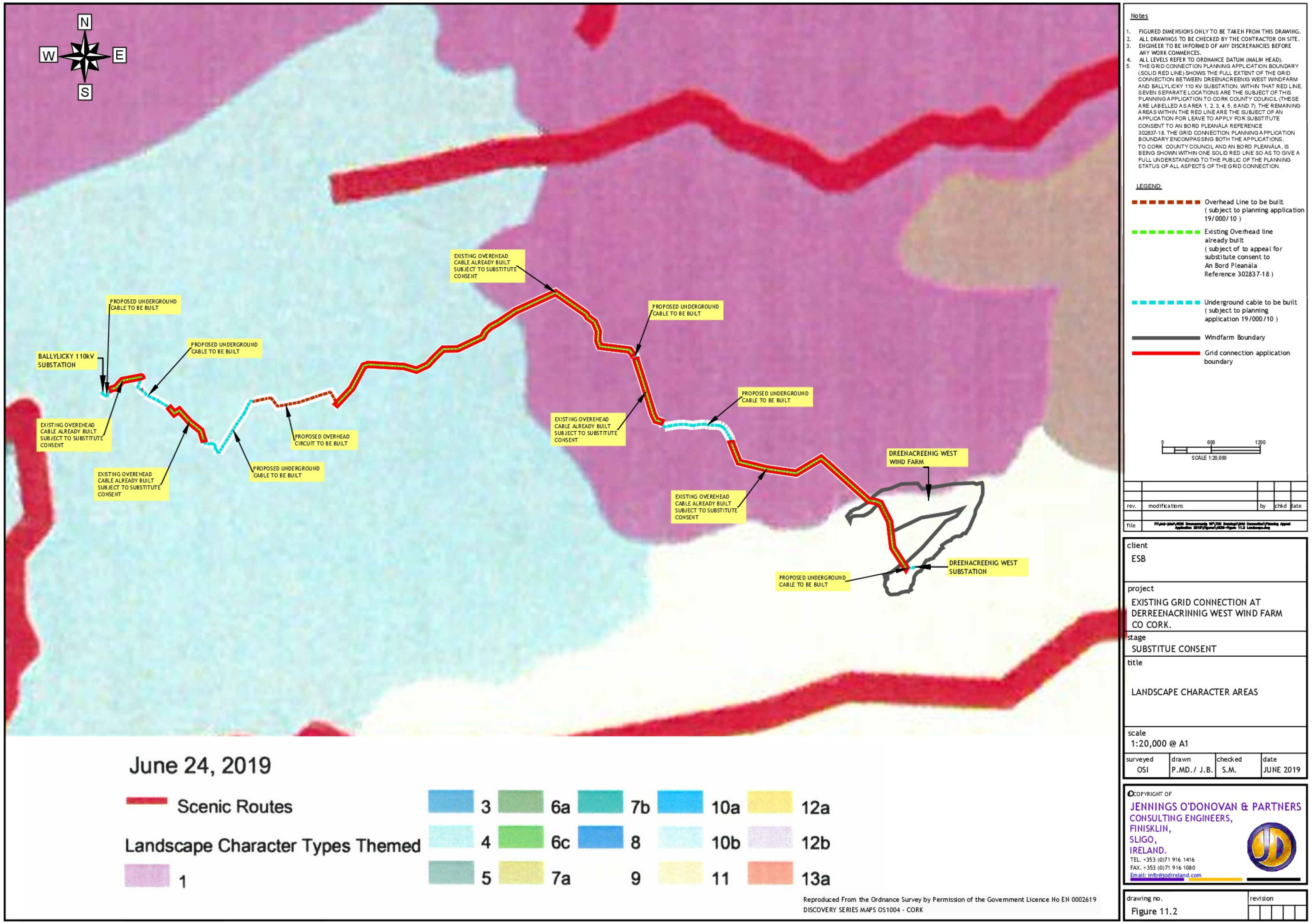


Figure 11.2 Extract from the Cork County Council Proposal Map showing Landscape Character Areas

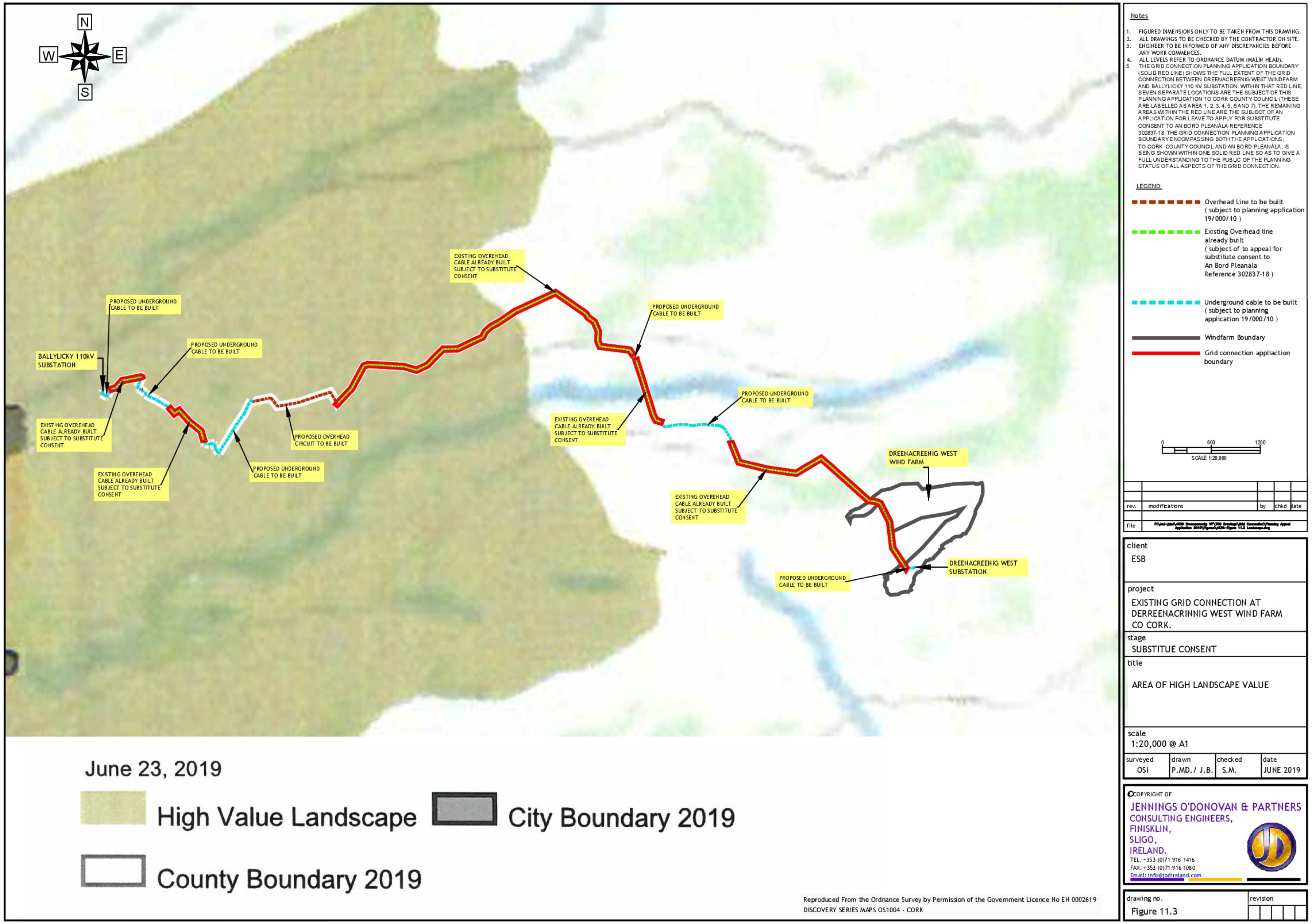


Figure 11.3 - Area of High Landscape Value

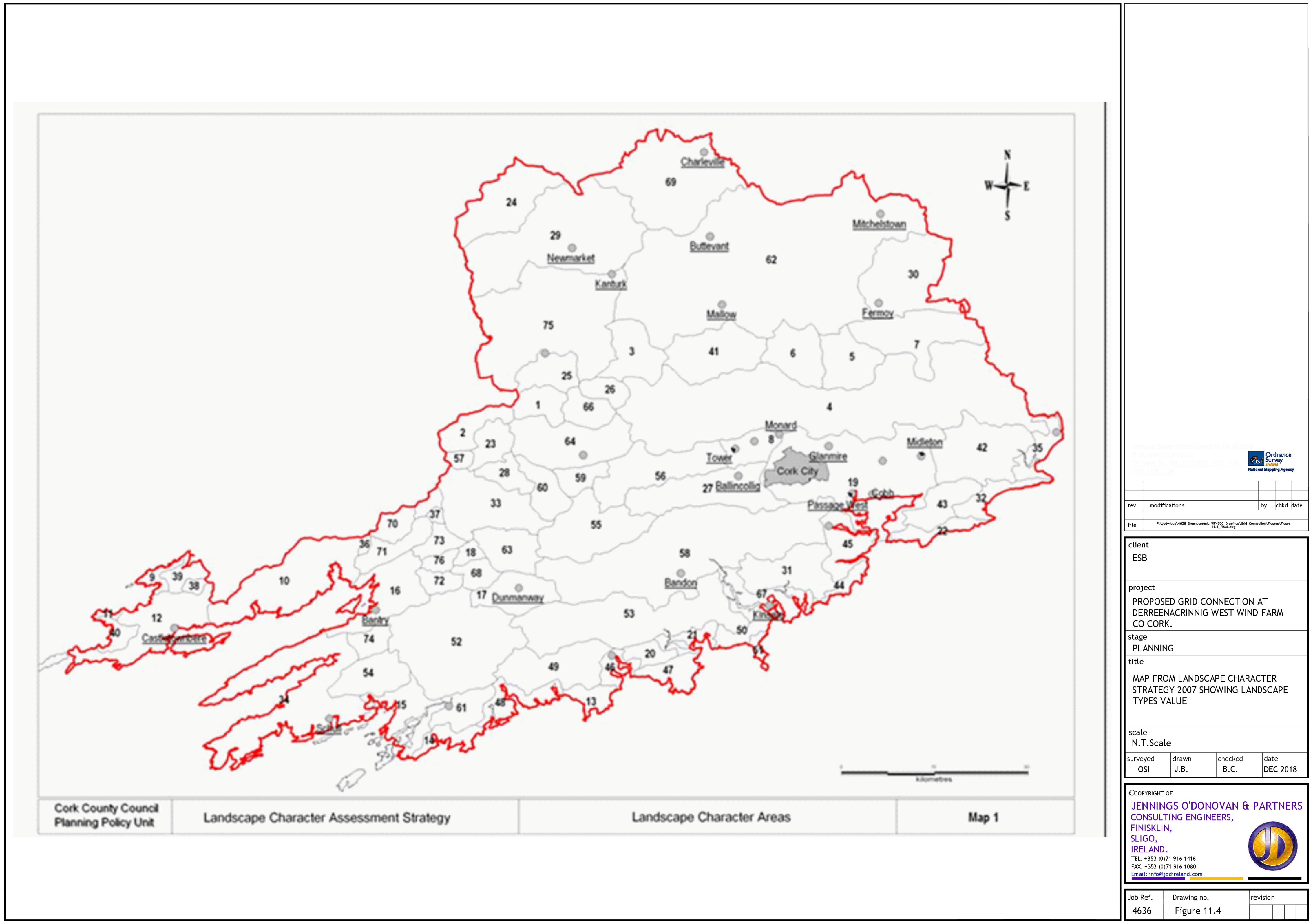
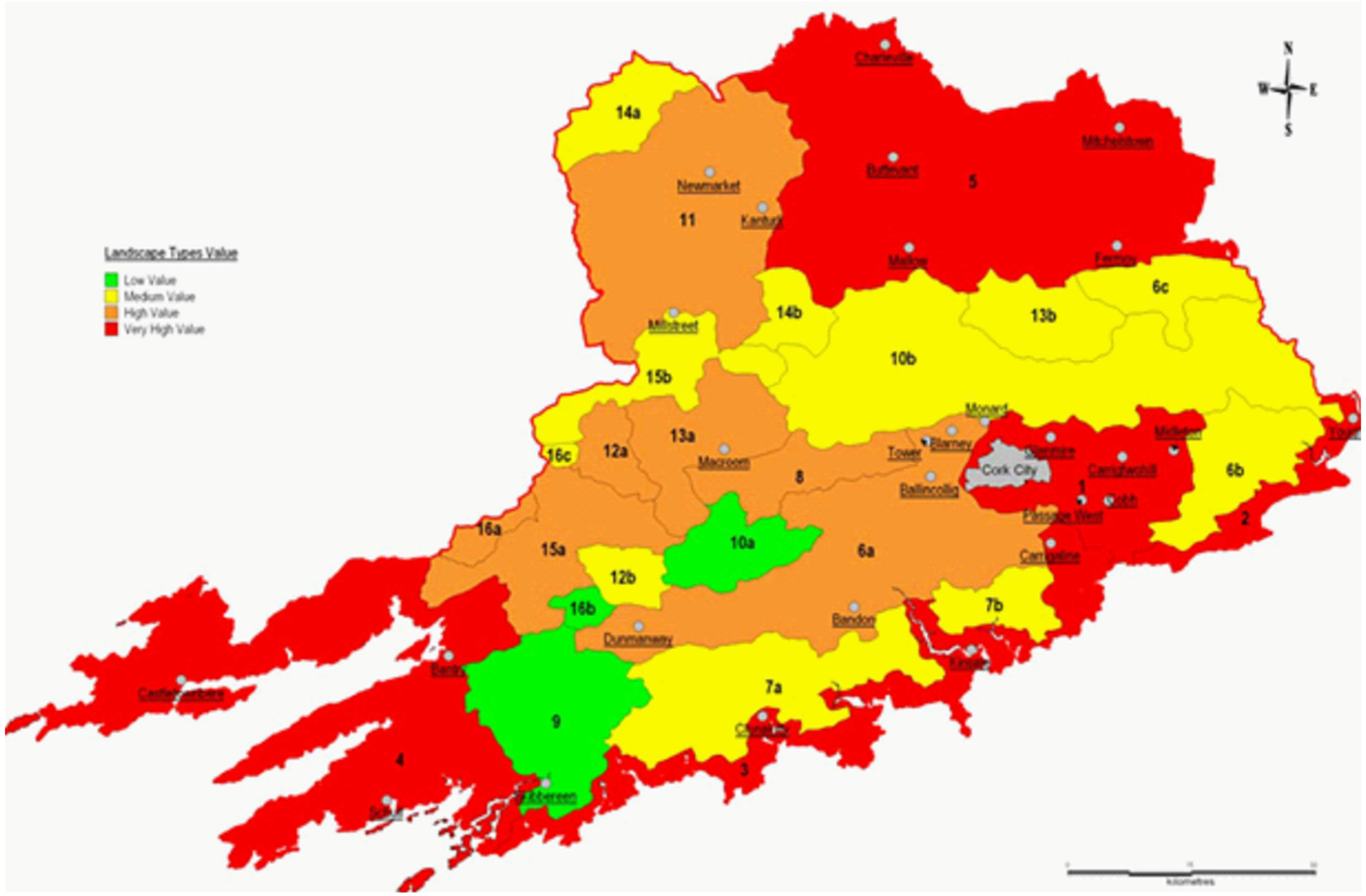


Figure 11.4 – Map from Landscape Character Strategy 2007 showing Landscape Types Value



rev.	modifications	by	chkd	date

client
ESB

project
PROPOSED GRID CONNECTION AT DERREENACRINNIG WEST WIND FARM CO CORK.

stage
PLANNING

title
MAP FROM LANDSCAPE CHARACTER STRATEGY 2007 SHOWING LANDSCAPE TYPES VALUE

scale
N.T.Scale

surveyed	drawn	checked	date
OSI	J.B.	B.C.	DEC 2018

JENNINGS O'DONOVAN & PARTNERS
CONSULTING ENGINEERS,
FINISKLIN,
SLIGO,
IRELAND.
TEL. +353 (0)71 916 1416
FAX. +353 (0)71 916 1080
Email: info@jodireland.com

Job Ref.	Drawing no.	revision
4636	Figure 11.5	

Figure 11.5 – Map from Landscape Character Strategy 2007 showing Landscape Types Value

11.4.1 Vegetation and Land Use

The vegetation and land use of the study area is almost as varied as the topography but is predominantly agricultural and public roadway along the Grid Connection route. These areas tend to consist of a combination of plantation forestry, marginal farmland and peatland.

The development proposals are not located within an Area of High Landscape Value which is the subject of this planning application. The overhead Grid Connection located within the townland of Shundrum is in an Area of High Landscape Value.

Part of the Grid Connection route is located within a Type 4 landscape designation *'Rugged Ridge Peninsulas'* The majority of the proposed Grid Connection is underground cables, located within the carriageway of the existing road network thus having an imperceptible impact on the landscape. The wind farm site itself is located within an area which is considered to be acceptable in principle in the County Wind Energy Strategy. [See Wind Energy Map – **Figure 3.5**]

With regard to the Grid Connection, planning policies **ED6:1 and ED6:2** from the CDP are applicable to the proposals in question.

Relevant Planning Policies from The Cork County Development Plan 2014-2020

ED 6-1: Electricity Network: "Support *and facilitate the sustainable development, upgrade and expansion of the electricity transmission grid, storage and distribution network infrastructure.*

Support the sustainable development of the grid including strategic energy corridors and distribution networks in the region to international standards.

Facilitate where practical and feasible infrastructure connections to wind farms and other renewable energy sources subject to normal proper planning considerations.

Proposals for development which would be likely to have a significant effect on nature conservation sites and/or habitats or species of high conservation value will only be approved if it can be ascertained, by means of an Appropriate Assessment or other ecological assessment, that the integrity of these sites will not be adversely affected."

The supporting text in paragraph 9.6.2 further states that "*The siting of overhead power lines can have a significant impact on the visual character of an area. Proposals for connections to renewable energy developments should where practical be fully assessed as part of the* *renewable energy application. When processing applications involving the siting of electricity powerlines and other overhead cables, the following should be considered:*

- *Avoid areas of high value landscape where practical;*
- *Avoid sites and areas of nature conservation and archaeological interest;*
- *Minimise their visual impact;*
- *Consider the use of underground technology in areas of special sensitivity where appropriate. The best option (underground or over ground) for each particular site will be chosen having regard to the particular conditions or sensitivities pertaining to the site."*

ED 6-2: Transmission Network: "*Proposals for new electricity transmission networks need to consider the feasibility of undergrounding or the use of alternative routes especially in landscape character areas that have been evaluated as being of high landscape sensitivity. This is to ensure that the provision of new transmission networks can be managed in terms of their physical and visual impact on both the natural and built environment and the conservation value of European sites.*

Proposals for development which would be likely to have a significant effect on nature conservation sites and/or habitats or species of high conservation value will only be approved if it can be ascertained, by means of an Appropriate Assessment or other ecological assessment, that the integrity of these sites will not be adversely affected."

Process of Change

The assessment also notes that the character of this part of the Landscape has undergone, and continues to undergo, significant visual change arising from construction of new and replacement dwellings, and changes to the frontages of properties, including construction of new drives, boundary walls and gates. Accordingly, the landscape character of the area cannot be described as static or unchanging. This process of change is illustrated by the photographic evidence set out in **Appendix K**.

