DALMANUTHA WIND (PTY) LTD

DALMANUTHA WIND ENERGY FACILITY (ALTERNATIVE 1 AND 2), BELFAST, MPUMALANGA

DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT

DRAFT
MAY 2023

PUBLIC

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CONTENTS

DOCUMENT DESCRIPTION 2

PRODUCTION TEAM 3

1 INTRODUCTION 31

1.1 PURPOSE OF THIS REPORT 31
1.2 BACKGROUND INFORMATION 31
1.3 KEY ROLE PLAYERS 34
1.4 IMPACT ASSESSMENT TERMS OF REFERENCE 36
1.5 IMPACT ASSEMENT REPORT STRUCTURE 38
1.6 ASSUMPTION AND LIMITATIONS 42

2 GOVERNANCE FRAMEWORK 51

2.1 NATIONAL ENVIRONMENTAL LEGAL FRAMEWORK 51
2.2 CONSISTENCY WITH NATIONAL ENVIRONMENTAL MANAGEMENT ACT (NEMA) PRINCIPLES 67
2.3 POLICIES AND PLANS 73
2.4 PROVINCIAL AND MUNICIPAL LEGAL AND REGULATORY FRAMEWORK 77
2.5 INTERNATIONAL ENVIRONMENTAL AND SOCIAL STANDARDS 80
2.6 OTHER GUIDELINES AND PERMITS 93

3 SCOPING PHASE SUMMARY 95

3.1 PROCEDURAL PROCESS 95
3.2 AUTHORITY CONSULTATION 95
3.3 STAKEHOLDER CONSULTATION 116
3.4 PUBLIC PARTICIPATION PLAN 117
3.5 STAKEHOLDER IDENTIFICATION 117
3.6 STAKEHOLDER NOTIFICATION 118

3.7 SCOPING STUDY FINDINGS 119
3.8 SCOPING RECOMMENDATIONS 130
4 EIA METHODOLOGY 132
4.1 DETAILED ENVIRONMENTAL ASSESSMENT 132
4.2 IMPACT ASSESSEMNT METHODOLOGY 133
4.3 STAKEHOLDER ENGAGEMENT 136
4.4 DFFE WEB-BASED ENVIRONMENTAL SCREENING TOOL 137
5 NEED AND DESIRABILITY 142
6 PROJECT DESCRIPTION 147
6.1 SITE LOCATION 147
6.2 WIND ENERGY POWER GENERATION PROCESS 154
6.3 SOLAR ENERGY GENERATION PROCESS 155
6.4 PROJECT INFRASTRUCTURE 157
6.5 GENERAL CONSTRUCTION ACTIVITIES 160
6.6 ALTERNATIVES 161
7 DESCRIPTION OF BASELINE ENVIRONMENT 170
7.1 PHYSICAL ENVIRONMENT 170
7.2 BIOLOGICAL ENVIRONMENT 191
7.3 SOCIAL ENVIRONMENT 264
8 SITE SENSITIVITY VERIFICATION 325
8.1 AGRICULTURE 325
8.2 ANIMAL SPECIES 329
8.3 AQUATIC BIODIVERSITY 330
8.4 ARCHAEOLOGICAL & CULTURAL HERITAGE 332
8.5 BATS 335
8.6 AVIFAUNA 338

8.7	FLICKER	346
8.8	LANDSCAPE/VISUAL	348
8.9	PALAEONTOLOGY	358
8.10	NOISE	360
8.11	TERRESTRIAL PLANT SPECIES	361
8.12	TERRESTRIAL BIODIVERSITY	366
8.13	CIVIL AVIATION	370
8.14	RFI	372
8.15	DEFENCE	374
8.16	SITE SENSITIVITY VERIFICATION SUMMARY	377
8.17	CONSOLIDATED SITE SENSITIVITY	379
9	**IMPACT ASSESSMENT**	**384**
9.1	NOISE AND VIBRATIONS	384
9.2	GEOLOGY	387
9.3	SOILS, LAND CAPABILITY AND AGRICULTURAL POTENTIAL	389
9.4	SURFACE WATER	397
9.5	HAZARDOUS SUBSTANCES AND POLLUTANTS	407
9.6	WASTE MANGAEMENT	409
9.7	TERRESTRIAL PLANT BIODIVERSITY	412
9.8	TERRESTRAIL ANIMAL BIODIVERSITY	423
9.9	AQUATIC BIODIVERSITY	436
9.10	AVIFAUNA	443
9.11	BATS	455
9.12	VISUAL AND LANDSCAPE	458
9.13	HERITAGE AND CULTURAL RESOURCES	471
9.14	PALAEONTOLOGY	482
9.15	TRAFFIC	483
9.16	SOCIO-ECONOMIC	487
9.17	SHE RISK	500

10 CUMULATIVE IMPACTS 571

10.1 NOISE 572
10.2 SURFACE WATER 572
10.3 SOILS AND AGRICULTURE 573
10.4 AVIFUANA 576
10.5 ANIMAL SPECIES 577
10.6 PLANT SPECIES 578
10.7 AQUATIC BIODIVERSITY 579
10.8 PALAEONTOLOGY 580
10.9 HERITAGE 580
10.10 VISUAL AND LANDSCAPE 580
10.11 TRAFFIC 581
10.12 SOCIAL 582
10.13 GEOTECHNICAL 582
10.14 BATS 583

11 ENVIRONMENTAL IMPACT STATEMENT 585

11.1 SPECIALIST CONCLUSIONS 585
11.2 IMPACT SUMMARY 605
11.3 BIODIVERSITY OFFSET STRATEGY 620
11.4 ALTERNATIVES ASSESSMENT 630
11.5 LAYOUT OPTIMISATION 636
11.6 IMPACT STATEMENT 640

12 CONCLUSION 642

TABLES

Table 1-1 - Details of Project Proponent 34
Table 1-2 - Competent Authority 34
Table 1-3 - Details of the Environmental Assessment Practitioner 35
Table 1-4 - Details of Specialists 36
Table 1-5 - Legislated Report Requirements as detailed in GNR 982 38
Table 2-1 - Applicable National Legislation 51
Table 2-2 - Consistency of the Dalmanutha Renewable Energy Facility and the EIA Process with the NEMA principles 67
Table 2-3 - Applicable Regional Policies and Plans 73
Table 2-4 - Provincial Plans 77
Table 2-5 - District and Local Municipality Plans 79
Table 2-6 - IFC Performance Standards Applicability to the Project 82
Table 2-7 - Requirements and Applicability of the Equator Principles 89
Table 2-8 - Additional Permits and Authorisations required for the proposed development 94
Table 3-1 - Comments received from the DFFE regarding the DSR 96
Table 3-2 - Comments received from the DFFE regarding the FSR 106
Table 3-3 - Dates on which the Adverts were published 118
Table 3-4: Construction Phase Impacts 119
Table 3-5: Operational Phase Impacts 124
Table 3-6: Initial Cumulative Impacts 128
Table 3-7: Alternatives Summary 130
Table 4-1: Details of the Specialists 132
Table 4-2: Impact Assessment Criteria and Scoring System 134
Table 4-3: Sensitivities identified in the screening report for the Dalmanutha WEF 138
Table 4-4: Sensitivities identified in the screening report for the Dalmanutha Hybrid Facility 139
Table 4-5 – Specialists Studies identified by the DFFE Screening Tool 140
Table 6-1 - Dalmanutha WEF Affected Farm Portions 147

Table 6-2 - Co-ordinates of the application site 151
Table 6-3 – Proposed project infrastructure 157
Table 6-4 - Construction Activities 160
Table 7-1 - Metadata for the rainfall stations 170
Table 7-2 - Conceptual Catchment Characteristics 186
Table 7-3 – Extent of loss of mapped CBA and ESA 199
Table 7-4 -Wetlands identified within the Project area 225
Table 7-5 - Wetland identified within the Project area with associated PES and EIS scores 230
Table 7-6 - Bird species data for the site 251
Table 7-7 - List of bat species that has been detected on the area including their conservation status, foraging habits and risk of impact with wind turbines 263
Table 7-8. Burial sites identified in the study area. 277
Table 7-9. Recorded structures in the study area. 280
Table 7-10. Stone age Features in the Project area. 284
Table 7-11. Recorded Iron Age features in the Project Area. 285
Table 7-12. Recorded battlefield sites in the Project area. 291
Table 7-13 - Population of Emakhazeni Local Municipality 314
Table 7-14 - Percentage Distribution of Emakhazeni Municipality by population group -2011 314
Table 7-15 - Percentage Distribution of Emakhazeni Municipality by Population Group- 2016 314
Table 8-1 - Sensitivity Classes 326
Table 8-2 - Ecological importance of mapped vegetation communities in the LSA 368
Table 8-3 - Assessment Protocols and Site Sensitivity Verification Summary 377
Table 9-1 – Construction Impact of Noise 385
Table 9-2 – Operational Impact of Noise 386
Table 9-3 – Operational Impact of Noise 386
Table 9-4 – Construction Impact of soil erosion 387
Table 9-5 – Construction Impact of oil spillages 388
Table 9-6 – Operational Impact of soil erosion 388
Table 9-7 – Operational Impact of oil spillages 389

Table 9-8 – Construction Impact on soils 390
Table 9-9 – Construction Impact on agricultural land 391
Table 9-10 – Construction Impact on agricultural practices 391
Table 9-11 – Construction Impact on erosion and sedimentation 392
Table 9-12 – Construction Impact on soil contamination 393
Table 9-13 – Operational Impact on soils 393
Table 9-14 – Operational Impact on agricultural land 394
Table 9-15 – Operational Impact on agricultural practices 395
Table 9-16 – Operational Impact on erosion and sedimentation 396
Table 9-17 – Operational Impact on soil contamination 396
Table 9-18 – Construction Impact on clearing of vegetation and stripping of top soil 398
Table 9-19 – Construction Impact of earthworks 400
Table 9-20 – Construction Impact of materials management 401
Table 9-21 – Construction Impact of turbines, road network and substations 402
Table 9-22 – Construction Impact of Movement of vehicles and machinery 403
Table 9-23 – Operational Impact of Physical presence of turbines, road network and substations 404
Table 9-24 – Operational Impact of Materials management 404
Table 9-25 – Operational Impact of Movement of vehicles and machinery 405
Table 9-26 – Decommissioning Impact of Physical presence of former turbines, former solar fields, road network and substations 406
Table 9-27 – Decommissioning Impact of Movement of vehicles and machinery 407
Table 9-28: Construction Impact of contaminants on soil, groundwater and surface water 408
Table 9-29: Operational Impact due to hazardous substances 409
Table 9-30 – Typical Construction Waste Types 410
Table 9-31: Construction Impact of waste generation 411
Table 9-32: Construction Impact associated with sanitation waste 412
Table 9-33 – Construction Impact on flora habitat-Alternative 1 413
Table 9-34 – Construction Impact on flora habitat-Alternative 2 414
Table 9-35 – Construction Impact on ecosystems-Alternative 1 416

Table 9-36 – Construction Impact on ecosystems-Alternative 2 416
Table 9-37 – Construction Impact on alien invasive species 417
Table 9-38 – Construction Impact on flora SCC 419
Table 9-39 – Construction Impact on soil erosion 420
Table 9-40 – Operational Impact on alien invasive species 421
Table 9-41 – Decommissioning Impact on alien invasive species 422
Table 9-42 – Decommissioning Impact on erosion 423
Table 9-43 – Construction Impact on fauna habitat- Alternative 1 424
Table 9-44 – Construction Impact on fauna habitat-Alternative 2 425
Table 9-45 – Construction Impact on fauna habitat-Alternative 1 427
Table 9-46 – Construction Impact on fauna habitat-Alternative 2 427
Table 9-47 – Construction Impact on fauna mortality 428
Table 9-48 – Construction Impact on fauna SCC 430
Table 9-49 – Construction Impact of alien invasive species 431
Table 9-50 – Operational Impact fauna morality 432
Table 9-51 – Operational Impact on fauna habitat 433
Table 9-52 – Operational Impact on fauna SCC 434
Table 9-53 – Decommissioning Impact on fauna mortality 435
Table 9-54 – Decommissioning Impact on habitat 435
Table 9-55 – Construction Impact on wetland habitat 437
Table 9-56 – Construction Impact on wetland hydrology 439
Table 9-57 – Construction Impact on wetland water quality 440
Table 9-58 – Construction Impact on wetland soil 441
Table 9-59 – Operational Impact on alien invasive plants 443
Table 9-60 – Construction Impact on bird habitat destruction 443
Table 9-61 – Construction Impact on disturbance of birds 445
Table 9-62 – Operational Impact on disturbance of birds 446
Table 9-63 – Operational Impact on displacement of birds 449
Table 9-64 – Operational Impact on bird collisions 452
Table 9-65 – Operational Impact on collision & electrocution of birds on overhead power lines 455

Table 9-66 – Construction Impact on bat habitats and roosts 456
Table 9-67 –Operational Impact on bat mortalities 457
Table 9-68 –Operational Impact of artificial lighting 457
Table 9-69 – Construction Impact on visual receptors 458
Table 9-70 – Operational Impact on visual receptors within 5km radius 459
Table 9-71 – Operational Impact on visual receptors within 5km-10km radius 460
Table 9-72 – Operational Impact on visual receptors within 10km-20km radius 461
Table 9-73 – Operational Impact on visual receptors beyond 20km radius 462
Table 9-74 – Operational Impact on protected areas within a 5 – 20km radius 463
Table 9-75 – Operational Impact of shadow flicker 464
Table 9-76 – Operational Impact of shadow flicker 465
Table 9-77 – Operational Impact of solar glint 466
Table 9-78 – Operational Impact of solar glint 467
Table 9-79 – Operational Impact of operational, safety and security lighting of the facility at night 468
Table 9-80 – Operational Impact of ancillary infrastructure 469
Table 9-81 – Operational Impact on sense of place 470
Table 9-82 – Construction Impact on graves in the areas-Alternative 1 471
Table 9-83 – Construction Impact on Historical infrastructure-Alternative 1 472
Table 9-84 – Construction Impact on Iron Age sites-Alternative 1 472
Table 9-85 – Construction Impact on sense of place the cultural landscape-Alternative 1 473
Table 9-86 – Construction Impact on graves in the areas-Alternative 2 473
Table 9-87 – Construction Impact on Historical infrastructure-Alternative 2 473
Table 9-88 – Construction Impact on Iron Age sites-Alternative 2 474
Table 9-89 – Construction Impact on battlefields-Alternative 2 474
Table 9-90 – Construction Impact on sense of place the cultural landscape-Alternative 2 475
Table 9-91 – Operational Impact on graves in the areas-Alternative 1 475
Table 9-92 – Operational Impact on Historical infrastructure-Alternative 1 475
Table 9-93 – Operational Impact on Iron Age sites-Alternative 1 476
Table 9-94 – Operational Impact on sense of place the cultural landscape-Alternative 1 476
Table 9-95 – Operational Impact on graves in the areas-Alternative 2 476

Table 9-96 – Operational Impact on Historical infrastructure-Alternative 2 477
Table 9-97 – Operational Impact on Iron Age sites-Alternative 2 477
Table 9-98 – Operational Impact on battlefields-Alternative 2 478
Table 9-99 – Operational Impact on sense of place the cultural landscape-Alternative 2 478
Table 9-100 – Decommissioning Impact on graves in the areas-Alternative 1 478
Table 9-101 – Decommissioning Impact on Historical infrastructure-Alternative 1 479
Table 9-102 – Decommissioning Impact on Iron Age sites-Alternative 1 479
Table 9-103 – Decommissioning Impact on sense of place the cultural landscape-Alternative 1 480
Table 9-104 – Decommissioning Impact on graves in the areas-Alternative 2 480
Table 9-105 – Decommissioning Impact on Historical infrastructure-Alternative 2 480
Table 9-106 – Decommissioning Impact on Iron Age sites-Alternative 2 481
Table 9-107 – Decommissioning Impact on battlefields-Alternative 2 481
Table 9-108 – Decommissioning Impact on sense of place the cultural landscape-Alternative 2 482
Table 9-109 – Construction Impact on palaeontological finds 482
Table 9-110 – Construction Impact of vehicle trips on-site 483
Table 9-111 – Construction Impact of additional trips on unsurfaced district roads 484
Table 9-112 – Construction Impact of additional trips on the surfaced roads 484
Table 9-113 – Operational Impact of vehicle trips on-site 485
Table 9-114 – Operational Impact of additional trips on unsurfaced district roads 485
Table 9-115 – Operational Impact of additional trips on the surfaced roads 486
Table 9-116 – Construction Impact on economic benefits 487
Table 9-117 – Construction Impact on employment 488
Table 9-118 – Construction Impact on noise 488
Table 9-119 – Construction Impact on dust 489
Table 9-120 – Construction Impact on lighting 489
Table 9-121 – Construction Impact on traffic 490
Table 9-122 – Construction Impact on population 491
Table 9-123 – Construction Impact on health and safety 492
Table 9-124 – Operational Impact on power generation 492

Table 9-125 – Operational Impact on employment 493
Table 9-126 – Operational Impact on economic development 494
Table 9-127 – Operational Impact on noise-alternative 1 494
Table 9-128 – Operational Impact on noise-alternative 2 495
Table 9-129 – Operational Impact on visual receptors 496
Table 9-130 – Operational Impact on traffic 497
Table 9-131 – Operational Impact on health and safety 497
Table 9-132 – Decommissioning Impact on employment 498
Table 9-133 – Decommissioning Impact on regional economy 499
Table 9-134 – Decommissioning Impact on infrastructure 499
Table 9-135: Construction Impact on Human Health chronic exposure to toxic chemical or biological agents 500
Table 9-136: Construction Impact on human health - exposure to noise 501
Table 9-137: Construction Impact on human health - exposure to temperature extremes 501
Table 9-138: Construction Impact on human health – exposure to psychological stress 502
Table 9-139: Construction impact on human health – exposure to ergonomic stress 502
Table 9-140: Construction impact on human and equipment safety – exposure to fire radiation 503
Table 9-141: Construction Impact on human and equipment safety - exposure to fire radiation for SSL BESS 504
Table 9-142: Construction Impact on human and equipment safety - exposure to explosion over pressures 505
Table 9-143: Construction Impact on human and equipment safety - exposure to acute toxic chemical and biological agents 506
Table 9-144: Construction Impact on human and equipment safety - exposure to acute toxic chemical and biological agents for SSL BESS 507
Table 9-145: Construction Impact on human and equipment safety - exposure to violent release of kinetic or potential energy 508
Table 9-146: Construction Impact on human and equipment safety - exposure to electromagnetic waves 509
Table 9-147: Construction Impact on the environment - emissions to air 510
Table 9-148: Construction impact on the environment - emissions to water 510

Table 9-149: Construction impact on the environment - emissions to earth 511
Table 9-150: Construction impact on the environment – waste of resources 511
Table 9-151: Construction impact on public - aesthetics 512
Table 9-152: Construction impact on Investors - Financial 512
Table 9-153: Construction impact on employees and investors - security 513
Table 9-154: Construction impact on emergencies 513
Table 9-155: Construction impact on investors - legal 514
Table 9-156: Construction Impact on human health – exposure to toxic chemical or biological agents 515
Table 9-157: Construction Impact on human health - exposure to noise 516
Table 9-158: Construction Impact on human health - exposure to temperature extremes 516
Table 9-159: Construction Impact on human health – exposure to psychological stress 517
Table 9-160: Construction impact on human health – exposure to ergonomic stress 517
Table 9-161: Construction impact on human and equipment safety – exposure to fire radiation 518
Table 9-162: Construction Impact on human and equipment safety - exposure to acute toxic chemical and biological agents 519
Table 9-163: Construction Impact on human and equipment safety - exposure to violent release of kinetic or potential energy 520
Table 9-164: Construction Impact on human and equipment safety - exposure to electromagnetic waves 521
Table 9-165: Construction Impact on the environment - emissions to air 521
Table 9-166: Construction impact on the environment - emissions to water 522
Table 9-167: Construction impact on the environment - emissions to earth 523
Table 9-168: Construction impact on the environment – waste of resources 523
Table 9-169: Construction impact on public - aesthetics 524
Table 9-170: Construction impact on Investors - Financial 524
Table 9-171: Construction impact on employees and investors - security 525
Table 9-172: Construction impact on emergencies 525
Table 9-173: Construction impact on investors - legal matters 526

Table 9-174: Operational Impact on human health - chronic exposure to toxic chemical or biological agents 527
Table 9-175: Operational Impact on human health - chronic exposure to toxic chemical or biological agents for SSL BESS 528
Table 9-176: Operational Impact on human health - exposure to noise 529
Table 9-177: Operational Impact on human health - exposure to temperature extremes and/or humidity 530
Table 9-178: Operational Impact on human health - exposure to psychological stress 530
Table 9-179: Operational Impact on human health - exposure to ergonomic stress 531
Table 9-180: Operational Impact on human and equipment safety - exposure to fire radiation 532
Table 9-181: Operational Impact on human and equipment safety - exposure to fire radiation for SSL BESS 534
Table 9-182: Operational Impact on human and equipment safety - exposure to explosion over pressures 534
Table 9-183: Operational Impact on human and equipment safety - exposure to acute toxic chemical and biological agents 535
Table 9-184: Operational Impact on human and equipment safety - exposure to acute toxic chemical and biological agents for SSL BESS 536
Table 9-185: Operational Impact on human and equipment safety - exposure to violent release of kinetic or potential energy 537
Table 9-186: Operational Impact on human and equipment safety - exposure to electromagnetic waves 538
Table 9-187: Operational Impact on environment - emissions to air 539
Table 9-188: Operational Impact on environment - emissions to water 539
Table 9-189: Operational Impact on environment - emissions to earth 540
Table 9-190: Operational Impact on environment - waste of resources e.g. water, power 541
Table 9-191: Operational Impact on public 541
Table 9-192: Operational Impact on investors – financial 542
Table 9-193: Operational Impact on employees and investors – security 542
Table 9-194: Operational Impact on employees and investors – security 543
Table 9-195: Operational Impact on emergencies 543
Table 9-196: Operational Impact on investors – legal 544

Table 9-197: Operational Impact on human health - chronic exposure to toxic chemical or biological agents 545
Table 9-198: Operational Impact on human health - chronic exposure to toxic chemical or biological agents 546
Table 9-199: Operational Impact on human health - exposure to noise 547
Table 9-200: Operational Impact on human health - exposure to temperature extremes and/or humidity 547
Table 9-201: Operational Impact on human health - exposure to psychological stress 548
Table 9-202: Operational Impact on human health - exposure to ergonomic stress 548
Table 9-203: Operational Impact on human and equipment safety - exposure to fire radiation 549
Table 9-204: Operational Impact on human and equipment safety - exposure to fire radiation 551
Table 9-205: Operational Impact on human and equipment safety - exposure to explosion over pressures 551
Table 9-206: Operational Impact on human and equipment safety - exposure to acute toxic chemical and biological agents 552
Table 9-207: Operational Impact on human and equipment safety - exposure to acute toxic chemical and biological agents for VRF BESS 553
Table 9-208: Operational Impact on human and equipment safety - exposure to violent release of kinetic or potential energy 553
Table 9-209: Operational Impact on human and equipment safety - exposure to electromagnetic waves 554
Table 9-210: Operational Impact on environment - emissions to air 555
Table 9-211: Operational Impact on environment - emissions to water 556
Table 9-212: Operational Impact on environment - emissions to earth 557
Table 9-213: Operational Impact on environment - waste of resources e.g. water, power etc 557
Table 9-214: Operational Impact on public - aesthetics 558
Table 9-215: Operational Impact on investors - financial 558
Table 9-216: Operational Impact on employees and investors – security 559
Table 9-217: Operational Impact on employees and investors – security 559
Table 9-218: Operational Impact on emergencies 560
Table 9-219: Operational Impact on investors – legal 561

Table 9-220: Decommissioning Impact on human health - chronic exposure to toxic chemical or biological agents for both BESS types 561

Table 9-221: Decommissioning Impact on human health - exposure to noise for both BESS types 562

Table 9-222: Decommissioning Impact on human health - exposure to temperature extremes and/or humidity for both BESS types 562

Table 9-223: Decommissioning Impact on human health - exposure to psychological stress for both BESS types 563

Table 9-224: Decommissioning Impact on human health - exposure to ergonomic stress for both BESS types 563

Table 9-225: Decommissioning Impact on human and equipment safety - exposure to fire radiation for both BESS types 564

Table 9-226: Decommissioning Impact on human and equipment safety - exposure to explosion over pressures for both BESS types 564

Table 9-227: Decommissioning Impact on human and equipment safety - exposure to acute toxic chemical and biological agents for both BESS types 565

Table 9-228: Decommissioning Impact on human and equipment safety - exposure to violent release of kinetic or potential energy for both BESS types 565

Table 9-229: Decommissioning Impact on human and equipment safety - exposure to electromagnetic waves for both BESS types 566

Table 9-230: Decommissioning Impact on environment - emissions to air for both BESS types 566

Table 9-231: Decommissioning Impact on environment - emissions to water for both BESS types 567

Table 9-232: Decommissioning Impact on environment - emissions to earth for both BESS types 567

Table 9-233: Decommissioning Impact on environment - waste of resources e.g. water, power etc for both BESS types 568

Table 9-234: Decommissioning Impact on public - aesthetics for both BESS types 568

Table 9-235: Decommissioning Impact on investors - financial for both BESS types 569

Table 9-236: Decommissioning Impact on employees and investors – security for both BESS types 569

Table 9-237: Decommissioning Impact on emergencies for both BESS types 569

Table 9-238: Decommissioning Impact on investors – legal for both BESS types 570

Table 10-1 – Cumulative Impact on surface water 573

Table 10-2 – Cumulative Impact on soil loss 574
Table 10-3 – Cumulative Impact on Loss of Arable Land 574
Table 10-4 – Cumulative Impact on Disturbance to Agricultural Practices 575
Table 10-5 – Cumulative Impact on Erosion and Sedimentation 575
Table 10-6 – Cumulative Impact on soil contamination 575
Table 10-7 – Cumulative Impact on avifauna 577
Table 10-8 – Cumulative impact on terrestrial fauna 578
Table 10-9 – Cumulative Impact on terrestrial flora 579
Table 10-10 – Cumulative impact on aquatic biodiversity 579
Table 10-11 – Cumulative Impact Cultural landscape 580
Table 10-12 – Cumulative Impact of wind farms on the visual quality of the landscape 580
Table 10-13 – Cumulative Impact of erosion 582
Table 10-14 – Cumulative Impact on geology from potential oil spillages 583
Table 11-1 – Construction, Operation and Decommissioning Impact Summary 605
Table 11-2: Cumulative impacts summary 619
Table 11-3 – Predicted wetland losses to proposed project infrastructure 620
Table 11-4 – Wetland ecosystem offset ratio determination (after Macfarlane et al., 2014) 621
Table 11-5 – Basic and adjusted biodiversity offset ratios for terrestrial habitats 622
Table 11-6 – Terrestrial habitat offset targets 622
Table 11-7 – Bird fatalities due to collision with wind turbines (WildSkies, 2023) 624
Table 11-8 – Preferred alternative based on reduced need for biodiversity offsetting 626
Table 11-9 - Preferred Alternative Co-ordinates 633
Table 11-10 - Preferred Alternative Co-ordinates 637

FIGURES

Figure 1-1 - Proposed Dalmanutha WEF layout map - Alternative 1 70 WTG 32
Figure 1-2 - Proposed Dalmanutha Hybrid facility -Alternative 2 44 WTG and Solar PV facility 33
Figure 4-1: Mitigation hierarchy 135

Figure 5-1: Load shedding hours over the years in South Africa 144

Figure 5-2: Career Opportunities presented by the Wind Industry (Source: https://www.res4africa.org/wp-content/uploads/2020/09/RES4Africa-Foundation-A-Just-Energy-Transition-in-South-Africa.pdf) 145

Figure 6-1 - Locality map for the proposed Dalmanutha Wind Energy Complex, near Belfast in the Mpumalanga Province 148

Figure 6-2 - Proposed Dalmanutha WEF (up to 300MW) 70 turbine layout (Alternative 1) 149

Figure 6-3 - Proposed Dalmanutha Hybrid facility (up to 300MW) 44 turbine layout and Solar PV facility (Alternative 2) 150

Figure 6-4 - Coordinates of the Application Site 153

Figure 6-5 - Illustration of the main components of a wind turbine 155

Figure 6-6 - Illustration of the main components of a solar power plant (Source: www.electricaltechnology.org/2021/07/solar-power-plant.html) 156

Figure 6-7 - Typical Turbine Hard Standing Requirements (illustration purposes only) 159

Figure 6-8 - Dalmanutha WEF WTG layout ranked according to avifaunal risk (Pre-optimised 77 turbine layout) 163

Figure 6-9 - Revised Dalmanutha WEF layout (70 Turbines) 164

Figure 6-10 - Proposed Dalmanutha WEF and associated infrastructure (70 Turbine Layout) 165

Figure 6-11 – Layout of the proposed Dalmanutha WEF (Alternative 1) 166

Figure 6-12 – Layout of the proposed Dalmanutha WEF (Alternative 2) 167

Figure 7-1 - Average monthly rainfall for the stations 171

Figure 7-2 - Cumulative rainfall for the stations analysed 171

Figure 7-3 - Brakspruit weather station daily rainfall 172

Figure 7-4 - Brakspruit weather station annual rainfall readings and mean annual precipitation (MAP) 173

Figure 7-5 - Rainfall analysis from Brakspruit station 173

Figure 7-6 - Rainfall and evaporation 174

Figure 7-7 - Average wind speed in Belfast 175

Figure 7-8 - Wind direction in Belfast 175

Figure 7-9 - Elevation map of project area indicating both project alternatives 177

Figure 7-10 - Slope classification of Project Area (Alternative 1 and Alternative 2) 178

Figure 7-11 - Proposed WEF Area Characterized by Hilly Terrain 178

Figure 7-12 - Geology of the site 180
Figure 7-13 - Seismic Hazard Map of South Africa 181
Figure 7-14 - Dalmanutha Site Soil Capability for project Alternative 1 (Scotney et al. 1987) 183
Figure 7-15 - Dalmanutha Site Soil Capability for project Alternative 2 (Scotney et al. 1987) 184
Figure 7-16 - Land capability classification system (Scotney et al., 1987) 185
Figure 7-17 - Dalmanutha WEF Sub-catchments 187
Figure 7-18 - Hydrological map of the area with infrastructure for both alternatives 188
Figure 7-19 - Elevation and watercourses maps (Alternative 1 and 2) 189
Figure 7-20 - Flooding during a 1:100-year rainfall event 190
Figure 7-21 - Short open grassland, flanked by alien tree plantations 191
Figure 7-22 - Short, rocky grasslands are often characterised by scattered indigenous woody shrubs and trees favouring rupicolous fauna. 191
Figure 7-23 - Well-vegetated stream located in the west of the study area. 192
Figure 7-24 - Large farm dam located in the centre of the study area. 192
Figure 7-25 - Well-wooded indigenous forest. 193
Figure 7-26 - Well-vegetated cliffs enclose the gorge forest. 193
Figure 7-27 - Alien tree plantations provide dense, well-wooded habitat. 193
Figure 7-28 - Cultivated field under maize production. 194
Figure 7-29 - Regional Vegetation Types of the Study Area 197
Figure 7-30 - Biodiversity Map of the Project Area according to the MBSP 201
Figure 7-31 - Proposed Alternative 1 infrastructure and areas (red) of land designated CBA Irreplaceable and CBA Optimal designated land that are actually characterised by modified habitat, as determined by a comparison with land cover imagery and/or field observations 202
Figure 7-32 - Proposed Alternative 2 infrastructure and areas (red) of land designated CBA Irreplaceable and CBA Optimal designated land that are actually characterised by modified habitat, as determined by a comparison with land cover imagery and/or field observations 203
Figure 7-33 - Cultivated field, recently ploughed and ready for planting. 205
Figure 7-34 - A *Pennisetum clandestinum* dominated cultivated field, managed as a grazing pasture. 205

Figure 7-35 - A large alien tree plantation in the study area. 206

Figure 7-36 - Alien tree plantation dominated by young Acacia dealbata trees and largely denuded of herbaceous vegetation. 206

Figure 7-37 - Typical dry mixed grassland in the study area 207

Figure 7-38 - Dry mixed grassland, with stands of invasive wattle trees in the background. 207

Figure 7-39 - Typical disturbed grassland, dominated by Eragrostis grass species. 208

Figure 7-40 - Disturbed grassland - recovering from the clearing of alien wattle trees. Note the presence of the invasive weed Solanum sisymbriifolium. 208

Figure 7-41 - Prominent stretch of rocky grassland occurring along a hillside in the study area. 209

Figure 7-42 - Large rock outcrops and a higher abundance of woody vegetation characterise the rocky grassland vegetation community. 209

Figure 7-43 - Rocky outcrop with colonised by alien wattle species. The indigenous *Diospyros lycioides* is also present. 209

Figure 7-44 - Typical area of moist grassland in the study area. 210

Figure 7-45 - Stream flanked by various reeds, grasses and sedges, as well as scattered alien Salix babylonica trees. 210

Figure 7-46 - Steep, rocky cliffs covered by various shrubs and succulents. 212

Figure 7-47 - Well-developed indigenous forest along the valley bottom. 212

Figure 7-48 - Vegetation community map of the study area and proposed infrastructure for Alternative 1. 213

Figure 7-49 - Vegetation community map of the study area and proposed infrastructure for Alternative 2. 214

Figure 7-50 - Quaternary catchments associated with the project area 220

Figure 7-51 - Mpumalanga Biodiversity Sector Plan classification of the study area 222

Figure 7-52 - National Freshwater Ecosystem Priority Areas associated with the study area 224

Figure 7-53 – Wetlands delineated within the Project Area - Alternative 1 227

Figure 7-54 -Wetlands delineated within the Project Area - Alternative 2 228

Figure 7-55 -Impact scores and categories of Present Ecological State used by WET-Health for describing the integrity of wetlands (Macfarlane et al., 2008) 229

Figure 7-56 -Ecological importance and sensitivity categories 230

Figure 7-57 -Wetlands EIA category - Alternative 1 232

Figure 7-58 -Wetlands EIS Category- Alternative 2 233
Figure 7-59 - Aquatic sampling sites utilised during the aquatic specialist assessment 234
Figure 7-60 - IBA in relation to project area (Wildskies, 2022) 236
Figure 7-61 - The position of the site relative to the Avian wind farm sensitivity map (Retief *et al,* 2011) & Important Bird Areas (Marnewick *et al* 2015). 238
Figure 7-62 – Layout of Bird monitoring activities 244
Figure 7-63 - Movement of four tracked Cape Vultures since January 2021 relative to the site (map and data from Endangered Wildlife Trust). Approximate project location shown in yellow polygon 247
Figure 7-64 - Cape Vulture population utilisation distribution map (from Cervantes 2023). (Dalmanutha site boundary shown in white). 248
Figure 7-65 - Broad land cover classification indicating both project alternatives (LoGIS, 2023) 266
Figure 7-66 - Sensitive receptors surrounding the Dalmanutha WEF 267
Figure 7-67 - National and Provincial Road network & site location 270
Figure 7-68 - Alternative 1 - On-site access roads (provisional alignments) & farm portions 271
Figure 7-69 - Alternative 2 - On-site access roads (provisional alignments) & farm portions 272
Figure 7-70 - Access via Berg-en-Dal memorial access road 273
Figure 7-71 - SAHRIS palaeosensitivity map for the site for the proposed Dalmanutha facility shown within the yellow outline. Background colours indicate the following degrees of sensitivity: red = very highly sensitive; orange/yellow = high; green = moderate; blue = low; grey = insignificant/zero. 274
Figure 7.72. DN010 – Jacob de Clercq Memorial 279
Figure 7.73. DN018 – Burial site with in multi component site. 279
Figure 7.74. Formal grave with headstone at DN039 279
Figure 7.75. Small cemetery with formal and informal graves at DN049. 279
Figure 7.76. Farmstead at DN008 283
Figure 7.77. Structure at DN008 283
Figure 7.78. Farming infrastructure at DN056 283
Figure 7.79. Structure at DN073 283
Figure 7.80. Stone Age artefacts from DN054. 285

Figure 7.81. Weathered artefact from DN063. 285
Figure 7.82. Stone walls at DN038. 288
Figure 7.83. General site conditions at DN064. 288
Figure 7.84. Dilapidated stone packed features at DN041. 288
Figure 7.85. Lower Grindstone at DN074. 288
Figure 7.86. Plan drawing of complex LIA settlement DN018 to DN0220 289
Figure 7.87. Plan drawing of simple ruins at LIA site DN028. 290
Figure 7.88. DN022 - Possible gun placement/ fortification 292
Figure 7.89. DN023 - Possible gun placement/ fortification 292
Figure 7.90. DN036 – Packed stone fortification/ sanger 292
Figure 7.91. DN036 – Packed stone fortification/ sanger 292
Figure 7.92. DN037 – Packed stone fortification/ sanger. 293
Figure 7.93. DN071 – Remnants of the historical railroad. 293
Figure 7.94. Plan drawing of stone packed features at Site DN036 and DN037. 294
Figure 7-95 - Project area in relation to known Cultural and Heritage sites 295
Figure 7-96 - Viewshed analysis for Alternative 1: Dalmanutha Wind Facility 300
Figure 7-97 - Viewshed analysis for Alternative 2: Dalmanutha Wind and Solar Facility 305
Figure 7-98 - Potential sensitive receptors exposed to shadow flicker for Alternative 1: Dalmanutha Wind facility 308
Figure 7-99 - Potential sensitive receptors exposed to shadow flicker for Alternative 2: Dalmanutha Wind and Solar facility 310
Figure 7-100 - Location of Municipalities within the Mpumalanga Province 313
Figure 7-101 - Educational attainment for Emakhazeni Local Municipality from 2004 to 2014 316
Figure 7-102 - Education profile of Chief Albert Luthuli LM (Stats SA 2016) 317
Figure 7-103 - Percentage of household access to electricity in the Emakhazeni LM 317
Figure 7-104 - Access to electricity in the Chief Albert Luthuli LM (Statistics South Africa, 2011 via MapAble, 2017 318
Figure 7-105 - Possible BESS locations for Dalmanutha WEF in relation to occupied farmhouses 320
Figure 8-1 - DFFE agricultural theme sensitivity-Alternative 1 325
Figure 8-2 - DFFE agricultural theme sensitivity-Alternative 2 326

Figure 8-3 – Dalmanutha soil sensitivity -Alternative 1 327
Figure 8-4 – Dalmanutha soil sensitivity -Alternative 2 328
Figure 8-5 - DFFE animal species theme sensitivity-Alternative 1 329
Figure 8-6 - DFFE animal species theme sensitivity-Alternative 2 329
Figure 8-7 - DFFE aquatic theme sensitivity-Alternative 1 330
Figure 8-8 - DFFE aquatic theme sensitivity-Alternative 2 331
Figure 8-9 - DFFE archaeological & cultural heritage theme sensitivity-Alternative 1 332
Figure 8-10 - DFFE archaeological & cultural heritage theme sensitivity-Alternative 2 333
Figure 8-11 – Distribution of cultural and heritage finds on the site 334
Figure 8-12 - DFFE bats theme 335
Figure 8-13 – Proposed Alternative 1 Layout with suggested Bat buffer zones. 336
Figure 8-14 - Proposed Alternative 2 Layout with suggested Bat buffer zones. 337
Figure 8-15 - Roads, powerlines and infrastructure and their overlap with bat sensitive zones 338
Figure 8-16 - DFFE Avian Theme-Alternative 1 339
Figure 8-17 - DFFE Avian Theme-Alternative 2 340
Figure 8-18 - Leeukloof Pan 2 (Wildskies, 2022) 341
Figure 8-19 - The gorge where Southern Bald Ibis roost (Wildskies, 2022) 342
Figure 8-20 - Avifaunal Sensitivities for both the Dalmanutha Alternative layouts (Wildskies, 2023) 343
Figure 8-21 – Individual turbine risk ranking 345
Figure 8-22 - DFFE flicker theme 346
Figure 8-23 - DFFE Landscape Theme-Alternative 1 348
Figure 8-24 - DFFE Landscape Theme-Alternative 2 349
Figure 8-25 - Likely areas of potential visual impact and sensitive visual receptors for Alternative 1: Dalmanutha Wind facility 353
Figure 8-26 - Likely areas of potential visual impact and sensitive visual receptors for Alternative 1: Dalmanutha Wind facility 357
Figure 8-27 - DFFE palaeontology theme-Alternative 1 358
Figure 8-28 - DFFE palaeontology theme-Alternative 2 359
Figure 8-29 - DFFE noise theme 360
Figure 8-30 - DFFE plant species theme-Alternative 1 361

Figure 8-31 - DFFE plant species theme-Alternative 2 362

Figure 8-32 - Proposed Alternative 1 infrastructure and areas (red) of land designated CBA Irreplaceable and CBA Optimal designated land that are actually characterised by modified habitat, as determined by a comparison with land cover imagery and/or field observations. 364

Figure 8-33 - Proposed Alternative 2 infrastructure and areas (red) of land designated CBA Irreplaceable and CBA Optimal designated land that are actually characterised by modified habitat, as determined by a comparison with land cover imagery and/or field observations. 365

Figure 8-34 - DFFE terrestrial biodiversity theme-Alternative 1 366

Figure 8-35 - DFFE terrestrial biodiversity theme-Alternative 2 367

Figure 8-36 - DFFE Civil Aviation Theme-Alternative 1 371

Figure 8-37 - DFFE Civil Aviation Theme-Alternative 2 371

Figure 8-38 - Satellite Imagery of Belfast Aerodrome (left - 2023, Right - 2019) 372

Figure 8-39 - DFFE RFI Theme- Alternative 1 373

Figure 8-40 - DFFE RFI Theme-Alternative 2 374

Figure 8-41 - DFFE Defence Theme-Alternative 1 375

Figure 8-42 - DFFE Defence Theme-Alternative 2 376

Figure 8-43 - Consolidated Sensitivity map-Alternative 1 380

Figure 8-44 - Consolidated Sensitivity map-Alternative 2 381

Figure 8-45 - Consolidated No-Go Areas map-Alternative 1 382

Figure 8-46 - Consolidated No-Go Areas map-Alternative 2 383

Figure 10-1 – Renewable energy projects within 40km of the proposed site. 576

Figure 10-2 – Location of Proposed Elispec coal prospecting project 581

Figure 11-1 - Candidate offset areas - unaffected wetland and terrestrial habitat in LSA 629

Figure 11-2 – Proposed Dalmanutha Hybrid facility layout -Alternative 2 44 WTG and Solar PV facility 631

Figure 11-3 - Proposed Dalmanutha Hybrid facility -Alternative 2 Solar PV facility co-ordinates 632

Figure 11-4 – Optimised Proposed Dalmanutha Hybrid facility layout -Alternative 2 44 WTG and Solar PV facility 638

Figure 11-5 – Consolidated Sensitivity Optimised Proposed Dalmanutha Hybrid facility layout -Alternative 2 44 WTG and Solar PV facility 639

APPENDICES

APPENDIX A

EAP CV

APPENDIX B

EAP DECLARATION

APPENDIX C

SPECIALISTS DECLARATION

APPENDIX D

STAKEHOLDER ENGAGEMENT REPORT

APPENDIX E

MAPS

APPENDIX E.1

LOCALITY MAP

APPENDIX E.2

COMBINED SENSITIVITY MAP

APPENDIX F

DFFE ACCEPTANCE OF APPLICATION

APPENDIX G

SCOPING PHASE APPROVAL

APPENDIX H

SPECIALIST STUDIES

APPENDIX H.1

SOILS/AGRICULTURE ASSESSMENT

APPENDIX H.2

AVIFAUNAL ASSESSMENT

APPENDIX H.3

TERRESTRIAL ANIMAL ASSESSMENT

APPENDIX H.4

AQUATIC BIODIVERSITY ASSESSMENT

APPENDIX H.5

BATS ASSESSMENT

APPENDIX H.6

HERITAGE ASSESSMENT

APPENDIX H.7

PALAEONTOLOGICAL ASSESSMENT

APPENDIX H.8

SOCIO-ECONOMIC ASSESSMENT

APPENDIX H.9

TRAFFIC ASSESSMENT

APPENDIX H.10

VISUAL ASSESSMENT

APPENDIX H.11

ACOUSTIC ASSESSMENT

APPENDIX H.12

SHE RISK ASSESSMENT

APPENDIX H.13

GEOTECHNICAL ASSESSMENT

APPENDIX H.14

SURFACE WATER ASSESSMENT

APPENDIX H.15

TERRESTRIAL PLANT ASSESSEMENT

APPENDIX H.16

TERRESTRIAL BIODIVERSITY

APPENDIX H.17

WETLAND ASSESSMENT

APPENDIX I

EMPR

APPENDIX J

BIODIVERSITY OFFSET STRATEGY

APPENDIX K

DFFE SCREENING TOOL REPORTS

APPENDIX L

PRE-APPLICATION MEETING MINUTES

1 INTRODUCTION

1.1 PURPOSE OF THIS REPORT

This Draft Environmental Impact Report (EIR) documents the processes and findings of the impact assessment phase of the Scoping and Environmental Impact Reporting (S&EIR) process for the proposed establishment of the Dalmanutha Wind Energy Facility (WEF). Two alternatives are proposed for the Dalmanutha WEF: Alternative 1 - a full wind energy facility, with a capacity of up to 300MW, comprising up to 70 wind turbines; and Alternative 2 - a hybrid facility, with a capacity of up to 300MW, comprising 44 turbines and two solar fields.

The EIR aims to provide stakeholders with information on the proposed development including location, layout and technological alternatives, the scope of the environmental assessment and key impacts to be addressed in the environmental assessment, and the consultation process undertaken through the environmental impact assessment (EIA) process.

1.2 BACKGROUND INFORMATION

The proponent is proposing the development of the Dalmanutha Wind Energy Complex in Mpumalanga. The complex consists of three distinct projects referred to as:

- Dalmanutha WEF (up to 300MW) (Alternative 1 and 2)
- Dalmanutha West Wind Energy Facility (up to, but not including, 20MW)
- Dalmanutha Common Collector Switching Station and Powerline (up to 132kV)

The focus of this EIR is the proposed = Dalmanutha WEF (up to 300MW) (Alternative 1 and 2).

The proposed project will be applied for under a Special Purpose Vehicle (SPV), and the Project Applicant is therefore Dalmanutha Wind (Pty) Ltd. The Dalmanutha WEF is located approximately 7km southeast of the Belfast town within Emakhazeni Local Municipality, Mpumalanga Province. Site access is via the N4, which is approximately 220 meters from the proposed development area. Dalmanutha WEF will be located over eighteen farm portions (**Figure 1-1**).

In order for the proposed project to proceed, it will require an Environmental Authorisation (EA) from the Competent Authority (CA) (i.e., the National Department of Forestry, Fisheries and Environment, (DFFE)).

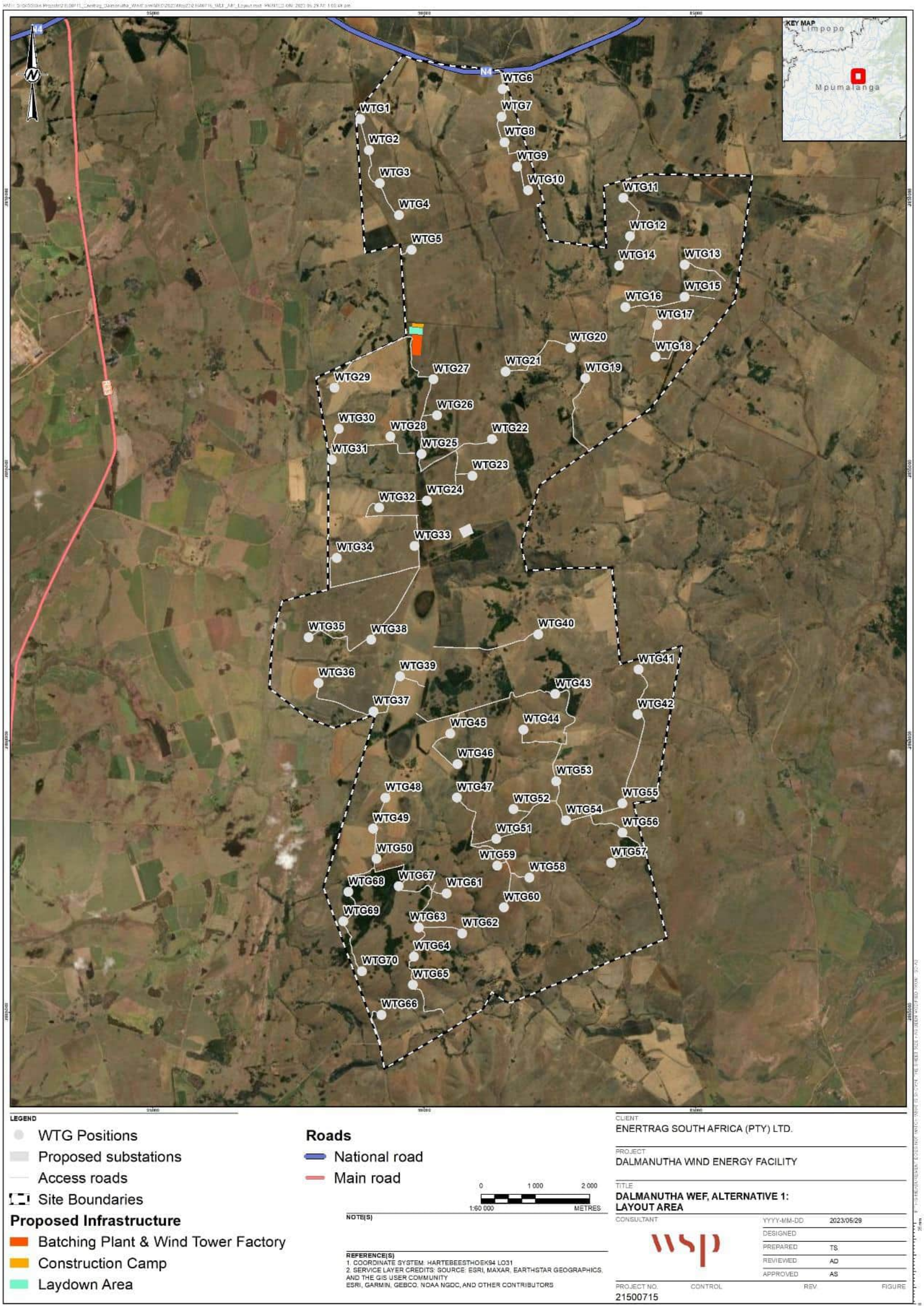


Figure 1-1 - Proposed Dalmanutha WEF layout map - Alternative 1 70 WTG

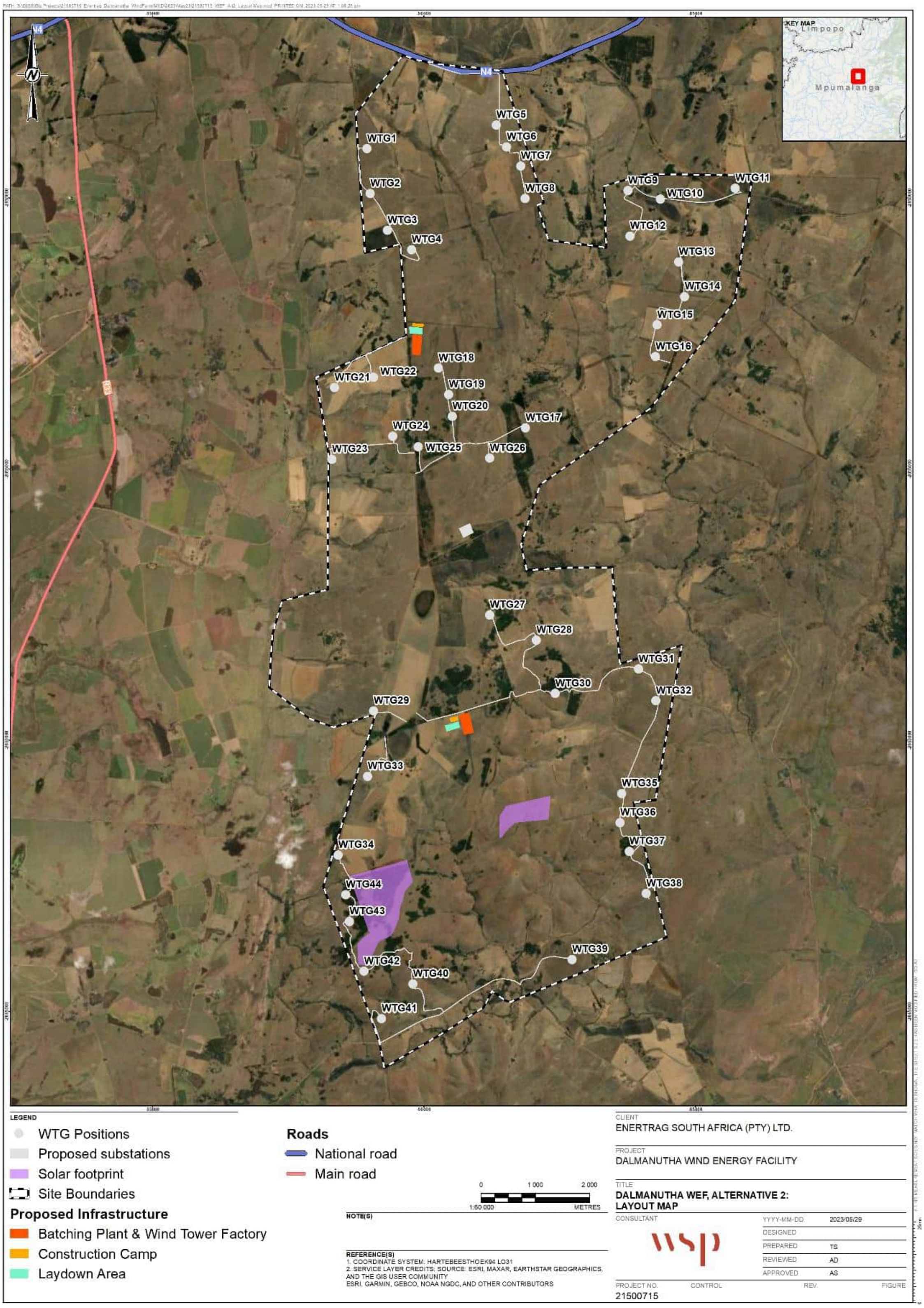


Figure 1-2 - Proposed Dalmanutha Hybrid facility -Alternative 2 44 WTG and Solar PV facility

1.3 KEY ROLE PLAYERS

1.3.1 PROJECT PROPONENT

Dalmanutha Wind (Pty) Ltd is the project proponent (Applicant) with regards to this application for the construction and operation of the Dalmanutha WEF and associated infrastructure (Alternative 1 and 2). **Table 1-1** provides the relevant details of the project proponent.

Table 1-1 - Details of Project Proponent

Proponent:	Dalmanutha Wind (Pty) Ltd
Contact Person:	Mercia Grimbeek
Postal Address	Suite 104, Albion Springs, 183 Main Road, Rondebosch, Cape Town, South Africa 7700
Telephone:	+27 78 152 1022 / +27 71 875 0193
Email:	Mercia.Grimbeek@enertrag.com / Mmakoena.Mmola@enertrag.com

1.3.2 COMPETENT AUTHORITY

Section 24C(2)(a) of NEMA stipulates that the Minister of Forestry, Fisheries and the Environment (“the Minister”) must be identified as the CA if the activity has implications for international environmental commitments or relations. GN 779 of 01 July 2016 identifies the Minister as the CA for the consideration and processing of environmental authorisations and amendments thereto for activities related to the Integrated Resource Plan (IRP) 2010 – 2030.

The CA (i.e., DFFE) was confirmed during the Pre-Application Meeting held on **14 June 2022.**

Table 1-2 provides the relevant details of the competent authority on the Project.

Table 1-2 - Competent Authority

Aspect	Competent / Commenting Authority	Contact Details
Competent Authority: Environmental Authorisation	Department of Forestry, Fisheries, and the Environment (DFFE)	Case Officer: Trisha Pillay tpillay@dffe.gov.za Integrated Environmental Authorisations

1.3.3 COMMENTING AUTHORITIES

The following commenting authorities have been identified for this application:

- Mpumalanga Department Agriculture, Rural Development, Land and Environmental Affairs (MDARDLEA);
- DFFE: Biodiversity and Conservation;
- DFFE: Protected areas;
- Department of Water and Sanitation (DWS);
- Inkomati-Usuthu Management Area (WMA) Authority;
- South African Heritage Resource Agency (SAHRA);

- Mpumalanga Heritage Resources Authority (MHRA);
- Mpumalanga Tourism and Parks Agency (MTPA);
- Civil Aviation Authority (CAA);
- Air Traffic and Navigation Services (ATNS);
- Department of Defence (SA Army) (DD);
- Astronomy Management Authority (AMA);
- South African Weather Services (SAWS);
- South African National Roads Agency Limited (SANRAL);
- Gert Sibande District Municipality;
- Nkangala District Municipality;
- Emakhazeni Local Municipality; and
- Chief Albert Luthuli Local Municipality.

1.3.4 ENVIRONMENTAL ASSESSMENT PRACTITIONER

WSP Group Africa (Pty) Ltd (WSP) has been appointed in the role of Independent Environmental Assessment Practitioner (EAP) to undertake the S&EIR processes for the development of the Project. The CV of the EAP is available in **Appendix A**. The EAP declaration of interest and undertaking is included in **Appendix B**. **Table 1-3** details the relevant contact details of the EAP. In order to adequately identify and assess potential environmental impacts, a number of specialists have supported the EAP.

Table 1-3 - Details of the Environmental Assessment Practitioner

Environmental Assessment Practitioner (EAP)	WSP Group Africa (Pty) Ltd
Contact Person:	Ashlea Strong
Postal Address:	Building C, Knightsbridge, 33 Sloane Street, Bryanston, 2191, South Africa
Telephone:	011 361 1392
Fax:	011 361 1381
E-mail:	Ashlea.Strong@wsp.com
Qualifications:	- Masters in Environmental Management, University of the Free State - B Tech, Nature Conservation, Technikon SA - National Diploma in Nature Conservation, Technikon SA
EAPASA Registration Number:	EAPASA (2019/1005)

STATEMENT OF INDEPENDENCE

Neither WSP nor any of the authors of this Report have any material present or contingent interest in the outcome of this Report, nor do they have any business, financial, personal, or other interest that could be reasonably regarded as being capable of affecting their independence. WSP has no beneficial interest in the outcome of the assessment.

1.3.5 SPECIALISTS

Specialist input was required in support of this application for EA. The details of the specialists are provided in **Table 1-4** below. The specialist declarations are included in **Appendix C.**

Table 1-4 - Details of Specialists

Assessment	Name of Specialist	Company	Appendix
Agriculture and Soils	Karen King	WSP Group Africa (Pty) Ltd	**Appendix H.1**
Avifauna	Jon Smallie	Wild Skies Ecological Services (Pty) Ltd	**Appendix H.2**
Bats	Dr Low de Vries	Volant Environmental (Pty) Ltd	**Appendix H.5**
Terrestrial and Aquatic Biodiversity (including Animal and Plant species themes)	Aisling Dower Lufuno Nemakhavhani Andrew Zinn Byron Grant	WSP Group Africa (Pty) Ltd and Ecology International (Pty) Ltd	**Appendix H.3** **Appendix H.4** **Appendix H.15**
Geotechnical	Khuthadzo Bulala	WSP Group Africa (Pty) Ltd	**Appendix H.13**
Surface water (Hydrology)	Eugeshin Naidoo	WSP Group Africa (Pty) Ltd	**Appendix H.14**
Heritage	Jaco van der Walt	Beyond Heritage	**Appendix H.6**
Palaeontology	Prof Marion Bamford	Beyond Heritage	**Appendix H.7**
Social	Stephen Horak	WSP Group Africa (Pty) Ltd	**Appendix H.8**
Traffic	Christo Bredenhann	WSP Group Africa (Pty) Ltd	**Appendix H.9**
Visual	Lourens du Plessis	LoGIS	**Appendix H.10**
Noise	Kirsten Collett	WSP Group Africa (Pty) Ltd	**Appendix H.11**
Risk	Debra Mitchell	ISHECON cc	**Appendix H.12**

1.4 IMPACT ASSESSMENT TERMS OF REFERENCE

The 2014 Environmental Impact Assessment (EIA) Regulations (GNR 982), as amended, identifies the proposed Dalmanutha WEF development as an activity being subject to an S&EIR process due to the applicability of the EIA Listing Notices 1 and 2 (GNR 983 and 984, as amended). In order for the project to proceed it will require an Environmental Authorisation (EA) from DFFE.

WSP has been appointed as the independent EAP to carry out the S&EIR process in accordance with the EIA Regulations, 2014, as amended in 2017.

The Scoping Process has been completed and involved consultation with interested and affected parties and the drafting of the Plan of Study (PoS) for EIA, which culminated in the submission of a

Final Scoping Report (FSR) to the DFFE. The DFFE acceptance of the FSR and authorisation to proceed with the EIR was received on **15 March 2023 (dated 14 March 2023) (Appendix G).**

This draft EIAr will be made available for public comment from **31 May 2023 to 03 July 2023**.

As defined in Appendix 3 of GNR 982, as amended, the objective of the impact assessment process is to, through a consultative process:

- Determine the policy and legislative context within which the activity is located and document how the proposed activity complies with and responds to the policy and legislative context;
- Describe the need and desirability of the proposed activity, including the need and desirability of the activity in the context of the preferred location;
- Identify the location of the development footprint within the preferred site based on an impact and risk assessment process inclusive of cumulative impacts and a ranking process of all the identified development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects of the environment;

Determine the:

- Nature, significance, consequence, extent, duration and probability of the impacts occurring to inform identified preferred alternatives; and
- Degree to which these impacts
- Can be reversed;
- May cause irreplaceable loss of resources, and
- Can be avoided, managed or mitigated;
- Identify the most ideal location for the activity within the preferred site based on the lowest level of environmental sensitivity identified during the assessment;
- Identify, assess, and rank the impacts the activity will impose on the preferred location through the life of the activity;
- Identify suitable measures to avoid, manage or mitigate identified impacts; and
- Identify residual risks that need to be managed and monitored.

Public participation is a requirement of the S&EIR process; it consists of a series of inclusive and culturally appropriate interactions aimed at providing stakeholders with opportunities to express their views, so that these can be considered and incorporated into the S&EIR decision-making process. Effective public participation requires the prior disclosure of relevant and adequate project information to enable stakeholders to understand the risks, impacts, and opportunities of the Proposed Project. The objectives of the public participation process can be summarised as follows:

Identify relevant individuals, organisations and communities who may be interested in or affected by the Proposed Project;

- Clearly outline the scope of the Proposed Project, including the scale and nature of the existing and proposed activities;
- Identify viable Proposed Project alternatives that will assist the relevant authorities in making an informed decision;
- Identify shortcomings and gaps in existing information;
- Identify key concerns, raised by Stakeholders that should be addressed in the subsequent specialist studies;
- Highlight the potential for environmental impacts, whether positive or negative; and

- To inform and provide the public with information and an understanding of the Proposed Project, issues and solutions.

1.5 IMPACT ASSEMENT REPORT STRUCTURE

Table 1-5 cross-references the sections within the EIA with the legislated requirements as per Appendix 3 of GNR 982.

Table 1-5 - Legislated Report Requirements as detailed in GNR 982

Appendix 3	Legislated requirements as per the NEMA GNR 982	Relevant Report Section
(a)	Details of	
	the EAP who compiled the report; and	Section 1.3.4 and **Appendix A**
	the expertise of the EAP, including a Curriculum Vitae	**Appendix A**
(b)	The location of the activity, including-	
	The 21-digit Surveyor code for each cadastral land parcel;	Section 6
	Where available, the physical address and farm name	Section 6
	Where the required information in terms of (i) and (ii) is not available, the coordinates of the boundary of the property.	N/A
(c)	A plan which locates the proposed activities applied for at an appropriate scale, or, if it is-	
	A linear activity, a description of the corridor in which the proposed activity or activities is to be undertaken; or	N/A
	On land where the property has not been defined, the coordinates within which the activity is to be undertaken.	N/A
(d)	A description of the proposed activity, including-	
	All listed and specified activities triggered;	Section 2.1
	A description of the activities to be undertaken, including associated structures and infrastructure;	Section 2.1
(e)	A description of the policy and legislative context within which the development is proposed including an identification of all legislation, policies, plans, guidelines, spatial tools, municipal development	Section 2.3

Appendix 3	Legislated requirements as per the NEMA GNR 982	Relevant Report Section
	planning frameworks and instruments that are applicable to this activity and are to be considered in the assessment process;	
(f)	A motivation for the need and desirability for the proposed development including the need and desirability of the activity in the context of the preferred location;	Section 5
(g)	A full description of the process followed to reach the proposed preferred activity, site and location of the development footprint within the site, including-	
	Details of all the alternatives considered;	Section 6.6
	Details of the public participation undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs;	Section 4.3
	a summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reasons for not including them;	Appendix D
	the environmental attributes associated with the alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	Section 7
	the impacts and risks which have informed the identification of each alternative, including the nature, significance, consequence, extent, duration and probability of such identified impacts, including the degree to which these impacts- (aa) can be reversed; (bb) may cause irreplaceable loss of resources; and (cc) can be avoided, managed or mitigated;	Section 9
	the methodology used in identifying and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks associated with the alternatives;	Section 4
	positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	Section 9
	the possible mitigation measures that could be applied and level of residual risk;	Section 9

Appendix 3	Legislated requirements as per the NEMA GNR 982	Relevant Report Section
	the outcome of the site selection matrix;	Section 11.3
	if no alternatives, including alternative locations for the activity were investigated, the motivation for not considering such and	N/A
	a concluding statement indicating the preferred alternatives, including preferred location of the activity;	Section 12
(h)	A full description of the process followed to reach the proposed preferred activity, site and location within the site, including-	
	Details of all the alternatives considered;	Section 6.6
	Details of the public participation undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs;	Section 4.3
	a summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reasons for not including them;	**Appendix D**
	the environmental attributes associated with the alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	Section 8 Section 7
	the impacts and risks identified for each alternative, including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts- (aa) can be reversed; (bb) may cause irreplaceable loss of resources; and (cc) can be avoided, managed or mitigated;	Section 9
	the methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks associated with the alternatives;	Section 4
	positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	Section 8
	the possible mitigation measures that could be applied and level of residual risk;	Section 9

Appendix 3	Legislated requirements as per the NEMA GNR 982	Relevant Report Section
	the outcome of the site selection matrix;	Section 8
	if no alternatives, including alternative locations for the activity were investigated, the motivation for not considering such and	N/A
	a concluding statement indicating the preferred alternatives, including preferred location of the activity;	Section 11.4
(i)	A plan of study for undertaking the environmental impact assessment process to be undertaken, including-	
	a description of the alternatives to be considered and assessed within the preferred site, including the option of not proceeding with the activity;	Section 6.6
	a description of the aspects to be assessed as part of the environmental impact assessment process;	Section 7
	aspects to be assessed by specialists;	Section 9
	a description of the proposed method of assessing the environmental aspects, including a description of the proposed method of assessing the environmental aspects including aspects to be assessed by specialists;	Section 4
	a description of the proposed method of assessing duration and significance;	Section 4
	an indication of the stages at which the competent authority will be consulted;	Section 4
	particulars of the public participation process that be conducted during the environmental impact assessment process; and	Section 4.3
	a description of the tasks that will be undertaken as part of the environmental impact assessment process;	Section 4
	identify suitable measures to avoid, reverse, mitigate or manage identified impacts and to determine the extent of the residual risks that need to be managed and monitored.	Section 9
(j)	An undertaking under oath or affirmation by the EAP in relation to-	
	the correctness of the information provided in the report;	**Appendix B**

Appendix 3	Legislated requirements as per the NEMA GNR 982	Relevant Report Section
	the inclusion of comments and inputs from stakeholders and interested and affected parties; and	
	any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested or affected parties;	
(k)	An undertaking under oath or affirmation by the EAP in relation to the level of agreement between the EAP and interested and affected parties on the plan of study for undertaking the environmental impact assessment;	**Appendix B**
(l)	Where applicable, any specific information required by the competent authority; and	N/A
(m)	Any other matter required in terms of section 24(4)(a) and (b) of the Act.	N/A

1.6 ASSUMPTION AND LIMITATIONS

General assumptions and limitations

- The EAP hereby confirms that they have undertaken to obtain project information from the client that is deemed to be accurate and representative of the project;
- Site visits have been undertaken to better understand the project and ensure that the information provided by the client is correct, based on site conditions observed;
- The EAP hereby confirms their independence and understands the responsibility they hold in ensuring all comments received are accurately replicated and responded to within the EIA documentation;
- The comments received in response to the public participation process, will be representative of comments from the broader community; and
- Based on the Pre-Application meeting and subsequent minutes, the CA would not require additional specialist input, in order to make a decision regarding the application.

Terrestrial Biodiversity

- The following assumptions, uncertainties or gaps in knowledge were highlighted:
- Vegetation and flora: Little summer rain had fallen prior to the field visit. Moreover, portions of the study area had also been recently burnt prior to the field survey and displayed little new season regrowth. It is thus possible that certain flora taxa, including inter alia short-lived annuals, geophytes, cryptic species or dormant deciduous species, that are most readily visible or distinguishable when in leaf or flower later in the wet/growing season following sufficient rain, may have been overlooked during field visit.
- Vegetation and flora: large tracts of grassland in the north of the study area had recently been converted to cultivated fields at the time of field survey; some of these changes may not be reflected in the vegetation mapping.

- Fauna: fieldwork was conducted over four days in June and five days in October; considering the size of the LSA it is possible that rare, cryptic or transient fauna species were overlooked – as such, baseline descriptions were qualitative, and consideration was given to species that were considered likely to be present, though not confirmed during surveys;
- Birds: Various biases and challenges inherent in the methods that were employed to collect data are set out in the avifauna assessment report. Some of the key points include the potential effect of the presence of observers on site on bird behaviour, bias towards detection of larger birds, difficulties with walked transects, and the absence of established thresholds for fatality rates for priority bird species in South Africa.
- Bats: detectors did not record between 12 and 15 July and 10 and 22 May 2022 due to battery failure. In addition, SD cards were stolen from DAL 1, DAL 2 and DAL 3 and no data was captured between 1 October and 26 November 2021. Nevertheless, minimum requirements for survey duration were still met.

Aquatic Biodiversity (Rivers):

- In order to obtain a comprehensive understanding of the dynamics and diversity of the biota on a site, including species of conservation concern, studies should include investigations through the different seasons of the year, over a number of years, and extensive sampling of the area. This is particularly relevant where seasonal limitations to biodiversity assessments exist for the area of the proposed activity. Due to project time constraints inherent with Environmental Authorisation application processes, such long-term research is seldom feasible, and the information contained within this report is based on two seasonal field surveys conducted during the high and low flow periods.
- Predictions on future changes on ecosystems and populations once a development has happened are seldom straightforward, except in cases such as the total loss of a habitat to development. However, most development impacts are indirect, subtle, and cumulative or unfold over several years following construction or commencement of activities. Whilst a possible mechanism for an impact to occur can usually be identified, the actual likelihood of occurrence and its severity are much harder to describe (Hill & Arnold, 2012). Furthermore, a review to test the accuracy of the predictions of an ecologist following completion of the development is very rarely undertaken, which means the capacity to predict the future is not tested and therefore remains unknown (Hill & Arnold, 2012).
- A closely related issue is that of the effectiveness of ecological mitigation which stems from ecological assessments (including freshwater ecological assessments), as well as in response to legal and planning policy requirements for development. Many recommendations may be incorporated into planning conditions or become conditions of licences, but these recommendations are implemented to varying degrees. What is often missing is the follow-up monitoring and assessment of the mitigation with sufficient scientific rigour or duration to determine whether the mitigation, compensation or enhancement measure has actually worked in the way intended (Hill & Arnold, 2012).

Aquatic Biodiversity (Wetlands):

- The baseline description is based on available national datasets and published literature for the Dalmanutha/Dullstroom Plateau region, supplemented by field survey data (observations and photographs) gathered during April and May 2022, in the late rainy season.

- Comprehensive vegetation and fauna surveys, which are described in the terrestrial plant and animal specialist assessments accompanying this application, informed the determination of wetland ecological sensitivity.
- It is therefore considered that there are no sampling or information limitations pertaining to the baseline description of wetland ecosystems, the wetland impact assessment or the recommendations contained in this report.

Animal Species:

- Field work was conducted over a four-day period in June and a five-day period in October 2022. Considering, inter alia, the size of the study area and various seasonal influences, it is possible that rare, cryptic or transient fauna species may not have been present and/or observed during the field surveys;
- The absence or non-recording of a specific fauna species, at a particular time, does not necessarily indicate that 1) the species does not occur there; 2) the species does not utilise resources in that area; or 3) the area does not play an ecological support role in the ecology of that species; and
- Given the difficulty of fully sampling and characterising the abundance and distribution of fauna species in the study area during the short period of time allocated to field work, the baseline descriptions were qualitative.

Plant Species:

The following assumptions, limitations, uncertainties are listed regarding the terrestrial and aquatic ecological assessment of the Dalmanutha site:

- Field work was conducted over a five-day period from the 24-28th October 2022. This period coincides with the early wet/growing season. Little summer rain had fallen prior to the field visit. Moreover, portions of the study area had also been recently burnt prior to the field survey and displayed little new season regrowth. It is thus possible that certain flora taxa, including inter alia short-lived annuals, geophytes, cryptic species or dormant deciduous species, that are most readily visible or distinguishable when in leaf or flower later in the wet/growing season following sufficient rain, may have been overlooked during field visit; and
- The delineation of vegetation communities for the vegetation map was conducted, in part, using available Google Earth satellite imagery. It was noted during the field survey that large tracts of grassland in the north of the study area had recently been converted to cultivated fields by local farmers, and that some of these changes may not be reflected in the Google Earth satellite imagery available at the time of mapping.

Avifauna:

- Certain biases and challenges are inherent in the methods that have been employed to collect data in this programme. It is not possible to discuss all of them here, and some will only become evident with time and operational phase data, but the following are some of the key points:
- The presence of the observers on site is certain to have an effect on the birds itself. For example, during walked transects, certain bird species will flush more easily than others (and therefore be detected), certain species may sit undetected, certain species may flee, and yet others may be inquisitive and approach the observers. Likewise, with the vantage point counts, it is extremely unlikely that two observers sitting in position for hours at a time will have no effect on bird flight.

Some species may avoid the vantage point position because there are people present, and others may approach out of curiosity.

- In almost all data collection methods large bird species will be more easily detected, and their position in the landscape more easily estimated. This is particularly relevant at the vantage points where a large eagle may be visible several kilometres away, but a smaller kestrel perhaps only within 800 metres. A particularly important challenge is that of estimating the height at which birds fly above the ground. With no reference points against which to judge, it is exceptionally difficult and subjective. It is for this reason that the flight height data has been treated cautiously by this report, and much of the analysis conducted using flights of all height.
- The questions that one can ask of the data collected by this programme are almost endless. Most of these questions however become far more informative once post construction data has been collected and effects can be observed. For this reason, some of the analysis in this report is relatively crude. The raw data has however been collected and will be stored until such time as more detailed analysis is possible and necessary.
- Spotting and identifying birds whilst walking is a significant challenge, particularly when only fleeting glimpses of birds are obtained. As such, there is variability between observers' ability and hence the data obtained. The above data is therefore by necessity subjective to some extent. To control for this subjectivity, the same pairs of observers have been used for the full duration of the project, and it is hoped this can be maintained for the post construction phase. Despite this subjectivity, and a number of assumptions that line transects rely on (for more details see Bibby et al, 2000), this field method returns the greatest amount of data per unit effort (Bibby et al, 2000) and was therefore deemed appropriate for the purposes of this programme. Further, to maximise the returns from available resources, the walked transects were located close to each Vantage Point. This systematic selection may result in some as yet unknown bias in the data, but it has numerous logistical benefits.
- No thresholds for fatality rates for priority species have been established in South Africa to date. This means that impact assessments such as this one need to make subjective judgements on the acceptability of the estimated predicted fatalities for each species.

Bats:

As with any environmental study, there are certain assumptions and limitations that exist around the current knowledge we possess regarding bats and their behaviour, movements, and distribution. Some important points are discussed briefly below:

- Distribution records of bats in southern Africa are still poorly reported and limited for many species. In addition, migratory patterns of bats are largely unknown in South Africa. Studies have reported that bats do migrate, but the exact routes followed are not known (Pretorius et al., 2020).
- The same is true for breeding behaviour and the formation of maternity colonies for many species.
- WEF pre-construction monitoring reports on bats are reliant on reporting echolocation calls and identifying species from these calls, but without echolocation call libraries accurate identification is not always possible. Published libraries created from release and handheld calls of captured bats are available for southern Africa but are geographically limited. Since the echolocation calls of a particular species from different regions in South Africa are known to vary to some degree (Monadjem et al., 2020), call libraries created in different regions are not always comparable.

- Bat detectors are not always effective in recording echolocation calls for all bat species, and some species may be missed e.g., some fruit bat species that do not echolocate. Other species, such as the Egyptian slit-faced bat (*Nycteris thebaica*), emits low intensity calls that may not be recorded.
- Bat detectors are also limited in the range over which a call can be recorded, and this can be further influenced by environmental conditions such as humidity. In addition, the microphones that are coupled to the detectors are not omnidirectional and recording quality and number of recordings is influenced by the orientation of the call relative to the microphone.

Social:

There were no assumptions and limitations associated with this study.

Visual and Flicker:

- To prepare the report, LoGis utilised only the documents and information provided by WSP or any third parties directed to provide information and documents by WSP. LoGis has not consulted any other documents or information in relation to the Report, except where otherwise indicated.
- The findings, recommendations and conclusions given in the report are based on the author's best scientific and professional knowledge, as well as, the available information.
- The report is based on survey and assessment techniques which are limited by time and budgetary constraints relevant to the type and level of investigation undertaken. LoGis and its staff reserve the right to modify aspects of the report including the recommendations if and when new information may become available from on-going research or further work in this field, or pertaining to the investigation.
- The assessment was undertaken during the planning stage of the project and is based on information available at that time. It is assumed that all information regarding the project details provided by WSP and the Applicant is correct and relevant to the proposed project. The Visual Impact Assessment and all associated mapping has been undertaken according to the worst-case scenario with the layout provided.

Heritage:

- The authors acknowledge that the brief literature review is not exhaustive on the literature of the area. Due to the subsurface nature of heritage resources, the possibility of discovery of heritage resources during the construction phase cannot be excluded. Heavy rainfall during the survey caused gravel roads to become waterlogged which created access restraints. This limitation is successfully mitigated with the implementation of a chance find procedure and monitoring of the study area by the ECO. This report only deals with the current layout of the proposed development and consisted of non-intrusive surface surveys that focussed on tangible resources. This study did not assess the impact on medicinal plants and intangible heritage as it is assumed that these components would have been highlighted through the public consultation process if relevant.
- Field data were recorded by handheld GPS and Mobile GPS applications. It must be noted that during the process of converting spatial data to final drawings and maps the accuracy of spatial data may be compromised. Printing or other forms of reproduction might also distort the spatial distribution in maps. Due care has been taken to preserve accuracy. It is possible that new information could come to light in future, which might change the results of this Impact Assessment.

Palaeontology:

- Based on the geology of the area and the palaeontological record as we know it, it can be assumed that the formation and layout of the dolomites, sandstones, shales and sands are typical for the country and only some contain trace fossils or fossil plants.
- The soils and sands of the Quaternary period would not preserve fossils.
- The site visit and walkthrough confirmed that there NO fossils of any kind visible on the ground surface.
- It is unknown what lies below the ground until excavations commence.

Noise:

For this Environmental Acoustic Impact Assessment, various assumptions will be made that may impact the results obtained. These include:

- The turbine specifications provided are assumed to be representative of what will be installed in reality.
- The turbine locations provided are assumed to be an accurate representation of where these will be located in reality.
- Identification of sensitive receptors is based on a desktop assessment, and it is assumed that all key receptors have been included.