Potential Impacts of The Consented Derreenacrinnig West Wind Farm Development

Wireframes and Photomontages were prepared for the thirteen selected Visual Reference Points (VRP) Each VRP is located within 14 km of the proposed Derreenacrinnig West Wind Farm site. The grid co-ordinates of the proposed Derreenacrinnig West Wind Farm seven turbines are set out in Tables 11.2.

Derreenacrinnig West Wind Farm was assessed from thirteen different viewpoint locations. The assessment of each viewpoint takes into consideration the viewsheds sensitivity rating and the potential dominance of the proposed Derreenacrinnig West Wind Farm on the landscape. There are six existing and one consented wind farm in the vicinity of Derreenacrinnig West Wind Farm and therefore the cumulative visual impacts have been considered as part of this assessment. Viewpoints and their associated wireframes and photomontages are presented in the accompanying ***"Landscape and Visual Assessment Figures***" and are displayed in **Appendix K**.

Existing and planned wind farms in the vicinity of the proposed wind farm that were incorporated into the cumulative visual assessment include the five turbine Barrboy Wind Farm, the seven turbine Currabwee Wind Farm, the nine turbine Milane Hill Wind Farm, the ten turbine Kealkill Wind Farm, the five turbine Lahanaght Hill Wind Farm, the four turbine Coomatallin Wind Farm and the thirteen turbine Ballybane Wind Farm.

Ongoing Landscape Changes

Ongoing human interaction with the environment and the landscape such as afforestation, deforestation and house building will mean that views and the landscape in the Derreenacrinnig West area are constantly changing regardless of the proposed Derreenacrinnig West Wind Farm development.

Demographic changes alter the character of the landscape such as the presence of empty and derelict buildings, indicating the outward movement of population and the loss of traditionally built structures. Continued infrastructure extension of the road network in the vicinity of the proposed development site may result in straightening, widening and increased signage on local secondary roads. This may have a cumulative impact resulting in the loss of roadside trees and hedgerows and impacts to the local landscape character.

Climate Change Impacts to the Landscape

It is important to highlight the impact of climatic change on the Irish countryside as predicted regularly in the media and government policy. Climate change impacts will have profound and extensive effects on the both natural and built environment, as well as commerce and human well-being generally. Climate change would result in more extreme weather patterns, which are likely to cause floods, coastal erosion and disruption of energy supply (among other impacts.) Countryside impacts could include damage to native woodland, threats to species range and native species, freshwater eutrophication, invasive species, pest survival, forest fires, flooding and hydrological system changes, less outdoor recreation due to higher rainfall, could result. These occurrences would have further resultant impacts on the landscape, the built environment and human ways of life.

The proposed wind farm will contribute to achieving policies established by government and international agreements to reduce global warming, carbon emissions and climatic changes created on the planet by due to human activities. The contribution to alleviating climatic change by the proposed wind farm can help positively in halting the predicted changes to Irelands countryside. This is a positive impact of the proposal.

11.4.1.1 **Cork County Draft Landscape Strategy (2007)**

Based on the Government's Draft Guidelines for Landscape and Landscape Assessment (2000), Cork County Council prepared a Draft Landscape Strategy in 2007. The Landscape Character Assessment (LCA) of County Cork established a set of 76 landscape character areas reflecting the complexity and diversity of the entire County. These have been amalgamated into a set of 16 landscape character types based on similarities evident within the various areas. The Draft Landscape Strategy for Cork County evaluated the sixteen different landscape types in terms of:

- Landscape Value - the environmental or cultural benefits, including services and functions, which are derived from various landscape attributes;
- Landscape Sensitivity - the measure of a landscape's ability to accommodate change or intervention without suffering unacceptable effects to its character and values; and
- Landscape Importance - importance of a landscape rated as Local Importance, County Importance or National Importance.

Landscape sensitivity is a measure of the ability of the landscape to accommodate change or intervention without suffering unacceptable effects to its character and values.

- Low sensitivity landscapes are robust landscapes which are tolerant to change, and which have the ability to accommodate development pressure.

- Medium sensitivity landscapes can accommodate development pressure but with limitations in the scale and magnitude. In this rank of sensitivity, landscape elements can accept some changes while others are more vulnerable to change.

- High sensitivity landscapes are vulnerable landscapes with the ability to accommodate limited development pressure. In this rank of sensitivity, landscape quality is at a high level and landscape elements are highly sensitive to certain types of change.

<u>Table 11.1:</u> Landscape Character Types which apply to the Proposed Grid Connection and consented Derreenacrinnig West Wind Farm

Landscape Character Type	Draft Landscape Strategy 2007
4	Summary: Rugged Ridge Peninsulas Landscape Value: Very High Landscape Sensitivity: Very High Landscape Importance: National *This landscape type is located in the extreme southwestern corner of Ireland. The predominant components of this landscape type include rocky peninsulas such as Mizen Head, Beara and Sheep's Head, separated by drowned valleys and relatively low-lying bays such as Bantry, Dunmanus and Roaringwater Bay. The high ridges and mountainous peaks of the peninsulas, such as Hungry Hill, are characterised by a jagged profile and include the occasional corrie lake and steep pass while others, notably on the Mizen Head peninsula, are more rounded with occasional rock outcrops and streams. The same variety and ruggedness characterise much of the shoreline, with rocky promontories and islands extending out into the sea. The sheltered recesses of the bay areas typically comprise flatter terrain extending inland and rising to low ridges and hills, including drumlins within Bantry Bay. Roaringwater Bay includes many small islands, including Shirkin Island, while Bantry Bay includes the notably larger Bere Island and Whiddy Island. The exceptional depth of Bantry Bay provides a natural harbour, which can accommodate large ocean– going tankards, while large metal cylinders are a significant feature in this coastal landscape.* *Typically, the rocky peninsulas comprise a mix of moorland, some relatively fertile patches of farmland and woodland including some smaller patches of coniferous plantations on higher ground. Fields of regular shape are more prevalent inland on the flatter ground but become more irregularly shaped and less fertile on the slopes of the surrounding hills, and include patches of bracken, rush and scrub as well as a mix of broadleaf hedgerows and coniferous shelterbelts.*

Landscape Character Type	**Draft Landscape Strategy 2007**
15a	Summary: Ridged and Peaked Upland Landscape Description The ridged, peaked and forested upland landscape type flanks much of the mid-western boundary of County Cork, from the vicinity of Bantry in the south to Millstreet in the north. This landscape type has been glaciated and comprises a fairly rugged and rolling mountainous topography at a relatively high elevation. The area around the Cousane Gap provides a good example of this landscape type which is inclined towards the rugged whereas the southern slopes of the Boggeragh Mountains further to the north in type 15B are a somewhat smoother example, thus adding to the openness of the moorland. These are often delineated by tight gorse hedgerows, walls, banks or post and wire fencing and punctuated by coniferous or broadleaf shelterbelts around small farmsteads. The landscape, with its rapid and steep rising and falling, seems to tumble down along the valleys. The rugged and diverse landcover, involving moorland, heath and scrub, lends a strong sense of the naturalistic. Urban settlements tend to be located on lower ground and include Ballingeary, Inchigeelagh.
9	Summary: Broad Marginal Middleground and Lowland Basin Landscape Value: Low Landscape Sensitivity: Medium Landscape Importance: Local **Landscape Description** A broad shallow basin serving the River Ilen and its tributaries enclosed by rugged ridges and rocky outcrops characterises this landscape in respect of landform. Contained by Mullaghmesha, Nowen Hill and Millane Hill to the north, Mount Kid to the west and Carrigfadda to the east, it falls gently

Landscape Character Type	Draft Landscape Strategy 2007
	southwards, gradually expanding its width in an east-west direction and southwards towards Skibbereen and ultimately beyond to the coastal fringe and the sea.

Photograph 1: View of northwest ridge in Derreenacrinnig West where the OHC commences

Photograph 2: View to west along proposed OHC route as it extends through Barnagowlane West townland

Photograph 3: View to west along Mealagh valley through which the constructed OHC extends

Photograph 4: View to northwest of constructed OHC in Maularaha townland

***Photograph 5: View south-westwards along the section of roadway in Shandrum Beg townland where underground cabling is proposed to extend*.**

Given the context of the grid connect within the landscape and surrounding existing ESB network, it is considered unlikely to be visually intrusive and therefore, there will be no significant impacts on the receiving environment.

Designated Scenic Routes and Views

Due to their identification in the County Development Plan this type of VRP location represents a general policy consensus on locations of high scenic value within the Study Area. These are commonly elevated, long distance, panoramic views and may or may not be mapped from precise locations. They are more likely to be experienced by static viewers who seek out or stop to take in such vistas.

Local Community Views

This type of VRP represents those people who live and/or work in the locality of the proposed EIA Development, usually within a 5 km radius of the site. Although the VRPs are generally located on local level roads, they also represent similar views that may be available from adjacent houses. The precise location of this VRP type is not critical; however, clear elevated views are preferred, particularly when closely associated with a cluster of houses and representing their primary views. Coverage of a range of viewing angles using several VRPs is necessary in order to sample the spectrum of views that would be available from surrounding dwellings.

Centres of Population

VRPs are selected at centres of population primarily due to the number of viewers that are likely to experience that view. The relevance of the settlement is based on the significance of its size in terms of the Study Area or its proximity to the site. The VRP may be selected from any location within the public domain that provides a clear view either within the settlement or in close proximity to it.

Major Routes

These include national and regional level roads and rail lines and are relevant VRP locations due to the number of viewers potentially impacted by the proposed development. The precise location of this category of VRP is not critical and might be chosen anywhere along the route that provides clear views towards the proposal site, but with a preference towards close and/or elevated views. Major routes typically provide views experienced whilst in motion and these may be fleeting and intermittent depending on screening by intervening vegetation or buildings.

Tourism, Recreational and Heritage Features

These views are often one and the same given that heritage locations can be important tourist and visitor destinations and amenity areas or walking routes are commonly designed to incorporate heritage features. Such locations or routes tend to be sensitive to development within the landscape as viewers are likely to be in a receptive frame of mind with respect to the landscape around them. The sensitivity of this type of visual receptor is strongly related to the number of visitors they might attract and, in the case of heritage features, whether these are discerning experts or lay tourists. Sensitivity is also heavily influenced by the experience of the viewer at a heritage site as distinct from simply the view of it. This is a complex phenomenon that is likely to be different for every site. Experiential considerations might relate to the sequential approach to a castle from the car park or the view from a hilltop monument reached after a demanding climb. It might also relate to the influence of contemporary features within a key view and whether these detract from a sense of past times. It must also be noted that the sensitivity rating attributed to a heritage feature for the purposes of a landscape and visual assessment is not synonymous with its importance to the Archaeological or Architectural Heritage record.

11.4.2 Cumulative Baseline

A search was conducted on the Cork County Council Planning portal within the townlands of the proposed 20kV grid connection in relation to permitted plans and projects that may have the potential to result in cumulative impacts have been undertaken. The searches revealed no additional large scale permitted projects that have the potential to result in likely significant cumulative impacts. Planning applications identified in the townlands and vicinity of the 20kV grid connection were small scale domestic or small scale agricultural, equestrian, electrical or retention applications. No large scale permitted developments were identified within the scope of the search, aside from Dreenacreenig West Wind Farm.

Table:11.2

Development	Planning Reference	Decision Date
Dreenacreenig West Wind Farm consisting of 7 no. turbines with a hub height up to 55 metres and a rotor diameter up to 52 metres	Cork County Council (CCC) Pl Ref: 10/857 An Bord Pleanála (ABP) (Ref. No.: PL 88.239767)	Decision to Grant Planning Permission by ABP (05/12/12)
Barrboy Wind Farm consisting of 5 turbines with a hub height 46m and a rotor diameter of 62m located approximately 2 km north east of the proposed	CCC Pl. Ref. 14143 & 025124	Decision on Extension of Duration Granted (16/04/2014). The application for this development included an appropriate assessment

Development	Planning Reference	Decision Date
Derreenacrinnig West Wind Farm site		screening which concluded that significant direct, indirect and in-combination impacts in light of the conservation objectives of the respective Natura 2000 sites were not likely to arise.
Coomanore North - Demolition of dwelling, construction of dwelling & erection of domestic wind turbine located approximately 3.5 km west of the proposed Derreenacrinnig West Wind Farm site	CCC Pl. Ref. 012687	Decision to Grant Planning Permission (26/02/2002)
1 no wind turbine of hub height 54.5m to serve the existing plastic factory (Brugmann Ltd) located approximately 3 south of Ballylickey.	CCC Pl. Ref. 16457 & 1147	Decision on Extension of Duration Granted (15/07/2016)
Erection of a 38kV overhead line from Glanta wind farm in Dromourneen to the 110kV ESB station in Ballylicky	CCC Pl Ref. 041990 ABP Pl 04.208577	Grant permission with revised conditions by An Bord Pleanála (10/01/2005)

Land Use

The environs of the proposed route are dominated by agriculture, with a small degree of commercial forestry. The eastern extent of the route traverses a more upland area with more unenclosed or unimproved grazing of sheep and drystock cattle rearing. The section in the lower Mealagh valley and the western extent of the route crosses more improved agricultural land with increased fertiliser usage, though stocking densities are unlikely to be very high.

The cumulative impacts in terms of neighbouring developments will be negated by the employment of a construction design to the highest standards, incorporating best practice methods. Considering this, significant effects on the environment are not likely, as outlined in the following sections.

The use of natural resources, in particular land, soil, water and biodiversity;

Overall the lands occurring within the route corridor range from local (low value) to national ecological value. All watercourses will be over sailed by the overhead line and no poles will be places within 25m of any watercourse transected by the route. No significant effects to watercourses are predicted. The grid connection will not result in significant disturbance to the hydrology of the wet heath habitat present along sections of the route due to the thin peats and will not undermine the functioning of this habitat in areas surrounding the excavation locations.

The overhead line will over-sail areas of gorse-dominated scrub at five locations along the route. There will be no disturbance or loss of this scrub habitat. The overhead line will skirt along the edge of wet willow woodland occurring in a meander of the Mealagh River in the townland of Ards Beg. The overhead line will over-sail the edge of the woodland at this location and will not result in any reduction to the footprint of the woodland. There will be no loss of linear hedgerows or treelines during the construction phase of the grid route. The construction of the elements of the proposed grid connection will not impact on the biodiversity of the region.

11.5 ASSESSMENT OF POTENTIAL EFFECTS

11.5.1 Do Nothing Impacts

The do-nothing scenario is an important aspect of the proposed EIA Development as there is an existing ‘live’ permission at this site to develop a 7-turbine wind farm (“the 2012 Permission”). Should this EIA Development not receive planning permission, the currently permitted wind farm (“the 2012 Permission”) cannot be expected to be constructed, as this is an essential part of the project. The proposed Grid Connection is required to allow the wind farm to become operational and transfer energy to the national grid.

11.5.2 Landscape Impacts

Landscape impacts are assessed on the basis landscape sensitivity weighed against the magnitude of physical landscape effects within the site and effects on landscape character within the wider landscape setting. This wider setting is considered in respect of the immediately surrounding landscape (<5 km) as well as the broader scale of the study area (5-20km).

11.5.2.1 Landscape Character, Value and Sensitivity

The landscape of the Proposed Development Site and its immediate surrounds is a varied one in terms of landscape character and the site is contained at something of a threshold between character types and this reflected in its location on the border between two LCAs in the Cork Draft Landscape Appraisal 2007.

11.5.2.2 **Magnitude of Landscape Impact**

The physical landscape as well as the character of the Proposed Development Site and its immediate surrounds is affected by the proposed turbines as well as ancillary development such as access and circulation roads and areas of hard standing for the turbines. By contrast, for the wider landscape of the study area, landscape impacts relate almost exclusively to the influence of the proposed turbines on landscape character.

It is considered that the proposed EIA Development will have a relatively minor physical impact on the landscape within the Proposed Development Site as none of the proposed development features have a significant ‘footprint’. The topography and land cover of the Proposed Development Site will remain largely unaltered with construction being limited to tracks, areas of hard standing for the turbines, a permanent meteorological mast as well as the substation and temporary site construction compound. Excavations will tie into existing ground levels and will be the minimum required for efficient working. Any temporary excavations or stockpiles of material will be re-graded to marry into existing site levels and reseeded appropriately in conjunction with advice from the project ecologist.

For most commercial wind energy developments, the greatest potential for landscape impacts to occur is as a result of the change in character of the immediate area due to the introduction of tall structures with moving components. Thus, wind turbines that may not have been a characteristic feature of the area become a new defining element of that landscape character. In this instance, wind turbines are a familiar feature of the wider area but by no means a defining characteristic. Nonetheless these developments ensure that the proposed EIA Development will not be a new and unfamiliar feature of its wider landscape setting. The effect, therefore, is one of intensification of an established land use type in this landscape and for wind energy development to become more of a defining feature of this predominantly rural landscape.

In terms of scale and function, the proposed EIA Development is well assimilated within the context of the central study area, which consists of a range of productive rural and industrial land uses within the hinterland setting of the Wind Farm Site and Proposed Grid Connection Rout. It is a working landscape and although the EIA Development represents a stronger human presence and level of built development than currently exists on the site, it will not detract significantly from its productive rural hinterland character.

Construction Phase Potential Visual and Landscape Impacts

Construction will result in physical impacts on the landscape for the excavation and construction of the new access tracks, turbine hardstands. Local visual impact of the Derreenacrinnig West Wind Farm site is likely to be most adverse during the construction phase and will decrease approaching the operational phase as the edges of hard stands and tracks are softened by the re-growth of vegetation and the turbines begin to function. The construction impacts on the landscape and visual amenities are therefore not permanent.

The visual and landscape impact of the operational development are also non-permanent, Associated with the 20 – 25-year operational lifetime of the development. At the end of this time the turbine structures can be deconstructed, removing any visual impacts that once resulted.

Site activity will be at its greatest during the construction phase due to the operation of machinery on site and movement of heavy vehicles to and from site. This phase will have a more significant impact on the character of the site, but it is a temporary impact that will cease as soon as the EIA Development is constructed and becomes operational.

It is important to note that in terms of duration, this EIA Development proposal represents a long term, but not permanent impact on the landscape and is reversible. The lifespan of the project is 25 years, after which time it is likely to be dismantled and the landscape reinstated to prevailing conditions. Within 2-3 years of decommissioning there would be little evidence that a wind farm or the proposed Grid Connection Route ever existed on the site.

The decommissioning phase will have similar temporary impacts as the construction phase with the movement of large turbine components away from the Proposed Development Site. There may be a minor loss of roadside and trackside vegetation that has grown during the operation phase of the development, but this can be reinstated upon completion of decommissioning. Areas of hard standing and access tracks that are of no further use will be reinstated and reseeded to blend with the prevailing surrounding land cover of the time. It is expected that the decommissioning phase would be completed within a period of approximately 6 months if the site roads and infrastructure are to be dug up and reinstated. This period will be significantly shorter if roads and hardstands are left in situ.

Impacts of the Grid Connection Route

In summary, there will be physical impacts on the land cover of the Proposed Development Site as a result of this EIA Development, but these will be relatively minor in the context of this modified rural hinterland. This scale of development can be comfortably assimilated into this landscape context without undue conflicts of scale with underlying landform and land use patterns or with the area for which it will form something of a backdrop when viewed from some locations. For these reasons the magnitude of the landscape impact is deemed to be **Medium-low** in the central study area (< c. 5 km) reducing to **low** and **negligible** at increasing distances beyond this threshold.

11.6 MITIGATION MEASURES AND RESIDUAL EFFECTS

Aside from construction stage mitigation measures to minimise the likes of land and vegetation disturbance, dust emissions and light spill, there is very little that can be done to mitigate the operational stage view of commercial scale wind turbines using on-site screening measures typically employed for other forms of development. Instead, landscape and visual mitigation measures must be incorporated into the siting and design of the development at an early stage. In the case of the EIA Development, the guidance provided in the 2006 Guidelines was the principal consideration. The relevant guidance for the landscape types that constitute the landscape and visual setting of the proposed EIA Development are discussed in detail in Section 11.3.4.1 above. It is considered that the proposed EIA Development is broadly in line with all of the recommendations from the 2006 Guidelines.

Opportunities to improve the landscape setting can be achieved, in part, through the creation and enhancement of hedgerows and the planting of new trees to reflect the existing character of the Proposed Development Site and its immediate environs.

The EIA Development that has been presented and assessed herein has embedded landscape and visual mitigation measures and thus, the appraisal of potential landscape and visual effects is equivalent to any appraisal of residual effects in this instance.

Some of the general mitigation measures that will be undertaken to make the development less intrusive and less eye catching on a localised level include;

- **Choice of Blade Arrangement** – The current industry standard of a three-blade rotor design, has been adopted in this design.
- **Tower Design** – The turbine towers are single tapering columns; these are considered more attractive than the lattice structures used in early American designs.
- **Turbine Colour** – The colour will be industry standard light grey semi-matt finish.
- **Sunlight Reflection** – The surface coating of the blades will be a semi-matt finish, which is designed to minimise the possible effect of flashing and glinting when rotating blades reflect direct sunlight.

- **Counter Rotation** – This occurs where blades on different turbines rotate in opposite directions and are considered to appear disordered. All turbines will only rotate in the same direction to ensure that counter rotating does not occur.

Despite the assumed successful implementation of the mitigation measures referred to above and in **Section 5: Biodiversity**, they are not considered to warrant an amendment to the significance of effect concluded as part of the assessment. Consequently, residual effects remain as those stated as pre mitigation.

11.6.1 Decommissioning Phase

The turbines are expected to be fully operational for up to 25 years. After this period, and if planning permission is not sought for an extension of this use at the site, the turbines and ancillary developments will be deconstructed and removed from the site. Waste materials will be disposed of by a licensed contractor and other recyclable materials will be transported by a waste recycling body or firm. Aspects of the ancillary site development including the site access roads may be retained in-situ. These may facilitate the use of the site for, as stated, suitable future rural development uses including animal grazing and husbandry, peat extraction, forestry works or recreational activities including walks and bridleways. Site reinstatement per se entails the reinstatement of the site vegetation through seeding and appropriate use of re-spread peat soils.

11.6.1.1 Decommissioning Phase Residual Impacts

The removal of the turbines will constitute the elimination of the main visually impacting factors of the development. Following their removal, visual impacts from the proposal would be **negligible**. The turbines would no longer be visible from any point in the receiving landscape.

11.7 STATEMENT OF SIGNIFICANCE

This LVIA has assessed the significance of potential effects of the EIA Development on the Landscape and visual setting of the Proposed Development Site. The EIA Development has been assessed as having the potential to result in effects of negative long-term effects in the range of **Moderate** to **Imperceptible**.

Potential cumulative effects were assessed as being negative in terms of quality and long term in duration, but of a **Low-negligible** magnitude due to the considerable separation distances involved.

Given that only effects of Substantial or Profound impact are considered “significant” in terms of the EIA Regulations, the potential effects of the EIA Development on the landscape and visual setting are not significant.

11.8 CONCLUSION

The selected viewpoints represent a variety of locations, directions, elevations and distances for observing the site. The photomontages, which show the wind farm in a “real” context, show that views can be both blocked and distracted by features in the foreground of a view, such as vegetation, houses, telephone and ESB poles and other landscape features.

The proposed Derreenacrinnig West Wind Farm will be visible from 26.16% of 15 km radius assessment range using the preferred turbine model with a hub height of 55m and a blade diameter of 52m (base to blade tip height of 81m).A zone of theoretical visibility was carried out for Option (A) 7 No. Nordex N90 2.3 MW turbines with a hub height of 80m and a blade diameter of 90m (Base to blade to tip height of 125 m). It was found that using a larger turbine model visibility would be increased by an additional 4%. Using a larger turbine would also not correspond to the adjacent wind farms in the area which utilise smaller turbines like the turbines proposed for Derreenacrinnig West Wind Farm.

11.9 BIBLIOGRAPHY & REFERENCE DOCUMENTS

This Landscape and Visual Impact Assessment also refers to or has reviewed the following guideline s and key documents:

1. Sitting and Designing Windfarms in the Landscape (Scottish Natural Heritage, 2009)
2. Visual Representation of Windfarms- Good Practice Guidelines (Scottish Natural Heritage, 2006)
3. Cork County Development Plan, 2009.
4. Guidelines for Landscape and Visual Impact Assessment (The Landscape Institute & Institute of Environmental Assessment & Management, 2nd ed.,2002)
5. Landscape Character Assessment Guidance for England and Scotland (Scottish Natural Heritage & The Countryside Agency, 2002)
6. Environmental Impact Assessment DCAN 10 (revised; Department of the Environment Planning Service, 1999)
7. Best Practice Guidelines for Wind Energy Development (British Wind Energy Association, 1994)
8. Planning Policy and Guidance
9. Planning Guidelines for Wind Farm Development (Department of the Environment, Heritage and Local Government, 2006)

10. Attitudes Towards the Development of Wind Farms in Ireland (Sustainable Energy Ireland, 2003)
11. Atlas of the Irish Rural Landscape (Aalen, F.H.A., Whelan, K. & Stout, M., 1997) ISBN 1 85918 0957

12. MATERIAL ASSETS

12.1 INTRODUCTION

12.1.1 Background

This chapter describes the potential impacts the proposed Derreenacrinnig West Wind Farm could have on physical material assets, including the following:

- Agriculture
- Natural Resources of Economic Value
- Road Network
- ESB Network
- Borrow Pit
- Forestry
- Telecommunications
- Air Traffic

For each topic a description of the existing environment is provided along with an analysis of what impact, if any, could be predicted and the mitigation measures that can be implemented to reduce or remove the impact.

12.2 RECEIVING ENVIRONMENT

12.2.1 Introduction

This section describes the regional and local agricultural practices as well as those specific to the site. A description of the effects, if any, that would arise from the proposed development of the wind farm is provided, along with mitigation measures designed to reduce or remove negative effects where possible.

12.2.2 Existing Environment

The location of the site, mountainous region predominantly covered in exposed bedrock and upland blanket bog. Blanket bog is unsuited to tillage crops because of its water retention, acidity and poor nutrient profile. The site is generally more suited to grazing and the higher areas only suited to sheep grazing.

The site of the proposed development has several characteristics that affect its suitability for agriculture as follows:

- The elevation of the site ranges from 200 to 402mOD; the site is exposed to the prevailing wind, making weather conditions unfavourable for crop growth.
- The site is situated within a landscape of mainly exposed bedrock and upland blanket bog.
- The prevalent weather pattern is wet and windy.

In general, the site consists of one distinct type of landscape and vegetation formation, namely exposed bedrock and upland blanket peat. A small amount of grazing is currently undertaken at the site.

12.2.3 Predicted Impacts

The total land take of the turbine foundations borrow pit and site roads is approximately 3.06 hectares from a total of a 123.2-hectare site. The effect of the proposed Derreenacrinnig West Wind Farm will be to remove less than 2.5 % of the total site area. It is expected that agricultural practices in the lands adjacent to the proposed Derreenacrinnig West Wind Farm will not change or experience any impacts resulting from the proposed development.

The proposed Grid Connection will be located in agricultural fields and within the road carriageway. There will be some areas of improved agricultural grassland through which the cable will run. However, it is intended to reinstate the ground to its original use after the cable is laid.

12.2.4 Mitigation Measures

No significant impacts are predicted on agricultural practices. Therefore, no mitigation measures are required.

12.2.5 Conclusion

No significant impacts are predicted on agricultural practices.

12.3 NATURAL RESOURCES OF ECONOMIC VALUE

12.3.1 Introduction

This section evaluates the effect on the natural resources of the site and also resources, which will be used in the locality during the construction phase. These resources include quarries, hydrocarbon fuels, precious metals etc.

12.3.2 Existing Environment

There are no known hydrocarbon fuel or precious metal resources within the site boundary. There is an existing borrow pit on site, this is located to the north of the site. This borrow pit was used to construct the existing road network on site. There are extensive conifer plantations to the north, north east, and north west of the site. The layout has been designed to minimise the amount of tree felling that will be required.

12.3.3 Predicted Impact

By the nature of this project, in that it is relatively non-invasive, no significant negative effect is predicted for the site or region. There may be some tree felling required and the expansion of the existing borrow pit which will be used for the extraction of rock for road and hardstand construction, but overall, no significant negative impact can be predicted as a result of this development. The impacts arising from the use of an on-site borrow pit are discussed further in section 12.6.

12.3.4 Mitigation Measures

As no negative impacts are predicted, no mitigation measures are required.

12.3.5 Conclusion

The impacts predicted on the natural resources in the area are low negligible.

12.4 ROAD NETWORK

12.4.1 Introduction

This section describes the proposed delivery traffic haul route to the site in terms of the national, regional and local road network. A description of the effects, if any, that would arise from the proposed development is provided along with mitigation measures designed to reduce or remove negative effects, where possible.

12.4.2 Proposed Haul Route

The assessment is based on the turbine components arriving in Ireland through the Port at Ringaskiddy and travelling from there to the proposed wind farm site. Delivery traffic will travel via the N28 and the N25 National Roads from Ringaskiddy, past Cork City as far as the roundabout in Bishopstown that joins the N25 and the N71. Here the traffic will turn left onto the N71 and travel through Inishannon as far as Bandon. In Bandon the traffic will turn right onto the R586 over the bridge and turn left, continuing along the R586. The traffic will then travel along R586 Regional road, through the town of Dunmanway, across the north of the square to Castle Street and on to the Regional road network. The traffic will follow Castle Street onto the L4609 for approximately 0.5km and turn left onto the Castledonovan Road (L4614-0). The traffic will follow this road for approximately 12km and turn right onto the local road to the site just before it reaches Castledonovan Bridge. The traffic will then follow this local road for approximately 1.6km before it reaches the site entrance. Please refer to Drawing 4636/TIA/01 for details of the haul route to site.

The routes for civil works construction traffic will be designated the same as that chosen for the turbine delivery traffic.

12.4.3 Existing Environment

The section of the proposed haul route between the Port of Ringaskiddy and Bandon Town will follow National Primary and National Secondary and Regional Roads. As such, it is not anticipated that any significant widening of or strengthening of roads will be required along these sections to drive vehicles along the haul route. This section of the route does not present any issues for the delivery of wind turbines.

In Bandon the traffic will turn right onto the R586 over the bridge and turn left, continuing along the R586 as far as Dunmanway Town. This section of road has been used to deliver turbines of similar dimensions, to the Milane Hill Wind Farm, before and does not present any issues for the delivery of turbines. Due to the one-way system in place in Dunmanway Town, a contra flow system will be required to allow long vehicles to navigate across the north of the square. Once past the square, vehicles will follow the route described above. There will be no road widening works required as far as Castledonovan as the road has a sufficient running width. The road will not need any improvement works either although there are two bridges in between the entrance to Milane Hill Wind Farm entrance and Casltedonovan that will require a structural assessment before any haulage takes place.

The proposed haul route turns right before Castledonovan Bridge towards the site entrance. Traffic will travel for approximately 1.6km along this road to the site entrance. The road has an average useful width of 3.2m along the majority of this stretch with an average verge width of 0.5m along both sides, some widening, strengthening and re-grading of the road will be required to accommodate delivery vehicles. The splay required at the junction of the L4614 and the local road to the site to accommodate the delivery vehicles is shown in Drawing 4636/TIA/003.

At least four telephone poles will have to be relocated as part of the road widening works. There is one small bridge to be crossed on the local road leading to the site. This bridge is 4.5m wide with a parapet approximately 0.8m high. The bridge is on a straight stretch of road therefore it may not need widening but a structural assessment will be undertaken prior to any haulage. A report will be issued to Cork County Council Roads Department outlining the structural condition of the bridge and a method statement outlining any required works prior to hauling the wind farm components. If works are required, then these will be discussed and agreed with Cork County Council prior to transporting turbine components.

12.4.4 Predicted Impact

The peak number of deliveries per day will occur during the period of turbine base construction when an estimated 43 concrete truck deliveries per day will be required. Some other materials may also be delivered on such days so that 11 – 13 deliveries per day are a realistic expectation of peak deliveries. On days when there is no turbine base construction there will be an average of 7 loads a day.

The majority of the haul route will follow National Primary and National Secondary Roads. As such, it is not anticipated that any widening or strengthening of roads will be required along these sections to drive vehicles along the haul route. Most of this haul route has been used to deliver turbines of similar dimensions to Milane Hill Wind Farm.

Furthermore, no significant widening or strengthening of the Regional Road Network will be required. Structural assessment will be required on two bridges on the road from Milane Hill Wind Farm site entrance to Castledonovan.

The Local Road leading up to the site will require widening, some strengthening and some minor re-grading. All local roads should be reassessed at turbine delivery stage.

12.4.5 Mitigation Measures

The developer will be required to lodge a bond with the local authority to offset the full cost of repair to the public roads used for access to the site. Should the local authority deem such a repair necessary the developer would be required to repair any damage to the roads that has arisen as part of the development pending more permanent repair after construction is complete. However, due to the high standard of roads on the haul route to the site, it is not expected that there will be any significant damage to the roads.

Other measures that should be undertaken to minimise road impact include:

- Any road works/modifications involving the public roads would be discussed and agreed with the roads section of Cork County Council prior to the commencement of the development.
- A structural assessment of all bridges and culverts on the local road should be carried out prior to commencement of construction. Smaller culverts can be temporarily strengthened by placing steel plates on the road surface to give a better distribution of vehicle loads.
- The condition of all bridges, culverts and road surfaces should be continuously monitored throughout the construction period. If any deterioration is observed,

appropriate remedial action should be agreed with the roads department of Cork County Council and completed as soon as practical.

- Prior to delivery of turbine components, any overhanging hedgerows should be cut back.
- Abnormal load permits shall be acquired by the turbine supplier prior to delivery, and where necessary, Garda escorts will be utilised to assist the delivery of the largest loads.
- Warning vehicles will be used for the delivery of all large turbine components.
- A trial run to the site with an empty turbine delivery vehicle should be carried out prior to the turbine delivery. Should the trial run highlight any problematic areas, the additional work required would then be discussed and agreed with Cork County Council.

12.4.6 Conclusion

It is concluded that the proposed haul route offers the least amount of disruption to local road users. The proposed haul route and any associated works and traffic management plans shall be discussed and agreed with Cork County Council prior to the commencement of construction.

12.5 PROPOSED GRID CONNECTION

12.5.1 Introduction

This section describes the proposed grid connection option. A description of the effects, if any, that would arise from the proposed Derreenacrinnig West Wind Farm development is provided along with mitigation measures designed to reduce or remove negative effects where possible.

12.5.2 Predicted Impact

The proposed Derreenacrinnig West Wind Farm will be connected to a 38kV substation. There is a substantial distribution network in the area. The Derreenacrinnig West substation will be linked to this distribution network, to an existing 38kV substation at Ballylicky Substation located approximately 13.920 km to the north west of the consented Derreenacrinnig West Wind Farm.

12.5.3 Mitigation Measures

As set out in Section 2- Project Description, the line route will be designed by ESB to ESB specifications. Within the site, all on site cabling will be underground so no impact is predicted within the landholding boundary.

12.5.4 Conclusion

There is a substantial distribution network in the area, and it is likely that the Derreenacrinnig West substation will be connected to this. Thus, it is considered that this proposed development will not create an unacceptable additional impact.

The project will indirectly, and in the long term, improve the standard of living in the region by virtue of providing a power supply platform on which to develop industrial sectors.

12.6 BORROW PIT

This section describes the exiting borrow pit on the site. A description of the effects, if any, that would be experienced from the expansion of the borrow pit is provided along with mitigation measures designed to reduce or remove negative effects, where possible.

12.6.1 Existing Environment

The majority of the site is underlain by the Gun Point Formation of the Old Red Sandstone Magnafacies. This formation is dominated by the green-grey sandstones and purple siltstones. The south of the site is underlain by the Castlehaven Formation, which is dominated by purple mudstone and siltstone. The very north of the site is underlain by the Toe Head Formation which is dominated by cross-bedded sandstones and purple siltstones with some mudstones. The site is mostly characterised by exposed bedrock; the remainder of the study area is mostly upland blanket peat ranging from depths of 0.1 m to 3.15 m. There is one area to the north of the site that has been previously used as a borrow pit.

12.6.2 Predicted Impacts

No significant negative impacts are predicted from the development if the mitigation measures below are put in place. Potential impacts include loss of habitat, release of suspended solids to surrounding water courses and short-term visual impact.

There are no slope stability issues where it is proposed to locate the borrow pit. There will be a direct loss of habitat during the construction phase as a result of the excavation of the borrow pits of approximately 0.32ha. There will be a short-term visual impact during the construction phase as there will be more bedrock exposed. This will not alter the landscape significantly as most of the site is already exposed bedrock. Both these impacts will be mitigated against by reinstating the borrow pit with excess peat from the construction phase. The potential hydrological impacts include the release of suspended solids and hydrocarbons into the surrounding water courses. These impacts should be avoided by establishing the drainage around and within the borrow pit prior to any excavation and the installation of an oil interceptor.

One significant positive impact is predicted in terms of traffic. It is anticipated that 952 delivery loads of hardcore will be required for the construction of roads, electrical compound and hardstandings for the proposed Derreenacrinnig West Wind Farm. By using the proposed on-site borrow pit and the material cut from the exposed bedrock; delivery traffic on the public road network would be reduced by 952 deliveries, resulting in a huge reduction in the traffic impact of the proposed wind farm.

12.6.3 Mitigation Measures

The borrow pit areas and extraction methodology should be reviewed by a geotechnical engineer prior to construction. Borrow Pit excavations have the potential to undermine the up-slope component of a peat and / or unstable subsoil slope. This should be sufficiently supported by buttress, frame or rampart to resist lateral slippage.

In the borrow pits pore water pressure should be kept low at all times and careful attention should be given to the existing drainage and how structures might affect it. In particular, ponding of water should not be allowed to occur in excavations. All deliberate or incidental sumps must be drained to carry water away from the sump following rainfall. Prior to excavation, drains should be established to effectively drain grounds before earthworks commence. Such drains should be positioned at an oblique angle to slope contours to provide for ground stability.

An oil interceptor will be located on the inner perimeter of the borrow pit drainage system to capture accidental hydrocarbon leaks from construction plant within the borrow pit. This is a precaution due to the expected intensity of plant operations within the borrow pit area. Blasting of bedrock will not be carried out in the borrow pit.