Soil Land and Agricultural:

- Cultivated lands have already had an impact on soils.
- The area demarcated as an Exclusion Area in the underlying images was not included in the study at the landowner's request.
- Site access was difficult owing to the terrain, a lack of access roads and inclement weather on one of the visits.
- The scope of the study dictated that sampling points for soil classification needed to target the initial proposed turbine positions only. The soil survey did not follow a grid survey pattern over the whole study area, which is a much costlier exercise. Grid surveys allow for improved interpolations between points. The trade-off with free format surveys is that if the positions of any turbines are shifted, additional micro-siting soil surveys will have to be undertaken on the new footprint areas.
- The final wind turbine layout plan was not yet available at the time of writing this report. As described above, if any turbines are repositioned additional micro-siting soil surveys of the footprint areas will need to be undertaken.
- The outcomes of this study cannot be used broadly to inform any additional studies.
- No geotechnical soils investigation was undertaken as a part of this agricultural soils study.
- Once the final turbine locations have been established, micro-siting will be necessary in order to establish with certainty the soil forms and characteristics that underlie these locations.
- Cumulative impact significance ratings are difficult to calculate as the extent to which impact mitigation measures are adhered to within nearby projects is unknown.

Risk:

The following assumptions and limitations are associated with this study:

- No detailed site visit was undertaken, although a general visit to the area was undertaken. The level of detail required for assessment of SHE impacts of the BESS SHE RA does not necessitate a detailed inspection of the exact area.
- Only lithium-ion or vanadium redox flow type batteries will be considered.
- As they have been more widely used there is more information readily available in the literature on lithium type batteries as opposed to vanadium redox flow batteries.
- Lithium BESS facilities are assumed to be containerized.
- The Vanadium redox batteries may be containerized (in which case the issues will be similar to lithium containers), but the more significant case is if the battery is installed a one large, centralized utility scale facility.

Geotechnical:

- The report has been prepared for the particular purpose outlined in WSP's proposal and no responsibility is accepted for the use of the report, in whole or in part, in other contexts or for any other purpose.
- The scope and the period of WSP's Services are as described in WSP's proposal, and are subject to restrictions and limitations. WSP did not perform a complete assessment of all possible conditions or circumstances that may exist at the site referenced in the report. If a service is not expressly indicated, do not assume it has been provided. If a matter is not addressed, do not assume that any determination has be made by WSP in regard to it.
- Conditions may exist which were undetectable given the limited nature of the enquiry WSP was retained to undertake with respect to the site. Variations in conditions may occur between investigatory locations, and there may be special conditions pertaining to the site which have not been revealed by the investigation and which have not therefore been taken into account in the report. Accordingly, additional studies and actions may be required.
- In addition, it is recognised that the passage of time affects the information and assessment provided in the report. WSP's opinions are based upon information that existed at the time of the production of the report. It is understood that the Services provided allowed WSP to form no more than an opinion of the actual conditions of the site at the time the site was visited and cannot be used to assess the effect of any subsequent changes in the quality of the site, or its surroundings, or any laws or regulations.
- Any assessments made in the report are based on the conditions indicated from published sources and the investigation described. No warranty is included, either express or implied, that the actual conditions will conform exactly to the assessments contained in the report.
- Where data supplied by the client or other external sources, including previous site investigation data, have been used, it has been assumed that the information is correct unless otherwise stated. No responsibility is accepted by WSP for incomplete or inaccurate data supplied by others.
- The Client acknowledges that WSP may have retained sub-consultants affiliated with WSP to provide Services for the benefit of WSP. WSP will be fully responsible to the Client for the Services and work done by all its sub-consultants and subcontractors. The Client agrees that it will only assert claims against and seek to recover losses, damages or other liabilities from WSP and not WSP's affiliated companies. To the maximum extent allowed by law, the Client acknowledges and agrees it will not have any legal recourse, and waives any expense, loss, claim, demand, or cause of action, against WSP's affiliated companies, and their employees, officers and directors.

- The report is provided for sole use by the Client and is confidential to it and its professional advisers. No responsibility whatsoever for the contents of the report will be accepted to any person other than the Client. Any use which a third party makes of the report, or any reliance on or decisions to be made based on it, is the responsibility of such third parties. WSP accepts no responsibility for damages, if any, suffered by any third party because of decisions made or actions based on the report.

Traffic:

The following assumptions were made to estimate the expected trip generation of the construction phase.

- An estimated construction period of 24 months, with a variable number of staff required depending on the construction phase.
- An absolute maximum of 150 workers could be on-site during the peak construction period, however the conservative estimate is 100 to 150 personnel. The maximum number was used for calculation purposes.
- 80% of the work force is expected to be unskilled and semi-skilled workers, and 20% will be skilled.
- 90% of the work force (unskilled and semi-skilled workers) is expected to utilise public transport to site from neighbouring towns, most notably Belfast which is located approximately 19km to the north.
- It is unlikely that bus transport will be available, therefore all public transport trips will be via minibus taxi, with an average 16 person per vehicle occupancy.
- Staff will not utilise non-motorised transport (NMT), such as cycling or walking to site due to the excessive distances to the closest towns.
- 10% of the work force is expected to travel to site by private car, with an average occupancy of 1.5 persons.
- It is assumed that the public transport vehicles will not remain on-site during the workday, therefore all these vehicles will arrive and depart during the AM and PM peaks.
- The delivery of materials during the AM and PM peak hours will therefore be negligible, as trucks will arrive and depart throughout the day. If a conservative maximum 10% of the daily trips are generated during the AM and PM peaks, a maximum of less than 1 trips (total in & out) per peak hour is expected.
- It is assumed that masts will be manufactured of steel, and not hybrid masts with concrete sections.
- Each mast will consist of 7 x 29 m steel segments.
- One mast segment can be delivered per vehicle trip.
- One rotor blade can be transported on an abnormal size vehicle.
- Concrete foundations of approximately of 25m diameter x 3.0m deep are required, reinforced with 100 tons of steel.

Surface Water (Hydrology):

- Rainfall across the catchments is homogenous temporally and spatially;
- Data obtained from site-specific literature, and previous and other professional investigations will be assumed to be valid and true;
- Publicly available topographical data have been used; and
- Any detailed design and engineering drawings are excluded.

Notwithstanding these assumptions and limitations, it is the view of WSP that this EIAr provides a good description of the issues associated with the project.

2 GOVERNANCE FRAMEWORK

2.1 NATIONAL ENVIRONMENTAL LEGAL FRAMEWORK

The South African regulatory framework establishes well-defined requirements and standards for environmental and social management of industrial and civil infrastructure developments. Different authorities at both national and regional levels carry out environmental protection functions. The applicable legislation and policies are shown in **Table 2-1.**

Table 2-1 - Applicable National Legislation

Legislation	Description of Legislation and applicability
The Constitution of South Africa (No. 108 of 1996)	The Constitution cannot manage environmental resources as a stand-alone piece of legislation hence additional legislation has been promulgated to manage the various spheres of both the social and natural environment. Each promulgated Act and associated Regulations are designed to focus on various industries or components of the environment to ensure that the objectives of the Constitution are effectively implemented and upheld in an on-going basis throughout the country. In terms of Section 7, a positive obligation is placed on the State to give effect to the environmental rights.
National Environmental Management Act (No. 107 of 1998)	In terms of Section 24(2) of the NEMA, the Minister may identify activities, which may not commence without prior authorisation. The Minister thus published GNR 983 (as amended) (Listing Notice 1), GNR 984 (as amended) (Listing Notice 2) and GNR 985 (as amended) (Listing Notice 3) listing activities that may not commence prior to authorisation. The regulations outlining the procedures required for authorisation are published in the EIA Regulations of 2014 (GNR 982) (as amended). Listing Notice 1 identifies activities that require a BA process to be undertaken, in terms of the EIA Regulations, prior to commencement of that activity. Listing Notice 2 identifies activities that require an S&EIR process to be undertaken, in terms of the EIA Regulations, prior to commencement of that activity. Listing Notice 3 identifies activities within specific areas that require a BA process to be undertaken, in terms of the EIA Regulations, prior to commencement of that activity. WSP undertook a legal review of the listed activities according to the proposed project description to conclude that the activities listed in in this section are considered applicable to the development: A S&EIR process must be followed. An EA is required and will be applied for with the DFFE.
Listing Notice 1: GNR 983	**Activity 11(i): –** *The development of facilities or infrastructure for the transmission and distribution of electricity—* *(i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts; or* (ii) inside urban areas or industrial complexes with a capacity of 275 kilovolts or more; excluding the development of bypass infrastructure for the transmission and distribution of electricity where such bypass infrastructure is — (a) temporarily required to allow for maintenance of existing infrastructure; (b) 2 kilometres or shorter in length; (c) within an existing transmission line servitude; and

Legislation	Description of Legislation and applicability
	(d) will be removed within 18 months of the commencement of development. **Description:** This activity will be triggered as the project is located outside of an urban area and includes internal grid infrastructure with a capacity of up to 33kV, an onsite IPP substation including a 33/132kV step-up transformer, and an over the fence 132kV cable to connect the onsite IPP substation to the Common Collector Switching Station as part of the infrastructure.
Listing Notice 1: GNR 983	**Activity 12(ii)(a)(c):** *The development of—* (i) dams or weirs, where the dam or weir, including infrastructure and water surface area, exceeds 100 square metres; or *(ii) infrastructure or structures with a physical footprint of 100 square metres or more* *(a) within a watercourse;* (b) in front of a development setback; or *(c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse.* excluding— (aa) the development of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour; (bb) where such development activities are related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies; (cc) activities listed in activity 14 in Listing Notice 2 of 2014 or activity 14 in Listing Notice 3 of 2014, in which case that activity applies; (dd) where such development occurs within an urban area; [or] (ee) where such development occurs within existing roads, [or] road reserves or railway line reserves; or (ff) the development of temporary infrastructure or structures where such infrastructure or structures will be removed within 6 weeks of the commencement of development and where indigenous vegetation will not be cleared. **Description:** The Facility will require the development of internal roads and/or access roads around the site. The physical footprint of internal access roads and electrical cabling required to connect the various components of the Facility will either traverse the delineated watercourses on site, or be located within 32m of the outer extent of the delineated watercourses on site.
Listing Notice 1: GNR 983	**Activity 14:** *The development and related operation of facilities or infrastructure, for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 cubic metres or more but not exceeding 500 cubic metres.* **Description:**

Legislation	Description of Legislation and applicability
	The Facility will require storage and handling of dangerous goods, including fuel, cement, and chemical storage onsite, that will be greater than 80m^3 but not exceeding 500m^3. This activity will also be applicable in the event that Redox Flow Battery technology is considered preferred.
Listing Notice 1: GNR 983	**Activity 19**: *The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse.* but excluding where such infilling, depositing, dredging, excavation, removal or moving— (a) will occur behind a development setback; (b) is for maintenance purposes undertaken in accordance with a maintenance management plan; (c) falls within the ambit of activity 21 in this Notice, in which case that activity applies; (d) occurs within existing ports or harbours that will not increase the development footprint of the port or harbour; or (e) where such development is related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies. **Description:** Internal access roads and stormwater control infrastructure, as well as electrical cabling required to connect the various components of the Facility will collectively require the excavation, infilling or removal of soil exceeding 10m^3 from delineated watercourses on site. The exact values will be confirmed once final designs have been provided.
Listing Notice 1: GNR 983	**Activity 24(ii):** *The development of a road:* (i) for which an environmental authorisation was obtained for the route determination in terms of activity 5 in Government Notice 387 of 2006 or activity 18 in Government Notice 545 of 2010; or *(ii) A road with a reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 metres* but excluding a road— a) which is identified and included in activity 27 in Listing Notice 2 of 2014; (b) where the entire road falls within an urban area; or (c) which is 1 kilometre or shorter.. **Description:** Internal access roads required by the Facility will be between 8m and 10m wide this can be increased to 12m on bends. The roads will be positioned within a 20m wide corridor to accommodate cable trenches, stormwater channels and bypass /circles of up to 20m during construction. The total length of the roads will be approximately 60km.

Legislation	Description of Legislation and applicability
Listing Notice 1: GNR 983	**Activity 28(ii):** *Residential, mixed, retail, commercial, industrial or institutional developments where such land was used for agriculture, game farming, equestrian purposes or afforestation on or after 01 April 1998 and where such development*: (i) will occur inside an urban area, where the total land to be developed is bigger than 5 hectares; or *(ii) will occur outside an urban area, where the total land to be developed is bigger than 1 hectare.* excluding where such land has already been developed for residential, mixed, retail, commercial, industrial or institutional purposes. **Description:** The Facility is considered a commercial and/or industrial development, and is located on several farm portions zoned for agricultural use outside an urban area, used for agricultural purposes. The total area to be developed for the Facility (buildable area) is approximately 400ha (i.e. greater than 1 hectare).
Listing Notice 1: GNR 983	**Activity 30:** *Any process or activity identified in terms of section 53(1) of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004).* **Description:** The Facility infrastructure is located within, and will require vegetation clearance or disturbance of Eastern Highveld Grassland. This ecosystem is confirmed to be listed in the National List of Ecosystems that are Threated and in Need of Protection (as indicated in GNR 1002 of 9 December 2011). Due to the fact that this ecosystem is listed as threatened, it is assumed that various threatened or protected species may be found within the development area. The restricted activity of "cutting, chopping off, uprooting, damaging or destroying, any specimen" has been identified in terms of NEM:BA and is therefore applicable to the vegetation clearance that will be required to construct the development. Considering this, Activity 30 is considered applicable.
Listing Notice 1: GNR 983	**Activity 48(i)(a)(c):** *The expansion of—* *(i) infrastructure or structures where the physical footprint is expanded by 100 square metres or more; or* (ii) dams or weirs, where the dam or weir, including infrastructure and water surface area, is expanded by 100 square metres or more *where such expansion occurs—* *(a) within a watercourse;* (b) in front of a development setback; or *(c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse;* excluding— (aa) the expansion of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour;

Legislation	Description of Legislation and applicability
	(bb) where such expansion activities are related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies; (cc) activities listed in activity 14 in Listing Notice 2 of 2014 or activity 14 in Listing Notice 3 of 2014, in which case that activity applies; (dd) where such expansion occurs within an urban area; or (ee) where such expansion occurs within existing roads, road reserves or railway line reserves. **Description:** Transport of large infrastructure components related to the facility will require the expansion of existing access and/or internal roads, culverts or similar drainage crossing infrastructure collectively exceeding 100m^2 or more beyond existing road or road reserves located within delineated watercourses on site, or within 32m of the outer extent of the delineated watercourses on site.
Listing Notice 1: GNR 983	**<u>Activity 56(i)(ii):</u>** *The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre—* *(i) where the existing reserve is wider than 13,5 meters; or* *(ii) where no reserve exists, where the existing road is wider than 8 metres;* excluding where widening or lengthening occur inside urban areas. **Description:** Transport of large infrastructure components related to the facility will require the widening of existing access and/or internal roads where no reserve exists and where such road is wider than 8 metres.
Listing Notice 2: GNR 984	**<u>Activity 1:</u>** *The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20 megawatts or more*, excluding where such development of facilities or infrastructure is for photovoltaic installations and occurs — (a) within an urban area; or (b) on existing infrastructure. **Description:** This activity will be triggered by the Dalmanutha WEF as the proposed energy generation technologies will generate more than 20MW of electricity output from a renewable resource. The proposed facility is located outside of an urban area.
Listing Notice 2: GNR 984	**<u>Activity 15:</u>** *The clearance of an area of 20 hectares or more of indigenous vegetation*, excluding where such clearance of indigenous vegetation is required for— (i) the undertaking of a linear activity; or (ii) maintenance purposes undertaken in accordance with a maintenance management plan. **Description:**

Legislation	Description of Legislation and applicability
	This activity will be triggered by the Dalmanutha WEF as it will result in the clearance of at least 20 hectares or more of indigenous vegetation.
Listing Notice 3: GNR 985	**Activity 4 (f)(i)(bb)(cc)(ee)(gg):** The development of a road wider than 4 metres with a reserve less than 13,5 metres. f. Mpumalanga i. Outside urban areas: (bb) National Protected Area Expansion Strategy Focus areas; (cc) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority; (ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans; (gg) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core areas of a biosphere reserve, excluding disturbed areas, where such areas comprise indigenous vegetation; or **Description:** Internal access roads required by the Facility will be between 8m and 10m wide, and approximately 60km in length. Where required for turning circle/bypass areas, however, access or internal roads may be up to 12m to allow for larger component transport. The roads will be positioned within a 20m wide corridor to accommodate cable trenches, stormwater channels and bypass /circles of up to 20m during construction. The exact values will be confirmed once final designs have been provided. The facility is located within 5km of one Protected Area registered as a designated Protected Area in the South African Protected Area Database (SAPAD 2022 Q1), namely, the Nooitgedacht Dam Nature Reserve. Furthermore, roads required for the Facility will be located within, and will require vegetation clearance or disturbance of Eastern Highveld Grassland. This ecosystem is listed in the National List of Ecosystems that are Threatened and in need of Protection (GNR 1002 of 9 December 2011), and subsequently listed in terms of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004). Similarly, roads required for the Facility will be located within, and will require vegetation clearance or disturbance within a National Protected Area Expansion Strategy Focus area and Critical Biodiversity Areas (CBA)
Listing Notice 3: GNR 985	**Activity 10 (f)(i)(bb)(cc)(ee)(gg)(hh):** The development and related operation of facilities or infrastructure for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of 30 but not exceeding 80 cubic metres. f. Mpumalanga i. Outside urban areas: (bb) National Protected Area Expansion Strategy Focus areas; (cc) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority;

Legislation	Description of Legislation and applicability
	(ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans; (gg) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core areas of a biosphere reserve, where such areas comprise indigenous vegetation; or (hh) Areas within a watercourse or wetland, or within 100 metres of a watercourse or wetland; **Description:** The Facility will require storage and handling of dangerous goods, including fuel, cement, and chemical storage onsite, that will be greater than 30m3 but not exceeding 80m3 within the specified geological areas. The storage contemplated is located within the extent, and within 5km of a private nature reserve. The facility is located within 5km of one Protected Area registered as a designated Protected Area in the South African Protected Area Database (SAPAD 2022 Q1), namely, the Nooitgedacht Dam Nature Reserve. Furthermore, storage contemplated above will be located within, and will require vegetation clearance or disturbance of Eastern Highveld Grassland, which is listed in the National List of Ecosystems that are Threatened and in need of Protection (GNR 1002 of 9 December 2011), and subsequently listed in terms of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004). Similarly, storage contemplated above will be located within, and will require vegetation clearance or disturbance within a National Protected Area Expansion Strategy Focus area and Critical Biodiversity Areas (CBA) as well as being located within delineated watercourses on site, or within 100m of the outer extent of the delineated watercourses on site. .
Listing Notice 3: GNR 985	**Activity 12(f)(i)(ii):** The clearance of an area of 300 square metres or more of indigenous vegetation except where such clearance of Indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan. f.Mpumalanga (i) Within any critically endangered or endangered ecosystem listed in terms of section 52 of the NEMBA or prior to the publication of such a list, within an area that has been identified as critically endangered in the National Spatial Biodiversity Assessment 2004; (ii) Within critical biodiversity areas identified in bioregional plans; **Description:** The clearance required for the Facility will be approximately 400ha of indigenous vegetation. Such clearance will be in excess of 300m^2 and be partly located within Eastern Highveld Grassland, which is listed in the National List of Ecosystems that are Threatened and in need of Protection (GNR 1002 of 9 December 2011), and subsequently listed in terms of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004). Similarly, vegetation clearance required for the Facility will be located within Critical Biodiversity Areas (CBA) and Ecological Support Areas (ESA), in excess of 300m^2.

Legislation	Description of Legislation and applicability
Listing Notice 3: GNR 985	**Activity 14(ii)(a)(c)(f)(i)(bb)(dd)(ff)(hh):** The development of— (ii) infrastructure or structures with a Physical footprint of 10 Square metres or more; where such development occurs— (a) within a watercourse; (c) if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse; f. Mpumalanga i. Outside urban areas: (bb) National Protected Area Expansion Strategy Focus areas; (dd) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority; (ff) Critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans; (hh) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core area of a biosphere reserve, where such areas comprise indigenous vegetation; **Description:** The Facility will require the development of internal roads and/or access roads around the site. The physical footprint of internal access roads, stormwater control infrastructure and electrical cabling required to connect the various components of the Facility will either traverse the delineated watercourses on site, or be located within 32m of the outer extent of the delineated watercourses on site. The facility is located within 5km of one Protected Area registered as a designated Protected Areas in the South African Protected Area Database (SAPAD 2022 Q1), namely, the Nooitgedacht Dam Nature Reserve. Furthermore, the physical footprint of internal access roads, stormwater control infrastructure and electrical cabling required to connect the various components of the Facility will be located within Eastern Highveld Grassland, which is listed in the National List of Ecosystems that are Threatened and in need of Protection (GNR 1002 of 9 December 2011), and subsequently listed in terms of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004). Finally, the physical footprint of internal access roads, stormwater control infrastructure and electrical cabling required to connect the various components of the Facility will be located within a National Protected Area Expansion Strategy Focus area, as well as Critical Biodiversity Areas (CBA) and Ecological Support Areas (ESA).
Listing Notice 3: GNR 985	**Activity 18 (f)(i)(bb)(cc)(ee)(gg):** The widening of a road by more than 4 metres, or the lengthening of a road by more than 1 kilometre. f. Mpumalanga i. Outside urban areas: (bb) National Protected Area Expansion Strategy Focus areas;

Legislation	Description of Legislation and applicability
	(cc) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority; (ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans; (gg) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core area of a biosphere reserve, where such areas comprise indigenous vegetation; **Description:** Transport of large infrastructure components related to the facility will require the widening of existing access and/or internal roads by more than 4 metres or the lengthening of existing access and/or internal roads by more than 1km within the Mpumalanga Province and outside urban areas. The facility is located within 5km of one Protected Area registered as a designated Protected Area in the South African Protected Area Database (SAPAD 2022 Q1), namely, the Nooitgedacht Dam Nature Reserve Furthermore, such widening will occur within Eastern Highveld Grassland, which is listed in the National List of Ecosystems that are Threatened and in need of Protection (GNR 1002 of 9 December 2011), and subsequently listed in terms of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004). Finally, such widening will be located within a National Protected Area Expansion Strategy Focus area and Critical Biodiversity Areas (CBA).
Listing Notice 3: GNR 985	**Activity 23(ii)(a)(c)(f)(i)(bb)(cc)(ee)(gg):** The expansion of— (ii) infrastructure or structures where the physical footprint is expanded by 10 square metres or more; where such expansion occurs — (a) within a watercourse; (c) if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse; f. Mpumalanga i. Outside urban areas: (bb) National Protected Area Expansion Strategy Focus areas; (cc) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority; (ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans; (gg) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core area of a biosphere reserve, where such areas comprise indigenous vegetation; **Description:** The Facility will require the expansion of existing internal roads and/or access roads around the site. The physical footprint of the expansion activities will either traverse the delineated watercourses on site, or be located within 32m of the outer extent of the delineated watercourses on site.

Legislation	Description of Legislation and applicability
	The facility is located within 5km of one Protected Area registered as a designated Protected Area in the South African Protected Area Database (SAPAD 2022 Q1), namely, the Nooitgedacht Dam Nature Reserve. Furthermore, the physical footprint of the expansion activities will be located within Eastern Highveld Grassland, this ecosystem of which is listed in the National List of Ecosystems that are Threatened and in need of Protection (GNR 1002 of 9 December 2011), and subsequently listed in terms of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004). Finally, the physical footprint of the expansion activities will be located within a National Protected Area Expansion Strategy Focus area, as well as Critical Biodiversity Areas (CBA) and Ecological Support Areas (ESA).
Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Themes (GNR 320, 20 March 2020 and GNR 1150, 30 October 2020)	The protocols provide the criteria for specialist assessment and minimum report content requirements for impacts for various environmental themes for activities requiring environmental authorisation. The protocols replace the requirements of Appendix 6 of the EIA Regulations, 2014, as amended. The assessment and reporting requirements of the protocols are associated with a level of environmental sensitivity identified by the national web based environmental screening tool (screening tool). The Screening Reports were generated for both project alternatives (**Appendix K**). The following environmental themes were applicable to the Dalmanutha WEF-Alternative 1: ▪ Agricultural Theme ▪ Animal Species Theme ▪ Aquatic Biodiversity Theme ▪ Archaeological and Cultural Heritage Theme ▪ Avian (Wind) theme ▪ Bats (Wind) Theme ▪ Civil Aviation Theme ▪ Defence Theme ▪ Flicker Theme ▪ Palaeontology Theme ▪ Plant Species Theme ▪ Noise Theme ▪ Landscape (Wind theme) ▪ Terrestrial Biodiversity Theme The following environmental themes were applicable to the Dalmanutha Hybrid Alternative 2: ▪ Agriculture Theme ▪ Animal Species Theme ▪ Aquatic Biodiversity Theme ▪ Archaeological and Cultural ▪ Heritage Theme ▪ Avian Theme ▪ Civil Aviation (Solar PV) Theme ▪ Defence Theme ▪ Landscape (Solar) Theme ▪ Palaeontology Theme ▪ Plant Species Theme ▪ RFI Theme

Legislation	Description of Legislation and applicability
	▪ Terrestrial Biodiversity Theme
National Environmental Management: Waste Act (59 of 2008) (NEM:WA)	This Act provides for regulating waste management in order to protect health and the environment by providing reasonable measures for the prevention of pollution and ecological degradation. The Act also provides for the licensing and control of waste management activities through GNR. 921 (2013): List of Waste Management Activities that Have, or are Likely to Have, a Detrimental Effect on the Environment. The proposed project does not constitute a Listed Activity requiring a Waste Management Licence (WML) as defined in GNR 921. However, the contents of this EIAr and the associated Environmental Management Programme (EMPr) which is included as **Appendix I** include reasonable measures for the prevention of pollution and good international industry practice (GIIP).
National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)	The National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA) was promulgated in June 2004 within the framework of NEMA to provide for the management and conservation of national biodiversity. The NEMBA's primary aims are for the protection of species and ecosystems that warrant national protection, the sustainable use of indigenous biological resources, the fair and equitable sharing of benefits arising from bioprospecting involving indigenous biological resources. In addition, the NEMBA provides for the establishment and functions of a South African National Biodiversity Institute (SANBI). SANBI was established by the NEMBA with the primary purpose of reporting on the status of the country's biodiversity and conservation status of all listed threatened or protected species and ecosystems. The biodiversity assessment identifies CBAs which represent biodiversity priority areas which should be maintained in a natural to near natural state. The CBA maps indicate the most efficient selection and classification of land portions requiring safeguarding in order to meet national biodiversity objectives. Based on the preliminary desktop assessment and the terrestrial ecology report, a significant part of the Project Area falls within CBA (Irreplaceable and Optimal) and a large wetland area adjacent and to the north of the Vaal River (near the southern part of the site) is mapped as an Ecological Support Area (ESA). According to the description for the MBSP Terrestrial Assessment categories, CBAs are areas that are required to meet biodiversity targets (for biodiversity pattern and ecological process features). The management approach is that they should remain in a natural state. CBAs are areas of high biodiversity value which are usually at risk of being lost and usually identified as important in meeting biodiversity targets, except for Critically Endangered Ecosystems or Critical Linkages. CBAs in the Province can be divided into two sub-categories: ▪ Irreplaceable (parts of the site are within this sub-category), and ▪ Optimal (northern parts of the site are within this sub-category). Supplementary baseline terrestrial ecology studies will be undertaken during the EIA phase to inform the assessment of impacts and will include flora surveys of the project footprint to determine the presence of flora species of concern (SoC), and bird surveys of the area to define the potential risks to bird SoC. The Conservation of Agricultural Resources Act (No. 43 of 1983) (CARA) Regulations with regards to alien and invasive species have been superseded by the National Environmental Management: Biodiversity Act, 2004 (Act no. 10 of 2004) – Alien and Invasive Species (AIS) Regulations which became law on 1 October 2014. Specific

Legislation	Description of Legislation and applicability
	management measures for the control of alien and invasive plants have been included in the EMPr (refer to **Appendix I** of this EIAr.
National Biodiversity Offset Guideline **(Issued Under Section 24j Of The National Environmental Management Act)** **(First Edition (October 2021)**	The purpose of this guideline is to indicate when biodiversity offsets are likely to be required as mitigation by any competent authority (CA), to lay down basic principles for biodiversity offsetting and to guide offset practice in the environmental authorisation (EA) application context. This guideline is therefore applicable to applications for EA in terms of section 24 of NEMA. However, it can also be used to inform other administrative processes that may involve biodiversity offsetting, including applications for EA in terms of section 24G of NEMA, emergency directives contemplated in section 30A of NEMA, applications for licences under the National Water Act, 1998, the National Forests Act, 1998 and the National Environmental Management: Waste Act, 2008, applications for development rights in terms of the Spatial Planning and Land Use Management Act, 2013 and requests for the de-proclamation, or the withdrawal of declarations, of protected areas in terms of provincial legislation or NEMPAA. Biodiversity is fundamental to the health and well-being of people, as well as economic activity and socio-economic upliftment. The National Biodiversity Assessment (2018) (NBA 2018) states that South Africa's biodiversity assets and ecological infrastructure contribute significantly towards meeting national development priorities. Biodiversity offsetting, if done correctly, can advance the environmental right in the Constitution of the Republic of South Africa, 1996 (Constitution). Section 24 of the Constitution provides that everyone has the right to, amongst other things, have the environment protected for the benefit of present and future generations through reasonable legislative and other measures that, amongst other things, promote conservation and secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development. Biodiversity offsetting is one of the ways in which South Africa's protected and conservation areas can be expanded, thereby promoting conservation. It may well also help to secure ecologically sustainable development as it mitigates the adverse impact of economic and social development on biodiversity, which, in turn, underpins such development. The biodiversity offsetting process, which only applies when a biodiversity offset is required involves the following steps: ▪ Identifying the need for a biodiversity offset. ▪ Determining the requirements of a biodiversity offset and compilation of a Biodiversity Offset Report. ▪ Selecting a biodiversity offset site. ▪ Securing the biodiversity offset site. ▪ Preparing a Biodiversity Offset Management Plan. ▪ Preparing biodiversity offset conditions for an EA. ▪ Concluding a Biodiversity Offset Implementation Agreement. A biodiversity offset strategy has been compiled and is included in **Appendix J**. The biodiversity offset strategy is included as a result of the very high sensitivities confirmed in terms of avifauna, the presence of primary grasslands and PES A/B wetlands on site, the potential residual impacts as well as recommendations received from the DFFE.
National Environmental Management Protected Areas Act (No. 57 of 2003)	The purpose of the National Environmental Management Protected Areas Act (No. 57 of 2003) (NEMPAA) is to, inter alia, provide for the protection and conservation of ecologically viable areas representative of South Africa's biological diversity and its natural landscapes and seascapes. To this end, it provides for the declaration and management of various types of protected areas.

Legislation	Description of Legislation and applicability
	Section 50(5) of NEMPAA states that "no development, construction or farming may be permitted in a nature reserve or world heritage site without the prior written approval of the management authority." There are no protected areas within the study area. According to the National Protected Area Expansion Strategy (NPAES), the study area forms part of the Mpumalanga PAES 20 year plan which corresponds to the NPAES (2018) map.
The National Water Act (No. 36 Of 1998)	The National Water Act, 1998 (Act No. 36 of 1998) (NWA) provides the framework to protect water resources against over exploitation and to ensure that there is water for social and economic development, human needs and to meet the needs of the aquatic environment. The Act defines water source to include watercourses, surface water, estuary or aquifer. A watercourse is defined in the Act as a river or spring, a natural channel in which water flows regularly or intermittently, a wetland, lake or dam into which or from which water flows, and any collection of water that the Minister may declare a watercourse. Section 21 of the Act outlines a number of categories that require a water user to apply for a Water Use License (WUL) and Section 22 requires water users to apply for a General Authorisation (GA) with the Department of Water and Sanitation (DWS) if they are under certain thresholds or meet certain criteria. The list of water uses applicable to the proposed Project include: - Taking water from a water resource; - Impeding or diverting the flow of water in a watercourse; - Disposing of waste in a manner which may detrimentally impact on a water resource; and - Altering the bed, banks, course or characteristics of a watercourse. The DWS will make the final decision on water uses that are applicable to the project through a pre-application meeting after which a Water Use Authorisation Application (WUA) as determined by the risk assessment will be undertaken in compliance with procedural regulations published by the DWS within General Notice 267 (GN267). These regulations specify required information per water use and the reporting structure of required supporting technical information.

The National Heritage Resources Act (No. 25 Of 1999)	The National Heritage Resource Act (Act No. 25 of 1999) (NHRA) serves to protect national and provincial heritage resources across South Africa. The NHRA provides for the protection of all archaeological and palaeontological sites, the conservation and care of cemeteries and graves by the South African Heritage Resources Agency (SAHRA), and lists activities that require any person who intends to undertake to notify the responsible heritage resources agency and furnish details regarding the location, nature, and extent of the proposed development.
	
	Part 2 of the NHRA details specific activities that require a Heritage Impact Assessment (HIA) that will need to be approved by SAHRA. Parts of Section 35, 36 and 38 apply to the proposed project, principally:
	- Section 35 (4) - No person may, without a permit issued by the responsible heritage resources authority-
	  • destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite;
	  • destroy, damage, excavate, remove from its original position, collect or own any archaeological or palaeontological material or object or any meteorite.

Legislation	Description of Legislation and applicability
	■ Section 38 (1) Subject to the provisions of subsections (7), (8) and (9), any person who intends to undertake a development categorised as- • any development or other activity which will change the character of a site— (i) exceeding 5 000 m^2 in extent, must at the very earliest stages of initiating such a development, notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development. In terms of Section 38(8), approval from the heritage authority is not required if an evaluation of the impact of such development on heritage resources is required in terms of any other legislation (such as NEMA), provided that the consenting authority ensures that the evaluation of impacts fulfils the requirements of the relevant heritage resources authority in terms of Section 38(3) and any comments and recommendations of the relevant resources authority with regard to such development have been taken into account prior to the granting of the consent. However, should heritage resources of significance be affected by the proposed Project, a permit is required to be obtained prior to disturbing or destroying such resources as per the requirements of Section 48 of the NHRA, and the SAHRA Permit Regulations (GN R668). A Heritage impact assessment report (**Appendix H.6**) has been carried out by a suitably qualified specialist, revealing: ■ No Stone Age or Iron Age archaeological sites are known from the immediate area although several sites are known from the wider geographical area. ■ Several burial sites are on record for the general area. ■ The study area is of low to moderate and high paleontological sensitivity and according to the South African Heritage Resources Information System (SAHRIS) palaeontological sensitivity map must be subjected to a palaeontological assessment in the impact assessment phase (**Appendix H.7**). The proposed project will be loaded onto the SAHRIS portal for comment by the provincial Heritage Resource Agency.
Mineral and Petroleum Resources Development Act (No. 28 of 2002)	The aim of the Mineral and Petroleum Resources Development Act (No. 28 of 2002) (MPRDA) is to make provision for equitable access to and sustainable development of the nation's mineral and petroleum resources. Section 53(1) of the MPRDA provides that any person who intends to use the surface of any land in any way that may be contrary to any object of the MPRDA, or which is likely to impede any such object, must apply to the Minister of Mineral Resources (the Minister) for approval. Section 53 of the MPRDA provides a mechanism for ensuring that, inter alia, the mining of mineral resources is not detrimentally affected through the use of the surface of land and which may, for example, result in the sterilisation of a mineral resource. A Section 53 approval will be required due to the fact that the project is located on various mining right areas. The Amendment Regulations (GNR 420 of 27 March 2020) introduced a template for section 53 applications (Form Z) and the specific information that applicants will need to provide as part of a section 53 application.
Noise Control Regulations in terms of the Environmental Conservation,	In South Africa, environmental noise control has been in place for three decades, beginning in the 1980s with codes of practice issued by the South African National Standards (formerly the South African Bureau of Standards, SABS) to address noise pollution in various sectors of the country. Under the previous generation of environmental legislation, specifically the Environmental Conservation Act 73 of 1989 (ECA), provisions were made to control noise from a National level in the form of the

Legislation	Description of Legislation and applicability
1989 (Act 73 of 1989)	Noise Control Regulations (GNR 154 of January 1992). In later years, the ECA was replaced by the National Environmental Management Act 107 of 1998 (NEMA) as amended. The National Environmental Management: Air Quality Act 39 of 2004 (NEMAQA) was published in line with NEMA and contains noise control provisions under Section 34: (1) The minister may prescribe essential national standards – (a) for the control of noise, either in general or by specific machinery or activities or in specified places or areas; or (b) for determining – (i) a definition of noise; and (ii) the maximum levels of noise. (2) When controlling noise, the provincial and local spheres of government are bound by any prescribed national standards. Under NEMAQA, the Noise Control Regulations were updated and are to be applied to all provinces in South Africa. The Noise Control Regulations give all the responsibilities of enforcement to the Local Provincial Authority, where location specific by-laws can be created and applied to the locations with approval of Provincial Government. Where province-specific regulations have not been promulgated, acoustic impact assessments must follow the Noise Control Regulations. Furthermore, NEMAQA prescribes that the Minister must publish maximum allowable noise levels for different districts and national noise standards. These have not yet been accomplished and as a result all monitoring and assessments are done in accordance with the South African National Standards (SANS) 10103:2008 and 10328:2008.
Conservation of Agricultural Resources Act (No. 43 of 1983)	The Conservation of Agricultural Resources Act (Act 43 of 1983) (CARA) provides for the implementation of control measures for soil conservation works as well as alien and invasive plant species in and outside of urban areas. In terms of the amendments to the regulations under the CARA, landowners are legally responsible for the control of alien species on their properties. Various Acts administered by the DFFE and the DWS, as well as other laws (including local by-laws), spell out the fines, terms of imprisonment and other penalties for contravening the law. Although no fines have yet been placed against landowners who do not remove invasive species, the authorities may clear their land of invasive alien plants and other alien species entirely at the landowners' cost and risk. The CARA Regulations with regards to alien and invasive species have been superseded by NEMBA Alien and Invasive Species (AIS) Regulations which became law on 1 October 2014.
Civil Aviation Act (No. 13 of 2009)	Civil aviation in South Africa is governed by the Civil Aviation Act (Act 13 of 2009). This Act provides for the establishment of a stand-alone authority mandated with controlling, promoting, regulating, supporting, developing, enforcing and continuously improving levels of safety and security throughout the civil aviation industry. This mandate is fulfilled by South African Civil Aviation Authority (SACAA) as an agency of the Department of Transport (DoT). SACAA achieves the objectives set out in the Act by complying with the Standards and Recommended Practices (SARPs) of the International Civil Aviation Organisation (ICAO), while considering the local context when issuing the South African Civil Aviation Regulations (SA CARs). As of the 1st of May 2021, Air Traffic and Navigation Services (ATNS) has been appointed as the new Obstacle application Service Provider for Windfarms and later

Legislation	Description of Legislation and applicability
	Solar Plants. Their responsibility would pertain to the assessments, maintenance, and all other related matters in respect to Windfarms and in due time Power Plant assessments. The DFFE Screening Tool Report identified Civil Aviation as having low sensitivity for the proposed Dalmanutha WEF, and as being located between 8 and 15km of other civil aviation aerodrome. An Application for the Approval of Obstacles has been submitted to ATNS. SACAA will be included on the project stakeholder database. They will be informed of the proposed Project, and comment will be sought from these authorities as applicable.
Occupational Health and Safety Act (No. 85 of 1993)	The National Occupational Health and Safety Act (No. 85 of 1993) (OHSA) and the relevant regulations under the Act are applicable to the proposed project. This includes the Construction Regulations promulgated in 2014 under Section 43 of the Act. Adherence to South Africa's OHSA and its relevant Regulations is essential.
National Energy Act (No. 34 of 2008)	The National Energy Act aims to ensure that diverse energy resources are available, in sustainable quantitates, and at affordable prices, to the South African economy in support of economic growth and poverty alleviation, taking into account environmental management requirements and interactions amongst economic sectors. The main objectives of the Act are to: - Ensure uninterrupted supply of energy to the Republic; - Promote diversity of supply of energy and its sources; - Facilitate effective management of energy demand and its conservation; - Promote energy research; - Promote appropriate standards and specifications for the equipment, systems and processes used for producing, supplying and consuming energy; - Ensure collection of data and information relating to energy supply, transportation and demand; - Provide for optimal supply, transformation, transportation, storage and demand of energy that are planned, organised and implemented in accordance with a balanced consideration of security of supply, economics, consumer protection and a sustainable development; - Provide for certain safety, health and environment matters that pertain to energy; - Facilitate energy access for improvement of the quality of life of the people of Republic; - Commercialise energy-related technologies; - Ensure effective planning for energy supply, transportation, and consumption; and - Contribute to sustainable development of South Africa's economy. In terms of the act, the Minister of Energy is mandated to develop and, on an annual basis, review and publish the Integrated Energy Plan (IEP) in the Government Gazette. The IEP analyses current energy consumption trends within different sectors of the economy (i.e. agriculture, commerce, industry, residential and transport) and uses this to project future energy requirements, based on different scenarios. The IEP and the Integrated Resource Plan are intended to be updated periodically to remain relevant. The framework is intended to create a balance between energy demand and resource availability so as to provide low-cost electricity for social and economic development, while taking into account health, safety and environmental parameters.
Electricity Regulation Act (No. 4 of 2006)	The Electricity Regulation Act (No. 4 of 2006) (ERA) aims to: - Achieve the efficient, effective, sustainable and orderly development and operation of electricity supply infrastructure in South Africa;

Legislation	Description of Legislation and applicability
	▪ Ensure that the interests and needs of present and future electricity customers and end users are safeguarded and met, having regard to the governance, efficiency. effectiveness and long-term sustainability of the electricity supply industry within the broader context of economic energy regulation in the Republic: ▪ Facilitate investment in the electricity supply industry; ▪ Facilitate universal access to electricity; ▪ Promote the use of diverse energy sources and energy efficiency; ▪ Promote competitiveness and customer and end user choice; and ▪ Facilitate a fair balance between the interests of customers and end users, licensees, investors in the electricity supply industry and the public. The Act establishes a National Energy Regulator as the custodian and enforcer of the National Electricity Regulatory Framework. The Act also provides for licenses and registration as the manner in which generation, transmission, distribution, trading and the import and export of electricity are regulated.