The Borrow Pits will be re-instated with excess spoil finished with layer of peat from the wind farm construction phase. This will allow for regeneration of the natural habitat. By using the uppermost layer (acrotelm layer < 0.3 m) from the excavated peat as the top layer of the re-instated peat, re-vegetation of the area should be accelerated which will also accelerate the stabilisation of the re-instated peat.

12.6.4 Conclusion

By using the proposed on-site borrow pit the environmental impact from this project will be greatly reduced for the following reasons:

The material cut from the exposed bedrock will reduce the delivery traffic on the public road network by 952 deliveries, resulting in a huge reduction in the traffic impact of the proposed wind farm.

Excess peat from the construction stage of the proposed Derreenacrinnig West Wind Farm can be used to reinstate the borrow pits.

The site's geochemistry will be maintained by using rock from within the site for the construction of roads and hardstanding areas.

12.7 TELECOMMUNICATIONS

Early consultation with O2 established that there was no potential impact on their networks. Vodafone, Meteor and RTÉ NL were consulted during the initial scoping phase of the project, no comment was issued. UPC communications confirmed that they have no concerns with the proposal. The written responses from the network operators can be seen in Appendix A of this report.

12.7.1 Existing Environment

There is an existing telecommunications tower on the nearby Nowen Hill. The nearest turbine to the telecommunications tower is approximately 700m. This tower is operated by O2 and after consultation with O2 they have stated that this development should not impact on their service in the area. The 2010 EIS set out details of consultation response [See **Appendix A –** 2010 EIS]

12.7.2 Predicted Impact

No impact is predicted in terms of telecommunications.

12.7.3 Mitigation Measures

No mitigation measures are required.

12.7.4 Conclusion

No impact is predicted in terms of telecommunications. Electromagnetic interference is discussed in more detail in Chapter 10

12.8 FORESTRY

This section describes the forestry resource and practices on the site. A description of the effects, if any, that would be experienced from the development of the proposal is provided along with mitigation measures designed to reduce or remove negative effects, where possible.

12.8.1 Existing Environment

There is an existing conifer plantation covering the north and the north east of the site. This area of forestry covers 35.9 ha, just under 30% of the total 123 ha landholding. There are also conifer plantations in the fields immediately to the north of the site.

12.8.2 Predicted Impacts

There will be an impact on the current forestry activities on site. There are no turbines situated within the afforested area, however, the proposed borrow pit is within the afforested area and the existing site roads within that area will need to be widened to allow access for construction vehicles. Harvesting was carried out prior to Construction. There will be no impact on the forested areas adjacent to the site.

12.8.3 Mitigation Measures

Mitigation by avoidance was used by the design team when completing the layout for the proposed Derreenacrinnig West Wind Farm. No turbines were located in the afforested areas; this reduced the number of trees to be felled. No other mitigation measures are required as the forest is of low ecological value; see Chapter 5: Flora and Fauna.

12.8.4 Conclusion

The proposed development will impact slightly on forestry activities on site as there will be a number of trees felled. However, forestry activities will be able to continue during the construction and operational phase of this development. There will be no impact on forestry activities in lands adjacent to the proposed development.

12.9 AIR NAVIGATION

12.9.1 Introduction

Any tall object, particularly on an elevated site has the potential to affect air traffic. The wind turbine heights selected for the proposed Dereenacrinnig West Wind Farm are 81m metres above ground level.

12.9.2 Existing Environment

There are two airports equidistance from the proposed Derreenacrinnig West Wind Farm; one is Farranfore, which is situated approximately 54 km north west of the site. Cork Airport is situated 55 km east of the proposed Derreenacrinnig West Wind Farm site.

12.9.3 Predicted Impact

A consultation exercise was undertaken with the Irish Aviation Authority (IAA) and Cork Airport. The IAA stated that the proposed Derreenacrinnig Wind Farm would have no negative impact on aviation. Cork Airport had no comment to make on the proposed development. Their response is included in Appendix A of the 2010 EIS report.

12.9.4 Mitigation Measures

Although no significant impacts are predicted, it is standard policy of the IAA Safety Regulation Division to request an Obstruction Survey for wind farms. This survey is designed to collate data on the height, latitude, longitude, elevation and dimensions of any structures or feature that the IAA deems necessary. An Obstruction Survey will be undertaken at the pre-construction phase.

However, private air traffic, which may not follow routes to or from these airports, may use this airspace and it is considered prudent to fix each wind turbine with flashing warning beacons before they are erected. The IAA will be consulted on the type of beacon and their installation prior to the erection of the turbines and mast. The IAA will also be issued with the grid co-ordinates of the turbines upon completion of the project.

12.10 RESIDUAL IMPACTS OF THE DEVELOPMENT

No significant residual impacts are predicted from the proposed development regarding material assets.

12.11 CUMULATIVE AND IN-COMBINATION IMPACTS

There will be a small cumulative impact with the consented Derreenacrinnig West Wind Farm. There will be a short-term cumulative impact between the proposed Grid Connection route and the consented Derreenacrinnig West Wind Farm and in-combination with other plans and projects, should they be constructed at the same time, in terms of increased traffic on local roads. There could be a short-term minor negative impact between the proposed development and other plans and projects, if they are constructed at the same time, in terms of noise emissions during construction although this will be temporary.

12.12 CONCLUSION

No significant impacts are predicted in terms of agriculture, natural resources, aviation or house prices. A small temporary impact is predicted in terms of traffic as there will be a small increase in the numbers of truck movements on local and regional roads during the construction phase both on its own and in combination with other plans and projects should they constructed at the same time, in particular the consented Derreenacrinnig West Wind Farm.

13. ARCHAEOLOGY AND CULTURAL HERITAGE

13.1 INTRODUCTION

13.1.1 Background and Objectives

John Cronin Associates have been commissioned by Jennings O'Donovan & Partners Ltd to assess the potential impacts of the proposed EIA Development on the archaeological, architectural and cultural heritage environment of the study area. Full details of the proposed EIA Development are provided in **Section 2** of the EIA and are not repeated here.

The study area comprises lands within the boundaries of the wind farm site, as well as lands within a 200-metre-wide corridor centred on the grid connection route.

Archaeological heritage generally refers to objects, monuments, buildings or landscapes of an (assumed) age typically older than AD1700 and usually recorded as archaeological sites within the Record of Monuments and Places. The term architectural heritage applies to structures, buildings, their contents and setting of an (assumed) age, typically younger than AD 1700. Cultural heritage is applied to other aspects of the landscape such as historical events, folklore and cultural associations and can accompany archaeological and architectural designation.

Where appropriate, mitigation measures to limit potentially significant impacts to the archaeological, architectural and cultural heritage are documented, and thereafter residual effects are identified and assessed.

13.1.2 Statement of Authority

This report was written and compiled by David Murphy BA. David graduated from UCC with a BA (Hons) in Archaeology and Geography in 2003. Since graduating, David worked initially as a field archaeologist and subsequently as a project archaeologist, gaining significant experience along the way. He became licence eligible in 2012 and has since directed numerous archaeological excavations, archaeological testing and monitoring programmes, as well as working on a number of large-scale infrastructural projects. He has also authored a large number of archaeological assessments and screening reports in relation to infrastructural projects.

13.1.3 Assessment Structure

This Section contains the following sections:

- Assessment Methodology and Significance Criteria – a description of the methods used in baseline surveys and in the assessment of the significance of effects;

- Baseline Description - a description of the archaeology and cultural heritage of the Proposed Development Site based on the results of desk-based information and a walk over survey;
- Assessment of Potential Effects - identifying the ways in which archaeology and cultural heritage could be affected by the proposed EIA Development, including a summary of the measures taken during design of the proposed EIA Development to minimise any effects;
- Mitigation Measures and Residual Effects - a description of measures recommended to off-set potential negative effects and a summary of the significance of the effects of the proposed EIA Development after mitigation measures have been implemented;
- Cumulative Effects – identifying the potential for effects of the proposed EIA Development to combine with those from other developments to affect the archaeological and cultural heritage resources;
- Summary of Significant Effects;
- Statement of Significance; and
- Comparison with The Derreenacrinnig West Wind Farm Environmental Impact Statement ("EIS"), November 2010, prepared by Jennings O'Donovan Consulting Engineers ("the 2010 EIA") - commentary identifying any material variations in potential effects and levels of significance.

13.2 ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA

13.2.1 Assessment Methodology

This assessment methodology has involved the following elements, further details of which are provided in the following sections:

- Legislation and guidance review;
- Desk study, including review of available maps and published information;
- Site walkover;
- Evaluation of potential effects;
- Evaluation of the significance of these effects; and
- Identification of measures to avoid and mitigate potential effects.

The methodology used in this assessment is based on the EPA Advice Notes on Current Practice (in the preparation of Environmental Impact Statements)[40] (EPA, 2003) on Cultural Heritage, including folklore/tradition, architecture/settlements and monuments/features, following a

[40] https://www.epa.ie/pubs/advice/ea/guidelines/EPA_advice_on_EIS_2003.pdf

baseline study of the existing cultural heritage features in the area of the proposed EIA Development, as well as per the Institute of Archaeologists (“IAI”) Good Practice Guidelines.

13.2.2 Relevant Legislation and Guidance

Archaeological monuments are protected through national and international policy designed to secure the protection of the cultural heritage resource. This is facilitated in accordance with the provisions of the European Convention on the Protection of the Archaeological Heritage (Valletta Convention), which was ratified by Ireland in 1997.

The National Monuments Act 1930 to 2004 and relevant provisions of the National Cultural Institutions Act 1997 are the primary means of ensuring the satisfactory protection of archaeological remains, which includes all man-made structures of whatever form or date except buildings habitually used for ecclesiastical purposes. A National Monument is described as:
“*a monument or the remains of a monument the preservation of which is a matter of national importance by reason of the historical, architectural, traditional, artistic or archaeological interest attaching thereto*” (National Monuments Act 1930 Section 2).

A number of mechanisms under the National Monuments Act are applied to secure the protection of archaeological monuments. These include the Register of Historic Monuments, the Record of Monuments and Places and the placing of Preservation Orders and Temporary Preservation Orders on endangered sites.

The minister may acquire National Monuments by agreement or by compulsory order. The State or the Local Authority may assume guardianship of any National Monument (other than dwellings). The owners of National Monuments may also appoint the Minister or the local Authority of that monument if the State or Local Authority agrees. Once the site is in ownership or guardianship of the State, it may not be interfered with without the written consent of the Minister.

Section 5 of the 1987 Act requires the Minister to establish and maintain a Register of Historic Monuments. Historic monuments and archaeological areas present on the Register are afforded statuary protection under the 1987 Act. Any interference with sites recorded on the Register is illegal without the permission of the Minister. Two months’ notice in writing is required prior to any work being undertaken on or in the vicinity of a Registered Monument. The Register also includes sites under preservation orders and temporary preservation orders with the written consent, and at the discretion of the Minister.

Section 12(1) of the 1994 Act requires the Minister to establish and maintain a Record of Monuments and Places where the Minister believes that such monuments exist. The Record comprises a list of monuments and relevant places and a map showing each monument and relevant place in respect of each county in the state. All sites recorded on the Record of Monuments and Places receive statuary protection under the National Monuments Act 1994.
Section 12(3) of the 1994 Act provides that:
"Where the owner or occupier (other than the Minister) of a monument or place included in the Record, or any other person, proposed to carry out, or to cause or permit the carrying out of, any work at or in relation to such a monument or place, he or she shall give notice to the Minister to carry out work and shall not, except in the case of urgent necessity and with the consent of the Minister, commence the works until two months after the giving of notice".

The Architectural Heritage and Historic Properties Act 1999 and the Planning and Development Act of 2000 are the main built heritage legislation. The Architectural Heritage Act requires the Minister to establish a survey to identify, record and assess the architectural heritage of the country. The National Inventory of Architectural Heritage ("NIAH") records all built heritage structures within specific counties in Ireland. The document is used to advise local Authorities on the register of a Record of Protected Structures ("RPS") as required by the Planning and Development Act, 2000.

The Act of 2000 requires Local Authorities to establish a Record of Protected Structures to be included in the County Development Plan ("CDP"). Buildings recorded in the RPS can include Recorded Monuments, structures listed in the NIAH or buildings deemed to of architectural, archaeological or artistic importance by the Minister. Once listed in the RPS the sites/areas receive statuary protection from injury or demolition under the 2000 Act. Damage to or demolition of a site registered in the RPS is an offence. The detail of the list varies from County to County. If the Local Authority considers a building to be in need of a repair, it can order conservation and/or restoration works. The owner or developer must make a written application/request to the local Authority to carry out any works on a protected Structure and its environs.

13.2.2.1 Cork County Development Plan 2014-2020

Cork County Council has written policies on the preservation of archaeological, architectural and cultural heritage remains in relation to permitted development in the Cork County Development Plan 2014-2020 ("the CDP"). These relate to archaeological features and objects, built structures, views and scenic routes.

Relevant policies include:

- **County Development Plan Objective HE 1-1*: "County Biodiversity Action Plan:*** *Continue to implement the County Biodiversity Action Plan (2008) in partnership with all relevant stakeholders."*
- **HE 1-2: County Heritage Plan:** *"Continue to implement the current County Heritage Plan (2005) in partnership with relevant stakeholders and any successor to this document."*

- ***HE 4-1: Record of Protected Structures***
  - ***a)*** *The identification of structures for inclusion in the Record will be based on criteria set out in the Architectural Heritage Protection Guidelines for Planning Authorities (2005).*
  - ***b)*** *Extend the Record of Protected Structures in order to provide a comprehensive schedule for the protection of structures of special importance in the County during the lifetime of the plan.*
  - ***c)*** *Seek the protection of all structures within the County, which are of special architectural, historical, archaeological, artistic, cultural, scientific, social or technical interest. In accordance with this objective, a Record of Protected Structures has been established and is set out in Volume 2, Chapter 1 of the Plan.*
  - ***d)*** *Ensure the protection of all structures (or parts of structures) contained in the Record of Protected Structures.*
  - ***e)*** *Protect the curtilage and attendant grounds of all structures included in the Record of Protected Structures.*
  - ***f)*** *Ensure that development proposals are appropriate in terms of architectural treatment, character, scale and form to the existing protected structure and not detrimental to the special character and integrity of the protected structure and its setting.*

  - **HE 4-2: Protection of Structures on the NIAH: "*Give*** *regard to and consideration of all structures which are included in the NIAH for County Cork, which are not currently included in the Record of Protected Structures, in development management functions."*

  - ***HE 4-3: Protection of Non- Structural Elements of Built Heritage:*** **"***Protect important non-structural elements of the built heritage. These can include designed gardens/garden features, masonry walls, railings, follies, gates, bridges, and street furniture. The Council will promote awareness and best practice in relation to these elements."*

- ***HE 5-1: Cultural Heritage "Protect*** *and promote the cultural heritage of County Cork*
- *as an important economic asset."*

13.2.3 Desk Study

This involved an examination of the archaeological, historical and cultural heritage context of the area in general and specifically the Proposed Development Site through a paper survey of archaeological, historical, architectural, cultural heritage and cartographic sources.

The following sources were examined as part of the assessment:

- Record of Monuments and Places ("RMP") for County Cork
- Sites and Monuments Record ("SMR") for County Cork
- The Archaeological Inventory for County Cork
- Topographical files of the National Museum of Ireland;
- Cork County Development Plan 2014-2020;
- National Inventory of Architectural Heritage;
- First edition ordnance survey maps;
- Second edition ordnance survey maps;
- Third edition ordnance survey maps;
- Aerial photography;
- Excavation bulletins; and
- Townland names.

13.2.4 Field Survey

An archaeological inspection of the areas impacted by the already constructed OHC portion of the grid connection route and the yet be constructed OHC and underground portions of the grid connection route was conducted on 16th October 2018. A photographic record was kept of this survey and extracts are provided below. Field inspections were also undertaken in March and May 2017 during the compilation of a previous archaeological assessment of the grid connection route (John Cronin & Associates, May 2017).

13.2.5 Predicted Impacts on Archaeological, Architectural and Cultural Heritage

The statutory criteria (EPA, 2002; EPA, 2003) for the assessment of impacts require that likely impacts are described with respect to their extent, magnitude, type (i.e. negative, positive or neutral) probability, duration, frequency, reversibility, and trans boundary nature (if applicable). The descriptors used in this EIS/EIAR are those set out in EPA (2002) 'Glossary of Impacts'.

Impacts can be assessed based on the detailed information on the project, the nature of the area affected, and the range of resources potentially affected. Wind farms, in general, can potentially affect the architectural, archaeological and cultural heritage landscape in a number of ways, as follows.

- Direct Impacts:
  - Archaeological sites can be adversely affected by excavation for development, topsoil stripping for roadways and by the effects of heavy machinery passing over features of archaeological significance.
  - Permanent and temporary land-take, landscaping, mounding and general excavations associated with construction may result in the loss or damage of archaeological remains or physical loss to the setting of historic landscapes and to the physical coherence of the landscape.
  - Construction work can alter the hydrological system resulting in changes to groundwater levels. This may have an adverse impact on archaeological sites and features.
  - Landscaping associated with developments can damage or destroy sub-surface archaeological features. Root action of trees for example can adversely impact on archaeological layers.
  - The weight of permanent embankments can cause damage to sub-surface archaeological layers and features.
- Indirect Impacts:
  - Noise impacts on the archaeological landscape can arise from construction. Traffic associated with construction, machinery working, and the noise associated with general construction can impact on the landscape.
  - Visual impacts on the archaeological, architectural and cultural heritage landscape can arise through the physical construction of structures, landscaping mounding and planting as well as boundary fences, perimeter walls and associated works. These features can impinge directly on historic and archaeological landscape as well as their visual amenity value.
- No Predicted Impact: where the proposed development has neither negative nor a positive impact upon the archaeological and cultural heritage environment.

Positive impacts can also be attributed from development. These may include improved maintenance and access to archaeological monuments and an increase in the level and understanding of an archaeological or historical landscape as a result of archaeological assessments and subsequent fieldwork.

13.2.5.1 Level of Impact

The level of impact on an archaeological, historical or architectural landscape depends on a number of factors which include the existing environment and the type of monument impacted. The level or severity of impact was assessed by taking the following into consideration:

- The proportion of the feature affected and the potential loss of characteristics essential to the understanding of the monument, feature or site.
- Consideration of the type, condition, vulnerability and potential amenity value of the landscape, feature, site or monument affected.
- Consideration of the likely impacts of visual, noise and hydrological alterations which were informed by other specialist reports or observations.

Impacts can be very high, high, medium, low or indeterminable on archaeological, architectural and cultural heritage remains.

Table 13.1: Criteria for Rating Site Attributes

Level of Impact	Significance
Very high	Attribute has a high-quality significance or value on a regional or national scale
High	Attribute has a high-quality significance or value on a local scale
Medium	Attribute has a medium quality significance or value on a local scale
Low	Attribute has a low-quality significance or value on a local scale
Indeterminable	An impact on a feature of unknown archaeological significance

13.2.5.2 Magnitude

The magnitude of potential impacts has been defined in accordance with the criteria provided in the 2002 EPA publication 'Guidelines on the information to be contained in Environmental Impact Statements'.

Table 13.2: Impact Assessment Criteria

Magnitude of Impact	Description
Imperceptible	An impact capable of measurement but without noticeable consequences
Slight	An impact that alters the character of the environment without affecting its sensitivities
Moderate	An impact that alters the character of the environment in a manner that is consistent with existing or emerging trends
Significant	An impact, which by its character, magnitude, duration or intensity alters a sensitive aspect of the environment
Profound	An impact which obliterates all previous sensitive characteristics

Table 13.3: Criteria for Rating Impact Significance on Archaeological, Architectural and Cultural Heritage

Magnitude of Impact	Criteria	Example
Large Adverse	Result in loss of attribute	Removal of a monument or a Protected structure
Moderate Adverse	Results in impact on integrity of attribute or loss of part of attribute	Partial removal of recorded structure or protected structure/heritage feature. This could also include the construction of a turbine in very close proximity to a recorded monument.
Small Adverse	Results in minor impact on integrity of attribute or loss of small part of attribute	Partial loss of the integrity of an archaeological monument, architectural or Cultural Heritage feature
Negligible	Results in an impact on attribute but of insufficient magnitude to affect either use or integrity	No measurable changes in attributes
Minor Beneficial	Results in minor improvement of attribute quality	Minor enhancement of archaeological, architectural, cultural heritage feature/landscape

Magnitude of Impact	Criteria	Example
Moderate Beneficial	Results in moderate improvement of attribute quality	Moderate enhancement of archaeological, architectural, cultural heritage feature/landscape
Major Beneficial	Results in major improvement of attribute quality	Major enhancement of archaeological, architectural, cultural heritage feature/landscape

13.3 BASELINE DESCRIPTION

13.3.1 Introduction

This section provides a description of the receiving environment and historical background of the Proposed Development Site and wider survey area and is based on the results of the desk based and walk over survey.

The National Monuments Acts 1930 to 2014, the Heritage Act 1995 and relevant provisions of the National Cultural Institutions Act 1997 are the primary means of ensuring the satisfactory protection of archaeological remains, which are deemed to include all man-made structures, of whatever form or date, except buildings habitually used for ecclesiastical purposes. The Record of Monuments and Places (RMP) was established under Section 12 (1) of the National Monuments (Amendment) Act, 1994 and replaced the earlier Sites and Monuments Record (SMR). It comprises of lists and maps of archaeological monuments and relevant places in respect of each county in the State. All sites recorded on the RMP receive statutory protection under the National Monuments Act 1994 and any work undertaken at these sites must be licenced by the National Monuments Service (NMS).

There are 18 archaeological sites located within the study area. A National Monument is described as ‘a monument or the remains of a monument, the preservation of which is a matter of national importance by reason of the historical, architectural, traditional, artistic or archaeological interest attaching thereto’ (Section 2, National Monument Act, 1930). There is one National Monument within the study area. In Derryarkane townland, c.59 metres north of ‘Pole 63’ along the constructed portion of the OHC route (ITM grid co-ord: 505156, 553755), is the site of Derryarkane stone circle (CO106-019) (a five-stone circle) and an adjacent standing stone (CO106-057----) (National Monument No. 600). A field survey undertaken as part of a previous assessment associated with the grid connection route (John Cronin and

Associates, May 2017) revealed that the location of this National Monument, as recorded on the Historic Environment Viewer of the ASI was inaccurate, this has since been corrected. The Historic Environment Viewer had recorded the stone circle as being located at ITM co-ord. 505203E, 553806N when in fact it is actually located c.77 metres to the southwest of this location at ITM co-ord. 505156E, 553755N. This is the location where Historic Environment Viewer had placed a standing stone (CO106-057----), which itself is in fact located c.29 metres to the south of this location at ITM co-ord. 505167E, 553725N. The location and details of these sites and all other recorded archaeological sites within the study area are provided below (Table 13.4).

13.3.2 Archaeological & Historical Context

The following section is based on a desktop survey of the archaeological resource within the study area undertaken to inform assessment of the impacts of the constructed portion of the scheme and the potential impacts of the yet to be constructed portion of the proposed scheme. It provides a summary of the main phases of the Irish archaeological record and the date ranges used are based on those published by the National Monuments Service (2006). The following table (Table 1) provides a list of all of the recorded archaeological sites (as recorded by the Historic Environment Viewer) within the study area and provides grid coordinates for their locations.

Table 13.4: ***List of Recorded archaeological sites located within the study area, listed from west to east of route (Ballylicky 110kV substation to Derreenacrinnig West Wind Farm)***

SMR Number	Class	Townland	ITM Ref (E, N)	Distance
CO105-023----	Megalithic tomb – wedge tomb	Crossoge	501525, 553383	c.95m to SW
CO105-058---	Cairn – radial-stone cairn	Shandrum Beg	502975, 553117	c.30m to E
CO105-026----	Ringfort - rath	Shandrum Beg	502922, 553155	c.5m to W
CO105-071----	Standing stone	Shandrum Beg	503179, 553157	c.100m to S
CO105-075--	Hut Site	Shandrum Beg	503185, 553196	c.70m to S
CO106-077002-	Standing stone	Derryarkane	504828, 553662	c.20m to S
CO106-077001-	Fulacht fia	Derryarkane	504920, 553384	c.50m to N

SMR Number	Class	Townland	ITM Ref (E, N)	Distance
CO106-079----	Fulacht fia	Derryarkane	505022, 553598	c.40m to S
CO106-022----	Enclosure	Maulikeeve	505134, 553585	c.80m to S
CO106-057----	Standing stone	Derryarkane	505167, 553725	c.55m to NW
CO106-019----	Stone circle – five stone	Derryarkane	505156, 553755	c.85m to NW
CO106-021----	Standing stone	Maulikeeve	505445, 553871	c.22m to S
CO106-056----	Souterrain	Maulikeeve	505495, 553967	c.70m to N
CO106-020002-	Standing stone	Maulikeeve	505490, 553962	c.70m to N
CO106-020001-	Ringfort - rath	Maulikeeve	505495, 553967	c.55m to N
CO106-114----	Standing stone	Maularaha	505926, 554118	c.15m to NW
CO106-009----	Ringfort - rath	Ardrah	507183, 554400	c.80m to NE
CO106-083----	Mass rock	Ardrah	507368, 554024	c.95m to E

Early Prehistoric

Traditionally, the earliest recorded evidence for human settlement in Ireland dates to the Mesolithic period (7000–4000 BC) when groups of hunter-gatherers arrived on the island, however recent evidence in the form of a butchered bear bone found in Alice and Gwendoline Cave near Ennis in Co. Clare now suggests that humans were present in Ireland c.12,500 years ago during the Palaeolithic period. The earliest recorded evidence for human settlement in Ireland dates to the Mesolithic period (7000–4000 BC) when groups of hunter-gatherers arrived on the island. While these Mesolithic settlers did not construct any settlements or monuments that leave any above ground traces, their presence in an area can often be identified by scatters of worked flints in ploughed fields. The Neolithic period (4000-2400 BC) began with the arrival and establishment of agriculture as the principal form of economic subsistence, which resulted in more permanent settlement patterns. As a consequence of the more settled nature of agrarian life, new site-types, such as more substantial rectangular timber houses and various types of megalithic tombs, begin to appear in the archaeological record during this period. There is archaeological evidence for a dispersed settlement pattern within the Munster region during the Mesolithic period which developed into a more extensive settlement during the Neolithic period. There is one megalithic tomb, a wedge tomb (CO105-023----), located within the study area. It is located in Crossoge townland c.95 metres southwest of the grid connection route near the western terminus of the scheme in Ballylickey. While three of the four main types of megalithic tombs (passage, court and portal tombs) date from the Neolithic period, wedge tombs represent the last phase of megalithic tomb building with dated examples generally dating from the transitional period between the Neolithic and Bronze Ages (c.2550 – 2000 BC), there are no other recorded sites from either the Mesolithic or Neolithic periods within the study area.

Late Prehistoric Periods

Metalworking arrived in Ireland with the advent of the Bronze Age period (c. 2400–500 BC). This period was also associated with the construction of new monument types such as standing stones, stone rows, stone circles and fulachta fiadh. The later first millennium BC and the early centuries AD comprise the Irish Iron Age, which is the most obscure period in the Irish archaeological record. While there is general agreement that the introduction of an iron technology was a significant factor in the eventual demise of bronze working on a large scale, but how, why and when this came about in Ireland is far from clear. The majority of the recorded sites (10) within the study area date to the late prehistoric period. The most significant of these are a stone circle (five-stone) (CO106-019----) and adjacent standing stone (CO106-057----), located in Derryarkane townland, which together comprise a National Monument in the ownership of the State (National Monument No. 600). Five-stone stone circles are a distinctive form of stone circle found only in counties Cork and Kerry. They comprise a ring of five free-standing stones, symmetrically arranged so that one stone, the axial stone, is set directly opposite two stones, usually the tallest, marking the entrance to the circle. In the Derryarkane example, the north entrance stone is prostrate having fallen at some point in the past. Characteristically, the stones reduce in height to the axial stone, which is set consistently in the south-western part of the circle. These circles are thought to have a ritual function. Although outside the 200-metre-wide study area, there is also another example of a stone circle of a type which is distinctive to the counties of Cork and Kerry within the general grid connection area. Located in Cappanaboul townland, the multiple-stone circle (CO105-029001-) most likely originally consisted of 13 stones, however, only 10 of these are still upright. The development of new burial practices saw the construction of funerary monuments such as cairns, barrows, boulder burials and cists. There are two examples of such sites within the general grid connection area. Located in the centre of the multiple-stone circle in Cappanaboul is a boulder-burial (C0105-029003-) consisting of a cover stone and one visible support stone. Approximately 470 metres to the southwest, in Shandrum Beg townland, is a peat-covered radial-stone cairn. The above described sites together with an additional five standing stones demonstrate a landscape rich in ritual and funerary monuments dating to the late prehistoric period.

Also dating to this period and located within Derryarkane are two fulachta fiadh (CO106-077001-; CO106-079----). Fulacht fiadh translates as cooking places of the wild (or of deer). They are often interpreted as the remains of cooking sites and are the most numerous archaeological site type in Ireland and radiocarbon dating of excavated examples has generally produced dates in the Bronze Age (c.2400-500BC). These sites are typically found close to a water source and survive as horseshoe-shaped mounds surrounding a trough, which is often found to be stone or timber-lined. They functioned by filling the trough with water, which was then heated by the introduction of heated stones. Modern experiments have shown that this technique can bring the trough water to boiling point in and has been successfully demonstrated that it could cooked wrapped meats within a short period of time. The heated stones shattered on entering the cold water, and after use the trough was cleaned out and the burnt stones were thrown behind and to the sides of the trough, which eventually resulted in a horseshoe-shaped mound. Over time many of the mounds were ploughed out and now survive as subsurface spreads of blackened soils with frequent inclusions of burnt stones. A number of alternative interpretations have been forwarded as to the function of these archaeological sites, such as their potential uses as bathing, saunas, garment washing and dyeing, leather processing sites and even brewing sites.

Early Medieval

This period began with the introduction of Christianity in Ireland and continued up to the arrival of the Anglo-Normans during the 12th-century (c. 400–1169 AD). The establishment of the Irish church was to have profound implications for political, social and economic life and is attested to in the archaeological record by the presence of church sites, associated places for burial and holy wells. The early medieval church sites were morphologically similar to ringforts but are often differentiated by the presence of features such as church buildings, graves, stone crosses and shrines. This period saw the emergence of the first phases of urbanisation around the large monasteries and the Hiberno-Norse ports. However, the dominant settlement pattern of the period continued to be rural based in sites such as ringforts, which comprise roughly circular enclosures delimited by roughly circular earthen banks formed of material thrown up from a concentric external ditch. Ringforts are one of the most numerous monuments in the Irish landscape and the early medieval terms for these sites – rath/lios/dun these still form some of the most common place-name elements in the country. Archaeological excavations indicate that the majority of ringforts were early medieval farmsteads with internal timber buildings and were surrounded by associated field systems. There are three ringforts recorded within the study area in the townlands of Ardrah (CO106-009----), Maulikeeve (CO106-020001-) and Shandrum Beg (CO105-026----). One enclosure site (CO106-022----), located in Maulikeeve may form the remains of an unclassified ringfort.

Late and Post Medieval

The arrival and conquest of large parts of Ireland by the Anglo-Normans in the late 12th century broadly marks the advent of the Irish late medieval period, which continued up until the beginning of the post-medieval period in c.1550. Within the late medieval period, towns, markets, and fairs were established and change and reform attempted in the Irish church. By the 15th-century the native Irish chieftains and lords began to establish tower houses and smaller castles as centres of territorial control. While, there are no definitive late medieval monuments recorded within the study area, it is possible that a hut site (CO105-075----) located in Shandrum Beg may date to this period, however, it is also possible that this site dates to earlier time periods. The post-medieval period (1550+) saw the development of high and low status stone houses throughout the Irish country. During this period any given settlement cluster is likely to have consisted primarily of single-storey thatched cottages with associated farm buildings while two-storey farmhouses became more common in the 19th century.

The scheme extends through Kilmocomoge parish which was described as follows during the 19th-century (Lewis 1837):

***KILMACOMOGUE**, a parish, partly in the Western Division of the barony of EAST CARBERY, and partly in the Eastern Division of that of WEST CARBERY, but chiefly in the barony of BANTRY, county of CORK, and province of MUNSTER; containing, with the post-town of Bantry and the island of Whiddy, 14,483 inhabitants. This parish, which is situated at the extremity of Bantry bay, comprises 56,910 statute acres, of which 5841 are applotted under the tithe act, and valued at £13,977 per annum. Very great improvements have been made in agriculture since 1815, and a large portion of land has been brought into profitable cultivation. The principal manure is the calcareous deposit found in abundance on the shores of the bay, which in some places is so mixed with coral sand as to be quite as effective as pure lime in fertilising the soil. There are, however, still more than 20,000 acres of waste land, the greater portion of which is mountainous, in some places quite barren, and in others affording good pasturage for young cattle, of which vast herds are reared; and there are about 15,000 acres of bog and marshy ground, much of which is capable of being reclaimed.*

The mountains are of the schistose formation, based on argillaceous grit; in a small rock in Reendonagan bay, limestone is found mixed with the grit, which can be only partially calcined, and is therefore of little use; the schistose rocks merge into clay-slate, and slate of a tolerably good colour is found in several parts. Four rivers intersect the parish in their course to the bay; namely, the Maulagh, or Moyalla, which, on its entrance into the bay, forms a beautiful fall of 30 feet at Dunamarc; the Auvane, which rises in the pass of

Caminea, and falls into the bay at Ballylicky; the Coomola, which forms the small creek of that name, and the Drumgariff, which forms the north-western boundary of the parish and barony.

13.3.3 Cartographic and Placename Evidence

The detail on historic cartographic sources demonstrates the nature of past settlements and land use patterns in recent centuries and also highlights the impact of modern developments and agricultural practices. This information can aid in the identification of the location and extent of unrecorded, or partially levelled, features of archaeological or architectural heritage interest. The cartographic sources examined for the study areas include the 1st edition of the 6-inch OS maps (surveyed in 1842) and the 25-inch OS maps (surveyed in 1899). There were no unrecorded features of archaeological interest noted on the footprint of the proposed scheme during the inspection of these sources, which both indicate that the study area has been occupied by a mixture of mountainous heath land, rough grazing land and irregularly enclosed small-scale pasture fields of varying quality since at least the 19th century.

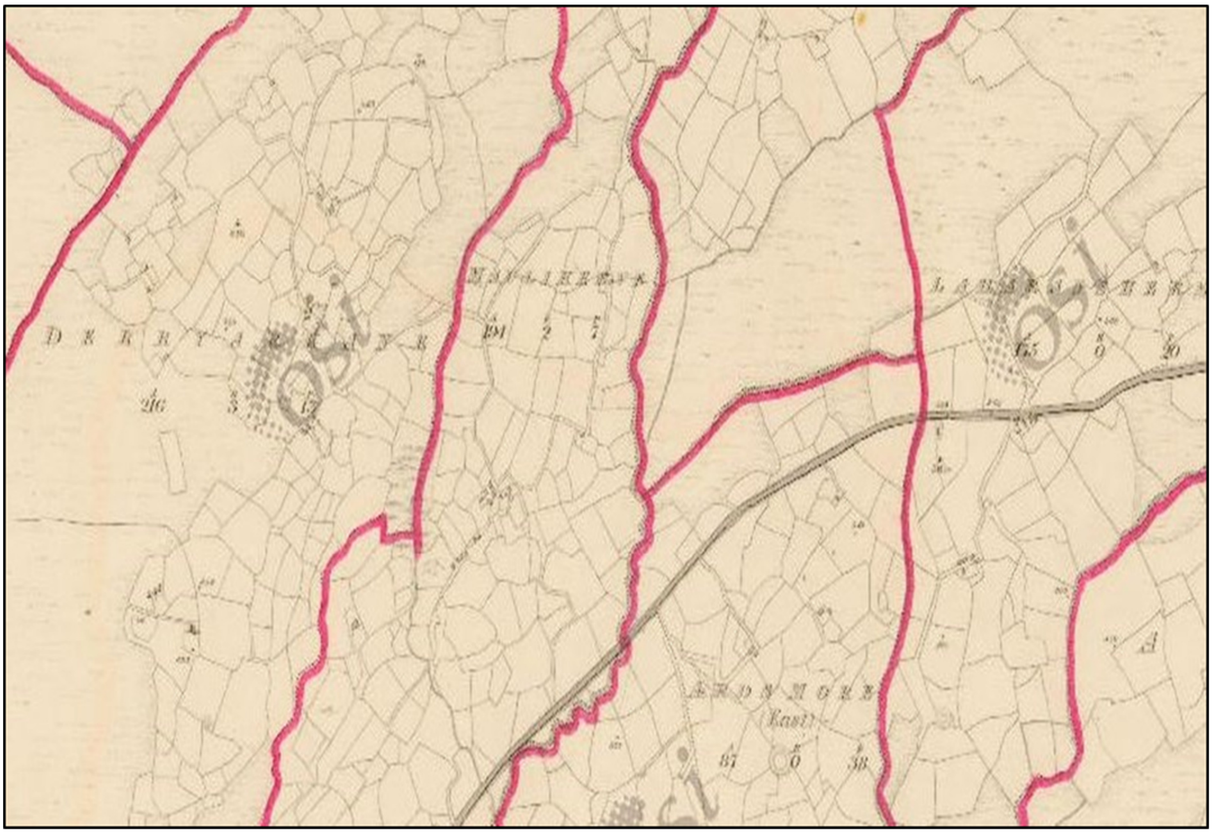


Figure 13.1: Extract from 1st edition 6-inch O.S. map (1842) depicting a portion of the townlands of Derryarkane, Maulikeeve, Maularaha and Laharanshermeen through which the built section of the OHC grid connection extends. Note the mixed nature of the landscape which consists of open upland/heathland and irregularly enclosed small-scale pasture fields.