2.2 CONSISTENCY WITH NATIONAL ENVIRONMENTAL MANAGEMENT ACT (NEMA) PRINCIPLES

Table 2-2 - Consistency of the Dalmanutha Renewable Energy Facility and the EIA Process with the NEMA principles

NEMA Principles	Discussion
(2) Environmental management must place people and their needs at the forefront of its concern, and serve their physical, psychological, developmental, cultural and social interests equitably. (3) Development must be socially, environmentally and economically sustainable.	Although all the specialists undertake their studies from a sustainability point of view, this principle was specifically upheld by specialists undertaking the studies within the social environment such as Biodiversity (terrestrial & aquatic), Avifaunal Impact, Air Quality, Visual Impact, Noise Impact, Socio-Economic Impact, Heritage and Archaeology, Financial Aspects, Land Use and Traffic and Transportation. All studies included the assessment of impacts that either directly or indirectly affect people and their living environment. The Dalmanutha WEF/Dalmanutha Hybrid Facility project aims to demonstrate a technology that could improve access to electricity that has a lower climate change impact than conventional power generation technologies such as coal-fired power and open cycle gas turbines.
(4) *(a)* Sustainable development requires the consideration of all relevant factors including the following:	
(i) That the disturbance of ecosystems and loss of biological diversity are avoided, or, where they cannot be altogether avoided, are minimised and remedied;	All specialist studies have included recommendations and mitigation measures that encourage the minimisation or avoidance of the disturbance of ecosystems, in particular a number of sensitive wetlands, CBAs and ESAs. These mitigation measures have been included along with other more generic specifications in the EMPr.

NEMA Principles	Discussion
	The Dalmanutha WEF/Dalmanutha Hybrid Facility will be required to adhere to the EMPr developed for its construction and operation.
(ii) that pollution and degradation of the environment are avoided, or, where they cannot be altogether avoided, are minimised and remedied;	All specialist studies have included recommendations and mitigation measures that encourage the minimisation or avoidance of pollution and degradation of the study area due to construction and operational activities. These mitigation measures have been included along with other more generic specification in the EMPr. The Dalmanutha WEF/Dalmanutha Hybrid Facility will be required to adhere to the EMPr developed for its construction and operation.
(iii) that the disturbance of landscapes and sites that constitute the nation's cultural heritage is avoided, or where it cannot be altogether avoided, is minimised and remedied;	The Heritage and Archaeological Impact Assessment investigated this principle. No Stone Age or Iron Age archaeological sites are known from the immediate area although several sites are known from the wider geographical area. No Stone Age or Iron Age archaeological sites are on record within the immediate study area but this could be due to a lack of focused research in the area. Several burial sites are on record for the general area. The Dalmanutha WEF/Dalmanutha Hybrid Facility will be required to adhere to the EMPr developed for its construction and operation.
(iv) that waste is avoided or where it cannot be altogether avoided, minimised and re-used or recycled where possible and otherwise disposed of in a responsible manner;	Mitigation measures for waste management have been included in the EMPr. The Dalmanutha WEF/Dalmanutha Hybrid Facility will be required to adhere to the EMPr developed for its construction and operation.
(vi) that the development, use and exploitation of renewable resources and the ecosystems of which they are part do not exceed the level beyond which their integrity is jeopardised;	On 6 May 2011, the then Department of Energy (DoE) released the Integrated Resource Plan 2010-2030 (IRP 2010) in respect of South Africa's forecast energy demand for the 20-year period from 2010 to 2030. The promulgated IRP 2010–2030 identified the preferred generation technology required to meet expected demand growth up to 2030. It incorporated government objectives such as affordable electricity, reduced greenhouse gas (GHG) emissions, reduced water consumption, diversified electricity generation sources, localisation and regional development.. The Dalmanutha WEF/Dalmanutha Hybrid Facility focuses on utilising a non-fossil based resource, and in so doing could assist in reducing stress on

NEMA Principles	Discussion
	existing resources and the ecosystems of which they are part. The Dalmanutha WEF/Dalmanutha Hybrid Facility will be required to adhere to adhere to the EMPr developed for its construction and operation.
(vii) that a risk-averse and cautious approach is applied, which takes into account the limits of current knowledge about the consequences of decisions and actions; and	Undertaking any project based on new technology could be considered risky. It can be said that a “Cautious approach” is being followed as Enertrag Sa's Business Planning Process and Methodology (through the use of the PMP and PIM) requires close scrutiny of certain aspects *inter alia*: ▪ Financial projections ▪ Cost estimates ▪ Inflation and interest rate assumptions ▪ Contingency provisions This implies continuous monitoring and updating of input data. Risk is inherent in any new technology, the EIA has endeavoured to identify these risks and recommend sufficient measures that can be implemented in order to minimise the risks to acceptable levels. In terms of the specialist studies undertaken for the EIR, specialists have undertaken their studies utilising data that represents the “Worst-Case Scenario” thus also up holding a cautious approach to their studies.
(viii) that negative impacts on the environment and on people’s environmental rights be anticipated and prevented, and where they cannot be altogether prevented, are minimised and remedied.	The EIA process in itself is a tool that is utilised to ensure that impacts on the environment and on people’s rights are anticipated. Where a specialist study identified a negative impact, mitigation measures have been proposed in order to either prevent or minimise the impact. These mitigation measures have been included along with other more generic specifications in the EMPr. The Dalmanutha WEF/Dalmanutha Hybrid Facility will be required to adhere to the EMPr developed for its construction and operation
(4) (b) Environmental management must be integrated, acknowledging that all elements of the environment are linked and interrelated, and it must take into account the effects of decisions on all aspects of the environment and all people in the environment by pursuing the selection of the best practicable environmental option.	The EIA and all specialist studies have been undertaken taking best practise principles into consideration. The integration of the studies was ensured by specialist interaction during the study period and the integration of their findings. The construction, operation and decommissioning of the Dalmanutha WEF/Dalmanutha Hybrid Facility project will be undertaken in recognition of the need for a holistic approach to environmental management.

NEMA Principles	Discussion
(4) (c) Environmental justice must be pursued so that adverse environmental impacts shall not be distributed in such a manner as to unfairly discriminate against any person, particularly vulnerable and disadvantaged persons.	All studies were required to uphold the principle of sustainable development. The project Alternative 2 was developed as a result of trying to achieve sustainable development, to reduce impacts associated with wind turbines to Avifauna on the site.
(4) (d) Equitable access to environmental resources, benefits and services to meet basic human needs and ensure human well-being must be pursued and special measures may be taken to ensure access thereto by categories of persons disadvantaged by unfair discrimination.	All studies were required to uphold the principle of sustainable development. The project in totality will benefit the community both regionally and locally. The project will give greater certainty in terms of the ability to provide present and future needs for electricity to all sectors of the populations including those that may have been disadvantaged by unfair discrimination. Locally communities may benefit from aspects such as job creation particularly within the construction phase.
(4) (e) Responsibility for the environmental health and safety consequences of a policy, programme, project, product, process, service or activity exists throughout its life cycle.	The EIA addressed impacts throughout the life cycle of the development from construction to decommissioning. All specialists studies were also required to uphold the principle of sustainable development. The EMPr and the auditing processes as required by the Environmental Authorisation (still to be issued) will ensure that these responsibilities are up held throughout the projects' life cycle.
(4) (f) The participation of all interested and affected parties in environmental governance must be promoted, and all people must have the opportunity to develop the understanding, skills and capacity necessary for achieving equitable and effective participation, and participation by vulnerable and disadvantaged persons must be ensured.	A comprehensive Public Participation Process has been undertaken. I&APs have been given the opportunity to comment on the EIA. Public input will continue through to the construction, operational and decommissioning stages of the project through the provisions that have been made in the EMPr to appoint a community liaison officer, whose duties must include communication regarding environmental issues.
(4) (g) Decisions must take into account the interests, needs and values of all interested and affected parties, and this includes recognizing all forms of knowledge. Including traditional and ordinary knowledge.	The comments and queries from I&APs have all been either taken into account or responded to within the studies undertaken. Communication will continue through to the construction, operational and decommissioning stages of the project through the provisions that have been made in the EMPr to appoint a community liaison officer.
(4) (h) Community wellbeing and empowerment must be promoted through environmental education, the raising of environmental awareness, the sharing of knowledge and experience and other appropriate means.	The EMPr has upheld this recommendation. All contractors and operators involved in the Dalmanutha WEF/Dalmanutha Hybrid Facility will be required to adhere to the EMPr developed for its construction and operation.

NEMA Principles	Discussion
(4) (i) The social, economic and environmental impacts of activities, including disadvantages and benefits, must be considered, assessed and evaluated, and decisions must be appropriate in the light of such consideration and assessment.	The EIA assesses the advantages and disadvantages of the project. The Dalmanutha WEF/Dalmanutha Hybrid Facility Business Planning Process and Methodology (through the use of the PMP and PIM) also requires close scrutiny of certain aspects *inter alia*: ▪ Financial projections; ▪ Cost estimates; ▪ Inflation and interest rate assumptions; and ▪ Contingency provisions. This implies continuous monitoring and updating of input data throughout the project's lifecycle. The social and environmental impacts of the project have similarly been identified, studied assessed and mitigation measures proposed.
(4) (j) The right of workers to refuse work that is harmful to human health or the environment and to be informed of dangers must be respected and protected.	This is upheld in the EMPr where the required Occupational Health and Safety specifications are dealt with. The Dalmanutha WEF/Dalmanutha Hybrid Facility will be required to adhere to the EMPr developed for its construction and operation.
(4) (k) Decisions must be taken in an open and transparent manner, and access to information must be provided in accordance with the law.	All documentation compiled as a result of the EIA process has been made available for public comment and scrutiny, as per legal requirements and best practice. Communication will continue through to the construction and operational stages of the project through the provisions that have been made in the EMPr to appoint a community liaison officer.
(4) (l) There must be intergovernmental co-ordination and harmonisation of policies, legislation and actions relating to the environment.	The EIA process makes allowance for discussion between different authorities at local, provincial and national levels. Intergovernmental coordination on this project includes co-operation between the DFFE, MDARDLEA, MTPA and BirdLifeSA; resulting in the development of the Dalmanutha Hybrid facility alternative.
(4) (m) Actual or potential conflicts of interest between organs of state should be resolved through conflict resolution procedures.	The Public Participation Process endeavoured to ensure that conflict between organs of state was minimised throughout the project duration. Focus Group meetings will be held with a number of government departs such as the Department of Public Enterprises, the Department of Minerals and Energy and the ministry of Health
(4) (n) Global and international responsibilities relating to the environment must be discharged in the national interest.	All specialist studies have endeavoured to up hold this principle.

NEMA Principles	Discussion
(4) (o) The environment is held in public trust for the people, the beneficial use of environmental resources must serve the public interest and the environment must be protected as the people's common heritage.	The Dalmanutha WEF/Dalmanutha Hybrid Facility is a project that will endeavour to demonstrate a new technology that strives to achieve the objectives of improved renewalble energy safety, improved proliferation resistance, minimized waste and natural resource utilisation and decreased cost to build and run such plants. The long term objectives for Dalmanutha WEF/Dalmanutha Hybrid Facility is to provide a new generation technology that can be included into the generation mix of the country which will improve electricity provision. The provision of electricity is seen to be in the public interest. All specialist studies have endeavoured to up hold this principle. The Dalmanutha WEF/Dalmanutha Hybrid Facility will be constructed, operated and decommissioned according to the Environmental Management Policies and Systems that apply to it.
(4) (p) The costs of remedying pollution, environmental degradation and consequent adverse health effects and of preventing, controlling or minimizing further pollution, environmental damage or adverse health effects must be paid for by those responsible for harming the environment.	This principle is upheld in the EIA as it will be the responsibility of Dalmanutha WEF/Dalmanutha Hybrid Facility operator Company to ensure that pollution control and rehabilitation are undertaken. In addition to this, the relevant contractors appointed will be responsible for the development of method statements to ensure the minimisation of all impacts and will be responsible for their own areas of disturbance.
(4) (q) The vital role of women and youth in environment management and development must be recognised and their full participation therein must be promoted.	The Public Participation Process has endeavoured to include the participation of all role-players including women and youth in this project. Communication with the public (Including women and the youth) will continue through to the construction, operational and decommissioning stages of the project through the provisions that have been made in the EMP to appoint a community liaison officer. Employment equity will also be an important part of the Dalmanutha WEF/Dalmanutha Hybrid Facility project moving forward in terms of providing work to local communities and to Previously Disadvantaged Individuals (including women).
(4) (r) Sensitive, vulnerable, highly dynamic or stressed ecosystems, such as coastal shores, estuaries, wetlands and similar systems require specific attention in management and planning procedures, especially where they are subject to significant human resource usage and development pressure.	This principle has been upheld in this EIA. The design of the layout of infrastructure on the Dalmanutha WEF/Dalmanutha Hybrid Facility site has required extensive liaison with specialists regarding issues such as buffer zones and the various mitigation measures that may be required. In particular the site layout has been revised after buffer zones were recommended by

NEMA Principles	Discussion
	the wetland, flora and avifaunal specialists in order to protect a sensitive areas to the north of the site. The Dalmanutha WEF/Dalmanutha Hybrid Facility will be required to adhere to the EMPr developed for its construction and operation.

2.3 POLICIES AND PLANS

Table 2-3 summarised key policies and plans as an outline of the governance framework for the project.

Table 2-3 - Applicable Regional Policies and Plans

Applicable Policy	Description of Policy
National Development Plan	The National Development Plan aims to eliminate poverty and reduce inequality by 2030. The NDP identifies several enabling milestones. Of relevance to the proposed development the NDP refers to the need to produce sufficient energy to support industry at competitive prices and ensure access for poor households, while reducing carbon emissions per unit of power by about one-third. In this regard the infrastructure is not just essential for faster economic growth and higher employment. It also promotes inclusive growth, providing citizens with the means to improve their own lives and boost their incomes. Infrastructure is essential to development. Chapter 3, Economy, and Employment, identifies some of the structural challenges specific to South Africa, including an energy constraint that will act as a cap on growth and on options for industrialisation. The NDP notes that from an environmental perspective South Africa faces several related challenges. The reduction of greenhouse gas emissions and shift to a green low-carbon economy, is one of these challenges. In terms of implementation the NDP identifies three phases. The first two are of specific relevance to the proposed project. The first phase (2012–2017) notes that ensuring the supply of energy and water is reliable and sufficient for a growing economy. The second phase (2018–2023) involves building on the first phase to lay the foundations for more intensive improvements in productivity. The provision of affordable and reliable energy is a key requirement for this to take place. Chapter 4, Economic infrastructure, notes that economic infrastructure provides the foundation for social and economic development. In this regard South Africa must invest in a strong network of economic infrastructure designed to support the country's medium- and long-term economic and social objectives. The plan envisages that, by 2030, South Africa will have an energy sector that promotes: Economic growth and development through adequate investment in energy infrastructure. The sector should provide reliable and efficient energy service at competitive rates, while supporting economic growth through job creation. Environmental sustainability through efforts to reduce pollution and mitigate the effects of climate change. More specifically, South Africa should have adequate supply security in electricity and in liquid fuels, such that economic activity, transport, and welfare are not disrupted.

Applicable Policy	Description of Policy
	The plan sets out steps that aim to ensure that, in 20 years, South Africa's energy system looks very different to the current situation. In this regard coal will contribute proportionately less to primary-energy needs, while gas and renewable energy resources, will play a much larger role.
Integrated Resource Plan 2010 – 2030	The IRP is an electricity capacity plan which aims to provide an indication of the country's electricity demand, how this demand will be supplied and what it will cost. On 6 May 2011, the then Department of Energy (DoE) released the Integrated Resource Plan 2010-2030 (IRP 2010) in respect of South Africa's forecast energy demand for the 20-year period from 2010 to 2030. The promulgated IRP 2010–2030 identified the preferred generation technology required to meet expected demand growth up to 2030. It incorporated government objectives such as affordable electricity, reduced greenhouse gas (GHG) emissions, reduced water consumption, diversified electricity generation sources, localisation and regional development. The IRP recognises that Solar photovoltaic (PV), wind and concentrated solar power (CSP) with storage present an opportunity to diversify the electricity mix, to produce distributed generation and to provide off-grid electricity. Renewable technologies also present huge potential for the creation of new industries, job creation and localisation across the value chain.
New Growth Path	Government released the New Economic Growth Path Framework on 23 November 2010. The aim of the framework is to enhance growth, employment creation and equity. The policy's principal target is to create five million jobs over the next 10 years and reflects government's commitment to prioritising employment creation in all economic policies. The framework identifies strategies that will enable South Africa to grow in a more equitable and inclusive manner while attaining South Africa's developmental agenda. Central to the New Growth Path is a massive investment in infrastructure as a critical driver of jobs across the economy. In this regard the framework identifies investments in five key areas namely: energy, transport, communication, water, and housing.
National Infrastructure Plan	The South African Government adopted a National Infrastructure Plan (NIP) in 2012. The NIP aims to transform the South African economic landscape while simultaneously creating significant numbers of new jobs and strengthening the delivery of basic services. It outlines the challenges and enablers which needs to be addressed in the building and developing of infrastructure. The Presidential Infrastructure Coordinating Commission (PICC) was established by the Cabinet to integrate and coordinate the long-term infrastructure build. The plan also supports the integration of African economies. In terms of the plan Government will invest R827 billion over the next three years to build new and upgrade existing infrastructure. The aim of the investments is to improve access by South Africans to healthcare facilities, schools, water, sanitation, housing and electrification. The plan also notes that investment in the construction of ports, roads, railway systems, electricity plants, hospitals, schools and dams will contribute to improved economic growth.
Integrated Energy Plan	The development of a National IEP was envisaged in the White Paper on the Energy Policy of the Republic of South Africa of 1998 and, in terms of the National Energy Act, 2008 (Act No. 34 of 2008), the Minister of Energy is mandated to develop and, on an annual basis, review and publish the IEP in the Government Gazette. The purpose of the IEP is to provide a roadmap of

Applicable Policy	Description of Policy
	the future energy landscape for South Africa which guides future energy infrastructure investments and policy development. The IEP notes that South Africa needs to grow its energy supply to support economic expansion and in so doing, alleviate supply bottlenecks and supply-demand deficits. In addition, it is essential that all citizens are provided with clean and modern forms of energy at an affordable price. As part of the Integrated Energy Planning process, eight key objectives are identified, namely: ▪ Objective 1: Ensure security of supply. ▪ Objective 2: Minimise the cost of energy. ▪ Objective 3: Promote the creation of jobs and localisation. ▪ Objective 4: Minimise negative environmental impacts from the energy sector. ▪ Objective 5: Promote the conservation of water. ▪ Objective 6: Diversify supply sources and primary sources of energy. ▪ Objective 7: Promote energy efficiency in the economy. ▪ Objective 8: Increase access to modern energy. The IEP provides an assessment of current energy consumption trends within different sectors of the economy (i.e., agriculture, commerce, industry, residential and transport) and uses this information to identify future energy requirements, based on different scenarios. The scenarios are informed by different assumptions on economic development and the structure of the economy and consider the impact of key policies such as environmental policies, energy efficiency policies, transport policies and industrial policies, amongst others. Based on this information the IEP then determines the optimal mix of energy sources and technologies to meet those energy needs in the most cost-effective manner for each of the scenarios. The associated environmental impacts, socio-economic benefits and macroeconomic impacts are also analysed. The IEP is therefore focused on determining the long-term energy pathway for South Africa, considering a multitude of factors which are embedded in the eight objectives. As part of the analysis four key scenarios were developed, namely the Base Case, Environmental Awareness, Resource Constrained and Green Shoots scenarios: ▪ The Base Case Scenario assumes that existing policies are implemented and will continue to shape the energy sector landscape going forward. It assumes moderate economic growth in the medium to long term. ▪ The Environmental Awareness Scenario is characterised by more stringent emission limits and a more environmentally aware society, where a higher cost is placed on externalities caused by the supply of energy. ▪ The Resource Constrained Scenario in which global energy commodity prices (i.e. coal, crude oil and natural gas) are high due to limited supply. ▪ The Green Shoots Scenario describes an economy in which the targets for high economic growth and structural changes to the economy, as set out in the National Development Plan (NDP), are met. The IEP notes that South Africa should continue to pursue a diversified energy mix which reduces reliance on a single or a few primary energy sources. In terms of existing electricity generation capacity, the IEP indicates that existing capacity starts to decline notably from 2025, with significant plant retirement occurring in 2031, 2041 and 2048. By 2050 only 20% of the current electricity

Applicable Policy	Description of Policy
	generation capacity remains. As a result, large investments are required in the electricity sector in order to maintain an adequate supply in support of economic growth. By 2020, various import options become available, and some new coal capacity is added along with new wind, solar and gas capacity. The mix of generation capacity technologies by 2050 is considerably more diverse than the current energy mix, across all scenarios. The main differentiating factors between the scenarios are the level of demand, constraints on emission limits and the carbon dioxide externality costs. In all scenarios the energy mix for electricity generation becomes more diverse over the period to 2050, with coal reducing its share from about 85% in 2015 to 15–20% in 2050 (depending on the scenario). Solar, wind, nuclear, gas and electricity imports increase their share. The Environmental Awareness and Green Shoots scenarios take on higher levels of renewable energy. An assessment of each scenario against the eight objectives with reference to renewable energy notes while all scenarios seek to ensure that costs are minimised within the constraints and parameters of each scenario, the Base Case Scenario presents the least cost followed by the Environmental Awareness, Resource Constrained and Green Shoots scenarios respectively when total energy system costs are considered. In terms of promoting job creation and localisation potential the Base Case Scenario presents the greatest job creation potential, followed by the Resource Constrained, Environmental Awareness and Green Shoots scenarios respectively. In all scenarios, approximately 85% of total jobs are localisable. For electricity generation, most jobs result from solar technologies followed by nuclear and wind, with natural gas and coal making a smaller contribution. The Environmental Awareness Scenario, due to its stringent emission constraints, shows the lowest level of total emissions over the planning horizon. This is followed by the Green Shoots, Resource Constrained and Base Case scenarios. These trends are similar when emissions are considered cumulatively and individually by type.
National Protected Area Expansion Strategy, 2018	The National Protected Area Expansion Strategy 2010 (NPAES) areas were identified through a systematic biodiversity planning process. They present the best opportunities for meeting the ecosystem-specific protected area targets set in the NPAES and were designed with strong emphasis on climate change resilience and requirements for protecting freshwater ecosystems. These areas should not be seen as future boundaries of protected areas, as in many cases only a portion of a particular focus area would be required to meet the protected area targets set in the NPAES. They are also not a replacement for fine scale planning which may identify a range of different priority sites based on local requirements, constraints and opportunities (NPAES, 2010). According to the NPAES, the study area forms part of the Mpumalanga PAES 20 year plan which corresponds to the NPAES (2018) map.

2.4 PROVINCIAL AND MUNICIPAL LEGAL AND REGULATORY FRAMEWORK

Table 2-4 - Provincial Plans

Applicable Plan	Description of Plan
Mpumalanga Growth and Development Path	The primary objective of the Mpumalanga Economic Growth and Development Path (MEGDP) (2011) is to foster economic growth that creates jobs, reduce poverty and inequality in the province. The MEGDP identifies supporting the development of clean forms of energy such as wind and hydro power generation opportunities, as well as opportunities including gas production from landfill and organic waste, as one of the key interventions to facilitate growth and job creation in the manufacturing sector. A focal point of the MEGDP is massive investments in infrastructure as a key driver of job creation across the economy, with alternative energy production identified as one of the key opportunities in the Mpumalanga Economic sectors.
Mpumalanga Spatial Development Framework (MSDF), 2019	The Mpumalanga Spatial Development Framework (SDF) (2019) identifies that tourism is an important economic sector and has emerged as a robust driver of growth for emerging economies. The SDF also notes that a significant portion of Mpumalanga's land area is classified as Moderate to High-Very High agricultural potential which can be utilised for agricultural production. However, there are other factors affecting the agricultural sector including loss of agricultural land to other activities, availability of water, contamination of the water used for irrigation by other economic activities, and access to the market. The SDF further notes that mining is the largest economic sector in the province and has assisted other sectors such as manufacturing and power generation, to grow in the province. However, the mining sector has posed some key challenges, including soil and water contamination and environmental pollution, development of mines on good agricultural soil thus threatening food security, restriction of animal movement due to open cast mining thus affecting the ecosystem etc. It also notes that Mpumalanga's manufacturing plants and coal fired power plants are the key polluters of air, with climate change also identified as a key challenge in the province. Therefore, the province must carefully design interventions that provide a gradual shift from mining oriented sectors to the sustainable economic sectors to maintain sustained growth of the provincial economy. The SDF notes that a significant amount of the country's electricity comes from coal-fired stations in Mpumalanga. It also observes that there is a steady increase in the demand for electricity in the province, mostly attributed to residential, commercial and industrial development, including mining and heavy industry. The Provincial SDF also notes that the abundance of coal has led to the development of many coal-fired power stations in the province, however these coalfields are depleting, therefore making it necessary to consider renewable power sources in Mpumalanga. The SDF also recognises that Mpumalanga's Coal Mining and Coal Fired Power Plant region (mainly the Highveld area) will be under immense pressure for environmental considerations and as a result, the region will witness a possible decline in demand of coal and large-scale employment. The SDF proposes to diversify the regional economy and facilitate the gradual transition of economic activities in the region.

Applicable Plan	Description of Plan
Mpumalanga Industrial Development Plan	In terms of industry, the purpose of the Mpumalanga Industrial Development Plan (MIDP) (2015) is to promote the establishment of new industries and promote growth of existing industries in the province.
Mpumalanga Biodiversity Sector Plan (MBSP) (2015)	The Mpumalanga Biodiversity Sector Plan updates, revises and replaces the older Mpumalanga Biodiversity Conservation Plan and all of its products (Lötter & Ferrar, 2006; Ferrar & Lötter, 2007). The MBSP comprises two spatial components: maps of terrestrial and freshwater critical biodiversity areas (CBAs); and a set of land-use guidelines that are important for maintaining and supporting the inherent biodiversity values of these critical biodiversity areas. Terrestrial biodiversity priority areas were identified using a Systematic Biodiversity Planning approach (also called Systematic Conservation Planning in international literature; Margules & Pressey, 2000), whilst identification of freshwater biodiversity priority areas relied heavily on the recent National Freshwater Ecosystem Priority Areas assessment (NFEPA; Driver et al., 2011). The Mpumalanga Biodiversity Sector Plan (MBSP) technical report (Lotter, 2015) defines five categories of conservation focus; protected areas, CBA, ESA, other natural areas, and modified habitats. Definitions for each are listed below: ▪ Protected Areas: protected areas recognised in terms of the National Environmental Management Protected Areas Act, No. 57 of 2003, that are currently considered to meet biodiversity targets in the MBSP. ▪ Critical Biodiversity Area: areas (outside of Protected Areas) that are required to meet biodiversity targets for biodiversity pattern (species and ecosystems) and ecological processes. They should remain in a natural state that is maintained in good ecological condition. The MBSP recognises two CBA ranks, viz, CBA Irreplaceable and CBA Optimal. ▪ Ecological Support Area: play an important role in supporting the ecological functioning of critical biodiversity areas or for generating or delivering important ecosystem services. They support landscape connectivity and resilience to climate change adaptation. They need to be maintained in at least an ecologically functional state. ▪ Other Natural Areas: often retain much of their natural character and may contribute significantly to maintenance of viable species populations and natural ecosystem functioning, and may provide important ecological infrastructure and ecosystem services. They are not, however, prioritized for immediate conservation action in the MBSP. ▪ Modified: often referred to as transformed, these areas have lost a significant proportion (or all) of their natural biodiversity and in which ecological processes have broken down (in some cases irretrievably), as a result of biodiversity-incompatible land-use practices such as ploughing, hardening of surfaces, mining, cultivation and the construction of houses or other built infrastructure. Land-use activity descriptions used in the spatial planning zonation scheme used in Mpumalanga are outlined in the MBSP Handbook. Wind farms and power lines are included in the Utilities (U) zone where land is allocated for the provision of a diverse range of services. Wind farms are listed under the category “Waterworks, Sewerage Works”. None of the land-uses in this category are biodiversity-compatible and should not be located in CBAs or ESAs. They should be located in ONAs or heavily modified areas, subject to the appropriate authorisations.

Applicable Plan	Description of Plan
	However, Table 18 in the MBSP handbook indicates some flexibility in land-use options in the case of a CBA1 (or irreplaceable), CBA2 (or CBA optimal) and ESAs. Three land-use classes are used in Table 18, i.e. ▪ Permissible land-uses that are unlikely to compromise the biodiversity objective (green dot); ▪ Land-uses that may compromise the biodiversity objective and that are only permissible under certain conditions (yellow dot); ▪ Land-uses that will compromise the biodiversity objective and are not permissible (red dot). The CBA1 and CBA2 and all ESA categories are marked with a yellow dot thus implying land-uses that are permissible under certain conditions. The Utilities zone (which includes energy-generation facilities) should be located at a distance from residential or other land-uses where they may detract from levels of amenity or safety. They should also be located such that disruption to natural areas and water courses through the laying of service pipelines or cables is minimised by adhering to sound environmental management principles (MBSP 2014).

Table 2-5 - District and Local Municipality Plans

Applicable Plan	Description of Plan
Nkangala District Municipality Integrated Development Plan (IDP) (2020/ 2021)	According to the Municipal Systems Act (Act 32 of 2000) (MSA), all municipalities have to undertake an Integrated Development Plan (IDP) process. The IDP is a legislative requirement thus it has legal status and supersedes all other plans that guide development at local government level. The Nkangala District Municipality IDP Review (2020/ 2021) has identified the following development priorities: ▪ Municipal Transformation and Organisational Development ▪ Basic Service Delivery and Infrastructure Development ▪ Local Economic Development ▪ Municipal Financial Viability and Management ▪ Good Governance and Public Participation ▪ Spatial Development Analysis and Rationale The main goal and strategic objective of the Basic Service Delivery and Infrastructure Development priority is a reliable and sustainable service. One of the main strategic objectives for reaching the goal is the provision of basic services such as water and electricity to an approved minimum level of standards in a sustainable manner; as per the national guidelines. One of the key issues raised by the community of GSM is the need to have steady electricity provision. Consequently, the proposed Dalmanutha WEF will contribute to the required clean energy and electricity provision, in line with the MGDP and District's IDP, respectively.
Emakhazeni Local Municipality IDP (2020/ 2021)	The Revised IDP (2020/2021) has identified the following key Municipal priorities: ▪ Revenue collection. ▪ Access to basic services by communities. ▪ Job creation and economic development. ▪ Infrastructure maintenance and upgrading.

Applicable Plan	Description of Plan
	■ Community participation in the affairs of the municipality. ■ Fight against fraud and corruption. ■ Capable and responsive organizational structure. ■ Capabilities of the municipal ICT. ■ Integrated human settlements One of the main strategic objectives for the access to basic services priority is to provide sustainable and reliable services to communities. Most of the basic services are rendered within the municipality, however some rural areas are still faced with some challenges in the provision water, sanitation and electricity. The Municipality, through the IDP, aims to facilitate the provision of electricity, with a number of key projects planned to be implemented over the period of five years linked to the Municipal IDP. The proposed Dalmanutha WEF will therefore supplement electricity supply, identified as one of the top community priority needs within the Municipality.
Albert Luthuli Local Municipality IDP (2020/ 2021)	The Albert Luthuli Local Municipality Revised IDP (2020/2021) has identified the following key Municipal priorities: ■ Economic growth is the prerequisite for the achievement of other policy objectives such as poverty eradication and equitable development. ■ Government infrastructure investment- beyond basic service delivery- will be in areas of high development potential or economic growth. These are areas of development potential identified into corridors and/or nodes. The focus is to reverse the settlement patterns of the previous dispensation where settlements were established far outside of the places of work. ■ Efforts to address inequalities should focus on people and not places. ■ Areas with high levels of poverty and high development potential should receive investment beyond basic services to exploit this potential. ■ Areas with high levels of poverty and low development potential should receive investment to provide basic services as well as social transfers, HRD, and labour market information.
Emakhazeni Spatial Development Framework (SDF) (2015)	The Emakhazeni SDF (2015) is informed by a number of spatial objectives, including: ■ Consolidating the urban and rural structure of the District around urban and rural nodal points the District in a sustainable manner ■ Optimally utilise all resources associated with the space economy of with specific focus on Tourism in the Emakhazeni area. ■ Focus service delivery and infrastructure investment around the concentrations nodal structure which represent the highest population upgrading and areas requiring urban renewal. ■ Target intervention programmes around areas in need of service ■ Implement comprehensive Environmental Management mechanisms and procedures.

2.5 INTERNATIONAL ENVIRONMENTAL AND SOCIAL STANDARDS

2.5.1 IFC PERFORMANCE STANDARDS

The International Finance Corporation (IFC) is an international financial institution that offers investment, advisory, and asset management services to encourage private sector development in developing countries. The IFC is a member of the World Bank Group (WBG) and is headquartered in Washington, D.C., United States. It was established in 1956 as the private sector arm of the WBG to advance economic development by investing in strictly for-profit and commercial projects that purport to reduce poverty and promote development.

The IFC's stated aim is to create opportunities for people to escape poverty and achieve better living standards by mobilizing financial resources for private enterprise, promoting accessible and competitive markets, supporting businesses and other private sector entities, and creating jobs and delivering necessary services to those who are poverty-stricken or otherwise vulnerable. Since 2009, the IFC has focused on a set of development goals that its projects are expected to target. Its goals are to increase sustainable agriculture opportunities, improve health and education, increase access to financing for microfinance and business clients, advance infrastructure, help small businesses grow revenues, and invest in climate health.

The IFC is owned and governed by its member countries but has its own executive leadership and staff that conduct its normal business operations. It is a corporation whose shareholders are member governments that provide paid-in capital, and which have the right to vote on its matters. Originally more financially integrated with the WBG, the IFC was established separately and eventually became authorized to operate as a financially autonomous entity and make independent investment decisions. It offers an array of debt and equity financing services and helps companies face their risk exposures, while refraining from participating in a management capacity. The corporation also offers advice to companies on making decisions, evaluating their impact on the environment and society, and being responsible. It advises governments on building infrastructure and partnerships to further support private sector development.

The IFC's Sustainability Framework articulates the Corporation's strategic commitment to sustainable development and is an integral part of IFC's approach to risk management. The Sustainability Framework comprises IFC's Policy and Performance Standards on Environmental and Social Sustainability, and IFC's Access to Information Policy. The Policy on Environmental and Social Sustainability describes IFC's commitments, roles, and responsibilities related to environmental and social sustainability. The Access to Information Policy reflects IFC's commitment to transparency and good governance on its operations and outlines the Corporation's institutional disclosure obligations regarding its investment and advisory services. The Performance Standards (PSs) are directed towards clients, providing guidance on how to identify risks and impacts, and are designed to help avoid, mitigate, and manage risks and impacts as a way of doing business in a sustainable way, including stakeholder engagement and disclosure obligations of the client in relation to project-level activities. In the case of its direct investments (including project and corporate finance provided through financial intermediaries), IFC requires its clients to apply the PSs to manage environmental and social risks and impacts so that development opportunities are enhanced. IFC uses the Sustainability Framework along with other strategies, policies, and initiatives to direct the business activities of the Corporation to achieve its overall development objectives. The PSs may also be applied by other financial institutions (FIs).

The Project is considered a Category B project in terms of the IFC Policy on E&S Sustainability (2012), having the potential to cause limited adverse environmental or social risks and/or impacts that are few, generally site specific, largely reversible, and readily addressed through mitigation measures.

The objectives and applicability of the eight PSs are outlined in **Table 2-6.**

Table 2-6 - IFC Performance Standards Applicability to the Project

Reference	Requirements		Project Specific Applicability
Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts			
Overview	Performance Standard 1 underscores the importance of managing environmental and social performance throughout the life of a project. An effective Environmental and Social Management System (ESMS) is a dynamic and continuous process initiated and supported by management, and involves engagement between the client, its workers, local communities directly affected by the project (the Affected Communities) and, where appropriate, other stakeholders.		
Objectives	▪ To identify and evaluate environmental and social risks and impacts of the project. ▪ To adopt a mitigation hierarchy to anticipate and avoid, or where avoidance is not possible, minimize, and, where residual impacts remain, compensate/offset for risks and impacts to workers, Affected Communities, and the environment. ▪ To promote improved environmental and social performance of clients through the effective use of management systems. ▪ To ensure that grievances from Affected Communities and external communications from other stakeholders are responded to and managed appropriately. ▪ To promote and provide means for adequate engagement with Affected Communities throughout the project cycle on issues that could potentially affect them and to ensure that relevant environmental and social information is disclosed and disseminated.		
Aspects	1.1	Policy	The IFC Standards state under PS 1 (Guidance Note 23) that "*the breadth, depth and type of analysis included in an ESIA must be proportionate to the nature and scale of the proposed project's potential impacts as identified during the course of the assessment process*." This document is the Second deliverable from the Scoping and EIA process undertaken for the proposed Project. The impact assessment comprehensively assesses the key environmental and social impacts and complies with the requirements of the South African EIA Regulations. In addition, the EMPr (**Appendix I**) has been compiled during the EIA phase of the project.
	1.2	Identification of Risks and Impacts	
	1.3	Management Programmes	
	1.4	Organisational Capacity and Competency	
	1.5	Emergency Preparedness and Response	
	1.6	Monitoring and Review	
	1.7	Stakeholder Engagement	
	1.8	External Communication and Grievance Mechanism	
	1.9	Ongoing Reporting to Affected Communities	
Performance Standard 2: Labour and Working Conditions;			
Overview	Performance Standard 2 recognises that the pursuit of economic growth through employment creation and income generation should be accompanied by protection of the fundamental rights of workers.		
Objectives	▪ To promote the fair treatment, non-discrimination, and equal opportunity of workers.		

Reference	Requirements		Project Specific Applicability
	■ To establish, maintain, and improve the worker-management relationship. ■ To promote compliance with national employment and labour laws. ■ To protect workers, including vulnerable categories of workers such as children, migrant workers, workers engaged by third parties, and workers in the client's supply chain. ■ To promote safe and healthy working conditions, and the health of workers. ■ To avoid the use of forced labour.		
Aspects	2.1	Working Conditions and Management of Worker Relationship Human Resources Policy and Management Working Conditions and terms of Engagement Workers organisation Non- Discrimination and Equal Opportunity Retrenchment Grievance Mechanism	The construction activities will require contractors for completion. A safe working environment and fair contractual agreements must be in place. The operational phase will have permanent employees for day-to-day activities as well as contractors who will all need a safe working environment and fair contractual agreements. Whilst PS2 will be applicable to the Project, it is not intended to be addressed in detail at the ESIA stage. Recommendations are provided concerning development of a detailed Human Resources (HR) and Occupational Health and Safety (OHS) system by the developer and its partners as the Project moves towards implementation. In addition, measures to address the Interim Advice for IFC Clients on Supporting Workers in the Context of COVID-19 are referenced. The EMPr (**Appendix I**) incorporates the requirements for compliance with local and international Labour and Working legislation and good practice on the part of the contractors.
	2.2	Protecting the Workforce Child Labour Forced Labour	
	2.3	Occupational health and Safety	
	2.4	Workers Engaged by Third Parties	
	2.5	Supply Chain	
Performance Standard 3: Resource Efficiency and Pollution Prevention			
Overview	Performance Standard 3 recognises that increased economic activity and urbanisation often generate increased levels of pollution to air, water, and land, and consume finite resources in a manner that may threaten people and the environment at the local, regional, and global levels. There is also a growing global consensus that the current and projected atmospheric concentration of greenhouse gases (GHG) threatens the public health and welfare of current and future generations. At the same time, more efficient and effective resource use and pollution prevention and GHG emission avoidance and mitigation technologies and practices have become more accessible and achievable in virtually all parts of the world.		
Objectives	■ To avoid or minimise adverse impacts on human health and the environment by avoiding or minimising pollution from project activities. ■ To promote more sustainable use of resources, including energy and water. ■ To reduce project related GHG emissions.		
Aspects	3.1	Policy Resource Efficiency	

Reference	Requirements		Project Specific Applicability
		Greenhouse Gases Water Consumption	PS3-related impacts, such as the management of construction waste, hazardous substances, and stormwater are assessed in **Section 9** of this report.
	3.2	Pollution Prevention Air Emissions Stormwater Waste Management Hazardous Materials Management Pesticide use and Management	There are no material resource efficiency issues associated with the Project. The EMPr includes general resource efficiency measures. The project is not GHG emissions intensive and a climate resilience study or a GHG emissions-related assessment is not deemed necessary for a project of this nature. However, the Dalmanutha Energy Facility seeks to facilitate resource efficiency and pollution prevention by contributing to the South African green economy. Dust air pollution in the construction phase has been addressed in the EMPr. The Project will not result in the release of industrial effluents. Potential pollution associated with sanitary wastewater is low and mitigation measures have been included in the EMPr. Land contamination of the site from historical land use (i.e. low intensity agricultural / grazing) is not considered to be a cause for concern. The waste generation profile of the project is not complex. Waste mitigation and management measures have been included in the EMPr. Hazardous materials are not a key issue; small quantities of construction materials (oil, grease, diesel fuel etc.) are the only wastes expected to be associated with the project. The EMPr has taken these anticipated hazardous materials into account and recommend relevant mitigation and management measures.
Performance Standard 4: Community Health, Safety, and Security			
Overview	Performance Standard 4 recognizes that project activities, equipment, and infrastructure can increase community exposure to risks and impacts.		
Objectives	▪ To anticipate and avoid adverse impacts on the health and safety of the Affected Community during the project life from both routine and non-routine circumstances. ▪ To ensure that the safeguarding of personnel and property is carried out in accordance with relevant human rights principles and in a manner that avoids or minimizes risks to the Affected Communities.		
Aspects	4.1	Community Health and Safety Infrastructure and Equipment Design and Safety	The requirements included in PS 4 have been addressed in the S&EIA process and the development of the EMPr (**Appendix I**). During the construction phase there will be an increase in vehicular traffic along public roads, largely due to the

Reference	Requirements		Project Specific Applicability
		Hazardous Materials Management and Safety Ecosystem Services Community Exposure to Disease Emergency Preparedness and Response	need for importation of construction material. Pedestrian and road safety risks have been qualitatively evaluated in the S&EIA process and the clients' standard safety and security measures, as well as potential additional measures recommended by WSP, have been detailed in the EMPr (**Appendix I**).
	4.2	Security Personnel	
Performance Standard 5: Land Acquisition and Involuntary Resettlement			
Overview	Performance Standard 5 recognises that project-related land acquisition and restrictions on land use can have adverse impacts on communities and persons that use this land. Involuntary resettlement refers both to physical displacement (relocation or loss of shelter) and to economic displacement (loss of assets or access to assets that leads to loss of income sources or other means of livelihood) as a result of project-related land acquisition and/or restrictions on land use.		
Objectives	▪ To avoid, and when avoidance is not possible, minimise displacement by exploring alternative project designs. ▪ To avoid forced eviction. ▪ To anticipate and avoid, or where avoidance is not possible, minimise adverse social and economic impacts from land acquisition or restrictions on land use by (i) providing compensation for loss of assets at replacement cost and (ii) ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation, and the informed participation of those affected. ▪ To improve, or restore, the livelihoods and standards of living of displaced persons. ▪ To improve living conditions among physically displaced persons through the provision of adequate housing with security of tenure at resettlement sites.		
Aspects	5.1	Displacement Physical Displacement Economic Displacement Private Sector Responsibilities under Government Managed Resettlement	PS5 is not applicable to the proposed Dalmanutha Energy Facility as no physical or economic displacement or livelihood restoration will be required. The proposed Dalmanutha Energy Facility is located on privately owned land that is utilised for agriculture by the landowners. The significance of all potential agricultural impacts is kept low by the very small proportion of the land that is impacted.
Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources			
Overview	Performance Standard 6 recognizes that protecting and conserving biodiversity, maintaining ecosystem services, and sustainably managing living natural resources are fundamental to sustainable development.		
Objectives	▪ To protect and conserve biodiversity. ▪ To maintain the benefits from ecosystem services. ▪ To promote the sustainable management of living natural resources through the adoption of practices that integrate conservation needs and development priorities.		

Reference	Requirements		Project Specific Applicability
Aspects	6.1	Protection and Conservation of Biodiversity	A significant part of the Project Area falls within CBAs (Irreplaceable and Optimal). A Biodiversity Impact Assessment(**Appendix H.3**) as well as an Avifaunal Impact Assessment (**Appendix H.2**)and Freshwater Ecology Impact Assessment (**Appendix H.4**) have been undertaken. Furthermore, a biodiversity offset strategy is part of the EIA phase and has been included in **Appendix J**. The methodologies for the specialist assessments include a combination of literature review, in-field surveys and sensitivity mapping. This substantively complies with the PS 6 general requirements for scoping and baseline assessment for determination of biodiversity and ecosystem services issues. The determination of habitat sensitivity was undertaken within the legal and best practice reference framework for South Africa. The prevalence of invasive alien species will be determined and mitigation and management measures have been included in the EMPr (**Appendix I**).
Performance Standard 7: Indigenous People			
Overview	Performance Standard 7 recognizes that Indigenous Peoples, as social groups with identities that are distinct from mainstream groups in national societies, are often among the most marginalized and vulnerable segments of the population. In many cases, their economic, social, and legal status limits their capacity to defend their rights to, and interests in, lands and natural and cultural resources, and may restrict their ability to participate in and benefit from development. Indigenous Peoples are particularly vulnerable if their lands and resources are transformed, encroached upon, or significantly degraded.		
Objectives	▪ To ensure that the development process fosters full respect for the human rights, dignity, aspirations, culture, and natural resource-based livelihoods of Indigenous Peoples. ▪ To anticipate and avoid adverse impacts of projects on communities of Indigenous Peoples, or when avoidance is not possible, to minimize and/or compensate for such impacts. ▪ To promote sustainable development benefits and opportunities for Indigenous Peoples in a culturally appropriate manner. ▪ To establish and maintain an ongoing relationship based on Informed Consultation and Participation (ICP) with the Indigenous Peoples affected by a project throughout the project's life-cycle. ▪ To ensure the Free, Prior, and Informed Consent (FPIC) of the Affected Communities of Indigenous Peoples when the circumstances described in this Performance Standard are present. ▪ To respect and preserve the culture, knowledge, and practices of Indigenous Peoples.		
Aspects	7.1	General Avoidance of Adverse Impacts Participation and Consent	As per the international instruments under the United Nations (UN) Human Rights Conventions, no indigenous peoples are present within the study area. The Project does not involve displacement. PS7 will not be triggered.

Reference	Requirements		Project Specific Applicability
	7.2	Circumstances Requiring Free, Prior, and Informed Consent Impacts on Lands and Natural Resources Subject to Traditional Ownership or Under Customary Use Critical Cultural Heritage Relocation of Indigenous Peoples from Lands and Natural Resources Subject to Traditional Ownership or Under Customary Use	
	7.3	Mitigation and Development Benefits	
	7.4	Private Sector Responsibilities Where Government is Responsible for Managing Indigenous Peoples Issues	
Performance Standard 8: Cultural Heritage			
Overview	Performance Standard 8 recognizes the importance of cultural heritage for current and future generations.		
Objectives	▪ To protect cultural heritage from the adverse impacts of project activities and support its preservation. ▪ To promote the equitable sharing of benefits from the use of cultural heritage.		
Aspects	8.1	Protection of Cultural Heritage in Project Design and Execution	A Heritage Impact Assessment (**Appendix H.6**) has been carried out by a suitably qualified specialist, revealing that archaeological sites (Stone Age and Historic Archaeological), cultural heritage sites, burial grounds or isolated artifacts are present on the affected landscape. A Chance Find Procedure has been included in the EMPr for this EIA phase of the project.

2.5.2 WORLD BANK GROUP ENVIRONMENTAL HEALTH AND SAFETY GUIDELINES

In support of the Performance Standards, the World Bank Group (WBG) has published several Environmental Health and Safety (EHS) Guidelines. The EHS Guidelines are technical reference documents that address IFC's expectations regarding the industrial pollution management performance of its projects. They are designed to assist managers and decision makers with relevant industry background and technical information. This information supports actions aimed at avoiding, minimising, and controlling EHS impacts during the construction, operation, and decommissioning phase of a project or facility. The EHS Guidelines serve as a technical reference source to support the implementation of the IFC Performance Standards, particularly in those aspects related to PS3: Pollution Prevention and Abatement, as well as certain aspects of occupational and community health and safety.

Where host country regulations differ from the levels and measures presented in the EHS Guidelines, projects seeking international funding may be expected to achieve whichever is more stringent. If less stringent levels or measures are appropriate in view of specific project circumstances, a full and detailed justification for any proposed alternatives is required.

The following IFC / WBG EHS Guidelines have been generally consulted during the preparation of the EIA in order to aid the identification of EHS aspects applicable to the project:

- Wind Energy (August 2015) - The EHS Guidelines for wind energy include information relevant to environmental, health, and safety aspects of onshore and offshore wind energy facilities. It should be applied to wind energy facilities from the earliest feasibility assessments, as well as the environmental impact assessment, and continue to be applied throughout the construction and operation phases

  The guidelines list issues associated with wind energy facilities which need to be considered. These include:

  - Environmental impacts associated with the construction, operation, and decommissioning of wind energy facilities activities may include, among others, impacts on the physical environment (such as noise or visual impact) and biodiversity (affecting birds and bats, for instance).
  - Due to the typically remote location of wind energy facilities, the transport of equipment and materials during construction and decommissioning may present logistical challenges (e.g., transportation of long, rigid structures such as blades, and heavy tower sections).
  - Environmental issues specific to the construction, operation, and decommissioning of wind energy projects and facilities include the following:
    - Landscape, Seascape, and Visual impacts;
    - Noise;
    - Shadow Flicker; and
    - Water Quality.

- Electric Power Transmission and Distribution (2007) - information relevant to power transmission between a generation facility and a substation located within an electricity grid, in addition to power distribution from a substation to consumers located in residential, commercial, and industrial areas
- General EHS Guidelines – this includes a section on a range of environmental, occupational health and safety, community health and safety, and construction activities that would apply to the project. The guideline also contains recommended guidelines adopted form the World Health Organisation (WHO) for ambient air and water quality, which are referred to in the relevant impact assessment sections in the ESIA report.

2.5.3 EQUATOR PRINCIPLES

The Equator Principles (EPs) is a risk management framework, adopted by financial institutions, for determining, assessing, and managing environmental and social risk in projects and is primarily intended to provide a minimum standard for due diligence to support responsible risk decision-making.

The EPs apply globally to all industry sectors and to five financial products 1) Project Finance Advisory Services, 2) Project Finance, 3) Project-Related Corporate Loans, 4) Bridge Loans and 5) Project-Related Refinance and Project-Related Acquisition Finance. The relevant thresholds and criteria for application is described in detail in the Scope section of the EP. Currently 125 Equator Principles Financial Institutions (EPFIs) in 37 countries have officially adopted the EPs, covering the majority of international project finance debt within developed and emerging markets. EPFIs commit to implementing the EPs in their internal environmental and social policies, procedures and standards for financing projects and will not provide Project Finance or Project-Related Corporate Loans to projects where the client will not, or is unable to, comply with the EPs.

While the EPs are not intended to be applied retroactively, EPFIs apply them to the expansion or upgrade of an existing project where changes in scale or scope may create significant environmental and social risks and impacts, or significantly change the nature or degree of an existing impact. The EPs have greatly increased the attention and focus on social/community standards and responsibility, including robust standards for indigenous peoples, labour standards, and consultation with locally affected communities within the Project Finance market.

The EPs have also helped spur the development of other responsible environmental and social management practices in the financial sector and banking industry and have supported member banks in developing their own Environmental and Social Risk Management Systems.

The requirements and applicability of the EPs are outlined in **Table 2-7**

It should be noted that Principles 8 and 10 relate to a borrower's code of conduct and are therefore not considered relevant to the S&EIA process and have not been included in this discussion.

Table 2-7 - Requirements and Applicability of the Equator Principles

Requirement		Project Specific Applicability
Principle 1: Review and Categorisation		
Overview	When a project is proposed for financing, the EPFI will, as part of its internal social and environmental review and due diligence, categorise such project based on the magnitude of its potential impacts and risks in accordance with the environmental and social screening criteria of the IFC. Using categorisation, the EPFI's environmental and social due diligence is commensurate with the nature, scale, and stage of the Project, and with the level of environmental and social risks and impacts. ▪ The categories are:	Based upon the significance and scale of the Project's environmental and social impacts, the proposed project is regarded as a Category B project i.e., a project with potential limited adverse environmental or social risks and/or impacts that are few in number, generally site-specific, largely reversible, and readily addressed through mitigation measures.

Requirement		Project Specific Applicability
	▪ Category A: Projects with potential significant adverse environmental and social risks and/or impacts that are diverse, irreversible or unprecedented; ▪ Category B: Projects with potential limited adverse environmental and social risks and/or impacts that are few in number, generally site-specific, largely reversible and readily addressed through mitigation measures; and ▪ Category C: Projects with minimal or no adverse environmental and social risks and/or impacts.	
Principle 2: Environmental and Social Assessment		
Overview	For all Category A and Category B Projects, the EPFI will require the client to conduct an appropriate Assessment process to address, to the EPFI's satisfaction, the relevant environmental and social risks and scale of impacts of the proposed Project (which may include the illustrative list of issues found in Exhibit II). The Assessment Documentation should propose measures to minimise, mitigate, and where residual impacts remain, to compensate/ offset/ remedy for risks and impacts to Workers, Affected Communities, and the environment, in a manner relevant and appropriate to the nature and scale of the proposed Project The Assessment Documentation will be an adequate, accurate and objective evaluation and presentation of the environmental and social risks and impacts, whether prepared by the client, consultants or external experts. For Category A, and as appropriate, Category B Projects, the Assessment Documentation includes an Environmental and Social Impact Assessment (ESIA). One or more specialised studies may also need to be undertaken. For other Category B and potentially C Projects, a limited or focused environmental or social assessment may be appropriate, applying applicable risk management standards relevant to the risks or impacts identified during the categorisation process.	This document is the second deliverable (i.e., Draft EIA Report) from the S&EIA process undertaken for the proposed Project. The impact assessment has been undertaken. The assessment has comprehensively assessed the key environmental and social impacts and complies with the requirements of the South African EIA Regulations. In addition, an EMPr has also been compiled. (**Appendix I**)
Principle 3: Applicable Environmental and Social Standards		
Overview	The Assessment process should, in the first instance, address compliance with relevant host country laws, regulations and permits that pertain to environmental and social issues.	As South Africa has been identified as a non-designated country, the reference framework for environmental and social assessment is based on the IFC PS. In addition, this S&EIA

Requirement		Project Specific Applicability
	The EPFI's due diligence will include, for all Category A and Category B Projects globally, review and confirmation by the EPFI of how the Project and transaction meet each of the Principles. For Projects located in Non-Designated Countries, the Assessment process evaluates compliance with the then applicable IFC PS and WBG EHS Guidelines. For Projects located in Designated Countries, compliance with relevant host country laws, regulations and permits that pertain to environmental and social issues.	process has been undertaken in accordance with NEMA (the host country's relevant legislation).
Principle 4: Environmental and Social Management System and Equator Principles Action Plan		
Overview	For all Category A and Category B Projects, the EPFI will require the client to develop or maintain an Environmental and Social Management System (ESMS). Further, an Environmental and Social Management Plan (ESMP) will be prepared by the client to address issues raised in the Assessment process and incorporate actions required to comply with the applicable standards. Where the applicable standards are not met to the EPFI's satisfaction, the client and the EPFI will agree on an Equator Principles Action Plan (EPAP). The EPAP is intended to outline gaps and commitments to meet EPFI requirements in line with the applicable standards.	A formal project specific ESMS will be compiled in the event that the project is developed in the future. Management and monitoring plans outlined in the EMPr will serve as the basis for an ESMS for the proposed Project.
Principle 5: Stakeholder Engagement		
Overview	EPFI will require the client to demonstrate effective Stakeholder Engagement as an ongoing process in a structured and culturally appropriate manner with Affected Communities Workers and, where relevant, Other Stakeholders. For Projects with potentially significant adverse impacts on Affected Communities, the client will conduct an Informed Consultation and Participation process. To accomplish this, the appropriate assessment documentation, or non-technical summaries thereof, will be made available to the public by the borrower for a reasonable minimum period in the relevant local language and in a culturally appropriate manner. The borrower will take account of and document the process and results of the consultation,	The S&EIA process includes an extensive stakeholder engagement process which complies with the South African EIA Regulations. The process includes consultations with local communities, nearby businesses, and a range of government sector stakeholders (state owned enterprises, national, provincial and local departments). The stakeholder engagement process solicits interest from potentially interested parties through the placement of site notices and newspaper advertisements as well as written and telephonic communication. The stakeholder engagement process is detailed in **Section 4.3.**

Requirement		Project Specific Applicability
	including any actions agreed resulting from the consultation. Disclosure of environmental or social risks and adverse impacts should occur early in the Assessment process, in any event before the Project construction commences, and on an ongoing basis. All Projects affecting Indigenous Peoples will be subject to a process of Informed Consultation and Participation, and will need to comply with the rights and protections for Indigenous Peoples contained in relevant national law, including those laws implementing host country obligations under international law.	
Principle 6: Grievance Mechanism		
Overview	For all Category A and, as appropriate, Category B Projects, the EPFI will require the client, as part of the ESMS, to establish effective grievance mechanisms which are designed for use by Affected Communities and Workers, as appropriate, to receive and facilitate resolution of concerns and grievances about the Project's environmental and social performance. The borrower will inform the Affected Communities and Workers about the grievance mechanism in the course of the stakeholder engagement process and ensure that the mechanism addresses concerns promptly and transparently, in a culturally appropriate manner, and is readily accessible, at no cost, and without retribution to the party that originates the issue or concern.	The EMPr includes a Grievance Mechanism Process for Public Complaints and Issues. This procedure effectively allows for external communications with members of the public to be undertaken in a transparent and structured manner.
Principle 7: Independent Review		
Overview	For all Category A and, as appropriate, Category B Projects, an Independent Environmental and Social Consultant, not directly associated with the client, will carry out an Independent Review of the Assessment Documentation including the ESMPs, the ESMS, and the Stakeholder Engagement process documentation in order to assist the EPFI's due diligence, and assess Equator Principles compliance.	This principle will only become applicable in the event that that the project is developed in the future.

Requirement		Project Specific Applicability
Principle 9: Independent Monitoring and Reporting		
Overview	To assess Project compliance with the Equator Principles after Financial Close and over the life of the loan, the EPFI will require independent monitoring and reporting for all Category A, and as appropriate, Category B projects. Monitoring and reporting should be provided by an Independent Environmental and Social Consultant; alternatively, the EPFI will require that the client retain qualified and experienced external experts to verify its monitoring information, which will be shared with the EPFI in accordance with the frequency required.	This principle will only become applicable in the event that the project is developed in the future.

2.6 OTHER GUIDELINES AND PERMITS

2.6.1 GENERIC EMPR RELEVANT TO AN APPLICATION FOR SUBSTATION AND OVERHEAD ELECTRICITY TRANSMISSION AND DISTRIBUTION INFRASTRUCTURE

NEMA requires that an EMPr be submitted where an EIA has been identified as the environmental instrument to be utilised as the basis for a decision on an application for environmental authorisation. The content of an EMPr must either contain the information set out in Appendix 4 of the EIA Regulations, 2014, as amended, or must be a generic EMPr relevant to an application as identified and gazetted by the Minister in a government notice. Once the Minister has identified, through a government notice, that a generic EMPr is relevant to an application for EA, that generic EMPr must be applied by all parties involved in the EA process, including, but not limited to, the applicant and the CA.

GN 435 of 22 March 2019 identified a generic EMPr relevant to applications for substations and overhead electricity transmission and distribution infrastructure which require authorisation in terms of Section 42(2) of NEMA. Applications for overhead electricity transmission and distribution infrastructure that trigger Activity 11 of Listing Notice 1 or Activity 9 of Listing Notice 2 and any other listed or specified activities must use the generic EMPr.

The objective of the generic EMPr is "to prescribe and pre-approve generally accepted impact management outcomes and impact management actions, which can commonly and repeatedly be used for the avoidance, management and mitigation of impacts and risks associated with the development or expansion of overhead electricity transmission and distribution infrastructure. The use of a generic EMPr is intended to reduce the need to prepare and review individual EMPrs for applications of a similar nature."[1]

[1] DEA (2019) Appendix 1: Generic Environmental Management Programme (EMPr) for the Development and Expansion for Overhead Electricity Transmission and Distribution Infrastructure

The generic EMPrs for Substations and powerlines have been included in the Site-Specific EMPr (**Appendix I**).

2.6.2 ADDITIONAL PERMITS AND AUTHORISATIONS

Table 2-8 outlines the additional permits and authorisations required for the proposed development, as well as the relevant Competent Authorities responsible.

Table 2-8 - Additional Permits and Authorisations required for the proposed development

Permits/Authorisation	Legislation	Relevant Authority	Status
Water Use Licence / General Authorisation	National Water Act (Act No. 36 of 1998)	Department of Water and Sanitation	In Process
Section 38 Notification	National Heritage Resource Act (Act No. 25 of 1999)	Mpumalanga Heritage Resources Authority	In Process
Obstacle Permit	Civil Aviation Act (Act 13 of 2009)	Air Traffic and Navigation Services / Civil Aviation Authority	In Process
Section 53 Approval	Minerals and petroleum Resources Development Act (No. 28 of 2002)	Department of Mineral Resources and Energy	In Process

3 SCOPING PHASE SUMMARY

3.1 PROCEDURAL PROCESS

A request for a pre-application meeting was submitted to DFFE on **20 May 2022**. DFFE responded with the allocation of an assessing officer and reference number (2022-05-0020). A virtual pre-application meeting was held on **14 June 2022** with the DFFE to discuss the proposed Dalmanutha Renewable Energy Complex (inclusive of this Dalmanutha WEF project). The minutes of the meeting and the public participation plan were approved on **03 August 2022** respectively and are included in **Appendix L.**

The application phase consists of the completion of the appropriate application form by the EAP and the Proponent as well as the subsequent submission and registration of the application for EA with DFFE.

The application form was compiled and submitted to the DFFE on **09 December 2022**. The DFFE reference number allocated to this application is **14/12/16/3/3/2/2243.** This reference number will appear on all official correspondence with the authorities and the public regarding the Proposed Project.

The DSR was initially placed on public review for a period of 30 days from **12 December 2022 to 02 February 20232** at the Proposed Site. The report was also made available on the WSP website (https://www.wsp.com/en-ZA/services/public-documents).

The comprehensive FSR, including all comments received on the DSR, was submitted on the **10 February 2023**.

All registered stakeholders and authorising/commenting state departments were notified of the public review period as well as the locations of the FSRs via email and bulk SMS. The abovementioned plan, for notification and provision of reports, was also utilised for the review of the FSR as well as this EIAr.

The approval of the Final Scoping Report (FSR) and the plan of study for the environmental impact assessment was received on **24 March 2023** from the DFFE and is included in **Appendix G.**

3.2 AUTHORITY CONSULTATION

A pre-application meeting was held on **14 June 2022** with the DFFE in order to discuss the proposed project. The minutes of this meeting are included in **Appendix L**. In addition, WSP notified a number of commenting authorities of the Proposed Project via a notification letter, these included:

- MDARDLEA;
- DFFE: Biodiversity and Conservation;
- DFFE: Protected areas;
- DWS;
- Inkomati-Usuthu WMA Authority;
- SAHRA;
- MHRA;
- MTPA;
- CAA;
- ATNS;

- Department of Defence (SA Army);
- AMA;
- SAWS;
- SANRAL;
- Gert Sibande District Municipality;
- Nkangala District Municipality;
- Emakhazeni Local Municipality; and
- Chief Albert Luthuli Local Municipality.

WSP received comments on the DSR from the DFFE on **27 January 2023**. The comments and responses have been outlined in **Table 3-1** and included in the SER (**Appendix D).** The responses to the DFFE comments were applicable as at the time of final scoping submission and based on the project description included in the final scoping report. Lastly, **Table 3-2** shows the comments on the FSR received from DFFE on the **24 March 2023.**

Table 3-1 - Comments received from the DFFE regarding the DSR

DFFE Comment	Response
(a) Specific Comments (i) Please provide a concise, but complete, summary and bullet list of the project description and associated infrastructure (or project scope). This must include a list of all development components and associated infrastructure.	**EAP:** This comment is acknowledged. Section 2.3 of the FSR provides the project infrastructure in bullet form. Section 2.1 of the FSR provides the project description.
Kindly ensure the development footprints (hectares/square metres) and specifications of all proposed infrastructure and associated infrastructure during all phases are included in the final SR.	**EAP:** This comment is acknowledged. The FSR includes the development footprints (hectares/square metres) and specifications of all proposed infrastructure and associated infrastructure in Section 2.3.
The co-ordinates must be specific to each activity and infrastructure that is proposed on the site. The co-ordinates for substations and the battery energy storage systems (BESS) must be included in the report, i.e., we require that you provide us with the specific development footprints for each development parameter, and not an area outlining the entire site.	**EAP:** This comment is acknowledged. The coordinates of the application site have been included in the FSR in Table 2.2. The Draft EIAr will further include the coordinates of specific development footprints for each development parameter such as laydown areas, substations, access roads etc..

DFFE Comment	Response
Several activities applied for in the application form is said to occur within protected areas, such as Activity 4(f)(i) (aa)(bb) and Activity 10(f)(i) (aa)(bb) of Listing Notice 3 of the EIA Regulations 2014, as amended. Therefore, approval from the Management Authority in terms of the National Environmental Management: Protected Areas Act, 2003; Section 50(5) for commercial and community activities in the National Park, and/or World Heritage Site may be required. Comments from this Department's Protected Areas Directorate must be obtained to confirm whether Approval from the Management Authority in terms of the National Environmental Management: Protected Areas Act, 2003; Section 50(5) is required.	**EAP:** This comment is acknowledged, however there are no Protected areas on the project site in terms of the National Environmental Management: Protected Areas Act, 2003; Section 50(5). Therefore, this is not applicable. It has been noted to be an error on the Application form and the DSR that Activity 4(aa), Activity 10(aa), Activity 14(aa), Activity 18(aa), Activity 23(aa) were listed. This has been updated and removed in the FSR and the application form, which will be re submitted. WSP confirm that Mr Rofiwa Magodi and Tshwanelo Leballo are included on the project database and were provided with the opportunity to comment on the DSR.
Find below the contact details for personnel at this Department's Protected Areas Directorate: a) Name: Mr Rofhiwa Telephone no: (012) 399 8801 Email: RMagodi@dffe.gov.za; and b) Name: Tshwanelo Leballo Telephone no: (012) 399 9561 Email: tleballo@dffe.gov.za.	**EAP:** WSP confirm that Mr Rofiwa Magodi and Tshwanelo Leballo are included on the project database and were provided with the opportunity to comment on the DSR.
Kindly take note that when finalising the layout plan the position of all proposed infrastructure and linear activities, which includes but not limited to the following must be illustrated: Wind turbines (the proposed 70 turbines should be numbered on the layout plan); Access roads and internal roads; IPP portion onsite substation; Battery energy storage systems (BESS); Operation and maintenance buildings; and Construction camp laydown areas.	**EAP:** This comment is acknowledged. WSP can confirm that all of the proposed infrastructure and linear activities will be indicated on the layout map in the Draft EIAr. However, it should be noted that this layout plan is subject to change during the detailed design phase. The final layout plan that is submitted to the Department for approval post EA will include all infrastructure and linear activities.
According to the Mpumalanga Biodiversity Sector Plan, 2015, Wind Farms are not compatible land-use activities to be undertaken in areas classified as CBA 1. Therefore, the mitigation hierarchy should be applied in full, and a Biodiversity Offset should be	**Biodiversity Specialist:** Biodiversity offsets are being considered. A biodiversity offset strategy is being prepared in support of the EA application and will be included in the draft EIAr. Stakeholders including DFFE,

DFFE Comment	Response
considered to ensure that significant residual impacts of the development are remedied.	MDARDLEA, MTPA and BirdLife SA will be consulted to inform the development of the biodiversity offset strategy.
Further to the above, this must be included and addressed in the Plan of Study of the final SR.	**Biodiversity Specialist:** The biodiversity offset strategy has been included in the Plan of Study of the FSR
(b) Listed Activities (i) Please ensure that all relevant listed activities are applied for, are specific and can be linked to the development activity or infrastructure as described in the project description.	**EAP:** This comment is acknowledged. WSP can confirm that all the listed activities applied for are specific and can be linked to the development activity or infrastructure as described in the project description, in Section 3 of the FSR. The application form will be resubmitted with the FSR.
(ii) If the activities applied for in the application form differ from those mentioned in the final SR, an amended application form must be submitted. Please note that the Department's application form template has been amended and can be downloaded from the following link https://www.dffe.gov.za/documents/forms	**EAP:** WSP Acknowledges this comment and can confirm that the amended application form will be submitted with the revised listed activities to the department.
(c) Layout & Sensitivity Maps (i) The final SR must provide coordinate points for the proposed development site (note that if the site has numerous bend points, at each bend point coordinates must be provided) as well as the start, middle and end point of all linear activities.	**EAP:** WSP Acknowledges this comment. The coordinates of the boundary of the properties have been included in Section 2.1 of the FSR. Linear activities co-ordinates will be confirmed in the dEIAr., however please note that the required 132kV grid connection will be assessed as part of a separate BA process.
(ii) All preferred turbine positions must be clearly numbered. The turbine position numbers must be consistently used in all maps to be included in the reports.	**EAP:** WSP Acknowledges this comment, the optimised layout map has been revised to include turbine numbers. Turbine numbers will be included all maps for the draft EIA phase
(iii) Please provide a layout map which indicates the following: a) The proposed position of the 70 wind energy turbines, laydown areas, internal and external roads, substations, BESS, operational and maintenance buildings etc.;	**EAP:** WSP Acknowledges this comment. The layout map has been revised to include infrastructure mentioned in the comment. See Figure 6.26.

DFFE Comment	Response
b) The proposed WEF and associated infrastructure, overlain by the sensitivity map; c) All supporting onsite infrastructure e.g. roads (existing and proposed); d) The location of sensitive environmental features on site e.g. CBAs, heritage sites, wetlands, drainage lines etc. that will be affected; e) Buffer areas; and f) All "no-go" areas.	
(iv) The above map must be overlain with a sensitivity map and a cumulative map which shows neighbouring renewable energy developments and existing grid infrastructure.	**EAP:** This comment is acknowledged. A consolidated sensitivity map overlain by the layout has been included in the Figure 6.23 in the FSR. There are two renewable facilities identified within a 30km radius including: ▪ 14MW Machadodorp PV1 solar facility (10km northeast of the site); and ▪ Haverfontein WEF (9km south of the site).. WSP can confirm that no google maps will be provided in the draft EIAr.
(v) Google maps will not be accepted.	
(d) Alternatives (i) Please provide a description of any identified alternatives for the proposed activity that are feasible and reasonable, including the advantages and disadvantages that the proposed activity or alternatives will have on the environment and on the community that may be affected by the activity as per Appendix 2 of GN R.982 of 2014 (as amended).	**EAP:** Section 2.5.1 of the FSR outlines the alternatives that will be under consideration in the EIA phase such as layout alternatives. Furthermore, alternative technologies (e.g., solar) and the option of reducing turbines to minimize impacts to birds and the overall biodiversity of the site will be investigated in the EIA Phase. **Applicant:** Although an alternative location has not been considered as part of the application for environmental authorisation, the site was assessed during the site feasibility analysis. Identifying locations for wind energy facilities are guided by many factors but at the forefront are wind resource and available grid capacity. We are currently in an energy crisis in South Africa and finding locations where there is both a suitable resource and capacity to connect to the grid is challenging and essential. This specific site is at a high elevation and has the best wind speed in the Belfast area. The wind speed at the site is already marginal, so if we were to move the development to a different site, the projects will no longer be economical. Unlike the Cape Provinces of South Africa, where there is abundant wind

DFFE Comment	Response
	resources but no available grid capacity, the project site provides the opportunity to connect to the Eskom grid..
(ii) Alternatively, you should submit written proof of an investigation and motivation if no reasonable or feasible alternatives exist in terms of Appendix 2.	**EAP:** Please see Section 2.5 for the alternative's discussion. This section will be amended as required as a result of any technology and layout changes in the EIA phase.
(e) Public Participation Process (i) The newspaper advertisement attached under Appendix F-3 is deemed inadequate. Kindly include an actual copy of the newspaper advertisement that formed part of the public participation process for this project in the final SR. The newspaper advert provided should depict the name of the newspaper and date of publication of the advert. It should also be clear and legible.	**EAP:** WSP acknowledges this comment. Please note the FSR has been updated to include the newspaper adverts proof. This SER includes the proof of advert placement in Appendix B-1
(ii) Please provide photographs of the erected site notices placed around the boundaries of the proposed site.	**EAP:** WSP acknowledges this comment. Proof of the site notice placement has been included in Appendix B-2 of the SER.
(iii) Comments must be obtained from this Department's Biodiversity Conservation Directorate at BCAdmin@dffe.gov.za and this Department's Protected Areas Directorate at RMagodi@dffe.gov.za.	**EAP:** WSP acknowledges this comment. Comments from DFFE Biodiversity conservation unit have included in this SER. WSP can confirm that DFFE Protected Areas Directorate were on the database and were provided with the opportunity to comment on the DSR, however no comment was received. DFFE biodiversity and protected Ares unit will continue to be engaged throughout the EIA process.
(iv) Please ensure that all issues raised and comments received during the circulation of the SR from registered I&APs and organs of state which have jurisdiction in respect of the proposed activity are adequately addressed in the final SR, including comments from this Department, and must be incorporated into a Comments and Response Report (CRR).	**EAP:** WSP acknowledges this comment, and can confirm that all comments received to date from registered I&APs and organs of state which have jurisdiction in respect of the proposed activity are adequately addressed in this FSR.

DFFE Comment	Response
(v) Proof of correspondence with the various stakeholders must be included in the final SR. Should you be unable to obtain comments, proof should be submitted to the Department of the attempts that were made to obtain comments.	**EAP:** WSP acknowledges this comment. The proof of correspondence with the registered stakeholders is included in Appendix B-4 and Appendix D of the SER.
(vi) The Public Participation Process must be conducted in terms of Regulation 39, 40 41, 42, 43 and 44 of the EIA Regulations 2014, as amended.	**EAP:** WSP confirms that the Public Participation Process has been conducted in terms of Regulation 39, 40 41, 42, 43 and 44 of the EIA Regulations 2014, as amended.
(vii) A comments and response trail report (C&R) must be submitted with the final SR. The C&R report must incorporate all historical comments for this development. The C&R report must be a separate document from the main report and the format must be in the table format as indicated in Annexure 1 of this comments letter. Please refrain from summarising comments made by I&APs. All comments from I&APs must be copied verbatim and responded to clearly. Please note that a response such as "Noted" is not regarded as an adequate response to I&AP's comments.	**EAP:** WSP acknowledges this comment, this report is the C&R containing all the comments received to date from all registered I&APs.
(viii) The final SR must provide evidence that all identified and relevant competent authorities have been given an opportunity to comment on the proposed development.	**EAP:** WSP acknowledges this comment. Appendix B-4 & Appendix A shows relevant competent authorities which were identified and given the opportunity to comment.
(f) Specialist Assessments (i) A detailed description as well as any associated assessments related to the technology required for the Battery Energy Storage System (BESS) must be included in the Plan of Study of the final SR.	**EAP:** This comment is acknowledged. the plan of study for the Qualitative Risk Assessment for the BESS installation is outlined in Section 8.5 & 8.6.12 of the FSR.
(ii) The specialists undertaking the Terrestrial and Aquatic Biodiversity Report and the Geotechnical Desktop Assessment failed to submit signed Specialist Declaration of Interest forms. All Specialist Declaration of Interest forms must be signed by the relevant specialists and attached to the final SR. The forms are available on the Department's website (please use the Department's template).	**EAP:** This comment is acknowledged. The Terrestrial & Aquatic Biodiversity and the Geotechnical Specialists declaration will be included in the FSR in Appendix C.

DFFE Comment	Response
(iii) The final EIAr and all the attached specialist studies must indicate and adequately assess a consistent number of turbines.	**EAP:** WSP can confirm that the final EIAr and attached specialist studies will adequately assess a consistent number of turbines.
(iv) The EAP must ensure that the terms of reference for all the identified specialist studies include the following: a) A detailed description of the study's methodology; indication of the locations and descriptions of the development footprint, turbine positions and all other associated infrastructures that they have assessed and are recommending for authorisation.	**EAP:** WSP can confirm that the specialist studies to be undertaken in the EIA phase will be undertaken in line with Appendix 6 of the EIA Regulations, 2014, as amended, or as required under the gazetted specialist protocols (GNR 320 of 20 March 2020 and GNR 1150 of 30 October 2020). Therefore, the requested information will be included.
b) Provide a detailed description of all limitations to the studies. All specialist studies must be conducted in the right season and providing that as a limitation will not be allowed.	**EAP:** All relevant specialist assumptions and limitations have been included Section 1.6 of the FSR. These will be updated as required during the EIA Phase.
c) Please note that the Department considers a 'no-go' area, as an area where no development of any infrastructure is allowed; therefore, no development of associated infrastructure including access roads is allowed in the 'no-go' areas.	**EAP:** WSP acknowledge the DFFE's definition of 'No-go' areas. No-go areas will be re-evaluated and assessed during the EIA phase, based on further specialist field assessments. Where specialist definitions of 'no-go' areas differ from the Department's definition; these will be clearly indicated.
d) Should the specialist definition of 'no-go' area differ from the Department's definition; this must be clearly indicated. The specialist must also indicate the 'no-go' area's buffer if applicable	**EAP:** To date, specialists have clearly indicated where it is suitable for linear infrastructure (water pipelines, roads, powerline infrastructure etc.) to traverse a no-go area where required.
e) All specialist studies must be final, and provide detailed/practical mitigation measures for the preferred alternative and recommendations, and must not recommend further studies to be completed post EA.	**EAP:** All specialist studies to be appended to the Final EIA Report will be final. Specialist reports will provide detailed/practical mitigation measures for the preferred alternative and recommendations and will not recommend further studies to be completed post EA with the exception of pre- construction walkthroughs, search and rescue and micro-siting. The Specialist Studies will sufficiently inform the EA decision phase.