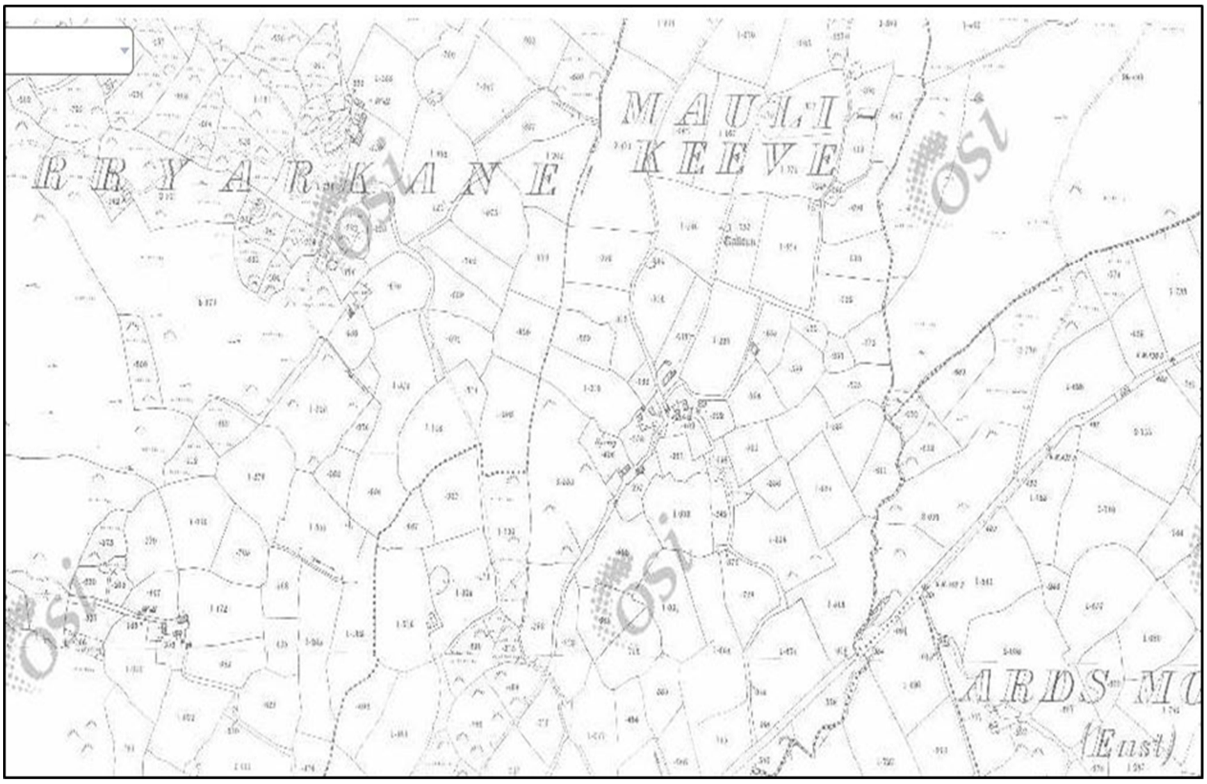


Figure 13:2 Extract from the 2ndedition 25-inch O.S. map (1899) showing little change in the landscape in the period since the publication of the 1st edition map.

The study area is located within largely within Kilmocomoge parish, with the extreme eastern end of the scheme located in Dromdaleague parish. These in turn are located within the baronies of Bantry and Carbery West respectively, the proposed route extends through fourteen townlands (Table 3). Townlands are the smallest unit of land division in the Irish landscape and many may preserve early Gaelic territorial boundaries that pre-date the Anglo-Norman conquest. The boundaries and nomenclature of the Irish townlands were recorded and standardised by the Ordnance Survey in the 19th century. The Irish roots of townland names often refer to natural topographical features but some name elements may also give an indication of the presence of past human activity within the townland, e.g. dun, lios or rath indicate the presence of a ringfort while temple, saggart, termon or kill record an association with a church site. The names of a number of the townlands within the study area indicate an association with past human settlement in the vicinity of the scheme, i.e. Ardrah (the high fort), Maulikeeve (O’Keeffe’s knoll/hillock) and Dromloughlin (Loughlin’s ridge)

13.3.4 Field Inspection

The lands impacted by the constructed OHC portion of the scheme and the lands proposed to be impacted by the yet to be constructed sections were inspected on 8th March and 10th May

2017 and again as part of this cumulative impact assessment on Tuesday 16th October 2018. During the most recent field inspection only the portions of the route in the vicinity of recorded archaeological sites were revisited. Sections of the constructed OHC route, which are located away from recorded sites, were not revisited as they had been assessed during the previous field inspections. Weather conditions were clear at the time of all inspections which provided good landscape visibility. All areas were accessible, and the grid route was assessed in terms of landscape, land use, vegetation cover, presence or lack of archaeology and potential for previously unrecorded features. Landscape descriptions of each portion of the grid route are provided in the relevant assessment sections below.

13.4 ASSESSMENT OF PROPOSED OVERHEAD CIRCUIT ROUTE

13.4.1.1 Route Description

There is one section of the proposed overhead circuit (OHC) yet to be constructed along the grid connection route. Commencing at the northern end of the proposed underground cable section in Shandrum Beg townland (approx. ITM grid co-ord. 503027, 553245), the proposed route extends upslope and to the east, traversing elevated and marginal lands in Cappanaboul townland before connecting with the western end of the longest section of previously constructed OHC in Skahanagh More townland (approx. ITM grid co-ord. 504078, 553214). The total length of this section of the proposed route is c.1201 metres.

13.4.1.2 Recorded Archaeological Monuments

There are two recorded archaeological sites located within 100 metres of the **yet to be constructed** overhead circuit portion of the grid connection route (***Table 5***). These sites comprise a standing stone (CO105-071----) and hut site (CO105-075----) located in Shandrum Beg townland. The site of a stone circle (CO105-029001-) containing a boulder-burial (CO105-029002-) is also located within 140 metres of this section of the route in Cappanaboul townland. The locations of all four sites were visited during the field inspection undertaken on 16th October 2018.

Table 13.5: Recorded archaeological monuments located within 100m of the proposed OHC route

SMR No.	Class	Townland	ITM Ref (E, N)	Distance
CO105-071	Standing stone	Shandrum Beg	503179, 553157	c.100m to S
CO105-075	Hut site	Shandrum Beg	503185, 553196	c.70m to S

13.4.2 Assessment of Potential Impacts

Located to the south of the proposed route of the **yet to be constructed** OHC section of the grid connection route, within Shandrum Beg townland, are a standing stone (CO105-071----) and a hut site (CO105-075----). There is no direct line of sight between the nearest proposed pole locations of the OHC route and the locations of the standing stone and hut site, which are situated c.100 metres and c.70 metres from the proposed route of the OHC respectively. This is due to higher ground being positioned between these sites and the route of the OHC to the northeast (***Plate 11***), while the OHC route to the north and northwest extends across significantly lower ground. As the single pole structures of the OHC are proposed to be constructed in fields to the northeast, north and northwest of both sites and as there is no direct line of site, construction of the OHC will have **no direct or visual impact** on the recorded sites.

To the north of the proposed OHC route, in the townland of Cappanaboul, is the site of a multiple stone circle (CO105-029001-) within which is a boulder-burial (CO105-029003-) (***Plate 12***). The combined sites are located on a small peat covered platform at the north-western end of an elevated, unenclosed plateau of marginal land. The incomplete stone circle appears to have originally consisted of thirteen stones. Ten of these stones survive, two of which are prostrate. The dimensions of the orthostats range between 0.5m to 1.3m in length, 0.2m to 0.4m in width and 0.7m to 1.5m in height. The stone circle encloses an internal area measuring 10.5m E-W. The boulder-burial is centrally placed within the stone circle. It comprises a cover-stone measuring 1.6m in length, 1.5m in width and 0.7m in height, there is one support stone visible beneath the cover stone. The combined sites are surrounded by post and barbed wire fencing which will assist in preventing any accidental damage occurring during the construction of the OHC (Plate 12).

On current planning drawings (see Figure 6 below) the proposed OHC route extends well to the south of the ZON of the combined monument. This will ensure that no direct impact to the recorded monuments occurs, however, the lack of any shielding elements, such as hedgerows or trees, between the proposed OHC route and the site of the recorded monuments, means there will be a very slight visual impact on the setting of both monuments due to the construction of the OHC in this area.

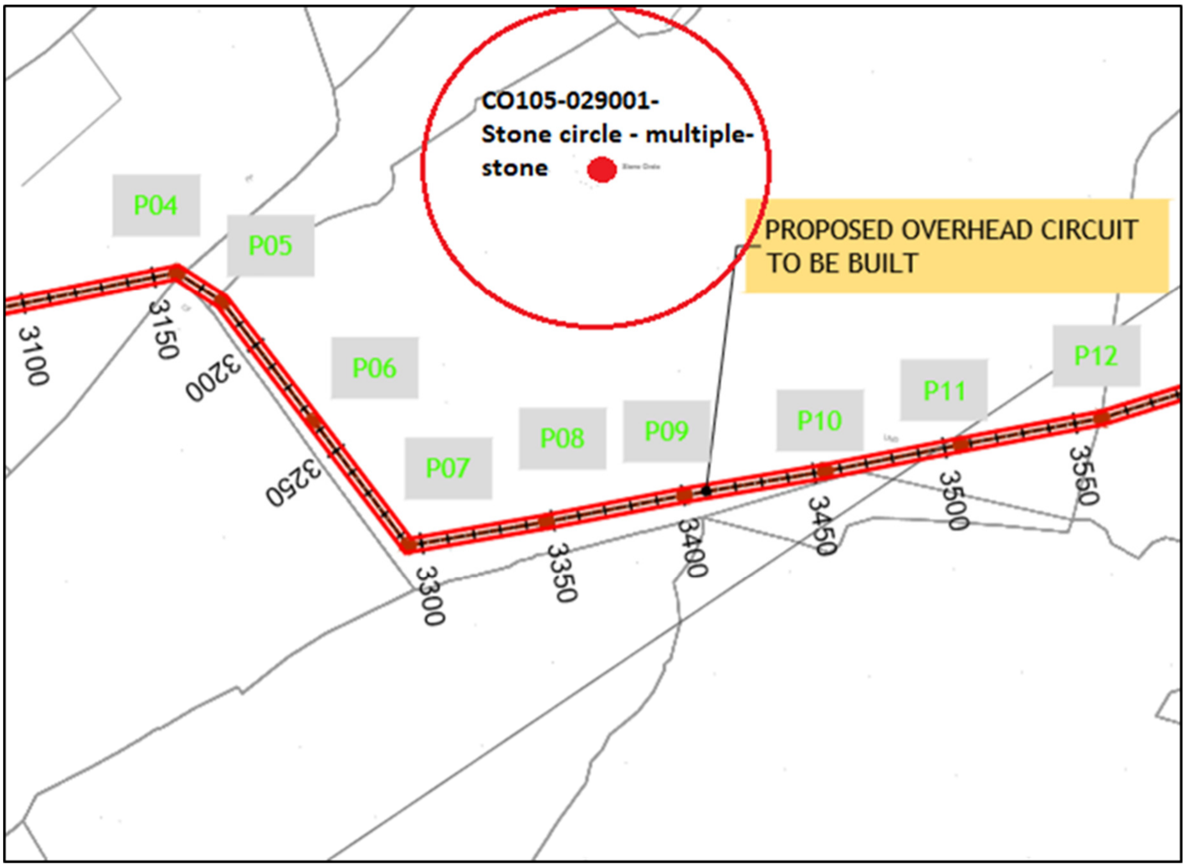


Figure 13.3 - Graphic depicting the route of the yet to be built OHC, large red circle to the north of the OHC route represents the Zone of Notification of the recorded monument CO105-029001- (Multiple stone circle) and CO105-029003- (Boulder-burial)

13.5 ASSESSMENT OF THE CONSTRUCTED OVERHEAD CIRCUIT

Route Description

Five separate sections of the 'overhead circuit' (OHC) portion of the grid connection route have been constructed to date. The largest constructed section comprises the central portion of the grid connection route between the townlands of Gortnacowly to the east and Skahanagh More to the west. The second longest constructed section is the most westerly portion of the entire grid connection route, between the Derreenacrinnig West Wind Farm substation and the western portion of Barnagowlane townland. Three shorter sections of the overhead circuit have also been constructed along the grid connection route. There are two short sections at the western end of the route, the more easterly of the two short sections extends across a portion of the townlands of Shandrum More and Dromloughlin, while the more westerly section extends between Dromloughlin and the northeast corner of Ballylicky 110 kV substation. The other short section of constructed OHC is located near the central portion of the route, extending between the townlands of Glanareagh and Ardsbeg. The combined length of the constructed sections of the OHC measures 9.537km.

Commencing at the Derreenacrinnig Wind Farm substation (approx. ITM grid co-ord. 510961, 551186), the constructed OHC route extends uphill to the north-northwest across an area of blanket bog and heathland on the south-facing slopes of the ridge at Derreenacrinnig West (Plate 1). Descending north-westwards from the crest of the ridge, the route cuts through c.300 metres of first and second rotation forestry before extending through an area dominated by rough unenclosed grazing in Barnagowlane townland (Plate 2). The route then descends downslope into the Mealagh River valley. This section of the constructed OHC terminates south of the public road in the western portion of Barnagowlane townland (approx. ITM grid co-ord. 508901, 552735), the easternmost portion of the yet to be constructed underground cable commences at this point.

Beyond the 1046m long section of proposed underground cabling, the constructed OHC commences once again and extends north-westwards from a point south of Glanareagh Hill (approx. ITM grid co-ord. 508040, 552998) traversing varying quality agricultural land before crossing the Mealagh River 1km southeast of Ardrah Bridge. To the north of the river there is a brief interruption in the route of the OHC as a c.112m long section of the grid connection between the boundaries of Ardsbeg and Gortnacowly townlands (approx. ITM co-ords. 507734, 553749 to 507688, 553834) is proposed to be installed underground. Beyond this short proposed underground section, the constructed OHC continues upslope to the north side of the valley to Ardrah townland (Plate 3). From here, the OHC route turns south-westwards again and extends through the townlands of Laharanshermeen, Maularaha, Maulikeeve, Derryarkane, Cappanaboul while descending steadily and crossing areas of improved and unimproved grassland with occasional areas of heath and mature coniferous forestry. This longest constructed section of the OHC route terminates at a point in the northern portion of Skahanagh More townland (approx. ITM grid co-ord. 504050, 553237).

The most westerly sections of the grid connection route extend across an area generally consisting of undulating, improved pastureland. It is across this landscape that the remaining two short sections of constructed OHC extend. These sections of constructed OHC traverse portions of the townlands of Shandrum More, Dromloughlin and Ballylicky between approx. ITM grid co-ords. 502436, 552770 and 501977, 553191 (eastern short section) and approx. ITM grid co-ords. 501670, 553540 and 501297, 553395 (western short section).

Recorded Archaeological Monuments

There are 13 archaeological sites recorded by the Historic Environment Viewer of the National Monuments Service (www.archaeology.ie) located within 100 metres of the route of the constructed section of OHC (see Table 4 below). The locations of all these sites were visited during the compilation of previous archaeological assessments associated with the grid connection route. During the compilation of this cumulative archaeological impact assessment a number of sites which were located in close proximity to the built section were reassessed in order to ascertain if any damage had occurred to the monuments, or their immediate environs, during the construction of the OHC. The sites which were reassessed include: stone row (CO106-008----); standing stone (CO106-114----) in the townland of Maularaha; ringfort (CO106-020001-) in Maulakeeve; stone circle (CO106-019----) and standing stone (CO106-057----) in Derryarkane (National Monument No. 600); fulacht fia (CO106-079----) in Derryarkane and standing stone (CO106-07702-) in Derryarkane.

Table 13.6: List of Recorded archaeological sites within 100m of the constructed portion of the OHC, listed from east to west of route

SMR No.	Class	Townland	ITM Ref (E, N)	Distance
CO106-083	Mass Rock	Ardrah	507368, 554024	c.95m to E
CO106-009	Ringfort - rath	Ardrah	507183, 554400	c.80m to NE
CO106-114---	Standing Stone	Maularaha	505926, 554118	c.15m to NW
CO106-020001	Ringfort - rath	Maulikeeve	505495, 553967	c.55m to N
CO106-020002-	Standing stone	Maulikeeve	505490, 553962	c.70m to N
CO106-056----	Souterrain	Maulikeeve	505495, 553967	c.70m to N
CO106-021----	Standing stone	Maulikeeve	505445, 553871	c.22m to S
CO106-019----	Stone circle - five stone	Derryarkane	505156, 553755	c.85m to NW
CO106-057----	Standing Stone	Derryarkane	505167, 553725	c.55m to NW
CO106-022--	Enclosure	Maulikeeve	505134, 553585	c.80m to S
CO106-079----	Fulacht fia	Derryarkane	505022, 553598	c.40m to S
CO106-077001	Fulacht fia	Derryarkane	504920, 553384	c.50m to N
CO106-077002-	Standing Stone	Derryarkane	504828, 553662	c.20m to S

Assessment of Impacts

Although outside the study area and not in immediate proximity to the grid connection route (being located c.160 metres northeast of the proposed route), the recorded site of a stone row (CO106-008----) (Plate 4) was reassessed to ascertain whether or not the constructed OHC impacts on the setting of the monument or if there is any associated visual impact on alignments or views associated with the monument. The stone row is situated on high ground c.190 metres northwest of a recorded ringfort (CO106-009----) (Plate 5). The OHC route approaches both sites from the southeast, extending in a southeast to northwest direction, and passes c.80 metres to the southwest of the ringfort site. The OHC route utilises a natural dip in the landscape to the southwest of both recorded sites. Through the utilisation of this natural depression the constructed OHC results in a very slight visual impact on the setting of both recorded sites. The stone row is aligned in a northeast to southwest direction (largest stone to southwest) and views in either direction are not impacted by the OHC route. The main view to the southwest is blocked by a line of mature trees which surround a derelict farmhouse (Plate 6), the OHC extends to the southwest of the treeline and is not visible from the stone row when facing south-westwards. The Archaeological Survey of Ireland records the stone row as comprising four aligned stones, a fifth smaller stone was noted at the northeast end of the alignment during the inspection.

Assessment of the first revisited recorded archaeological site in close proximity to the constructed portion of OHC route, that of a standing stone (CO106-114----) in Maularaha, revealed that no direct impact occurred during the construction of the OHC. The standing stone is situated on a level area of boggy ground between two outcroppings of rock c.20 metres southeast of the OHC route (Plate 7). While the route of the OHC slightly encroaches on the zone of notification (ZON) of the monument, no poles were erected, or ground disturbance undertaken, within the ZON. However, the construction of the OHC has caused a slight visual impact on the setting of the standing stone.

As the OHC route continues to the southwest it passes in proximity to the ZON of two further monuments in Maulikeeve townland, ringfort (CO106-020001-) and standing stone (CO106-021----). The ringfort is located on the crest of a hill c.55 metres north of the route which provides expansive views in all directions. The OHC route traverses an area which is outside the ZON of the ringfort and there was no evidence of any ground disturbance works having taken place within the zone. As the OHC route extends through an adjacent field, which is at a lower level than the ringfort and beyond a shielding field boundary (Plate 8), it can be considered that the erection of the OHC has had a very slight visual impact on the setting of the monument. The standing stone (CO106-020002-) and souterrain (CO106-056----) which are situated within the ringfort are unaffected by the OHC.

The recorded site of a standing stone (CO106-021----) is located c.22 metres to the south of the OHC route in the vicinity of ‘Pole 67’. The ASI record no visible surface trace of the stone, its recorded location is heavily overgrown with gorse, brambles and young trees. There was no evidence of any ground disturbance works as having taken place within the ZON of the recorded location of the standing stone during the construction of the OHC.