DFFE Comment	Response
f) Bird and Bat specialist studies must have support from Birdlife South Africa and SABAA.	**Biodiversity Specialist:** The comments already provided by BLSA are acknowledged. These stakeholders will be further consulted as part of the EIA process.
g) Should a specialist recommend specific mitigation measures, these must be clearly indicated.	**EAP:** All specific mitigation measures, will be clearly indicated and included in the EMPr during the EIA Phase.
(v) Should the appointed specialists specify contradicting recommendations, the EAP must clearly indicate the most reasonable recommendation and substantiate this with defendable reasons; and were necessary, include further expertise advice.	**EAP:** In the EMPr, WSP will clearly indicate the most reasonable recommendation and substantiate this with defendable reasons should any specialist recommendations be contradictory. To date no contradictory recommendations have been received.
(vi) Please ensure that all mitigation recommendations are in line with applicable and most recent guidelines.	**EAP:** This comment is acknowledged. The specialist's mitigation measures prescribed will be in line with applicable and most recent guidelines.
(vii) It is further brought to your attention that Procedures for the Assessment and Minimum Criteria for Reporting on identified Environmental Themes in terms of Sections 24(5)(a) and (h) and 44 of the National Environmental Management Act, 1998, when applying for Environmental Authorisation, which were promulgated in Government Notice No. 320 of 20 March 2020 (i.e. "the Protocols"), and in Government Notice No. 1150 of 30 October 2020 (i.e. protocols for terrestrial plant and animal species), have come into effect. Please note that specialist assessments must be conducted in accordance with these protocols.	**EAP:** WSP can confirm that the Procedures for the Assessment and Minimum Criteria for Reporting on identified Environmental Themes (as per the Screening Report), which were promulgated in Government Notice No. 320 of 20 March 2020 and in Government Notice No. 1150 of 30 October 2020 (i.e. "the Protocols") are being considered as applicable.
(viii) As such, the Specialist Declaration of Interest forms must also indicate the scientific organisation registration/member number and status of registration/membership for each specialist.	**EAP:** Specialist Declarations included in the FSR do indicate the name of scientific organisation/council and member number and the status of the registration/membership of each specialist.

DFFE Comment	Response
(ix) Please also ensure that the final SR includes the Site Verification Report as required by the relevant environmental themes and assessments.	**EAP:** This comment is acknowledged. Section 6 of the FSR included the site verifications of the relevant environmental themes and assessments.
(x) Please note further that the protocols, if applicable, require certain specialists' to be SACNASP registered. Please ensure that the relevant specialist certificates are attached to the relevant reports.	**EAP:** This comment is acknowledged. WSP can confirm that where required, SACNASP certificates of the relevant specialist will be included to the reports.
(xi) We note that the screening tool indicates that seventeen specialist studies need to be undertaken or conducted. We note that the SR does not include seventeen specialist reports. Please kindly peruse the protocols and provide in the SR site sensitivity reports for each theme/study listed, as well as compliance statements for assessments not needed to be conducted based on your site sensitivity verification.	**EAP:** This comment is acknowledged. The following specialist assessments have been commissioned for the project based on the environmental sensitivities identified by the Screening Report ▪ Soils and Agricultural Potential Assessment ▪ Archaeological and Cultural Heritage Assessment ▪ Palaeontology Impact Assessment ▪ Visual Impact Assessment (inclusive of landscape and flicker) ▪ Biodiversity Impact Assessment (inclusive of terrestrial biodiversity, plant species and animal species) ▪ Surface water Assessment ▪ Avifauna Impact Assessment ▪ Bat Impact Assessment ▪ Environmental Acoustic (Noise) Impact Assessment ▪ Social Impact Assessment ▪ Qualitative Risk Assessment (specific to the BESS) ▪ Desktop Geotechnical Assessment ▪ Desktop Traffic Assessment As per section 4.2.1 we motivate the following: A desktop Geotechnical study will be undertaken, however a detailed geotechnical study will not be undertaken as this will only be undertaken during the detailed design phase of the project. The defence and RFI themes are considered low sensitivity and therefore compliance statements are not required. However the relevant stakeholders have been included on the project stakeholder database i.e. Department of Defence, SARAO, SKA and SAWS. In the event that any high sensitivity

DFFE Comment	Response
	issues are raised by the stakeholders the required compliance statement will be included in the draft EIAr. The Civil Aviation and RFI themes are considered high – the required compliance statement will be included in the draft EIAr. The studies included are as agreed to during the pre-app meeting with the DFFE on 14 June 2022. Meetings minutes included in Appendix C-1 of the SER
(g) Cumulative Assessment (i) Should there be any other similar projects within a 30km radius of the proposed development site, the cumulative impact assessment for all identified and assessed impacts must be refined to indicate the following: a) Identified cumulative impacts must be clearly defined, and where possible the size of the identified impact must be quantified and indicated, i.e. hectares of cumulatively transformed land.	**EAP:** This comment is acknowledged. The EIA phase of the project will include the cumulative impacts identified as a result of the surrounding projects within 30km radius. However, at this stage there only two renewable facilities identified within a 30km radius including: 14MW Machadodorp PV1 solar facility (10km northeast of the site); and Haverfontein WEF (9km south of the site).
b) Detailed process flow and proof must be provided, to indicate how the specialist's recommendations, mitigation measures and conclusions from the various similar developments in the area were taken into consideration in the assessment of cumulative impacts and when the conclusion and mitigation measures were drafted for this project.	**EAP:** This comment is acknowledged. WSP can confirm that the specialists appointed to undertake the studies will provide reports inclusive of this for the EIA phase.
c) The cumulative impacts significance rating must also inform the need and desirability of the proposed development	**EAP:** This comment is acknowledged. The draft EIA report will include cumulative impacts significance rating informing the need and desirability of the proposed development.
d) A cumulative impact environmental statement on whether the proposed development must proceed.	**EAP:** This comment is acknowledged, This information will be included in the EIA Report to be compiled in the EIA Phase, along with the related impact and cumulative assessments, and concluding remarks.

DFFE Comment	Response
General You are further reminded to comply with Regulation 21(1) of the NEMA EIA Regulations 2014, as amended, which states that: "If S&EIR must be applied to an application, the applicant must, within 44 days of receipt of the application by the competent authority, submit to the competent authority a scoping report which has been subjected to a public participation process of at least 30 days and which reflects the incorporation of comments received, including any comments of the competent authority" You are are further reminded that the final SR to be submitted to this Department must comply with all the requirements in terms of the scope of assessment and content of scoping reports in accordance with Appendix 2 and Regulation 21(1) of the EIA Regulations 2014, as amended.	**EAP:** WSP confirms that the FSR will be submitted to the DFFE within 44 days of the receipt of the application, in line with the regulated timeframes.
Further note that in terms of Regulation 45 of the EIA Regulations 2014, as amended, this application will lapse if the applicant fails to meet any of the timeframes prescribed in terms of these Regulations, unless an extension has been granted in terms of Regulation 3(7).	**EAP:** WSP notes that the application will lapse if the applicant fails to meet any of the timeframes prescribed in terms of these Regulations.
You are hereby reminded of Section 24F of the National Environmental Management Act, Act No. 107 of 1998, as amended, that no activity may commence prior to an Environmental Authorisation being granted by the Department.	**EAP:** WSP acknowledges this comment. The applicant is fully aware that that no activity may commence prior to an Environmental Authorisation being granted by the Department.

Table 3-2 - Comments received from the DFFE regarding the FSR

DFFE	EAP
Dear Ms Strong ACCEPTANCE OF THE SCOPING REPORT FOR THE PROPOSED DALMANUTHA WIND ENERGY FACILITY (WEF) AND ITS ASSOCIATED INFRASTRUCTURE NEAR BELFAST IN MPUMALANGA PROVINCE The final Scoping Report (SR) and the Plan of Study for Environmental Impact Assessment dated February 2023 and received by the Department on 10 February 2023, refer.	**EAP:** This comment is acknowledged.

DFFE	EAP
The Department has evaluated the submitted final SR and the Plan of Study for Environmental Impact Assessment dated February 2023 and is satisfied that the documents comply with the minimum requirements of the Environmental Impact Assessment (EIA) Regulations, 2014, as amended. The final SR is hereby accepted by the Department in terms of Regulation 22(1)(a) of the EIA Regulations, 2014, as amended. You may proceed with the environmental impact assessment process in accordance with the tasks contemplated in the Plan of Study for Environmental Impact Assessment as required in terms of the EIA Regulations, 2014, as amended. In addition, the following amendments and additional information are required for the EIAr:	
(a) Specific Comments (i) The final SR mentions an option to include Solar PV panels which would be added for consideration in the EIA Phase. The only information regarding the inclusion of the Solar PV panels is mentioned under the technology alternative (page 39) and the revised project details (page 213), which only provides the height and mounting structures of the proposed Solar PV panels. Please take note that if the applicant plans to develop a hybrid energy facility a comprehensive assessment for both renewable energy generation types need to be conducted and included in the EIAr. Currently none of the specialist scoping reports and impact assessments mention the inclusion of Solar PV panels. The insufficient information regarding the inclusion of the Solar PV panels in the final SR is concerning as the applicant should be fully aware of what activities would be undertaken at this point in the process in order to effectively assess the impacts on site. The proposed activities described in the EIAr must be final, clear, and concise.	**EAP:** This comment is acknowledged. The inclusion of the Solar alternative was a development after the FSR specialist reporting had been undertaken and submitted. WSP can confirm that all the specialists appointed, have assessed both renewable alternatives in the EIA phase reports.
(ii) A Biodiversity Offset Report is planned to be included in the EIAr as the proposed site is covered in areas classified as a CBA 1, with very high sensitivities confirmed in terms of avifauna, primary grasslands, and PES A/B wetlands. Kindly take note that the draft National Biodiversity Offset Guideline should be utilised to inform the proposed Biodiversity Offset Report.	**EAP:** This comment is acknowledged. The biodiversity specialist undertaking the offset strategy has taken note that the draft National Biodiversity Offset Guidelines. The Biodiversity Offset Strategy is included in **Appendix J** of the EIAr.
(b) Listed Activities (i) The description of each Activity applied for in the application form is unclear and difficult to understand. Find examples below: ➢ Activity 4(f)(i)(bb)(cc)(ee)(gg) of Listing Notice 3	**EAP:** This comment is acknowledged. The application form has been updated to include clear descriptions of the activities applied for and will be resubmitted accordingly.

DFFE	EAP
"Internal access roads required by the Facility will be between 8m and 10m wide, and approximately 60km in length. Where required for turning circle/bypass areas, however, access or internal roads may be up to 12m to allow for larger component transport. The exact values will be confirmed once final designs have been provided. The facility is therefore both located within the extent, and within 5km of the abovementioned heritage site." ➢ Activity 14(ii)(a)(c) (f)(i)(bb)(cc)(dd)(ff)(hh) of Listing Notice 3 "The Facility will require the development of internal roads and/or access roads around the site. The physical footprint of internal access roads, stormwater control infrastructure and electrical cabling required to connect the various components of the Facility will either traverse the delineated watercourses on site or be located within 32m of the outer extent of the delineated watercourses on site. The facility is therefore both located within the extent, and within 5km of the abovementioned heritage site. This site is noted as having farming activity present and is currently managed and actively utilised for agriculture."	
It is unclear as to what heritage site is being referred to and what extent does the facility fall within?	**EAP:** This comment is acknowledged The heritage site referred to is the Berg-en-Dal War Memorial, however reference to the heritage site has been removed from the updated application form.
Kindly update the application form so that the description of each activity applied for is clear, applicable, and concise.	**EAP:** This comment is acknowledged The application form has been updated to include clear descriptions of the activities applied for and will be resubmitted accordingly.
(ii) The EIAr must provide an assessment of the impacts and mitigation measures for each of the listed activities applied for.	**EAP:** This comment is acknowledged The EIAr includes the assessment of potential impacts identified and corresponding mitigation measures in Section 9.
(iii) The listed activities represented in the EIAr and the application form must be the same and correct.	**EAP:** This comment is acknowledged. The listed activities in the application form and the EIAr are the same and correct.

DFFE	EAP
(iv) The EIAr must assess the correct sub listed activity for each listed activity applied for.	**EAP:** This comment is acknowledged. The EIAr assesses the sub activities accordingly in Section 9
(c) Public Participation (i) Please ensure that comments from all relevant stakeholders are submitted to the Department with the EIAr. This includes but is not limited to the Mpumalanga Department Agriculture, Rural Development, Land and Environment Affairs (DARDLEA), the Emakhazeni Local Municipality, the Nkangala District Municipality, the Gert Sibande District Municipality, the Albert Luthuli Local Municipality, the Department of Water and Sanitation (DWS), the South African Heritage Resources Agency (SAHRA), the Mpumalanga Heritage Resources Agency (MHRA), the Mpumalanga Tourism and Parks Agency, the Endangered Wildlife Trust (EWT), BirdLife SA, the South African Bat Assessment Association (SABAA), the Department of Mineral Resources and Energy, the Department of Forestry, Fisheries and the Environment: Directorate Biodiversity and Conservation.	**EAP:** This comment is acknowledged. WSP can confirm that the reports were sent and made available to all these relevant stakeholders for their comments. The stakeholder database is included in the Stakeholder Engagement Report (SER) (**Appendix D**)
(ii) Please ensure that all issues raised and comments received during the circulation of the draft SR and draft EIAr from registered I&APs and organs of state which have jurisdiction in respect of the proposed activity are adequately addressed in the final EIAr. Proof of correspondence with the various stakeholders must be included in the final EIAr. Should you be unable to obtain comments, proof should be submitted to the Department of the attempts that were made to obtain comments.	**EAP:** This comment is acknowledged. All issues raised and comments received during the circulation of the draft report from registered I&APs and organs of state which have jurisdiction in respect of the proposed activity will be adequately addressed in the final EIAr. Proof of correspondence with the various stakeholders will be included in the final EIAr in the SER (**Appendix D**). Should WSP not be able to obtain comments from specific stakeholders, proof of WSPs attempts to obtain comments will be provided to the Department.
(iii) A Comments and Response trail report (C&R) must be submitted with the final EIAr. The C&R report must incorporate all comments for this development. The C&R report must be a separate document from the main report and the format must be in the table format as indicated in Annexure 1 of this comments letter. Please refrain from summarising comments made by I&APs. All comments from I&APs must be copied verbatim and responded to clearly. Please note that a response such as "noted" is not regarded as an adequate response to I&AP's comments.	**EAP:** This comment is acknowledged. All comments received to date from all registered I&APs have been captured in this SER in verbatim, as a separate document (**Appendix D**).

DFFE	EAP
(iv) Comments from I&APs must not be split and arranged into categories. Comments from each submission must be responded to individually.	**EAP**: This comment is acknowledged. Each comment received has been provided with an individual response in the SER (**Appendix D**)
(v) The Public Participation Process must be conducted in terms of Regulation 39, 40, 41, 42, 43 and 44 of the EIA Regulations, 2014, as amended.	**EAP:** This comment is acknowledged. WSP can confirm that Public Participation Process has been conducted in terms of Regulation 39, 40, 41, 42, 43 and 44 of the EIA Regulations, 2014, as amended.
(d) Layout & Sensitivity Maps (i) The EIAr must provide coordinate points for the proposed development site and all proposed infrastructure (note that if the site has numerous bend points, at each bend point coordinates must be provided) as well as the start, middle and end point of all linear activities.	**EAP:** This comment is acknowledged. The EIAr includes the layout maps for the proposed alternatives with coordinate points indicated.
(ii) All preferred turbine positions must be clearly numbered. The turbine position numbers must be consistently used in all maps to be included in the reports.	**EAP:** This comment is acknowledged. All the turbines are numbered accordingly on all maps provided in the EIAr.
(iii) The EIAr must provide a copy of the final preferred layout map. All available biodiversity information must be used in the finalisation of the layout map. Existing infrastructure must be used as far as possible e.g., roads. The layout map must indicate the following: a) A clear indication of the envisioned area for the proposed wind energy facility; b) Position of the wind turbines; c) Internal roads; d) All supporting onsite infrastructure such as laydown area, guard house and control room etc.; e) Substations, transformers, switching stations and inverters; f) Battery Energy Storage System; g) The location of sensitive environmental features on site e.g. CBAs, heritage sites, wetlands, drainage lines etc. that will be affected by the facilities and its associated infrastructure; h) Connection routes (including pylon positions) to the distribution/transmission network;	**EAP:** This comment is acknowledged. The infrastructure layout maps have been included for both alternatives in Section 6 of the EIAr.

DFFE	EAP
i) All existing infrastructure on the site, especially railway lines and roads; and j) Buildings, including accommodation.	
(iv) Please provide an environmental sensitivity map which indicates the following: a) The location of sensitive environmental features identified on site, e.g. CBAs, protected areas, heritage sites, wetlands, drainage lines etc. that will be affected by the facility and its associated infrastructure; b) Buffer areas; and c) All “no-go” areas.	**EAP:** This comment is acknowledged. A consolidated site sensitivity map for each alternative has been included in Section 8.16 of the EIAr. These include the facility and associated infrastructure, Buffer areas and All “no-go” areas.
(v) The above layout map must be superimposed (overlain) with the sensitivity map and a cumulative map which shows neighbouring and existing infrastructure.	**EAP:** This comment is acknowledged. The cumulative sensitivity map is included in section 8.16 of the EIAr
(vi) Google maps will not be accepted.	**EAP:** This comment is acknowledged. Google map images have not been used for the sensitivity maps.
(e) Specialist assessments (i) The EAP must ensure that the terms of reference for all the identified specialist studies must include the following: a) A detailed description of the study’s methodology; indication of the locations and descriptions of the development footprint, and all other associated infrastructures that they have assessed and are recommending for authorisation.	**EAP:** This comment is acknowledged. It is confirmed that all the identified specialist studies include a detailed description of the study’s methodology; indication of the locations and descriptions of the development footprint, and all other associated infrastructures that they have assessed and are recommending for authorisation.
b) Provide a detailed description of all limitations to the studies. All specialist studies must be conducted in the right season and providing that as a limitation will not be allowed.	**EAP:** This comment is acknowledged. It is confirmed that all specialist studies have included a detailed description of all limitations to the relevant studies. Furthermore, all specialist studies have been conducted in the right season as required.
c) Please note that the Department considers a ‘no-go’ area, as an area where no development of any infrastructure is allowed; therefore, no development of associated infrastructure including access roads is allowed in the ‘no-go’ areas.	**EAP:** The DFFE’s definition of a ‘no-go’ area is acknowledged.

DFFE	EAP
d) Should the specialist definition of 'no-go' area differ from the Department's definition; this must be clearly indicated. The specialist must also indicate the 'no-go' area's buffer if applicable.	**EAP:** This comment is acknowledged. It can be confirmed that were the specialist's definition of 'no-go' areas differ from the DFFE's definition; they are clearly indicated.
e) All specialist studies must be final, and provide detailed/practical mitigation measures for the preferred alternative and recommendations, and must not recommend further studies to be completed post EA.	**EAP:** This comment is acknowledged. All specialist studies included in the EIAr are final and provide detailed/practical mitigation measures for the preferred alternative and recommendations.
f) Bird and bat specialist studies must have support from Birdlife South Africa and SABAA.	EAP: Birdlife South Africa and SABAA will be provided with the opportunity to comment on the bird and bat specialist studies. Any comments received will be addressed and responded to as required in the Final EIAr. It can be confirmed that the bird and bat studies have been undertaken in compliance with the relevant guidelines, namely: ▪ Best practice guidelines for assessing and monitoring the impact of wind energy facilities on birds in southern Africa" Unpublished guidelines by BirdLife South Africa & Endangered Wildlife Trust (Jenkins et al, 2015, 2021) and ▪ Species Environmental Assessment Guideline (SANBI, 2020 ▪ The South African Best Practice Guidelines for Pre-construction Monitoring of Bats at Wind Energy Facilities - ed 5 (SABPG, MacEwan et al., 2020)
g) Should a specialist recommend specific mitigation measures, these must be clearly indicated.	**EAP:** This comment is acknowledged. All mitigation measures recommended by specialist have been included in the EIAr as well as the EMPr (Appendix I).
(ii) Should the appointed specialists specify contradicting recommendations, the EAP must clearly indicate the most reasonable recommendation and substantiate this with defendable reasons; and were necessary, include further expertise advice.	**EAP:** This comment is acknowledged. The specialists have not provided contradicting recommendations.
(iii) It is further brought to your attention that Procedures for the Assessment and Minimum Criteria for Reporting in	**EAP:**

DFFE	EAP
identified Environmental Themes in terms of Sections 24(5)(a) and (h) and 44 of the National Environmental Management Act, 1998, when applying for Environmental Authorisation, which were promulgated in Government Notice No. 320 of 20 March 2020 (i.e. "the Protocols") and in Government Notice No. 1150 of 30 October 2020 (i.e. protocols for terrestrial plant and animal species), have come into effect. Please note that specialist assessments must be conducted in accordance with these protocols.	This comment is acknowledged. WSP can confirm that all specialist studies undertaken for the proposed project have been conducted in accordance with these protocols.
(iv) Please also ensure that the EIAr includes the Site Verification Report and Compliance Statements (where applicable) as required by the relevant themes.	**EAP:** This comment is acknowledged. Section 8 of the EIAr includes a site sensitivity verification for each of the relevant themes identified by the DFFE national screening tool.
(v) Please note further that the protocols, if applicable, require certain specialists' to be SACNASP registered. Please ensure that the relevant specialist certificates are attached to the relevant reports.	**EAP:** This comment is acknowledged. The relevant specialist who are required to be SACNASP registered have provided their relevant certificates.
(vi) As such, the Specialist Declaration of Interest forms must also indicate the scientific organisation registration/member number and status of registration/membership for each specialist.	**EAP:** This comment is acknowledged. All specialists have provided signed declarations for their reports undertaken.

DFFE	EAP
(vii) The following Specialist Assessments will form part of the EIAr: ➢ Soils and Agricultural Potential Assessment; ➢ Archaeological and Cultural Heritage Assessment; ➢ Palaeontology Impact Assessment; ➢ Visual Impact Assessment (inclusive of the Landscape and Flicker Assessments); ➢ Biodiversity Impact Assessment (inclusive of terrestrial biodiversity, plant species and animal species); ➢ Surface water Assessment; ➢ Avifauna Impact Assessment; ➢ Bat Impact Assessment; ➢ Environmental Acoustic (Noise) Impact Assessment; ➢ Social Impact Assessment; ➢ Qualitative Risk Assessment (specific to the BESS); ➢ Desktop Geotechnical Assessment; ➢ Desktop Traffic Assessment; and ➢ Biodiversity Offset Strategy.	**EAP:** This comment is acknowledged. These specialists' studies are included as appendices in the EIAr
(f) Cumulative Assessment (i) Should there be any similar projects within a 30km radius of the proposed development site, a cumulative impact assessment for all identified and assessed impacts must be conducted to indicate the following:	**EAP:** This comment is acknowledged. The following authorised projects have been identified within 30km of the site: ▪ 14MW Machadodorp PV 1 solar energy facility – 11km NE of the Site ▪ Haverfontein WEF – 9km S of the Site ▪ Eskom Arnot PV Facility – 31km SW of the site Section 10 of the EIAr addresses the cumulative impacts for the proposed project.
a) Identified cumulative impacts must be clearly defined, and where possible the size of the identified impact must be quantified and indicated, i.e. hectares of cumulatively transformed land.	**EAP:** This comment is acknowledged. Section 10 of the EIAr addresses the cumulative impacts for the proposed project.
b) Detailed process flow and proof must be provided, to indicate how the specialist's recommendations, mitigation measures and conclusions from the various similar developments in the area were taken into consideration in the assessment of cumulative impacts and when the	**EAP:** This comment is acknowledged. Section 10 of the EIAr addresses the cumulative impacts for the proposed project.

DFFE	EAP
conclusion and mitigation measures were drafted for this project.	
c) The cumulative impacts significance rating must also inform the need and desirability of the proposed development.	**EAP:** This comment is acknowledged. Section 10 of the EIAr outlines the cumulative impacts significance ratings for the proposed project.
d) A cumulative impact environmental statement on whether the proposed development must proceed.	**EAP:** This comment is acknowledged. Section 11.4 of the EIAr addresses the cumulative impact statement for the proposed project.
(g) General (ii) The EIAr must provide the technical details for the proposed facility in a table format as well as their description and/or dimensions. A sample for the minimum information required is listed under Annexure 2 below.	**EAP:** This comment is acknowledged. The technical details for the proposed project are included in table format in Section 6.2 of the EIAr
(iii) The EAP must provide landowner consent for all farm portions affected by the proposed project i.e., all farm portions where the access road, wind turbines and associated infrastructure are to be located.	**EAP:** This comment is acknowledged. Signed landowner consents are provided in Appendix 3 of the Application Form submitted to the DFFE. It can be confirmed that all relevant land portions are included.
(iv) A construction and operational phase EMPr that includes mitigation and monitoring measures must be submitted with the final EIAr, including the Generic EMPrs for substations.	**EAP:** This comment is acknowledged. All mitigation measures recommended by the relevant specialist have been included in the main EMPr. Furthermore, the generic EMPrs for the substation and powerline are included as an appendix to the main EMPr.

DFFE	EAP
The applicant is hereby reminded to comply with the requirements of Regulation 45 of GN R982 of 04 December 2014, as amendment, with regard to the time period allowed for complying with the requirements of the Regulations. You are hereby reminded of Section 24F of the National Environmental Management Act, Act No. 107 of 1998, as amended, that no activity may commence prior to an environmental authorisation being granted by the Department. Yours faithfully	**EAP:** This comment is acknowledged. The applicant is aware that no activity may commence prior to an environmental authorisation being granted by the Department. The applicant is aware that they need to comply with the requirements of Regulation 45 of GN R982 of 04 December 2014, as amendment, with regard to the time period allowed for complying with the requirements of the Regulations.

3.3 STAKEHOLDER CONSULTATION

Section 41 of the 2017 EIA Regulations states that written notices must be given to identified stakeholders.

Refer to the Stakeholder Engagement Report (SER) included in **Appendix D** for proof of notification. Relevant authorities (Organs of State) have been automatically registered as I&APs. In accordance with the EIA Regulations, 2014 (as amended), all other persons must request in writing to be placed on the register, submit written comments or attend meetings in order to be registered as stakeholders and included in future communication regarding the project.

Stakeholder engagement comprises a series of inclusive and culturally appropriate interactions aimed at providing stakeholders with opportunities to express their views, so that these can be considered and incorporated into the S&EIR process. Effective stakeholder engagement requires the prior disclosure of relevant and adequate project information to enable stakeholders to understand the risks, impacts, and opportunities of the proposed project.

The objectives of the stakeholder engagement process can be summarised as follows:

- Identify relevant individuals, organisations and communities who may be interested in or affected by the Proposed Project;
- Clearly outline the scope of the Proposed Project, including the scale and nature of the existing and proposed activities;
- Identify viable proposed project alternatives that will assist the relevant authorities in making an informed decision;
- Identify shortcomings and gaps in existing information;
- Identify key concerns, raised by Stakeholders that should be addressed in the subsequent specialist studies;
- Highlight the potential for environmental impacts, whether positive or negative; and
- To inform and provide the public with information and an understanding of the proposed project, issues and solutions.

In accordance with the NEMA, GNR 326, Chapter 6, the following activities have taken place or are proposed to take place within the DSR review period or beyond.

Stakeholders were identified and will continue to be identified through several mechanisms. These include:

- Utilising existing databases from other projects in the area;
- Networking with local business owners, non-governmental agencies, community based organisations, and local council representatives;
- Field work in and around the project area;
- Advertising in the press;
- Placement of community notices;
- Completed comment sheets; and
- Attendance registers at meetings.

All Stakeholders identified to date have been registered on the project stakeholder database. The EAP endeavoured to ensure that individuals/organisations from referrals and networking were notified of the Proposed Project. Stakeholders were identified at the horizontal (geographical) and vertical extent (organisations level).

A list of stakeholders captured in the project database is included in Appendix A of the SER (**Appendix D**). All concerns, comments, viewpoints and questions (collectively referred to as 'issues') received to date have been documented and responded to in the SER included in **Appendix D.** The following key issues were highlighted:

- Impacts on the biodiversity of the area with specific reference to Critical Biodiversity Areas; and
- Impacts on heritage and burial sites in the project area.

3.4 PUBLIC PARTICIPATION PLAN

As part of the pre-application consultation meeting held with DFFE on **14 June 2022,** the proposed plan for public participation was discussed. A public participation plan was subsequently submitted to DFFE, along with the meeting minutes, for approval. The public participation plan was approved by DFFE on **03 August 2022.** The approved public participation plan is included as part of the SER in **Appendix D**

3.5 STAKEHOLDER IDENTIFICATION

Stakeholders were identified and will continue to be identified through several mechanisms. These include:

- Utilising existing databases from other projects in the area;
- Networking with local business owners, non-governmental agencies, community based organisations, and local council representatives;
- Field work in and around the project area;
- Advertising in the press;
- Placement of community notices;
- Completed comment sheets; and
- Attendance registers at meetings.

All Stakeholders identified to date have been registered on the project stakeholder database. The EAP endeavoured to ensure that individuals/organisations from referrals and networking were notified of the Proposed Project. Stakeholders were identified at the horizontal (geographical) and vertical extent (organisations level).

A list of stakeholders captured in the project database is included in Appendix A of the SER (**Appendix D**)

3.6 STAKEHOLDER NOTIFICATION

3.6.1 DIRECT NOTIFICATION

Notification of the proposed Project were issued to potential Stakeholders, via direct correspondence (i.e., site notices and e-mail) on **12 December 2022**. The notification letter that was circulated is included in Appendix B-3 of the SER (**Appendix D**). Proof of notification is included in Appendix B of the SER (**Appendix D**).

3.6.2 NEWSPAPER ADVERTISEMENTS

In accordance with the requirements of GNR 982, as amended, the proposed project was advertised in two local newspapers. The purpose of the advertisement was to notify the public about the proposed project and to invite them to register as stakeholders. Copies of the advertisements are included in Appendix B-1 of the SER (**Appendix D**). The relevant advertisement dates are listed in **Table 3-3.**

Table 3-3 - Dates on which the Adverts were published

Newspaper	Publication Date	Language
Highvelder	9 December 2022	English
Middelburg Observer	9 December 2022	Afrikaans

3.6.3 SITE NOTICES

The official site notices were erected as per GNR 982, as amended, on the boundary fence of the proposed site. In addition, general project notices, announcing the Proposed Project and inviting stakeholders to register, were placed at various locations in and around the project area. A copy of the site notice is included in Appendix B-2 of the SER (**Appendix D**).

3.6.4 PUBLIC REVIEW

The DSR was placed on public review for a period of 30 days from **12 December 2022 to 02 February 2023,** at the following public places:

- Emakhazeni Local Municipality, Belfast Office
- Emakhazeni Public Library
- Carolina Public Library
- WSP website (https://www.wsp.com/en-ZA/services/public-documents).
- Data free website (https://wsp-engage.com/)

3.6.5 COMMENT AND RESPONSE REPORT

All concerns, comments, viewpoints, and questions (collectively referred to as ‘issues’) received during the comment period has been documented and responded to adequately in a Comment and Response Report (CRR) which is included as **Appendix D** in this EIAr. The CRR records the following:

- List of all issues raised;
- Record of who raised the issues;
- Record of where the issues were raised;

- Record of the date on which the issue was raised; and
- Response to the issues.

3.7 SCOPING STUDY FINDINGS

This section provides an overview of the likely significance of construction phase (**Table 3-4**), operational phase (**Table 3-5**) and initial cumulative impacts (**Table 3-6**) presenting the results of the impact screening tool based on two criteria, namely probability and consequence (outlined in Section 4.5). This was used as a guide to determine whether additional assessment may be required in this EIA phase. Impacts have been refined and assessed during this EIA phase.

Table 3-4: Construction Phase Impacts

Aspect	Impact	Nature	Probability	Consequence	Significance (Before Mitigation)	Further Assessment Required
Air Quality	Dust Emissions	Negative	3	1	**Low**	**No**
Noise and Vibrations	Noise Emissions	Negative	3	1	**Low**	**No**
Geology	The displacement of natural earth material and overlying vegetation leading to: Exposure of upper soil layer by removal of vegetation. Increase in stormwater velocity. Soil will be washed downslope, as well as into surrounding drainage channels leading to sedimentation. The erosion of these slopes will be exacerbated during periods of heavy rainfall.	Negative	4	3	**High**	**No**
	Contamination of ground and surface water resources from heavy plant leading to	Negative	4	3	**High**	

Aspect	Impact	Nature	Probability	Consequence	Significance (Before Mitigation)	Further Assessment Required
	quality deterioration of the water resources.					
Soils, Land Capability and Agricultural Potential	Soil erosion	Negative	4	3	**High**	**Yes**
	Soil compaction	Negative	3	3	**Medium**	
	Soil contamination	Negative	3	3	**Medium**	
Surface water	Loss of aquatic species of special concern	Negative	3	3	**Medium**	**Yes**
	Damage or loss of riparian and wetlands systems and disturbance of the waterbodies during construction	Negative	3	3	**Medium**	
	Potential impact on localised surface water quality	Negative	3	3	**Medium**	
	Impact on habitat change and fragmentation related to hydrological regime changes	Negative	3	3	**Medium**	
Groundwater	Ground Contamination	Negative	3	1	**Low**	**No**
Hazardous Substances and Pollutants	Soil, groundwater and surface water contamination	Negative	5	3	**High**	**No**
Waste Generation	Generation of General Waste	Negative	3	2	**Medium**	**No**
	Generation of Hazardous Waste	Negative	3	2	**Medium**	
	Sanitation Waste	Negative	3	2	**Medium**	

Aspect	Impact	Nature	Probability	Consequence	Significance (Before Mitigation)	Further Assessment Required
Terrestrial & Aquatic Biodiversity	Direct Loss of natural habitat and associated flora SCC	Negative	3	4	**High**	**Yes**
	Disturbance of natural habitat and associated flora SCC	Negative	3	2	**Medium**	
	Establishment and spread of AIS	Negative	3	2	**Medium**	
	Injury and mortality of fauna SCC-moles, mole rat	Negative	3	3	**Medium**	
	Injury and mortality of fauna SCC-Badplaas Black Millipede	Negative	3	4	**High**	
	Disturbance and fragmentation of faunal habitat	Negative	3	2	**Medium**	
	Catchment land use changes and activities	Negative	3	2	**Medium**	
Avifauna	Displacement due to disturbance during the Construction Phase	Negative	4	2	**Medium**	**Yes**
	Habitat destruction	Negative	4	2	**Medium**	
Bats	Loss of foraging habitat by clearing of vegetation	Negative	4	3	**High**	**Yes**
	Roost destruction during earthworks	Negative	4	3	**High**	
Visual and Landscape	Potential visual intrusion resulting from large construction	Negative	3	2	**Medium**	**Yes**

Aspect	Impact	Nature	Probability	Consequence	Significance (Before Mitigation)	Further Assessment Required
	vehicles and equipment					
	Potential visual effect of construction laydown areas and material stockpiles.	Negative	3	2	**Medium**	
	Potential impacts of increased dust emissions from construction activities and related traffic	Negative	3	2	**Medium**	
	Potential visual scarring of the landscape as a result of site clearance and earthworks	Negative	3	2	**Medium**	
	Potential visual pollution resulting from littering on the construction site	Negative	3	1	**Low**	
Heritage and Cultural Resources	Disturbance to known Cultural Resources	Negative	3	2	**Medium**	**Yes**
	Chance Find of Cultural Resources	Negative	3	2	**Medium**	
Palaeontology	Chance Find of Palaeontological resources	Negative	3	2	**Medium**	**Yes**
Traffic	Noise, dust & exhaust pollution due to vehicle trips on-site	Negative	4	1	**Medium**	**Yes**
	Noise, dust & exhaust pollution due to additional trips on the national and district roads	Negative	4	1	**Medium**	

Aspect	Impact	Nature	Probability	Consequence	Significance (Before Mitigation)	Further Assessment Required
Socio-Economic	Creation of local employment, training, and business opportunities	Positive	2	3	**Medium**	**Yes**
	Impact of construction workers on local communities	Negative	3	3	**Medium**	
	Influx of job seekers	Negative	3	3	**Medium**	
	Risk to safety, livestock, and farm infrastructure	Negative	3	3	**Medium**	
	Increased risk of grass fires	Negative	3	3	**Medium**	
	Nuisance impacts associated with construction related activities	Negative	3	3	**Medium**	
	Impacts associated with loss of farmland	Negative	3	3	**Medium**	
Climate Change	Greenhouse Gas Emissions	Negative	2	1	**Very Low**	**No**
	Climate Risks & Vulnerabilities	Negative	2	1	**Very Low**	

Table 3-5: Operational Phase Impacts

Aspect	Impact	Nature	Probability	Consequence	Significance (Before Mitigation)	Further Assessment Required
Noise and Vibrations	Acoustic impacts on surrounding sensitive receptors, namely Rec 02, Rec 30 and Rec 49	Negative	4	3	**High**	**Yes**
Geology	Displacement of natural earth material during maintenance	Negative	3	1	**Low**	**No**
	Potential oil spillages from service vehicles and heavy plant.	Negative	3	3	**Medium**	
Soils, Land Capability and Agricultural Potential	Enhanced agricultural potential through increased financial security for farming operations	Positive	3	3	**Medium**	**Yes**
	Prevention of crop spraying by aircraft over land occupied by turbines.	Negative	4	3	**High**	
	Interference with farming operations	Negative	4	3	**High**	
Surface Water	Increased runoff, sedimentation and erosion	Negative	3	3	**Medium**	**Yes**
Waste Generation	Generation of General Waste	Negative	3	2	**Medium**	**Yes**
	Generation of Hazardous Waste	Negative	3	2	**Medium**	

Aspect	Impact	Nature	Probability	Consequence	Significance (Before Mitigation)	Further Assessment Required
	Sanitation Waste	Negative	3	2	**Medium**	
Terrestrial & Aquatic Biodiversity	Proliferation of alien invasive plant species	Negative	3	3	**Medium**	**Yes**
	Catchment land use changes and activities	Negative	3	2	**Medium**	
	Habitat quality reductions due to stormwater runoff, land use changes	Negative	3	2	**Medium**	
	Spread of AIS	Negative	3	2	**Medium**	
	Fragmentation of habitats, barriers to movement	Negative	3	2	**Medium**	
	Injury and mortality of fauna SCC	Negative	3	2	**Medium**	
	Reduced habitat quality and availability for fauna SCC	Negative	2	3	**Medium**	
Avifauna	Displacement due to habitat loss	Negative	2	1	**Very low**	**Yes**
	Disturbance of bird species	Negative	2	1	**Very low**	
	Electrocution on the medium voltage network	Negative	4	3	**Very High**	
	Collisions with the medium voltage network	Negative	4	3	**Very High**	
Bats	Bat mortalities during foraging	Negative	4	3	**High**	**Yes**

Aspect	Impact	Nature	Probability	Consequence	Significance (Before Mitigation)	Further Assessment Required
	Bat mortalities during migration	Negative	4	3	**High**	
	Increased bat mortalities due to light attraction and habitat creation	Negative	4	3	**High**	
Visual	Potential alteration of the visual character of the area;	Negative	4	3	**High**	**Yes**
	Potential visual intrusion resulting from wind turbines dominating the skyline in a largely natural / rural area	Negative	4	3	**High**	
	Potential visual clutter caused by substation and other associated infrastructure on-site	Negative	3	3	**Medium**	
	Potential visual effect on surrounding farmsteads	Negative	4	3	**High**	
	Visual impact of shadow flicker impact, and motion-based visual intrusion	Negative	4	3	**High**	
	Potential alteration of the night time visual environment as a result of operational	Negative	3	3	**Medium**	

Aspect	Impact	Nature	Probability	Consequence	Significance (Before Mitigation)	Further Assessment Required
	and security lighting as well as navigational lighting on top of the wind turbines					
Social	Improve energy security and support the renewable energy sector	Positive	3	3	**Medium**	**Yes**
	Creation of employment and business opportunities	Positive	3	3	**Medium**	
	Generate income for affected landowners	Positive	3	3	**Medium**	
	Benefits associated with the socio-economic development contributions	Positive	3	3	**Medium**	
	Visual impact and impact on sense of place	Negative	4	3	**High**	
Climate Change	Reduced GHG Emissions	Positive	4	3	**High**	**No**
	Contribution of cleaner energy to the National Grid	Positive	4	3	**High**	

Table 3-6: Initial Cumulative Impacts

Receptor	Description	Nature	Probability	Consequence	Significance (Before Mitigation)	Further Assessment Required
Noise and Vibrations	Cumulative Noise Emissions	Negative	4	3	**High**	**Yes**
Soils, Land Capability and Agricultural Potential	Cumulative Agricultural Impacts	Negative	4	3	**High**	**Yes**
Geology	The displacement of natural earth material and overlying vegetation leading to: Exposure of upper soil layer. Increase in stormwater velocity. Soil washed downslope into drainage channels leading to sedimentation. The erosion of these slopes will be exacerbated during periods of heavy rainfall.	Negative	3	3	**Medium**	**No**
	Contamination of ground and surface water resources from heavy plant leading to quality deterioration of the water resources.	Negative	4	3	**High**	
Biodiversity	Cumulative impacts on biodiversity	Negative	4	3	**High**	**Yes**
Avifauna	Cumulative Collision impacts	Negative	4	3	**High**	**Yes**

Receptor	Description	Nature	Probability	Consequence	Significance (Before Mitigation)	Further Assessment Required
	Cumulative Electrocution Impacts	Negative	4	3	High	
Bats	Cumulative Mortalities	Negative	4	3	High	Yes
Visual	Combined visual impacts from mining, industrial, infrastructural and renewable energy development in the broader area could potentially alter the sense of place and visual character of the area	Negative	4	3	High	Yes
	Combined visual impacts from mining, industrial, infrastructural and renewable energy development in the broader area could potentially exacerbate visual impacts on visual receptors	Negative	4	3	High	
Social	Cumulative impact on sense of place	Negative	4	3	High	Yes
	Cumulative impact on local service and accommodation	Positive	3	3	Medium	
	Cumulative impact on local economy	Positive	3	3	Medium	

3.8 SCOPING RECOMMENDATIONS

The scoping report identified and evaluated the feasibility of a range of site options. **Table 3-7** provides a summary of the scoping phase alternatives assessment.