As the constructed OHC route continues to the southwest it extends through the townland of Derryarkane. Located within this townland is the site of a National Monument (ITM grid co-ord: 505156E, 553755N) comprising Derryarkane stone circle (CO106-019----) (a five-stone circle) and an adjacent standing stone (CO106-057----) (National Monument No. 600). The field survey undertaken as part of a previous assessment of the grid connection route (John Cronin & Associates, May 2017) revealed that the location of this National Monument was inaccurately recorded on the Historic Environment Viewer (www.archaeology.ie). The Historic Environment Viewer had recorded the stone circle as being located at ITM co-ord. 505203E, 553806N when in fact it is located c.77 metres to the southwest of this location at ITM co-ord. 505156E, 553755N. This is the location where the Historic Environment Viewer had placed a standing stone (CO106-057----), which itself is in fact located c.29 metres to the south of this location at ITM co-ord. 505167E, 553725N. Subsequent to receiving the previous assessment which highlighted the above inaccuracies, the correct locations of the above sites are now indicated on the Historic Environment Viewer.

The stone circle is situated on a level area of ground which is overgrown with small trees (such as whitethorn), gorse and tall rushes. This vegetation masks location of the stone circle and the standing stone c.29 metres to the southeast (Plates 9, 10). The project planning drawings (see Figure 4), detailing the constructed portion of the OHC, depict ‘Pole 64’ of the OHC route to the immediate southeast of ZON of the National Monument, however, these drawings depict the inaccurate recorded location of the National Monument. The actual location of both the stone circle (CO106-019----) and the standing stone (CO106-057----) mean that the location of ‘Pole 63’ instead falls marginally within the combined ZON of both monuments (see Figure 5). The assessment report of May 2017 (John Cronin & Associates, May 2017) had recommended that the location of what is now termed ‘Pole 63’ (then ‘Pole 62’) be moved southwards behind an adjacent tree-line in order to prevent works taking place within the ZON of the monument and to reduce the visual impact of the OHC. However, due to landowner constraints within the adjoining plot, the pole structure was erected in its original planned location. While no direct impact occurred to either monument during the erection of ‘Pole 63’, limited groundworks were undertaken within the combined ZON without the required consent being gained. The erection of the OHC in this area, and in particular ‘Pole 63’, is considered to have had a slight visual impact on the setting of both monuments.

The constructed OHC route passes in close proximity to three further sites in the west end of Derryarkane townland. These sites comprise two fulachta fia (CO106-079----), (CO106-077001-) and a standing stone (CO106-077002-) and all three sites are situated in undulating poor quality pastureland. Inspection of the location of fulacht fia (CO106-079----) revealed that while there was no direct impact to the monument itself, there was a slight encroachment into its ZON during the erection of ‘Pole 61’ (see Figure 5). The pole was erected c.37 metres northeast of the monument, its associated stays extended a further 10 metres into the ZON. There was no evidence that the associated groundworks disturbed any archaeological deposits. The construction of the OHC has had a very slight visual impact on the setting of the monument.

The erection of the OHC route has had a slight visual impact on the setting of standing stone (Plate 10) (CO106-077002-) due to the proximity of ‘Pole 58’ and a very slight visual impact on the setting of fulacht fia (CO106-077001-). No direct impact or ZON encroachment occurred at either site during the construction of the OHC at these locations.

It is noted that the “as constructed” sections of the OHC were not monitored by an archaeologist. Generally, however, the footprints and associated ground disturbances of the poles and stay supports are quite small (usually less that 1m2 each). Given that the site walkover/desktop assessment considered that such locations, outside the zone of notification (ZON) of recorded monuments, were of low archaeological potential, it is unlikely that any artefacts, features or deposits of an archaeological nature were disturbed during construction works. Nevertheless, this cannot be discounted.

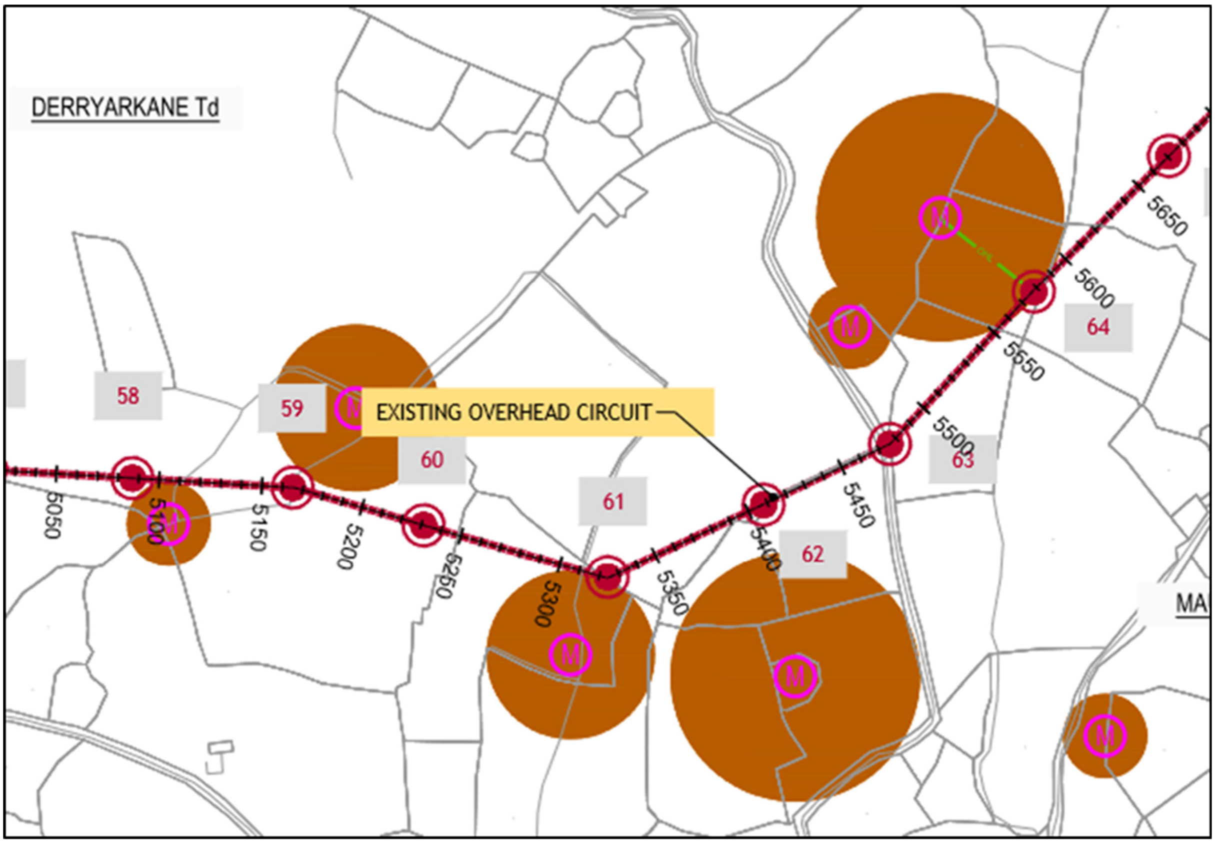


Figure 13.4 - Project planning drawings (Oct 2018) which depict the constructed portion of OHC as it extends through Derryarkane. The stone circle and associated standing stone (top right corner) which comprise National Monument No. 600 are depicted in the incorrect location on this drawing

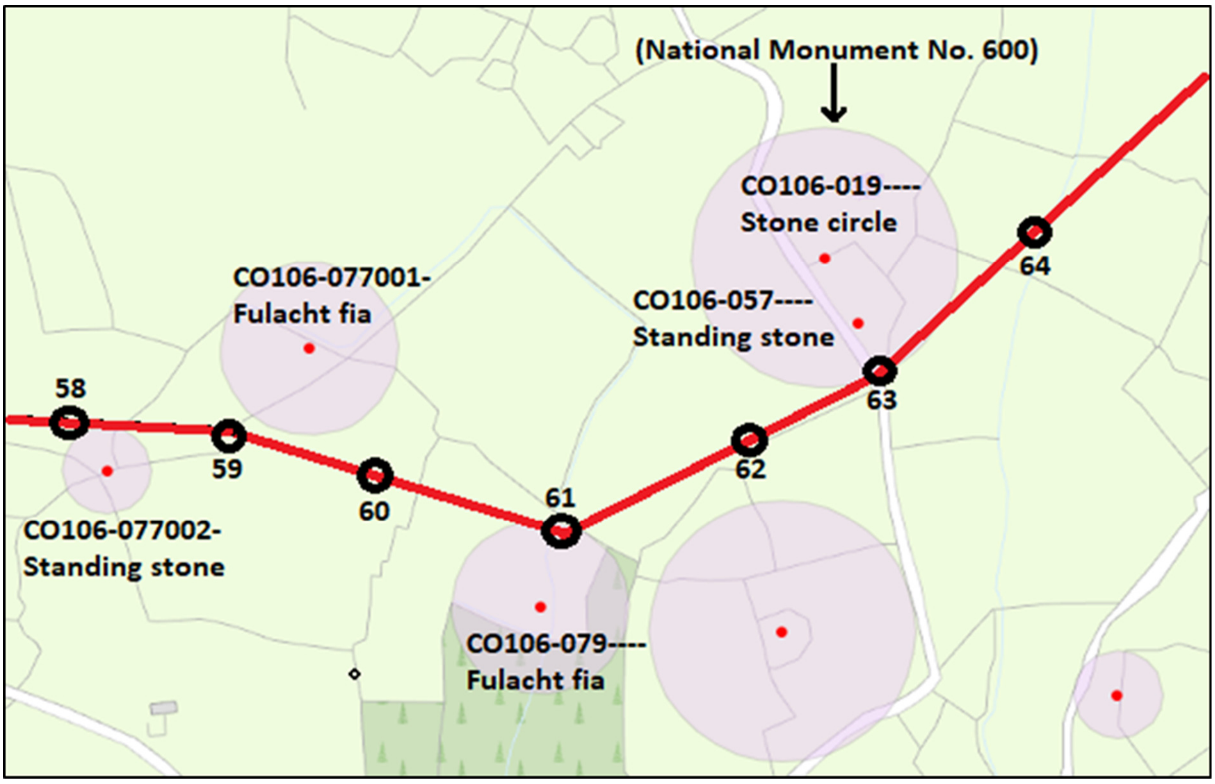


Figure 13.5 - Graphic depicting the actual location of National Monument No. 600 with the route of the OHC and the position of the associated pole structures overlaid, Poles 61 and 63 marginally encroached upon the ZON of their nearest recorded monuments

13.6 ASSESSMENT OF PROPOSED UNDERGROUND CIRCUIT ROUTE

Route Description

Six separate sections of underground cabling, totalling 3.178km in length, are proposed to be installed along the grid connection route. Commencing at the Ballylicky 110kV substation, the most westerly section of underground cabling (c.201 metres in length) is proposed to extend from within the substation (approx. ITM grid co-ord. 501201, 553364) and skirt around the perimeter of the facility before connecting with the most westerly constructed section of the overhead circuit (OHC) which terminated to the immediate northeast of the substation (approx. ITM grid co-ord. 501308, 553402).

The next proposed section of underground cabling extends south-south-westwards along a third-class road in Dromloughlin townland (commencing at approx. ITM grid co-ord. 501672, 553546) before extending south-eastwards across varying quality pastureland within the same townland and linking with a previously constructed section of OHC (approx. ITM grid co-ord. 502022, 553156). This section of the proposed underground cable within Dromloughlin measures c.624 metres in length.

The most extensive section of the proposed underground cable extends for c.1081 metres through the townlands of Shandrum More and Shandrum Beg. Commencing at approx. ITM grid co-ord. 502432, 552782 and initially extending down a farm laneway in a general south-eastward direction, the underground cable is then proposed to extend north-eastwards beneath a third-class road before connecting with the yet to be constructed section of overhead circuit which extends between Skahanagh More and Shandrum Beg townlands (approx. ITM grid co-ord. 503027, 553245). The lands in the vicinity of this section of the underground cable route comprise a mixture of undulating improved and unimproved pastureland.

The shortest section of underground cabling is proposed to be installed in agricultural land in the vicinity of the boundary between Ardsbeg and Gortnacowly townlands north of the Mealagh River (approx. ITM co-ords. 507734, 553749 to 507688, 553834). This section measures c.112 metres in length.

The second longest section (c.1046 metres) of the underground cable route is proposed to extend in a general west to east direction, largely beneath a third-class road in Gleanareagh townland (between approx. ITM grid co-ords. 508040, 552998 and 508905, 552735), which is located on the southern slopes of the Mealagh River Valley. The topography in the vicinity of this section generally comprises moderate sloping ground, generally sloping downwards to the north, with the road traversing the landscape in an east to west direction. The southside of the road generally cuts into the sloping ground along this section.

A final, short section of underground cabling is proposed to be installed on approach to the substation within the boundaries of the Derreenacrinnig West wind farm site. This section measures c.113 metres in length and extends between approx. ITM co-ords. 511039, 551205 and 511138, 551222.

Recorded Archaeological Monuments

There are three recorded archaeological sites located within 100 metres of the yet to be constructed underground cable portions of the grid connection route (Table 6). The locations of all three sites were visited during the field inspection undertaken on 16th October 2018. These sites comprise a wedge tomb (CO105-023----) located in Crossoge townland; and a ringfort (CO105-026----) and radial-stone cairn (CO105-058----) located in Shandrum Beg townland.

<u>Table 13.7:</u> Recorded archaeological monuments located within 100m of the proposed underground cable

SMR No.	Class	Townland	ITM Ref (E, N)	Distance
CO105-023--	Megalithic tomb – wedge tomb	Crossoge	501525, 553383	c.95m to SW
CO105-026---	Ringfort - rath	Shandrum Beg	502922, 553155	c.5m to W
CO105-058----	Cairn – radial-stone cairn	Shandrum Beg	502975, 553117	c.30m to E

Assessment of Potential Impacts

Located near the western terminus of the overall grid route, in Crossoge townland, is the site of wedge tomb (CO105-023----) (Plate 14). The extant partial remains of the megalithic tomb are evident to the immediate northwest of a farm lane and are located c. 95 metres southwest of the proposed section of underground cabling which will extend beneath a third-class road in Dromloughlin townland. The tomb is located on a small level platform to the west of an isolated rock outcrop. The remains of a chamber are formed by two upright slabs to the northwest and southeast with a further upright slab closing the chamber at the northeast end. A telephone wire pole is located c.10 metres to the northeast of the tomb, further pole sets, and residential development are evident in the immediate vicinity. The proposed grid connection will have no predicted impact on the setting of this monument.

Two further recorded archaeological sites are located in close proximity to the route of the proposed underground cable route in the townland of Shandrum Beg (see Figure 7 below). The third-class road, under which the cable is proposed to be laid, extends between these two sites which comprise a ringfort (CO105-026----) and a radial-stone cairn (CO105-058----). Although not obvious from road level as the ringfort is elevated above the road (up to 3 metres above) and obscured by a dense thicket of vegetation, the eastern portion of the ringfort directly abuts the western margin of the public road (Plate 15, 16). The sub-oval shaped ringfort, which is defined by a low earthen bank, measures c.60 metres NE-SW by c.40 metres NW-SE. As the road construction in this area cut significantly down into the hillside, it is highly unlikely that any archaeological remains associated with any potential enclosing ditch or outer ancillary features survive beneath the road surface.

Along the same section of the proposed route but situated c.30 metres east of the road within a moderate quality pasture field, is the location of a radial-stone cairn (CO105-058----) (Plate 17). This field lies at a lower level than the adjoining stretch of road. The sod covered, sub-circular cairn, which has a diameter of c.6 metres and a maximum height of 0.5 metres, is defined by three radially set stones and two further partially embedded slabs. A slight hollow is evident in its centre. Provided that construction works along this underground section of the grid route are restricted to the road itself, there is no predicted negative impact, either direct or visual, on either recorded monument in its vicinity. However, as the proposed route does extend through the ZON of both monuments, and as the road is at a higher level than the cairn (CO106-058----), it is recommended below (Section 8) that archaeological monitoring of the excavation of the cable trench be undertaken within the combined zones of notification ringfort (C0105-026----) and radial stone cairn (CO105-058----).

The underground cable route extends across agricultural land in the townland of Dromloughlin. Although there are no recorded archaeological sites in its vicinity, there is potential for the existence of sub-surface archaeological artefacts, features or deposits along this section of the route.

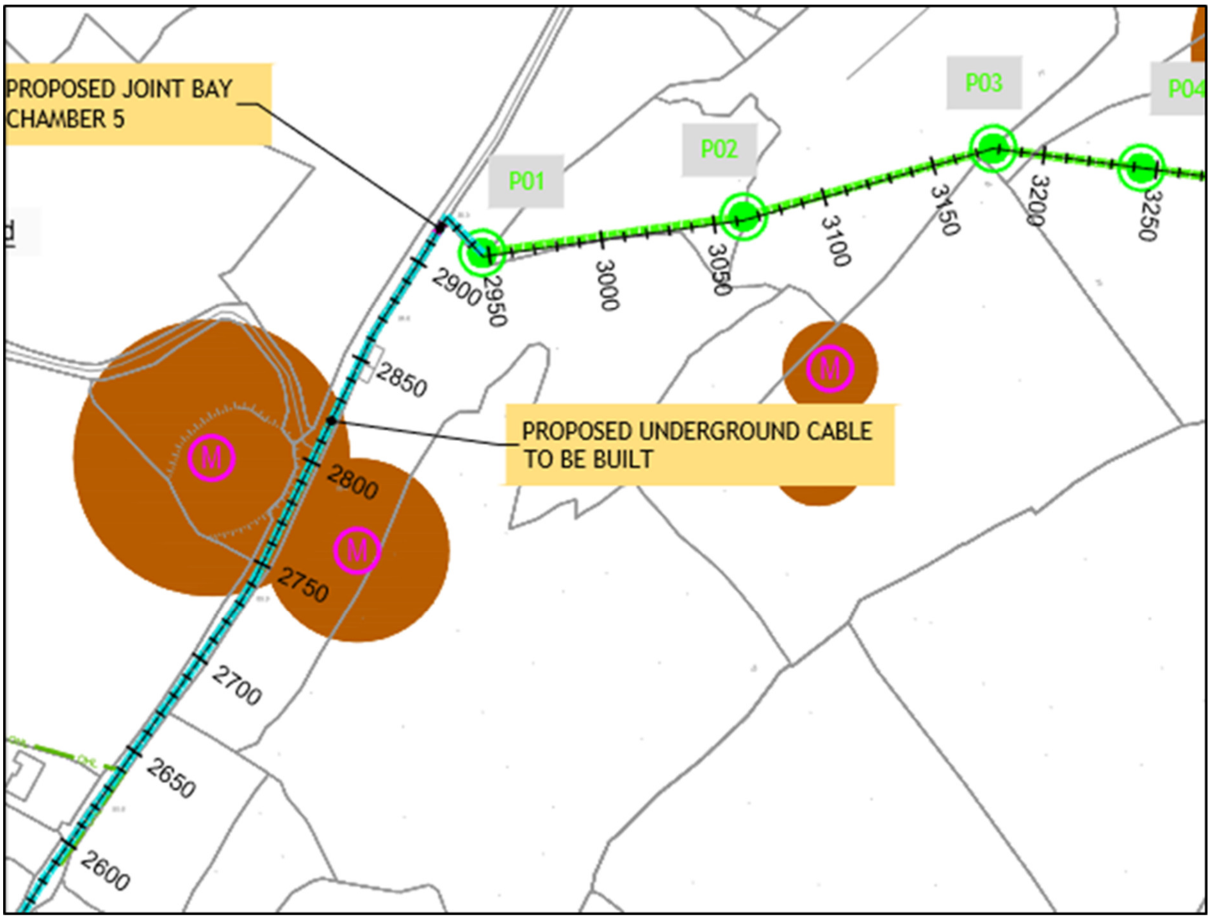


Figure 13.7 - Graphic depicting location of the recorded sites adjacent to the underground cable route in Shandrum Beg townland

13.7 ASSESSMENT OF WIND FARM SITE

The wind farm development site is located entirely within the townland of Derreenacrinnig West, and when completed, will comprise 7 wind turbines, a substation, associated access road and ancillary infrastructure. While there are 44 recorded archaeological sites (mainly comprising hut sites, standing stones and enclosures) within 1.5km of the boundaries of the wind farmland-holding, there are no recorded archaeological sites within the landholding or development boundary. The nearest recorded monument to the wind farm is that of a hut site (CO106-107----), which is located within Derreenacrinnig West townland, c.70m to the west of the land-holding boundary.