Table 3-7: Alternatives Summary

Alternative Category	Alternative Identified in Scoping	Assessment in EIA Phase (Yes / No)
Project Alternatives	**Alternative 1 - Dalmanutha WEF (up to 300MW)** ▪ Up to 70 turbines, each with a foundation of approximately 25m^2 in diameter (500m^2 area and requiring ~2 500m^3 concrete each) and approximately 3m depth; ▪ Turbine hub height of up to 200m; ▪ Rotor diameter up to 200m ▪ Turbine hub height of up to 200m. ▪ Rotor diameter up to 200m. ▪ IPP portion onsite substation of up to 4ha. The substation will consist of a high voltage substation yard to allow for multiple up to 132kV feeder bays and transformers, control building, telecommunication infrastructure, access road, etc. ▪ The Battery Energy Storage System (BESS) storage capacity will be up to 300MW/1200 megawatt-hour (MWh) with up to four hours of storage. It is proposed that Lithium Battery Technologies, such as Lithium Iron Phosphate, Lithium Nickel Manganese Cobalt oxides or Vanadium Redox flow technologies will be considered as the preferred battery technology; however, the specific technology will only be determined following Engineering, Procurement, and Construction (EPC) procurement. ▪ The main components of the BESS include the batteries, power conversion system and transformer which will all be stored in various rows of containers.	Yes
	Alternative 2 - Dalmanutha Hybrid Facility (up to 300MW) ▪ Up to 44 turbines, each with a foundation of approximately 25m^2 in diameter (500m^2 area and requiring ~2 500m^3 concrete each) and approximately 3m depth. ▪ Turbine hub height of up to 200m; ▪ Rotor diameter up to 200m ▪ Solar PV array comprising PV modules (solar panels), which convert the solar radiation into direct current (DC). ▪ PV panels will be up to a height of 6m (when the panel is horizontal) and will be mounted on fixed tilt, single axis tracking or dual axis	Yes

Alternative Category	Alternative Identified in Scoping	Assessment in EIA Phase (Yes / No)
	tracking mounting structures. Monofacial or bifacial Solar PV Modules are both considered. ▪ Footprint: ~160 ha. ▪ Inverters, transformers and other required associated electrical infrastructure and components. ▪ IPP portion onsite substation of up to 4ha. The substation will consist of a high voltage substation yard to allow for multiple up to 132kV feeder bays and transformers, control building, telecommunication infrastructure, access road, etc. ▪ The Battery Energy Storage System (BESS) storage capacity will be up to 300MW/1200 megawatt-hour (MWh) with up to four hours of storage. It is proposed that Lithium Battery Technologies, such as Lithium Iron Phosphate, Lithium Nickel Manganese Cobalt oxides or Vanadium Redox flow technologies will be considered as the preferred battery technology; however, the specific technology will only be determined following Engineering, Procurement, and Construction (EPC) procurement. ▪ The main components of the BESS include the batteries, power conversion system and transformer which will all be stored in various rows of containers.	

4 EIA METHODOLOGY

4.1 DETAILED ENVIRONMENTAL ASSESSMENT

4.1.1 SPECIALIST STUDIES

All specialist studies were required to consider and assess the full application site/study area as per the coordinates in **Table 6-2** and **Figure 6-4.**

Table 4-1 provides a list of the Specialist Studies that have been undertaken. The Specialist Declarations are included in **Appendix C**

Table 4-1: Details of the Specialists

Specialist Study	Specialist	Company	Appendix
Agriculture	Karen King	WSP Group Africa (Pty) Ltd	**Appendix H.1**
Avifauna	Jon Smallie	Wild Skies Ecological Services (Pty) Ltd	**Appendix H.2**
Bats	Dr Low de Vries	Volant Environmental (Pty) Ltd	**Appendix H.5**
Terrestrial and Aquatic Biodiversity (including Animal and Plant species themes)	Aisling Dower Lufuno Nemakhavhani Andrew Zinn Byron Grant	WSP Group Africa (Pty) Ltd and Ecology International (Pty) Ltd	**Appendix H.3** **Appendix H.4** **Appendix H.15** **Appendix H.16**
Geotechnical	Khuthadzo Bulala	WSP Group Africa (Pty) Ltd	**Appendix H.13**
Surface water (Hydrology)	Eugeshin Naidoo	WSP Group Africa (Pty) Ltd	**Appendix H.14**
Heritage	Jaco van der Walt	Beyond Heritage	**Appendix H.6**
Palaeontology	Prof. Marion Bamford	Beyond Heritage	**Appendix H.7**
Social	Stephen Horak	WSP Group Africa (Pty) Ltd	**Appendix H.8**
Traffic	Christo Bredenhann	WSP Group Africa (Pty) Ltd	**Appendix H.9**
Visual	Lourens du Plessis	LoGIS	**Appendix H.10**
Noise	Kirsten Collett	WSP Group Africa (Pty) Ltd	**Appendix H.11**
Risk	Debra Mitchell	ISHECON cc	**Appendix H.12**

4.1.2 CUMULATIVE ASSESSMENT

The specialist assessments include a detailed cumulative environmental impact statement. The cumulative impact statement is provided in **Section 10**

4.2 IMPACT ASSESSEMNT METHODOLOGY

The EIR uses a methodological framework developed by WSP to meet the combined requirements of international best practice and NEMA, Environmental Impact Assessment Regulations, 2014, as amended (GN No. 326) (the "EIA Regulations").

As required by the EIA Regulations (2014) as amended, the determination and assessment of impacts will be based on the following criteria:

- Nature of the Impact
- Significance of the Impact
- Consequence of the Impact
- Extent of the impact
- Duration of the Impact
- Probability if the impact
- Degree to which the impact:
- can be reversed;
- may cause irreplaceable loss of resources; and
- can be avoided, managed or mitigated.

Following international best practice, additional criteria have been included to determine the significant effects. These include the consideration of the following:

- Magnitude: to what extent environmental resources are going to be affected;
- Sensitivity of the resource or receptor (rated as high, medium and low) by considering the importance of the receiving environment (international, national, regional, district and local), rarity of the receiving environment, benefits or services provided by the environmental resources and perception of the resource or receptor);
- Severity of the impact, measured by the importance of the consequences of change (high, medium, low, negligible) by considering inter alia magnitude, duration, intensity, likelihood, frequency and reversibility of the change.

It should be noted that the definitions given are for guidance only, and not all the definitions will apply to all of the environmental receptors and resources being assessed. Impact significance was assessed with and without mitigation measures in place.

METHODOLOGY

The assessment of impacts and mitigation evaluates the likely extent and significance of the potential impacts on identified receptors and resources against defined assessment criteria, to develop and describe measures that will be taken to avoid, minimise or compensate for any adverse environmental impacts, to enhance positive impacts, and to report the significance of residual impacts that occur following mitigation.

The key objectives of the risk assessment methodology are to identify any additional potential environmental issues and associated impacts likely to arise from the proposed project, and to propose a significance ranking. Issues / aspects will be reviewed and ranked against a series of significance criteria to identify and record interactions between activities and aspects, and resources and receptors to provide a detailed discussion of impacts. The assessment considers direct, indirect, secondary as well as cumulative impacts. A standard risk assessment methodology is used for the ranking of the identified environmental impacts pre-and post-mitigation (i.e., residual impact). The significance of environmental aspects is determined and ranked by considering the criteria presented in **Table 4-2.**

Table 4-2: Impact Assessment Criteria and Scoring System

CRITERIA	SCORE 1	SCORE 2	SCORE 3	SCORE 4	SCORE 5
Impact Magnitude (M) **The degree of alteration of the affected environmental receptor**	Very low: No impact on processes	Low: Slight impact on processes	Medium: Processes continue but in a modified way	High: Processes temporarily cease	Very High: Permanent cessation of processes
Impact Extent (E) The geographical extent of the impact on a given environmental receptor	Site: Site only	Local: Inside activity area	Regional: Outside activity area	National: National scope or level	International: Across borders or boundaries
Impact Reversibility (R) The ability of the environmental receptor to rehabilitate or restore after the activity has caused environmental change	Reversible: Recovery without rehabilitation		Recoverable: Recovery with rehabilitation		Irreversible: Not possible despite action
Impact Duration (D) The length of permanence of the impact on the environmental receptor	Immediate: On impact	Short term: 0-5 years	Medium term: 5-15 years	Long term: Project life	Permanent: Indefinite
Probability of Occurrence (P) The likelihood of an impact occurring in the absence of pertinent environmental management measures or mitigation	Improbable	Low Probability	Probable	Highly Probability	Definite
Significance (S) is determined by combining the above criteria in the following formula:	$[S = (E + D + R + M) \times P]$ $Significance = (Extent + Duration + Reversibility + Magnitude) \times Probability$				
IMPACT SIGNIFICANCE RATING					
Total Score	**4 to 15**	**16 to 30**	**31 to 60**	**61 to 80**	**81 to 100**
Environmental Significance Rating (Negative (-))	**Very low**	**Low**	**Moderate**	**High**	**Very High**
Environmental Significance Rating (Positive (+))	**Very low**	**Low**	**Moderate**	**High**	**Very High**

IMPACT MITIGATION

The impact significance without mitigation measures will be assessed with the design controls in place. Impacts without mitigation measures in place are not representative of the proposed development's actual extent of impact and are included to facilitate understanding of how and why mitigation measures were identified. The residual impact is what remains following the application of mitigation and management measures and is thus the final level of impact associated with the development. Residual impacts also serve as the focus of management and monitoring activities during Project implementation to verify that actual impacts are the same as those predicted in this report.

The mitigation measures chosen are based on the mitigation sequence/hierarchy which allows for consideration of five (5) different levels, which include avoid/prevent, minimise, rehabilitate/restore, offset and no-go in that

order. The idea is that when project impacts are considered, the first option should be to avoid or prevent the impacts from occurring in the first place if possible, however, this is not always feasible. If this is not attainable, the impacts can be allowed, however they must be minimised as far as possible by considering reducing the footprint of the development for example so that little damage is encountered. If impacts are unavoidable, the next goal is to rehabilitate or restore the areas impacted back to their original form after project completion. Offsets are then considered if all the other measures described above fail to remedy high/significant residual negative impacts. If no offsets can be achieved on a potential impact, which results in full destruction of any ecosystem for example, the no-go option is considered so that another activity or location is considered in place of the original plan. The mitigation sequence/hierarchy is shown in **Figure 4-1** below.

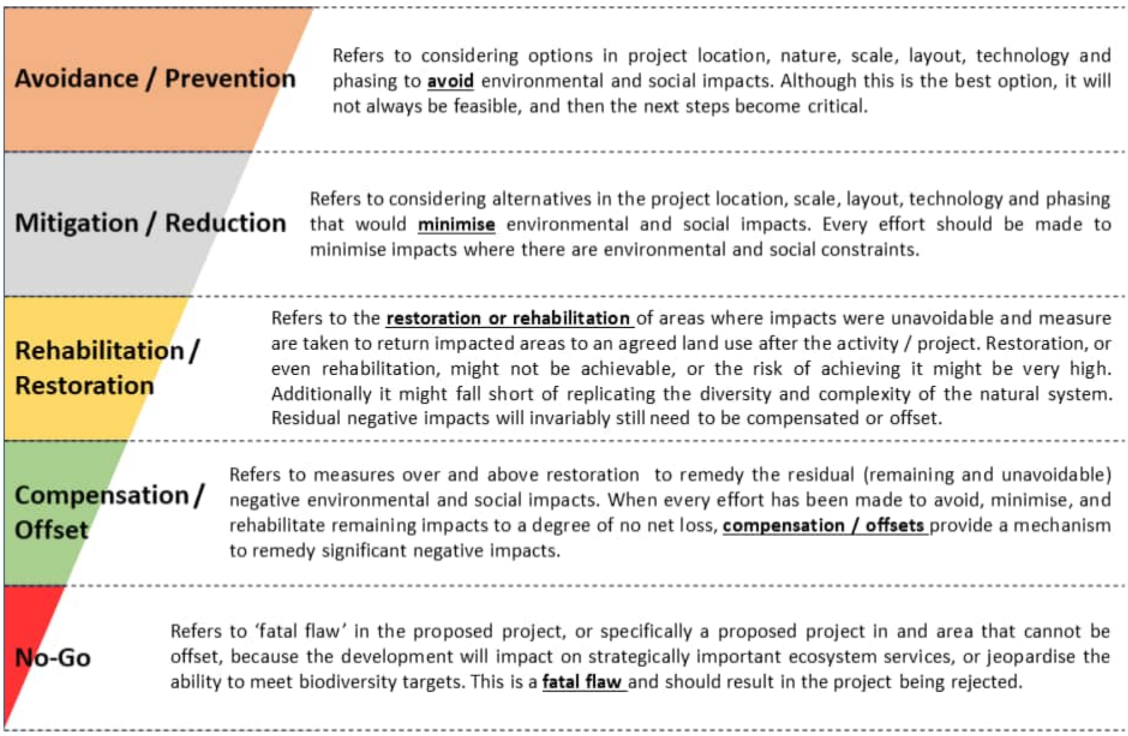


Figure 4-1: Mitigation hierarchy

4.3 STAKEHOLDER ENGAGEMENT

Stakeholder engagement (public participation) is a requirement of the S&EIA process. It consists of a series of inclusive and culturally appropriate interactions aimed at providing stakeholders with opportunities to express their views, so that these can be considered and incorporated into the S&EIA decision-making process. Effective engagement requires the prior disclosure of relevant and adequate project information to enable stakeholders to understand the risks, impacts, and opportunities of the proposed project. The objectives of the stakeholder engagement process can be summarised as follows:

- Identify relevant individuals, organisations and communities who may be interested in or affected by the proposed project;
- Clearly outline the scope of the proposed project, including the scale and nature of the existing and proposed activities;
- Identify viable proposed project alternatives that will assist the relevant authorities in making an informed decision;
- Identify shortcomings and gaps in existing information;
- Identify key concerns, raised by Stakeholders that should be addressed in the specialist studies;
- Highlight the potential for environmental impacts, whether positive or negative; and
- To inform and provide the public with information and an understanding of the proposed project, issues, and solutions.

It is important to note that since the proposed individual projects associated with the Dalmanutha Renewable Energy Complex, subject to a S&EIA Process, are located within the same geographical area, an integrated stakeholder engagement process (public participation) will be undertaken for these projects.

A Stakeholder Engagement Report (SER) has been compiled and included in the dEIAr detailing the projects' compliance with Chapter 6 of the NEMA EIA Regulations 2014, as amended.

4.3.1 STAKEHOLDER AND AUTHORITY CONSULTATION

There will continue to be ongoing communication between WSP and stakeholders throughout the S&EIR process. These interactions include the following:

- Interactions with stakeholders will be recorded in the comment and response report;
- Feedback to stakeholders will take place both individually and collectively;
- Written responses (email, faxes or letters) will be provided to stakeholders acknowledging issues and providing information requested (dependent on availability) and
- A letter will sent out to all registered stakeholders notifying them of the outcome of the environmental authorisation process

As per the GNR 982, particular attention will be paid to landowners, and neighbouring communities, specifically where literacy levels and language barriers may be an issue.

4.3.2 PUBLIC REVIEW

This draft EIAr will be placed on public review for a period of 30 days from **31 May 2023 to 03 July 2023** at the following public places:

- Emakhazeni Local Municipality, Belfast Office
- Emakhazeni Public Library

- Carolina Public Library
- WSP website (https://www.wsp.com/en-ZA/services/public-documents).
- Data free website (https://wsp-engage.com/)

All registered stakeholders and authorising/commenting state departments will be notified of the public review period as well as the locations of the draft EIR via email and SMS.

4.3.3 COMMENT AND RESPONSE REPORT

All concerns, comments, viewpoints, and questions (collectively referred to as ‘issues’) received during the comment period has been documented and responded to adequately in a Comment and Response Report (CRR) which is included as **Appendix D** to this EIAr. Where comments are project specific, this will be noted in the Comments and Response Report (CRR). The CRR records the following:

- List of all issues raised;
- Record of who raised the issues;
- Record of where the issues were raised;
- Record of the date on which the issue was raised; and
- Response to the issues.

4.3.4 REQUEST FOR EXTENTION

The EAP submitted a letter of motivation to the DFFE on the **5 April 2023**, for a request for 30 days extension to the EIA deadline. The DFFE denied this request on the grounds that it was not exceptional circumstances. Their response letter was sent to the EAP on **24 April 2023** (dated **17 April 2023).**

4.3.5 SUBMISSION AND DECISION MAKING

The EAP must submit the final EIR to the competent authority within 106 days of the acceptance of the scoping report. A request for extension to the submission deadline of the FEIR was submitted to the DFFE in terms of EIA Regulation 3(7). The final EIR is due to the DFFE by latest **13 July 2023.** Once submitted, the delegated competent authority (i.e. the DFFE) will be allocated 107 days to review the final EIR in order to either grant or refuse and environmental authorisation.

The final EIR will be placed on stakeholder review for a reasonable time period during the DFFE’s final review and decision-making process. All comments on the Final EIR should be submitted directly to DFFE. The delegated competent authority must issue their decision within this specified timeframe. It must be noted that the final reports will not be open to further comment and the commenting period as regulated will have closed by then, but that comments can be forwarded to the case relevant officer.

4.3.6 NOTIFICATION OF ENVIRONMENTAL AUTHORISATION

All stakeholders will receive a letter at the end of the process notifying them of the authority’s decision, thanking them for their contributions, and explaining the appeals procedure as outlined in the national Appeal Regulations, 2014 (GNR 993 of 2014).

4.4 DFFE WEB-BASED ENVIRONMENTAL SCREENING TOOL

DFFE has developed the National Web-based Environmental Screening Tool in order to flag areas of potential environmental sensitivity related to a site as well as a development footprint and produces the screening report required in terms of regulation 16 (1)(v) of the EIA Regulations (2014, as amended). The Notice of the requirement to submit a report generated by the national web-based environmental screening tool in terms of section 24(5)(h) of the NEMA, 1998 (Act No 107 of 1998) and regulation 16(1)(b)(v) of the EIA regulations, 2014, as amended (GN 960 of July 2019) states that the submission of a report generated from the national web-based environmental screening tool, as contemplated in Regulation 16(1)(b)(v) of the EIA Regulations, 2014, published under Government Notice No. R982 in Government Gazette No. 38282 of 4 December 2014, as amended, is compulsory when submitting an application for environmental authorisation in terms of regulation 19 and regulation 21 of the EIA Regulations, 2014 as of 04 October 2019.

The Screening Report generated by the National Web-based Environmental Screening Tool contains a summary of any development incentives, restrictions, exclusions or prohibitions that apply to the proposed development footprint as well as the most environmentally sensitive features on the footprint based on the footprint sensitivity screening results for the application classification that was selected.

Screening reports for the proposed Dalmanutha WEF were generated on **24 November 2022** and on **21 April 2023** for the Dalmanutha Hybrid Facility, attached **Appendix K**. The Screening Report for the project identified various sensitivities for the site. The report also generated a list of specialist assessments that should form part of the S&EIA based on the development type and the environmental sensitivity of the site. Assessment Protocols in the report provide minimum information to be included in a specialist report to facilitate decision-making.

Table 4-3 and **Table 4-4** below provides a summary of the sensitivities identified for the development footprint.

Table 4-3: Sensitivities identified in the screening report for the Dalmanutha WEF

Theme	Very High Sensitivity	High Sensitivity	Medium Sensitivity	Low Sensitivity
Agricultural Theme	✓			
Animal Species Theme		✓		
Aquatic Biodiversity Theme	✓			
Archaeological and Cultural Heritage Theme	✓			
Avian (Wind) Theme				✓
Bats (Wind) Theme		✓		
Civil Aviation (Wind) Theme		✓		
Defence (Wind) Theme	✓			✓
Flicker Theme	✓			

Theme	Very High Sensitivity	High Sensitivity	Medium Sensitivity	Low Sensitivity
Landscape (Wind) Theme	✓			
Palaeontology Theme	✓			
Noise Theme	✓			
Plant Species Theme			✓	
RFI (Wind) Theme		✓		
Terrestrial Biodiversity Theme	✓			

Table 4-4: Sensitivities identified in the screening report for the Dalmanutha Hybrid Facility

Theme	Very High Sensitivity	High Sensitivity	Medium Sensitivity	Low Sensitivity
Agricultural Theme		✓		
Animal Species Theme		✓		
Aquatic Biodiversity Theme	✓			
Archaeological and Cultural Heritage Theme				✓
Avian Theme				✓
Civil Aviation Theme (Solar PV)				✓
Defence Theme				✓
Landscape (Solar) Theme	✓			
Palaeontology Theme	✓			
Plant Species Theme			✓	
RFI Theme				✓
Terrestrial Biodiversity Theme	✓			

Based on the selected classification, and the environmental sensitivities of the proposed development footprint, the following list of specialist assessments have been identified for inclusion in the assessment report as determined by the screening tool (please refer to Section 4.4.1 below for the EAP motivation applicable to this list):

- Agricultural Impact Assessment
- Archaeological and Cultural Heritage Impact Assessment
- Palaeontology Impact Assessment

- Landscape/Visual Impact Assessment
- Terrestrial Biodiversity Impact Assessment
- Aquatic Biodiversity Impact Assessment
- Avifauna Impact Assessment
- Social Impact Assessment
- A Geotechnical Assessment
- Plant Species Assessment
- Animal Species Assessment
- Civil aviation Assessment
- Noise Assessment
- RFI Assessment
- Defence Assessment
- Flicker assessment
- Traffic assessment

4.4.1 MOTIVATION FOR SPECIALIST STUDIES

The report recognises that "it is the responsibility of the EAP to confirm this list and to motivate in the assessment report, the reason for not including any of the identified specialist study including the provision of photographic evidence of the footprint situation." The specialist studies required for the proposed Dalmanutha WEF, as identified by the DFFE Screening Tool are included in **Table 4-5**. The table also identifies the specialist studies commissioned and provides motivation for specialist studies not commissioned.

Table 4-5 – Specialists Studies identified by the DFFE Screening Tool

Specialist Study Identified	Specialist Study Commissioned	Motivation
Agricultural Impact Assessment	Yes	N/A
Archaeological and Cultural Heritage Impact Assessment	Yes	N/A
Palaeontology Impact Assessment	Yes	N/A
Landscape/Visual Impact Assessment	Yes	N/A
Terrestrial Biodiversity Impact Assessment	Yes	N/A
Freshwater Impact Assessment	Yes	An aquatic biodiversity assessment has been undertaken for both wetlands and rivers on the study area.
Avifauna Impact Assessment	Yes	N/A

Specialist Study Identified	Specialist Study Commissioned	Motivation
Socio-Economic Assessment	Yes	N/A
Geotechnical Assessment	Yes	A desktop Geotechnical Assessment has been commissioned. However, a detailed Geotechnical Assessment will not be undertaken as part of the S&EIA Process as this will be undertaken during the detailed design phase.
Plant Species Assessment	Yes	N/A
Animal Species Assessment	Yes	N/A
Civil Aviation Assessment	No	According to the DFFE Screening Tool Report, civil aviation is regarded as having high sensitivity. The proposed development site is located between 8 and 15 km of civil aviation aerodromes. The required Civil Aviation Compliance Statement will be included as part of the EIA Phase. The relevant Authorities have been included on the project stakeholder database. As of the 1st of May 2021, Air Traffic and Navigation Services (ATNS) has been appointed as the new Obstacle application Service Provider for Windfarms and later Solar Plants. Their responsibility would pertain to the assessments, maintenance, and all other related matters in respect to Windfarms and in due time Power Plant assessments. An Application for the Approval of Obstacles has been submitted to ATNS. The South African Civil Aviation Authority (SACAA) will be included on the project stakeholder database. They will be informed of the proposed Project, and comment will be sought from these authorities as applicable
Noise assessment	Yes	N/A
RFI Assessment	No	A Radio Frequency Interference (RFI) Study will not be undertaken. The proposed development area is not located within any Astronomy Advantage Area. Square Kilometre Array (SKA) South Africa as well as the South African Radio Astronomy Observatory (SARAO) will be engaged with as part of the Public Participation Process.
Flicker Assessment	Yes	This study forms part of the visual impact assessment
Traffic Assessment	Yes	N/A
Defence	No	The defence theme was identified as low sensitivity.

The following specialist studies have been commissioned in addition to those above:

- Bat Assessment; and
- Qualitative Risk Assessment.

5 NEED AND DESIRABILITY

South Africa is faced with significant increases in electricity demand and a shortage in electricity supply. South Africa is the seventh coal producer in the world, with approximately 77% of the country's electricity generated from coal. This large dependence on coal and its use has also resulted in a variety of negative impacts on the environment, including the contribution to climate change. South Africa is also the highest emitter of greenhouse gases in Africa; attributed to the country's energy-intensive economy that largely relies on coal-based electricity generation.

Renewable energy development is regarded as an important contribution to meeting international and national targets of reducing reliance on fossil fuels, such as coal, which contribute towards greenhouse gas emissions and resultant climate change. The need and desirability of the proposed Dalmanutha WEF has been considered from an international, national, and regional perspective.

5.1.1 INTERNATIONAL PERSPECTIVE

The proposed project will align with internationally recognised and adopted agreements, protocols, and conventions. This includes the Kyoto Protocol (1997) which calls for countries internationally to reduce their greenhouse gas emissions through cutting down on their reliance on fossil fuels and investing in renewable energy technologies for electricity generation. The proposed Dalmanutha WEF will therefore add capacity to the energy sector and generate electricity without greenhouse gas emissions and meet international requirements in this regard.

South Africa is also signatory to the United Nations' Development Programmes' (UNDP) Sustainable Development Goals (SDGs), particularly SGD 7 relating access to affordable, reliable and sustainable energy which is crucial to achieving many of the Sustainable Development Goals, therefore SDG 7 among the other goals specifically aligns with this project. The proposed WEF qualifies as a clean technology that will generate up to 300MW of affordable energy to contribute to South Africa's energy mix.

The project will also greatly contribute to the countries' efforts to reduce their carbon emissions and play their role as part of the Paris Climate Accord. The Paris Agreement is a legally binding international treaty signed by 196 countries at the COP 21 in Paris, on the 12$^{th\ of}$ December 2015 to combat climate change. The goal of the Paris Accord is to limit global warming to well below 2 degrees Celsius, compared to industrial levels to avoid catastrophic natural disasters which are driven by the global temperature increase. Therefore, to achieve this long-term temperature goal, countries aim to reach global peaking of greenhouse gas emissions as soon as possible to achieve a climate-neutral world by 2050. This project will aid in the efforts towards a just energy transition in accordance to recently signed Political Declaration between SA, USA, UK, EU, Ireland etc.

The authorization of the Project will further align with South Africa's National Climate Response White Paper which outlines the countries efforts to manage the impacts of climate change and to contribute to the global efforts to stabilize the Greenhouse gases concentrations in the atmosphere.

5.1.2 NATIONAL PERSPECTIVE

The South African Government, through the IRP, has set a target to secure 17 800 MW of renewable energy by 2030. This is an effort to diversify the country's energy mix in response to the growing electricity demand and promote access to clean sources of energy.

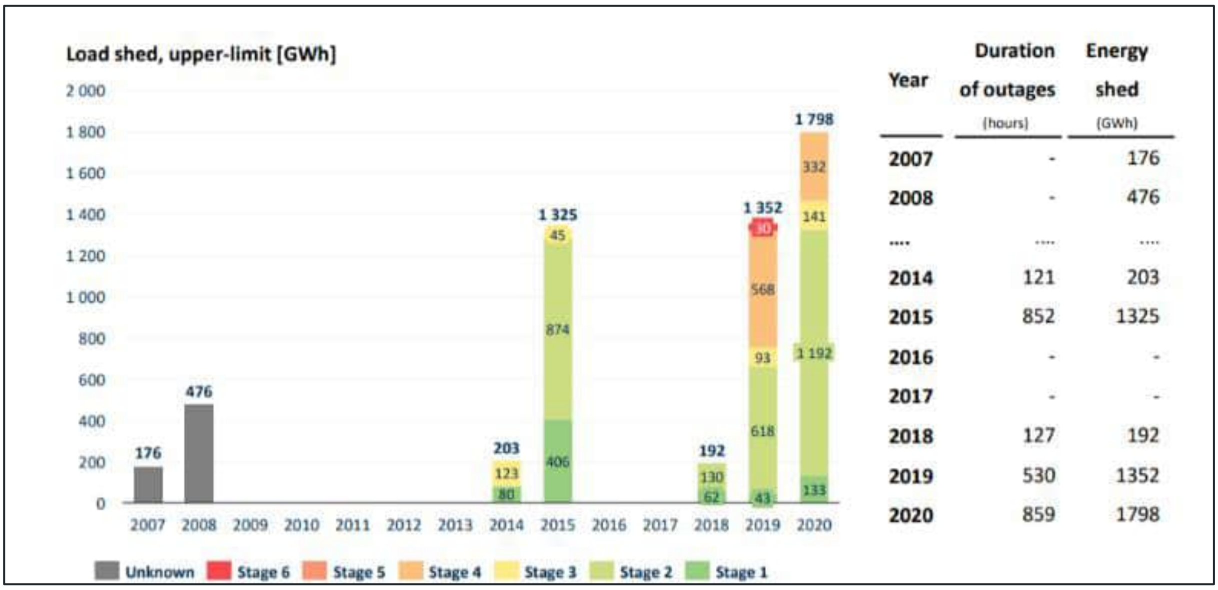
The National Development Plan (NDP) is aimed at reducing and eliminating poverty in South Africa by 2030. The NDP also outlines the need to increase electricity production by 2030, with 20 000 MW of electricity capacity generated from renewable sources to move to less carbon-intensive electricity production. The Plan also envisages that South Africa will have an energy sector that provides reliable and efficient energy service at competitive rates, while supporting economic growth through job creation.

The authorisation of the Dalmanutha WEF will further align with South Africa's National Climate Response White Paper which outlines the country's efforts to manage the impacts of climate change and to contribute to the global efforts to stabilize the greenhouse gases concentrations in the atmosphere.

The proposed Dalmanutha Wind Energy Complex, which includes the Dalmanutha WEF, will pave the way for the Just Energy Transition (JET)[2] in South Africa and promote the transition from a fossil fuel-based economy to a low carbon economy. The proposed Dalmanutha WEF aims towards the aforementioned national energy targets of diversification of energy supply and the promotion of clean energy. Wind and solar energy developments contribute to reduced emissions and subsequently climate change whilst promoting industrial development and job creation.

The proposed Dalmanutha WEF will also aid in overcoming the power shortages that are currently faced in the country. In 2020, South Africa witnessed its longest recorded hours of load shedding, with the power being off for 859 hours of the year as shown in **Figure 5-1**. The South African Government has taken strides to try reducing these power cuts through the implementation of bid Windows in REIPPP and lifting the independent power generation threshold to 100MW, but it is still expected that the country will undergo more load shedding. Over the years the construction of Wind facilities has become cheaper, and less time-consuming. Thus, acting as a faster and more efficient method of meeting the ever-growing demand for electricity in the country.

[2] The Just Transition is described as the transition towards a low-carbon and climate-resilient economy that maximizes the benefits of climate action while simultaneously improving the welfare of the workers and their communities.



Year	Duration of outages (hours)	Energy shed (GWh)
2007	-	176
2008	-	476
....	....	....
2014	121	203
2015	852	1325
2016	-	-
2017	-	-
2018	127	192
2019	530	1352
2020	859	1798

Figure 5-1: Load shedding hours over the years in South Africa

In addition, the Council for Scientific and Industrial Research (CSIR) reported that renewable energy assisted in relieving pressure on the constrained South African power system during load shedding in the first quarter of 2019. This indicates that renewable energy is a key factor in ensuring that the country does not face further load shedding in the future.

5.1.3 REGIONAL AND LOCAL PERSPECTIVE

Just Energy Transition

The Just Transition is described as the transition towards a low-carbon and climate-resilient economy that maximizes the benefits of climate action while simultaneously improving the welfare of the workers and their communities.

The project will pave the way for the Just Energy Transition in South Africa and promote the transition from a fossil fuel-based economy to a low carbon economy. South Africa is the seventh-largest coal consumer in the world and the leading African carbon emitter, with 471.6 million metric tons of carbon emitted in 2019. South Africa heavily relies on coal to fire up 30 000 MW of electricity, which serves an estimated 80% of the country's energy needs.

Coal power stations and the coal mining industry play a vital component in the economic and social components of the local Mpumalanga economy. Shifting to a low carbon economy will thus need to offset or exceed the benefits being realized by fossil fuels in the province. Thus, a key factor to ensuring the success of the Just Energy Transition is not only to focus on the transition from fossil fuels to renewable energy resources but to simultaneously ensure the Just Transition of jobs and skills.

The transition towards renewable energy will improve the socio-economic conditions of the Emakhazeni Local Municipality. The Emakhazeni Local Municipality recorded an unemployment rate of 26.9% in 2017, with the majority of its employed in the mining and transport sectors. The Project will aid in solving two of the leading challenges faced by most municipalities in the country, namely the cost of electricity and lack of adequate employment opportunities. The Project will be one of the first large-scale wind energy facilities being developed in Mpumalanga. The developer foresees this project as being one of main the catalysts to realizing a true Just Energy Transition for Mpumalanga. As various career opportunities are presented by the wind industry, these are divided into four pillars that are aligned with the value chain. These four pillars are project development, component manufacturing, construction, and operation and maintenance as shown in **Figure 5-2.**

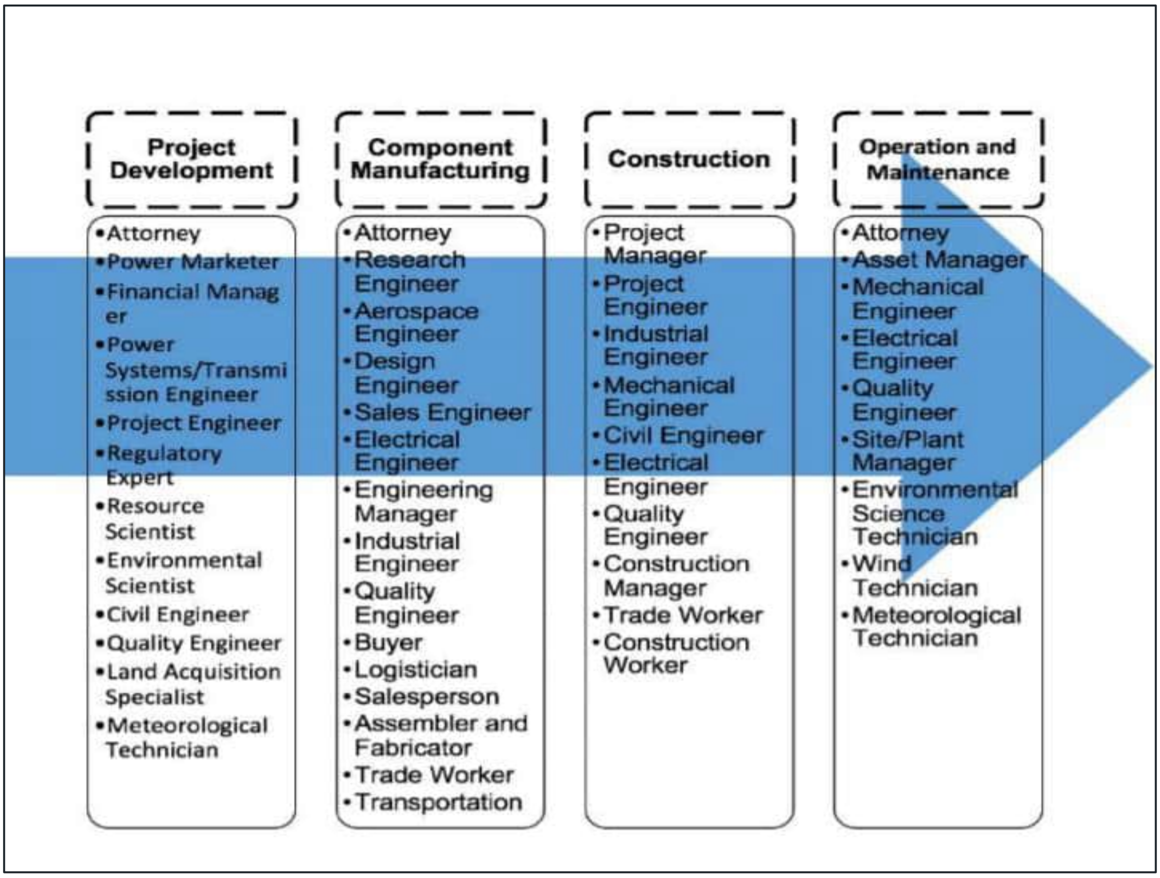


Figure 5-2: Career Opportunities presented by the Wind Industry (Source: https://www.res4africa.org/wp-content/uploads/2020/09/RES4Africa-Foundation-A-Just-Energy-Transition-in-South-Africa.pdf)

Figure 5-2 shows that the wind industry will create job opportunities throughout the supply chain. The wind industry will contribute to the Just transition in South Africa to ensure that there are no job losses but rather job transfers and skill exchange. For these opportunities to arise, renewable energy projects need to be approved in Mpumalanga to ensure that the transition from fossil fuels to renewable energy happens gradually and takes off effectively.

Multiple Land Use

Unlike opencast coal mining, the Project facilitates multiple land use functions within the development area. As wind turbines are spread out across the development area this allows multiple land use functions such as operating the wind farm in tandem with agricultural activities or even underground coal mining. This will boost the economic activities in the area which will in turn increase job opportunities in that area and help improve the local community's welfare without jeopardizing the environment. Furthermore, the multiple land use allows for the creation of multiple streams of income which assures landowners economic security.

Desirability of the Project Site

As mentioned previously, four of Eskom's coal-fired power stations have been targeted for decommissioning in the short term: Komati, Camden, Grootvlei, and Hendrina. Eskom is looking to decommission 5 400MW of electricity from coal generation by the year 2022, increasing to 10 500MW by 2030 and 35 000MW by 2050. Simultaneously Eskom has been looking at options for repurposing these power stations with the core aims of reusing existing power transmission infrastructure, developing new generation capacity, providing ancillary services, and mitigating socio-economic impact. The proposed Dalmanutha Renewable Energy Complex, inclusive of the Dalmanutha WEF, is ideally located to help Eskom achieve its diversification goal.