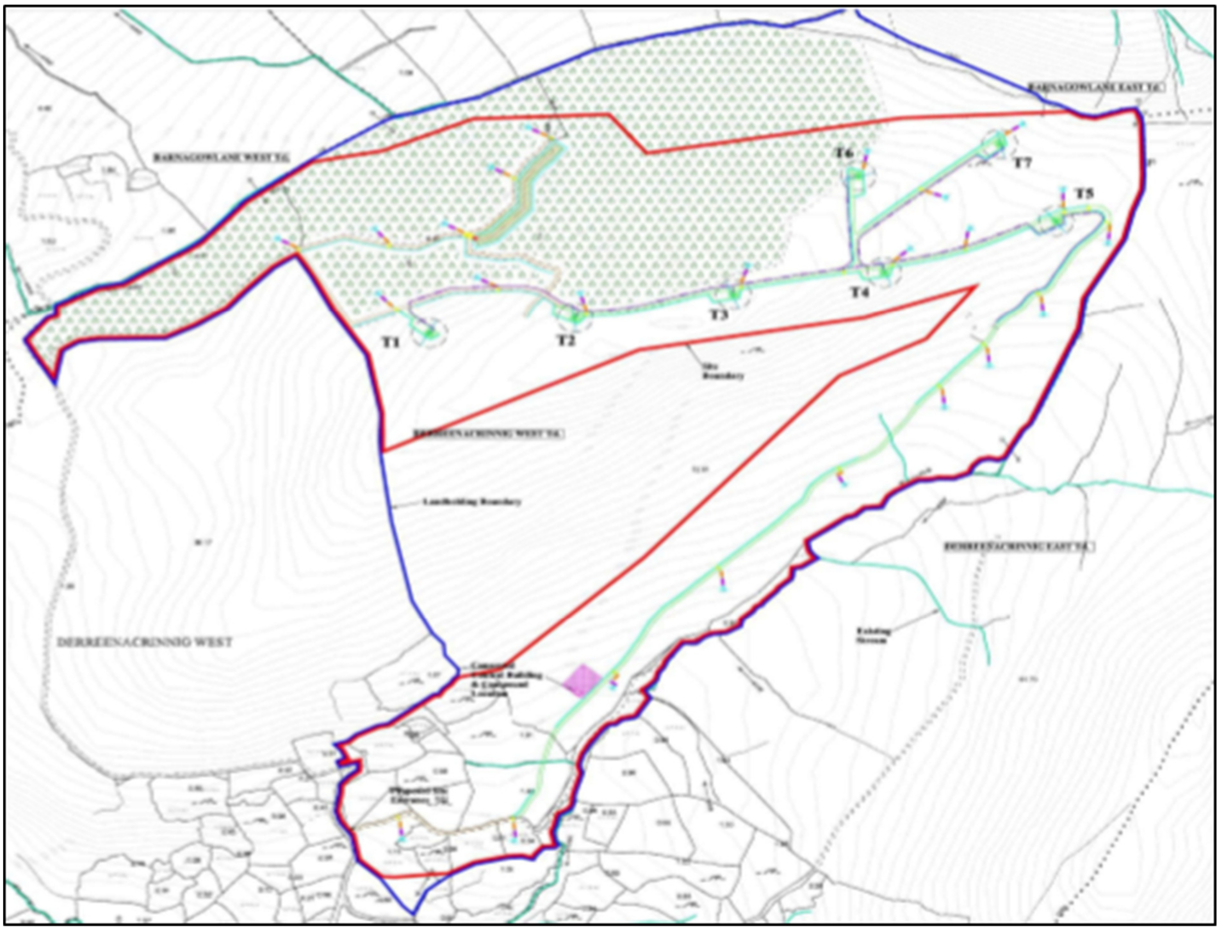


Figure 13.8 - Map depicting the Derreenacrinnig Wind Farm site layout, blue line defines the boundary of the overall landholding, red line defines the development boundary of the wind farm site

Archaeological monitoring of the first phase of construction at the wind farm development site was undertaken by Lane Purcell Archaeology during September and October of 2017. Groundworks which were monitored included the topsoil/peat stripping of approximately 1.5km of the main wind farm access road, as well as stripping at the hardstand locations of Turbines 1, 2, 3 and 4. Monitoring revealed that the peat ranged in thickness from 0.2m to 0.6m, with some deeper pockets approximately 1.75m in depth, and overlay either bedrock or compact, heavy white-grey sandy clay subsoil. No features or finds of archaeological significance were revealed during archaeological monitoring.

As there are no recorded archaeological monuments within the boundaries of the wind farm site, and as no archaeological remains were revealed during the monitoring of the first phase of construction works, development works to date at the Derreenacrinnig Wind Farm site have had no impact on the archaeological resource of the area. Furthermore, it can be considered that there is low potential for the uncovering of archaeological remains during future phases of work at the development site.

13.8 CONCLUSIONS ON CUMULATIVE IMPACTS

The assessment of the combined wind farm development and grid route connection has identified a number of slight visual impacts on archaeological monuments while no direct impacts have been identified.

Derreenacrinnig Wind Farm Site

The works completed to date at the Derreenacrinnig West Wind Farm development site have resulted in no impact on the archaeological resource of the area.

Constructed Overhead Line

It is noted that the "*as constructed*" sections of the Overhead Line were not monitored by an archaeologist. Generally, however, the footprints and associated ground disturbances of the poles and stay supports are quite small (usually less that 1m2 each). Given that the site walkover/desktop assessment considered that such locations, outside the zone of notification (ZON) of recorded monuments, were of low archaeological potential, it is unlikely that any artefacts, features or deposits of an archaeological nature were disturbed during construction works. Nevertheless, this cannot be discounted.

A marginal encroachment (without the required consent) into the Zones of Notification (ZON) of three recorded monuments in Derryarkane townland occurred during the construction of the OHC. This occurred during the erection of 'Pole 61' (ZON of fulacht fia CO106-079----) and 'Pole 63' (ZON of stone circle – five-stone (CO106-019----), and standing stone (CO106-057----) which combined form National Monument No. 600). No direct impacts at these monuments were identified.

The constructed portions of the OHC have resulted in a very slight visual impact occurring at the following sites within the study area: ringfort (CO106-009----) in Ardrah; ringfort (CO106-020001-) and standing stone (CO106-021----) in Maulikeeve; fulacht fia (CO106-077001-) in Derryarkane.

The constructed portions of the OHC have resulted in a slight visual impact occurring at the following sites within the study area: standing stone (CO106-114----); stone circle – five-stone (CO106-019----) and standing stone (CO106-057----) (National Monument No. 600) in Derryarkane; standing stone (CO106-077002-) and fulacht fia (CO106-079----) also in Derryarkane.

Propose Overhead Circuit

There will be no direct, negative impacts on any recorded archaeological monument or ZON of any monument in its vicinity, due to the construction of the remaining section of the OHC. However, the lack of any shielding elements, such as hedgerows or trees, between the proposed OHC route and the site of the stone circle – multiple-stone (CO105-029001-) and boulder-burial (CO105-029003-) in Cappanaboul townland, means there will be a very slight visual impact on the setting of both monuments due to the construction of the OHC in this area.

Proposed Underground Cable

There is no predicted direct, negative impact on the known archaeological resource due to the construction of the underground cable portion of the grid connection route. While the route does pass through the ZON of two recorded monuments in Shandrum Beg townland (ringfort (CO105-026----) and radial stone cairn (CO105-058----), the nature of the topography in the area, combined with the construction of the road that will carry the cable, substantially reduces the archaeological potential of this section of the route.

The underground cable route extends across agricultural land in the townlands of Dromloughlin, Gortnacowly and Dereenacrinnig West. Although there are no recorded archaeological sites within 100 metres of the proposed route in these townlands, there is potential for the existence of sub-surface archaeological artefacts, features or deposits along these sections of the route.

13.9 STATEMENT OF SIGNIFICANCE

Given that only effects of significant impact or greater are considered “significant” in terms of the EIA Regulations, the potential effects of the proposed Grid Connection and the consented Derreenacrinnig West Wind Farm on the archaeological, architectural and cultural heritage resources are considered to be not significant.

13.10 RECOMMENDATIONS

It is recommended that all ground disturbance works required by the scheme in green-field areas be monitored by a suitably qualified archaeologist during the construction phase. This is a standard archaeological mitigation strategy undertaken as part of infrastructure schemes that, while they have no predicted impacts on the recorded archaeological resource, may have a potential impact on unrecorded, sub-surface archaeological deposits or artefacts.

It is further recommended that archaeological monitoring of the excavation of the underground cable trench in Shandrum Beg townland be undertaken while the trench extends through the combined zones of notification of ringfort (C0105-026----) and radial stone cairn (CO105-058----).

13.11 REFERENCES

John Cronin & Associates. 2017. Derreenacrinnig West Wind Farm Grid Connection, Co. Cork. Archaeological Assessment. Unpublished.

Lane Purcell Archaeology. 2018. Derreenacrinnig West Wind Farm, Drimoleague, Co. Cork. Archaeological Monitoring Report. Unpublished.

Lewis, S. 1837. Topographical Dictionary of Ireland. London: Samuel Lewis & Son.

http://webgis.archaeology.ie/historicenvironment/

http://www.excavations.ie/

http://www.geohive.ie/

https://www.logainm.ie/en/

14. INTERACTIONS OF THE FOREGOING

14.1 INTRODUCTION

14.1.1 Background and Objectives

Jennings O'Donovan & Partners Ltd. ("JOD"), have been commissioned by ESB [The Applicant] to assess the interactions of the foregoing, i.e. the interactions between the various impacts identified in the previous sections of the Revised Environmental Impact Assessment Report (EIAR), during both the construction and the operational phases of the proposed EIA Development.

Article 3 of the Revised EIA Directive states that:

"The environmental impact assessment shall identify, describe and assess in appropriate manner, in the light of each individual case, the direct and indirect significant effects of a project on the following factors:

(a) Population and human health;

(b) biodiversity, with particular attention to species and habitats protected under Directive 92/43/EEC and Directive 2009/147/EC;

(c) land, soil, water, air and climate;

(d) material assets, cultural heritage and the landscape; and

(e) the interaction between the factors referred to in points (a) to (d)".

Parts (a) to (d) have been included in previous sections of the REIS / EIAR. This section provides the assessment under part (e).

Full details of the proposed EIA Development are provided in **Section 2: Project Description**. This section of the EIA looks at the potential for interactions and inter-relationships between the aspects of the environment. None of the foregoing topics exist in isolation from the others and, because of this; any impact on one element of the environment may also impact on another. A slight cumulative impact on a number of topics may result in a significant impact on another topic.

14.2 PREDICTED IMPACT

A matrix of all topics is presented in Table 14.1, which illustrates the overlap or interaction of topics. Interaction in the matrix, however, does not imply a cumulative impact.

TOPIC	HB	F&F	S&G	Water	A&C	L	CH	MA
Human Beings		*	*	*	*		*	*
Flora and Fauna	*		*	*		*		

Soils & Geology	*	*		*		*		*
Water	*	*	*					
Air and Climate	*							
Landscape		*	*					
Cultural Heritage	*							
Material Assets	*		*					

Table 14.1 Interaction matrix

As each diagonal half of the matrix is a mirror image of the other only the vertical side will be described in descending order from the first interaction – Human Beings and Flora and Fauna.

Human Beings and

i. Flora and Fauna
ii. Soils and Geology
iii. Water
iv. Air and Climate
v. Cultural Heritage
vi. Material Assets

Negative Effects of the Consented Derreenacrinnig West Wind Farm

Any negative affect on the environment as a result of this project is produced by Human Beings and, because it is the environment we live in, any negative affect will also affect us as Human Beings. For example, the use of fossil fuels (Material Assets) for electricity generation produces greenhouse gases and fumes (Air and Climate affect) which affects weather patterns and, in turn, agriculture (Human Beings). The partial removal of the reliance on fossil fuels for electricity generation as a result of the project can therefore be seen as having positive overlapping impacts on Material Assets, Air and Climate and Human Beings. Because no negative affect has been predicted for Human Beings there are no negative interactions with the other overlapping topics.

Negative Effects of the Proposed Grid Connection

Any negative effect on the effect on the environment as a result of the proposed Grid Connection is produced by Human Beings and, because it is the environment in which we as humans live, nay negative effect will also affect us as Human Beings. For example, the use of fossil fuels (Material Assets) for electricity generation produces greenhouse gases and fumes (Air and Climate effect) which affects weather patterns and, in turn, agriculture (Human Beings). The partial removal of the reliance on fossil fuels for electricity generation as a result of the Project through the facilitation of the Derreenacrinnig West Wind Farm can therefore be

seen as having positive overlapping impacts on Material Assets, Air and Climate and Human Beings. Because no negative effect has been predicted for Human Beings there are no negative interactions with the other overlapping topics.
No mitigation measures are proposed.

Flora and Fauna and

vii. Human Beings
viii. Soils and Geology
ix. Water
x. Landscape

The interrelationship of Flora and Fauna with the topics Soils and Geology and Water is very close. A negative effect on one topic has the potential to affect the other two and vice versa. This is particularly true where vegetation removal decreases soil stability, which can result in surface water runoff with high suspended solids content. Conversely, reduced water quality or the removal of large areas of soil would result in negative effects on plant and animal species.
It is anticipated that this complex interrelationship will be dealt with by reducing the vegetated area, which is to be affected, by carefully controlling the movement of vehicles during construction. Any surface water runoff, which originates at, or passes over exposed soil or peat, particularly at road construction, will be drained into settling ponds to allow the suspended solids to be removed before joining natural watercourses.

These potentially negative effects are only expected to occur at construction stage and are considered to be adequately mitigated by the measures outlined.

Affects on Flora and Fauna can also affect landscape in terms of vegetation. In the case of this site there is a small portion of trees to be removed for road widening, as the majority of the site is upland blanket bog and wet heath. Any negative impact on this habitat will be minor and short term with the development footprint taking up approximately 3 % of the site, no significant negative effect can be predicted, and no mitigation measures are proposed.

The Grid Connection and The Consented Wind Farm

The interrelationship of Flora and Fauna with the topics Soils and Geology and Water is very close. A negative effect on one topic has the potential to affect the other two and vice versa. This is particularly true where vegetation removal decreases soil stability, which can result in surface water runoff with a high content of suspended solids. Conversely, reduced water quality or the removal of large areas of soil would result in negative effects on plant and animal species.

It is anticipated that this complex interrelationship will be dealt with by reducing the vegetated area affected and by carefully controlling the movement of vehicles during construction. Most of the underground cable route will be placed in roadside verges. Most of the route will be reinstated to its previous use post construction.

Effects on Flora and Fauna can also affect landscape in terms of vegetation. In the case of this site an element of forestry will be removed. The proposed cable route runs through approximately? km of conifer plantation from the consented Derreenacrinnig West Wind Farm substation. Additionally, the EIS undertaken for the Derreenacrinnig West Wind Farm confirmed that the loss of conifer plantation and heath is not a significant impact given they are not valuable habitats. Indeed, tree removal around the turbine will create open spaces for recolonisation by bog and heath plants resulting in increased habitat diversity resulting in a minor positive impact.

No significant negative effect can be predicted, and no mitigation measures are proposed.

Soils and Geology

xi. Human Beings
xii. Flora and Fauna
xiii. Water
xiv. Landscape
xv. Material Assets

Several of these interactions have been described above.
The reaction between Soils and Geology and Landscape is concerned with the changes the landscape undergoes as a result of changes in the soil coverage or geological makeup. Landscape is usually viewed at a distance and the removal of small quantities of soil and rock should not be visible from even nearby viewpoints.

No negative effects are predicted, and no mitigation measures are proposed.

The Proposed Grid Connection and The Consented Derreenacrinnig West Wind Farm
Several of these interactions have been described above. The reaction between Soils and Geology and Landscape is concerned with the changes the landscape undergoes as a result of changes in the soil coverage or geological makeup. Landscape is usually viewed at a distance and the removal of small quantities of soil and rock should not be visible from even nearby viewpoints. The underground cable grid connection will not be visible during operation.

The overhead cable will have limited visual impact on the landscape however, this limited impact will be outweighed by the public benefits that the proposal will produce in terms of renewable energy targets.

No negative effects are predicted, and no mitigation measures are proposed.

Water

xvi. Human Beings

xvii. Flora and Fauna

xviii. Soils and Geology

These three interactions have been discussed above. No negative effects are predicted, and no mitigation measures are proposed.

Air and Climate

xix. Human Beings

Landscape

xx. Flora and Fauna

xxi. Soils and Geology

Material Assets

xxii. Human Beings

xxiii. Soils and Geology

These interactions have been discussed above. No significant negative impacts are predicted for these sections and as a result no negative interaction can be foreseen.

14.3 MITIGATION MEASURES

No mitigation measures are required in addition to those outlined in their respective chapters above.

14.4 CUMULATIVE AND IN-COMBINATIONS IMPACTS OF THE PROPOSED GRID CONNECTION AND THE CONSENTED DERREENACRINNING WEST WIND FARM

As outlined in the respective chapters above, there is likely to be a small cumulative effect with the Derreenacrinnig West Wind Farm for the various topics discussed. There could also be a small negative impact when taken in-combination with other plans and projects planned for the area, should they be constructed at the same time.

14.5 CONCLUSION ON THE DEVELOPMENT INTERACTIONS AND INTER-RELATIONSHIHPS AND THEIR IMPACTS IN CONTEXT

Following the assessment of the interactions of the foregoing topics, it can be concluded that no significant negative effects from the proposed cable grid connection are predicted. As set out above, the Grid Connection works are unlikely to have significant environmental effects for those topics outline above. Additionally, it is unlikely to significant cumulative or in-combination effects when assessed together with other plans and projects in the vicinity, especially the already consented Derreenacreenig West Wind Farm project. Furthermore, it is considered that, given the assessed effects, the conclusions reached in the Derreenacrinnig West Wind Farm EIS [November 2010] would not change as a result of the proposed Grid Connection works detailed in this EIA Report.