6 PROJECT DESCRIPTION

6.1 SITE LOCATION

The proposed Dalmanutha WEF will have a project area of approximately 9 179 hectares (ha). Within this project area the extent of the buildable area will be approximately 400 ha subject to finalization based on technical and environmental requirements. Two alternatives are proposed for the Dalmanutha WEF: Alternative 1 - a full wind energy facility, with a capacity of up to 300MW, comprising up to 70 wind turbines; and Alternative 2 - a hybrid facility, with a capacity of up to 300MW, comprising 44 turbines and two solar fields

The proposed Dalmanutha WEF and Hybrid facility is located south-east of Belfast in Mpumalanga and falls within the jurisdiction of the Emakhazeni and Albert Luthuli Local Municipalities, Nkangala and Gert Sibande District municipalities. The Dalmanutha WEF and Dalmanutha West WEF are located adjacent each other and as such, the overall locality of the Dalmanutha Wind Energy Complex is included in **Figure 6-1.** The Dalmanutha WEF and Hybrid facility (project under consideration for this EIAr) project site, including associated alternatives, is indicated in **Figure 6-2** and **Figure 6-3** respectively.

The details of the properties associated with the proposed Dalmanutha WEF and Hybrid facility, including the 21-digit Surveyor General (SG) codes for the cadastral land parcels are outlined in **Table 6-1.** The co-ordinates of the application site are included in **Table 6-2** and illustrated in **Figure 6-4**.

Table 6-1 - Dalmanutha WEF Affected Farm Portions

Farm portion and name	21 Digit Surveyor General Code of Each Cadastral Land Parcel
Portion 1 of Farm Berg-en-Dal 378 JT	T0JT00000000037800001
Portion 9 of Farm Berg-en-Dal 378 JT	T0JT00000000037800009
Portion 7 of Farm Vogelstruispoort 384 JT	T0JT00000000038400007
Portion 6 of Farm Waaikraal 385 JT	T0JT00000000038500006
Portion 7 of Farm Waaikraal 385 JT	T0JT00000000038500007
Portion 8 of Farm Waaikraal 385 JT	T0JT00000000038500008
Portion 10 of Farm Waaikraal 385 JT	T0JT00000000038500010
Portion 12 of Farm Waaikraal 385 JT	T0JT00000000038500012
Portion 13 of Farm Waaikraal 385 JT	T0JT00000000038500013
Poriton 5 of Farm Vogelstruispoort 384 JT	T0JT00000000038400005
Portion 24 of Farm Waaikraal 385 JT	T0JT00000000038500024
Portion 3 of Farm Leeuwkloof 403 JT	T0JT00000000040300003

Farm portion and name	21 Digit Surveyor General Code of Each Cadastral Land Parcel
Portion 4 of Farm Leeuwkloof 403 JT	T0JT00000000040300004
Portion 1 of Farm Leeuwkloof 404 JT	T0JT00000000040400001
Portion 2 of Farm Leeuwkloof 404 JT	T0JT00000000040400002
Portion 3 of Farm Geluk 405 JT	T0JT00000000040500003
Portion 1 of Farm Welgevonden 412	T0JT00000000041200001
Portion 0 of Farm Camelia 467 JT	T0JT00000000046700000

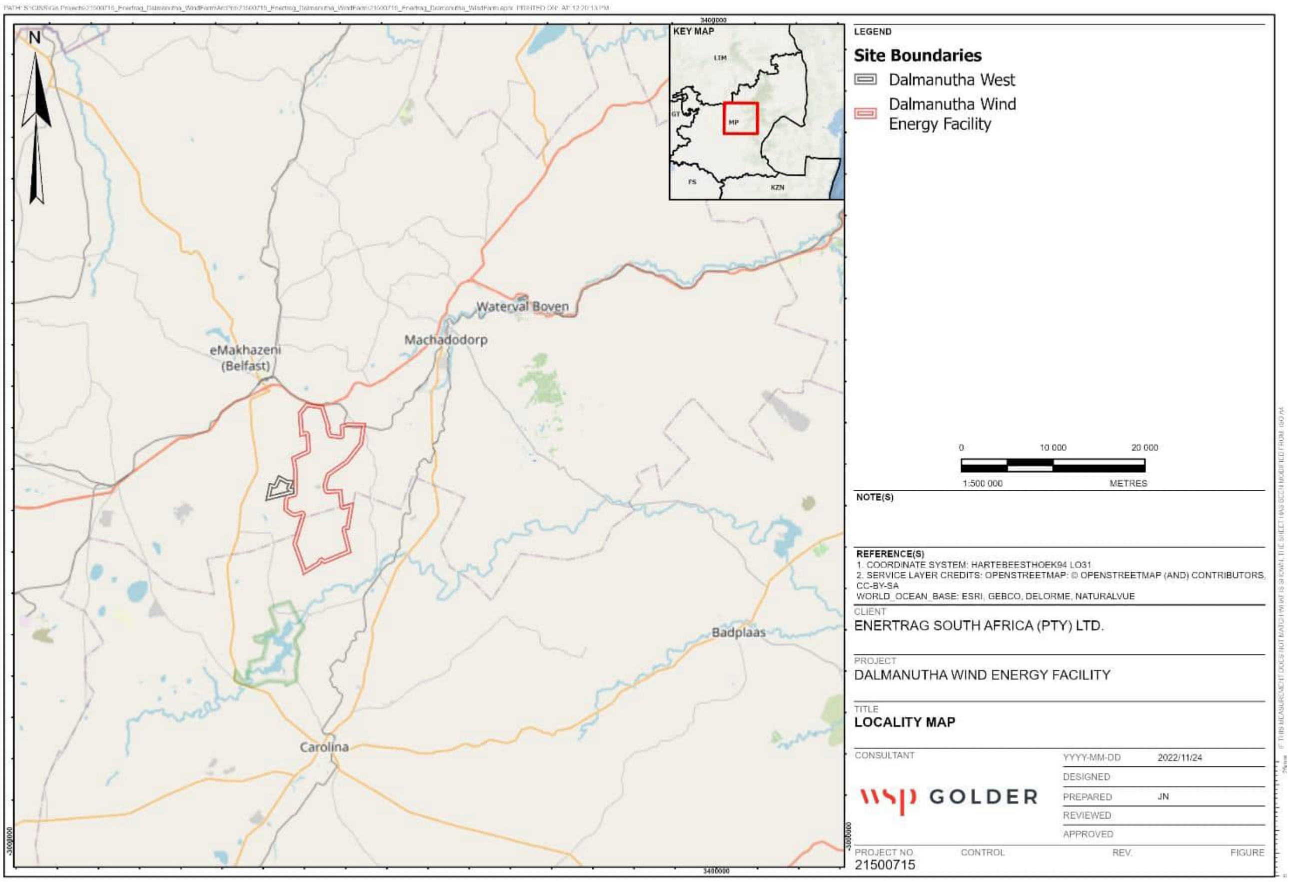


Figure 6-1 - Locality map for the proposed Dalmanutha Wind Energy Complex, near Belfast in the Mpumalanga Province

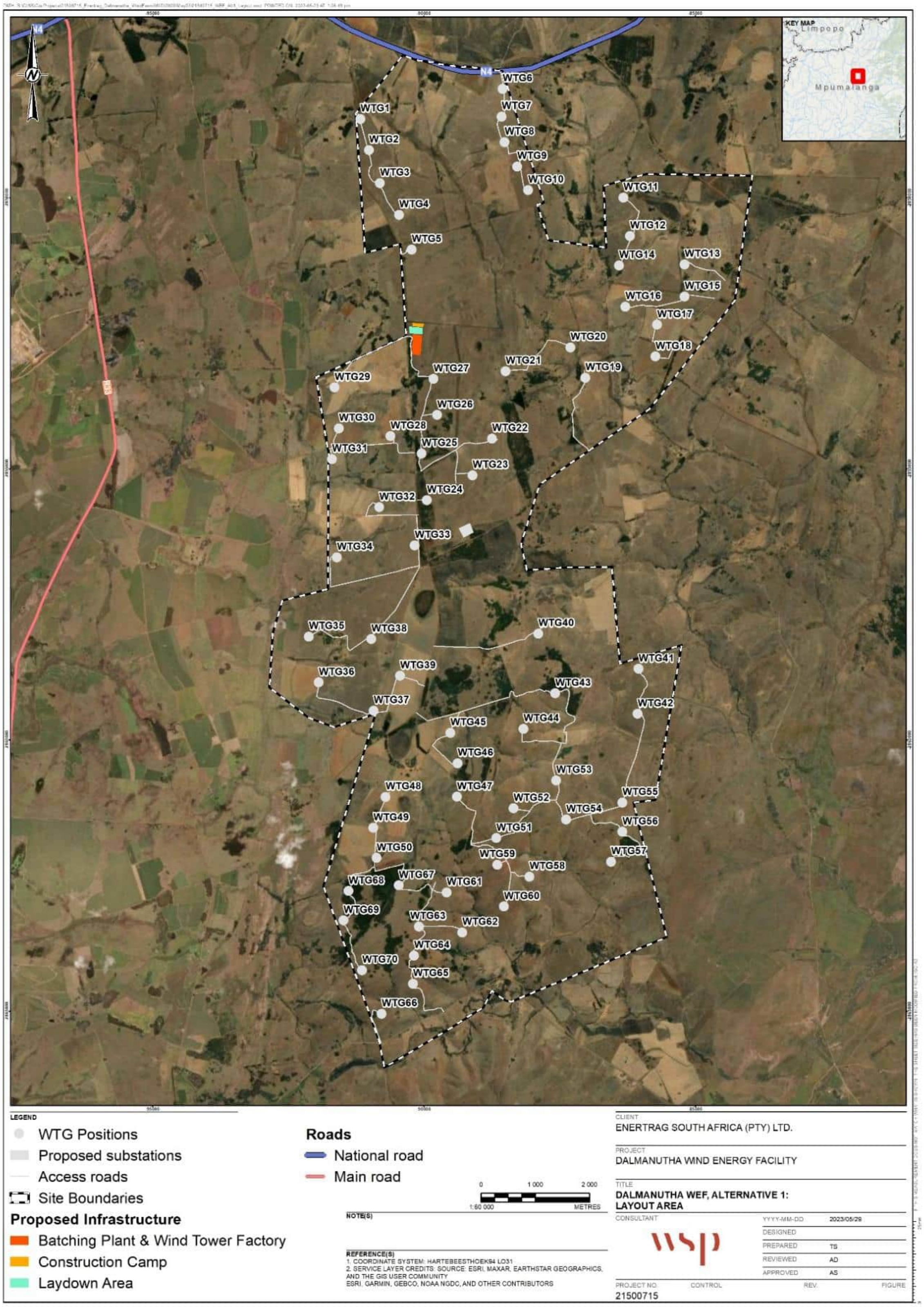


Figure 6-2 - Proposed Dalmanutha WEF (up to 300MW) 70 turbine layout (Alternative 1)

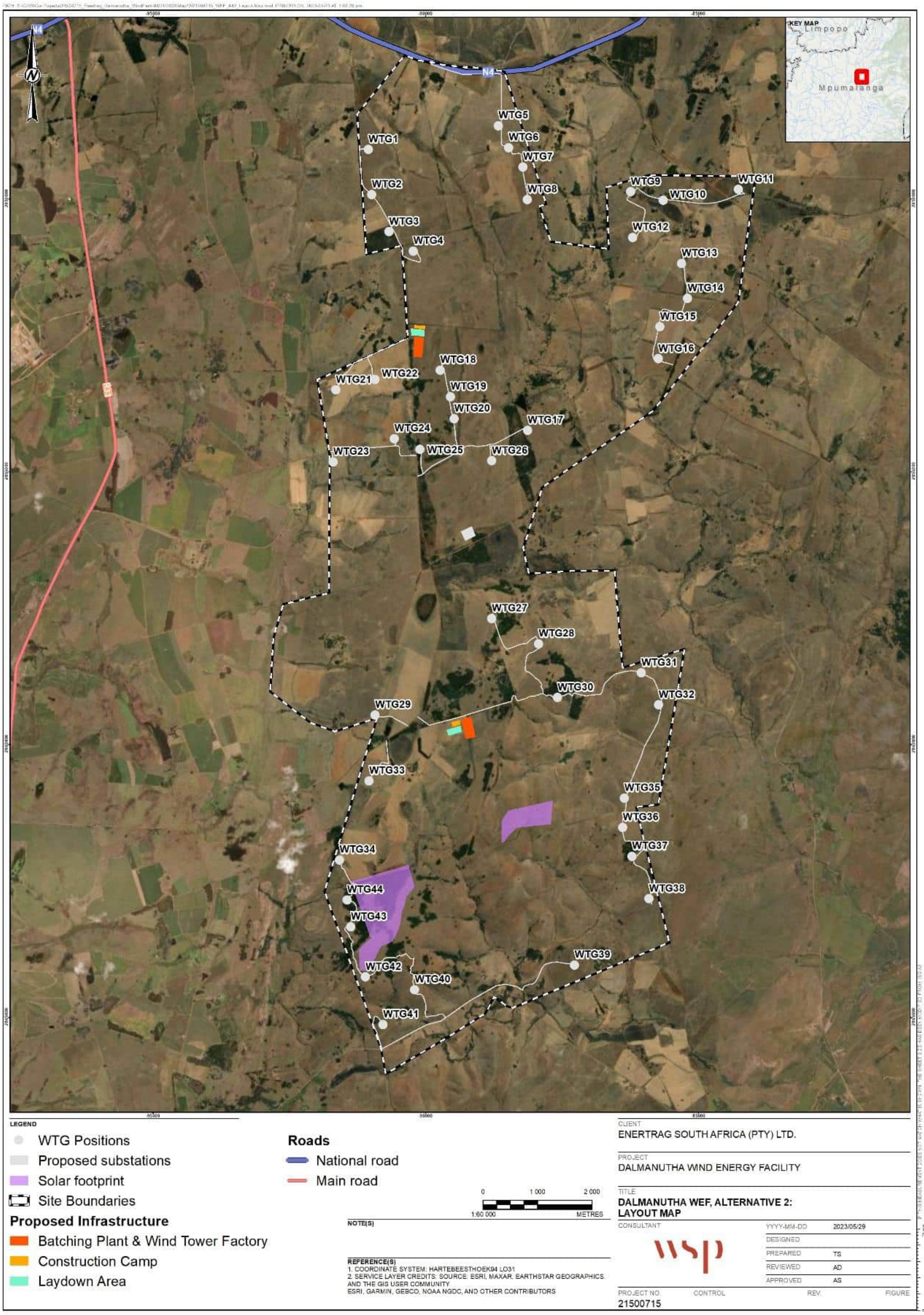


Figure 6-3 - Proposed Dalmanutha Hybrid facility (up to 300MW) 44 turbine layout and Solar PV facility (Alternative 2)

Table 6-2 - Co-ordinates of the application site

Vertex	X_Co-ordinate	Y_Co-ordinate
1	25°43'54.12"S	30° 5'55.66"E
2	25°43'57.22"S	30° 6'20.95"E
3	25°43'57.81"S	30° 6'20.86"E
4	25°43'59.86"S	30° 6'37.95"E
5	25°43'59.30"S	30° 6'38.10"E
6	25°44'2.41"S	30° 7'3.05"E
7	25°45'21.42"S	30° 7'29.79"E
8	25°45'22.62"S	30° 7'25.45"E
9	25°45'43.80"S	30° 7'32.58"E
10	25°45'48.28"S	30° 8'10.72"E
11	25°45'11.42"S	30° 8'9.34"E
12	25°45'4.36"S	30° 8'37.63"E
13	25°45'5.91"S	30° 9'47.70"E
14	25°46'20.77"S	30° 9'35.58"E
15	25°47'25.26"S	30° 8'38.98"E
16	25°48'10.27"S	30° 7'25.58"E
17	25°48'45.95"S	30° 7'13.05"E
18	25°49'2.15"S	30° 7'17.02"E
19	25°49'0.79"S	30° 7'44.58"E
20	25°49'0.15"S	30° 8'13.15"E
21	25°49'58.08"S	30° 8'18.01"E
22	25°49'47.55"S	30° 8'59.06"E
23	25°51'19.72"S	30° 8'40.86"E
24	25°51'21.20"S	30° 8'26.42"E
25	25°52'41.96"S	30° 8'47.84"E
26	25°53'20.35"S	30° 7'4.42"E

Vertex	X_Co-ordinate	Y_Co-ordinate
27	25°53'14.51"S	30° 6'52.29"E
28	25°53'23.79"S	30° 6'45.87"E
29	25°53'59.19"S	30° 5'40.38"E
30	25°53'43.58"S	30° 5'37.07"E
31	25°52'9.95"S	30° 5'0.86"E
32	25°50'27.19"S	30° 5'36.02"E
33	25°50'34.72"S	30° 5'8.47"E
34	25°50'29.04"S	30° 4'51.84"E
35	25°50'10.84"S	30° 4'25.99"E
36	25°49'38.37"S	30° 4'28.47"E
37	25°49'18.75"S	30° 4'34.79"E
38	25°49'11.85"S	30° 5'5.10"E
39	25°47'50.37"S	30° 5'6.15"E
40	25°47'5.08"S	30° 4'58.22"E
41	25°46'40.61"S	30° 5'58.12"E
42	25°45'45.56"S	30° 5'54.67"E
43	25°45'50.72"S	30° 5'30.95"E
44	25°44'28.78"S	30° 5'25.22"E

Label	Longitude	Latitude	Label	Longitude	Latitude
1	30° 5' 57.292" E	25° 43' 52.330" S	23	30° 8' 26.430" E	25° 51' 21.134" S
2	30° 5' 25.720" E	25° 44' 27.078" S	24	30° 8' 40.884" E	25° 51' 19.679" S
3	30° 5' 31.087" E	25° 45' 51.712" S	25	30° 8' 58.945" E	25° 49' 46.945" S
4	30° 5' 54.736" E	25° 45' 45.538" S	26	30° 8' 18.020" E	25° 49' 57.814" S
5	30° 5' 58.032" E	25° 46' 40.707" S	27	30° 8' 13.138" E	25° 49' 0.036" S
6	30° 4' 58.471" E	25° 47' 6.195" S	28	30° 7' 16.838" E	25° 49' 1.504" S
7	30° 5' 6.118" E	25° 47' 50.363" S	29	30° 7' 13.154" E	25° 48' 46.062" S
8	30° 5' 5.286" E	25° 48' 55.769" S	30	30° 7' 20.632" E	25° 48' 24.463" S
9	30° 5' 5.080" E	25° 49' 12.049" S	31	30° 7' 28.621" E	25° 48' 13.649" S
10	30° 4' 34.925" E	25° 49' 18.978" S	32	30° 8' 44.527" E	25° 47' 24.552" S
11	30° 4' 28.502" E	25° 49' 38.796" S	33	30° 8' 50.334" E	25° 47' 12.321" S
12	30° 4' 26.256" E	25° 50' 11.021" S	34	30° 9' 35.611" E	25° 46' 20.785" S
13	30° 4' 52.618" E	25° 50' 29.500" S	35	30° 9' 38.480" E	25° 46' 3.066" S
14	30° 5' 8.436" E	25° 50' 34.744" S	36	30° 9' 47.718" E	25° 45' 5.968" S
15	30° 5' 36.054" E	25° 50' 26.972" S	37	30° 8' 37.466" E	25° 45' 4.498" S
16	30° 5' 0.798" E	25° 52' 10.107" S	38	30° 8' 9.373" E	25° 45' 11.450" S
17	30° 5' 37.097" E	25° 53' 43.321" S	39	30° 8' 10.725" E	25° 45' 48.430" S
18	30° 5' 40.260" E	25° 53' 58.950" S	40	30° 7' 32.628" E	25° 45' 43.898" S
19	30° 6' 46.064" E	25° 53' 23.287" S	41	30° 7' 25.439" E	25° 45' 22.579" S
20	30° 6' 51.901" E	25° 53' 13.572" S	42	30° 7' 29.827" E	25° 45' 21.467" S
21	30° 7' 4.233" E	25° 53' 20.081" S	43	30° 7' 3.051" E	25° 44' 2.417" S
22	30° 8' 47.831" E	25° 52' 41.948" S	44	30° 6' 5.743" E	25° 43' 55.364" S

Figure 6-4 - Coordinates of the Application Site

6.2 WIND ENERGY POWER GENERATION PROCESS

Wind power is the conversion of wind energy into a useful form of energy, such as electricity, using modern and highly reliable wind turbines. Wind Power is non-dispatchable, meaning that for economic operation, all the available output must be taken when it is available.

Wind turbines, like windmills, are mounted on a tower to harness wind energy at an increased level above the ground where wind is faster and less turbulent. The kinetic energy of the wind is used to turn the blades of the turbine to generate electricity. Wind turbines can operate at varying wind speeds, with the amount of energy the wind transfers to the rotor depending on the density of the air, the rotor area and the wind speed.

The electricity generated by the wind turbines is passed through the step-up transformer and then transmitted via either underground or overhead cables to a central substation, which connects the wind energy facility to a high voltage network. Wind turbines are designed to operate automatically with minimal maintenance for approximately 20-25 years.

Figure 6-5 illustrates the following main components of a wind turbine:

- The rotor consists of three blades which are attached to a hub. The blades collect energy from the wind and converts the wind energy into rotational shaft motion/energy to turn the generator;
- The nacelle houses the equipment at the top of the tower as well as a gearbox, a generator that converts the turning motion/mechanical energy of the blades into electricity and coupling and brake;
- The tower supports the nacelle and rotor and allows the blades to be distanced safely off the ground so as to reach the stronger winds found at higher elevations;
- Turbine step-up transformer which can be indoor or outdoor, depending on the turbine model whose function is to increase the voltage capacity of the electricity generated by the turbine to a higher, grid-equivalent.
- The foundation unit ensures the stability of the turbine structure.

Figure 6-5 - Illustration of the main components of a wind turbine

6.3 SOLAR ENERGY GENERATION PROCESS

South Africa experiences some of the highest levels of solar radiation in the world between 4.5 and 6.5kWh/m2/day) and therefore, possesses considerable solar resource potential for solar power generation. In terms of large-scale grid connected applications the most used technologies include PV and Concentrated Solar Power (CSP); these are described in some detail in the following sections. It must be noted that this project is specific to solar power generation using solar PV technology only.

PHOTOVOLTAIC (PV) SYSTEMS

Internationally, solar PV is the fastest-growing power generation technology. Approximately 139 GW was added to the installed capacity globally in 2020, increasing the installed capacity by 18% from the previous year. The total capacity from PVs was 760 GW globally, producing approximately 3% of the world’s electricity. In South Africa the solar PV installed capacity in 2020 grew by 37% compared to the previous year's value. As much as 3.6 GW of PV is planned to be installed by 2026, with approximately 1.48GW already installed as recorded in 2019. Utility-scale CSP plants were in operation long before solar PVs became widely commercialized, however PV has taken over the market, attributed to the declining costs of solar PV modules and associated system. In South Africa, this is also coupled with the supportive government policies. Global CSP capacity grew only 1.6 percent in 2020 to 6.2 GW.

Large-scale or utility-scale PV systems are designed for the supply of commercial power into the electricity grid. Large-scale PV plants differ from the smaller units and other decentralised solar power applications because they supply power at the utility level, rather than to local users.

PV cells are made from semi-conductor materials that can release electrons when exposed to solar radiation. This is called the photo-electric effect. Several PV cells are grouped together through conductors to make up one module and modules can be connected to produce power in large quantities. In PV technology, the power conversion source is via PV modules that convert light directly to electricity. This differs from the other large-scale solar generation technology such as CSP, which uses heat to drive a variety of conventional generator systems.

Solar panels produce direct current (DC) electricity; therefore, PV systems require conversion equipment to convert this power to alternating current (AC), that can be fed into the electricity grid. This conversion is done by inverters. **Figure 6-6** provides an illustration of the main components of a solar PV power plant. There are two primary alternatives for inverters in large scale systems; being centralised and string inverters.

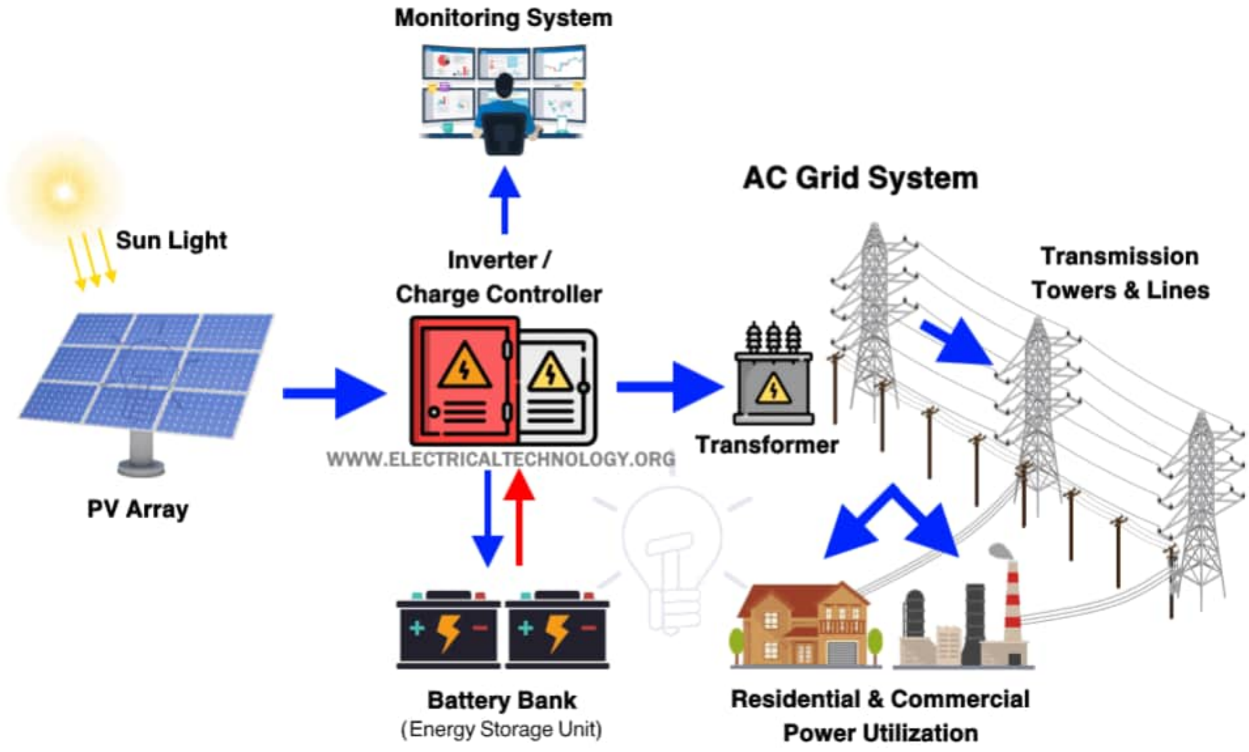


Figure 6-6 - Illustration of the main components of a solar power plant (Source: www.electricaltechnology.org/2021/07/solar-power-plant.html)

6.4 PROJECT INFRASTRUCTURE

The proposed Dalmanutha WEF and Hybrid facility will be developed with a capacity of up to 300 megawatts (MW), and will comprise the following key components:

Table 6-3 – Proposed project infrastructure

Project Infrastructure	Details
Wind turbines for Alternative 1	▪ The Dalmanutha WEF will have up to 70 turbines, each with a foundation of approximately $25m^2$ in diameter ($500m^2$ area and requiring ~2 $500m^3$ concrete each) and approximately 3m depth; ▪ Turbine hub height of up to 200m; ▪ Rotor diameter up to 200m ▪ Permanent hard standing area for each wind turbine (approximately 1ha). **Figure 6-7** illustrates the typical hardstanding requirements for the construction of each turbine (it should be noted that the figure below is for illustration purposes only – the exact layout and specification of the hardstanding will be determined once the design phase has been completed).
Wind turbines for Alternative 2	▪ The Dalmanutha Hybrid facility option will have Up to 44 turbines, each with a foundation of approximately $25m^2$ in diameter ($500m^2$ area and requiring ~2 $500m^3$ concrete each) and approximately 3m depth; ▪ Turbine hub height of up to 200m; ▪ Rotor diameter up to 200m ▪ Permanent hard standing area for each wind turbine (approximately 1ha). **Figure 6-7** illustrates the typical hardstanding requirements for the construction of each turbine (it should be noted that the figure below is for illustration purposes only – the exact layout and specification of the hardstanding will be determined once the design phase has been completed).
Solar Fields (Alternative 2 Only)	▪ Solar PV array comprising PV modules (solar panels), which convert the solar radiation into direct current (DC); ▪ PV panels will be up to a height of 6m (when the panel is horizontal) and will be mounted on fixed tilt, single axis tracking or dual axis tracking mounting structures. Monofacial or bifacial Solar PV Modules are both considered; ▪ Footprint: ~160 ha. ▪ Inverters, transformers and other required associated electrical infrastructure and components.
IPP Portion Onsite Substation and Battery Energy Storage System (Bess)	▪ IPP portion onsite substation of up to 4ha. The substation will consist of a high voltage substation yard to allow for multiple up to 132kV feeder bays and transformers, control building, telecommunication infrastructure, access road, etc. ▪ The Battery Energy Storage System (BESS) storage capacity will be up to 300MW/1200 megawatt-hour (MWh) with up to four hours of storage. It is proposed that Lithium Battery Technologies, such as Lithium Iron Phosphate, Lithium Nickel Manganese Cobalt oxides or Vanadium Redox flow technologies will be considered as the preferred battery technology; however, the specific technology will only be determined following Engineering,

Project Infrastructure	Details
	Procurement, and Construction (EPC) procurement. The main components of the BESS include the batteries, power conversion system and transformer which will all be stored in various rows of containers.
Operation and Maintenance Building Infrastructure	▪ Operations and maintenance (O&M) building infrastructure will be required to support the functioning of the WEF and for services required by operations and maintenance staff. The O&M building infrastructure will be near the onsite substation and will include: ▪ Operations building of approximately 200m$^{2;}$ ▪ Workshop and stores area of approximately 150m^2 each; ▪ Stores area of approximately 150m^2; ▪ Refuse area for temporary waste storage and septic/conservancy tanks with portable toilets to service ablution facilities. The total combined area of the buildings will not exceed 5 000m^2.
Construction Camp Laydown	▪ Temporary laydown or staging area -Typical area 220m x 100m = 22000m^2. ▪ Laydown area could increase to 30000m^2 for concrete towers, should they be required. ▪ Sewage: septic and/or conservancy tanks and portable toilets. ▪ Temporary cement batching plant, wind tower factory & yard of approximately 7ha, comprising amongst others, a concrete storage area, batching plant, electrical infrastructure and substation, generators and fuel stores, gantries and loading facilities, offices, material stores (rebar, concrete, aggregate and associated materials), mess rooms, workshops, laydown and storage areas, sewage and toilet facilities, offices and boardrooms, labour mess and changerooms, mixers, moulds and casting areas, water and settling tanks, pumps, silos and hoppers, a laboratory, parking areas, internal and access roads - Gravel and sand will be stored in separate heaps whilst the cement will be contained in a silo. The maximum height of the silo will be 20m.
Access Roads	▪ The Project site can be accessed easily via either the tarred R33 or the N4 national road which run along the northern and western boundaries of the site. ▪ There is an existing road that goes through the land parcels to allow for direct access to the project development area. ▪ Internal and access roads with a width of between 8m and 10m, which can be increased to approximately 12m on bends. The roads will be positioned within a 20m wide corridor to accommodate cable trenches, stormwater channels and bypass /circles of up to 20m during construction. Length of the internal roads will be approximately 60km.
Associated Infrastructure	▪ The medium voltage collector system will comprise of cables up to and including 33kV that run underground, except where a technical assessment suggest that overhead lines are required, within the facility connecting the turbines to the onsite substation. The solar energy facility (SEF) will comprise low and medium

Project Infrastructure	Details
	voltage cabling between components (above or below ground as needed). ▪ Over the fence 132kV cable to connect the on-site substation to the Common Collector Switching Station. ▪ Fencing of up to 4m high around the construction camp and lighting. ▪ Lightning protection. ▪ Telecommunication infrastructure. ▪ Stormwater channels. ▪ Water pipelines. ▪ Offices. ▪ Operational control centre. ▪ Operation and Maintenance Area/Warehouse/workshop. ▪ Ablution facilities. ▪ A gatehouse. ▪ Control centre, offices, warehouses. ▪ Security building. ▪ A visitor's centre. ▪ Substation building. ▪ The proposed development footprint (buildable area) is approximately 400ha (subject to finalisation based on technical and environmental requirements), and the extent of the project area is approximately 9 197 ha. The development footprint includes the turbine positions and all associated infrastructure as outlined above.

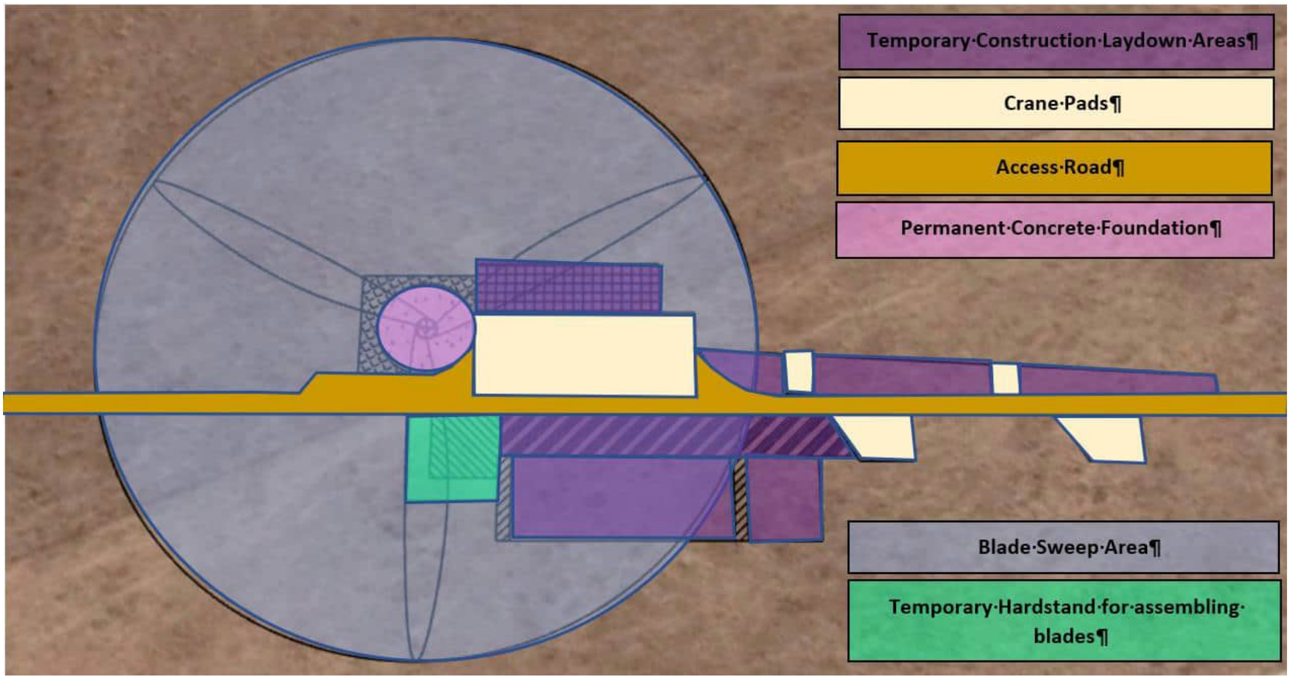


Figure 6-7 - Typical Turbine Hard Standing Requirements (illustration purposes only)

6.5 GENERAL CONSTRUCTION ACTIVITIES

The construction process will follow industry standard methods and techniques. Key activities associated with the construction phase are described in **Table 6-4.**

Table 6-4 - Construction Activities

Activity	Description
Site preparation and establishment	Site establishment will include clearing of vegetation and topsoil at the footprint of each turbine, for laydown area and access routes. The temporary laydown area will be constructed, including establishment of the construction camp (temporary offices, storage containers, concrete batching plant etc). Site establishment will also entail the installation and/or connection of services (sanitation, electricity etc).
Transport of components and equipment to site	Bulk materials (aggregate, steel etc.), infrastructure components (blades, tower sections etc), lifting and construction equipment (excavators, trucks, compaction equipment etc.) will be sourced and transported to site via suitable National and provincial routes and designated access roads. The infrastructure components may be defined as abnormal loads in terms of the Road Traffic Act (Act 29 of 1989) due to their large size and abnormal lengths and loads for transportation. A permit may be required for the transportation of these loads on public roads.
Excavation and earthworks	Subject to the determination of founding specifications, earthworks will be required. This is likely to entail: Excavation of foundation holes to a depth of approximately 3m and pouring of concrete foundations of approximately 500 – 650m^3 from the batching plant. Concrete foundations will be constructed at each turbine location Levelling of the construction camp area, substation area, and O&M building area, and excavation of foundations prior to construction. Excavation of trenches for the installation of underground cables.
Construction of wind turbines, onsite substation and BESS	A large lifting crane(s) will be required to lift the turbine sections (nacelle, blades) into place. The lifting crane/s will be brought on site and will be required to move between the turbine site. Cranes of varying sizes may be required depending on the size of the components. An IPP onsite substation will be constructed on the site. The wind turbines will be connected to the IPP onsite substation via underground or overhead (if required) up to 33kV electrical cables. The BESS will typically require the placement of multiple containers to house the BESS components, which will be brought to sight pre-assembled.
Establishment of ancillary infrastructure	Ancillary infrastructure will include construction site office, temporary laydown area and workshop area for contractor's equipment.
Rehabilitation	Once all construction is completed on site and all equipment and machinery has been removed from the site, the site will be rehabilitated.

6.6 ALTERNATIVES

The EIA Regulations of 2014 (as amended) require that the S&EIA process must identify and describe alternatives to the proposed activity that were considered, or motivation for not considering alternatives. Different types or categories of alternatives could be considered including different locations, technology types, and project layouts. At the scoping level the evaluation of alternatives is provided at a high level in the absence of detailed environmental comparators for each alternative; due to the two-staged nature of the S& EIA process it is more suitable to identify and describe the potential alternatives on a high-level basis within scoping, and to perform a more detailed analysis of alternatives (with environmental comparators) in the EIA phase of the project. As such, the S&EIA will holistically assess the impacts and risks of each alternative in a comparative way, as suggested by Appendix 2 of the EIA Regulations of 2014 (as amended).

All alternatives outlined below are considered both feasible and reasonable.

6.6.1 SITE ALTERNATIVES

The selection of the Dalmanutha WEF site is the outcome of a feasibility assessment by the proponent, which inter alia served to identify site options that would be optimal for energy production and grid interconnection. The Dalmanutha WEF site was selected because it is strategically located due to the following factors:

1) Proximity to the Eskom grid – The proposed Project requires connection to the Eskom grid to transmit the generated electricity. The Project site was selected due to its proximity to Gumeni MTS which will have sufficient capacity to allow the Project to connect to it. Thus, this Project site has ideal grid connection potential as the Project will connect to the existing Gumeni MTS, which is located approximately 17.5km from the proposed Project site.
2) Grid Capacity - Grid capacity is one of the main constraints to the expansion of renewable energy projects at large in South Africa. The failure to appoint any wind projects in Bid Window 6 was attributed to an unavailability of grid capacity in the Eastern, Northern and Western Cape provinces, where all the projects submitted as part of Bid Window 6 are located. Unlike the Cape Provinces of South Africa, where there is abundant wind resources but no available grid capacity, the Project site provides the opportunity to connect to the Eskom grid. For this reason, Dalmanutha Wind (Pty) Ltd is developing the proposed Project within the Mpumalanga Province.
3) Land Availability and Landowner Support – The availability of land is a key feasibility criterion in the site selection process. The project site is of a suitable land size for the proposed development. The land available for the development of the Dalmanutha WEF extends approximately 9197ha, providing a substantial amount of land for the development of an up to 300MW facility. The proponent has secured sufficient land for the development of the proposed Project with landowners within the respective cadastral portions comprising the development footprint, indicating their support and willingness for the project to proceed to development via entering into agreement with the developer. After intensive studies around the province, through analysing the aforementioned factors, it was determined that this site has the most ideal conditions for the Project.
4) Strategic Approach – Four of Eskom's coal-fired power stations are targeted for decommissioning in the short term. These include the Komati, Camden, Grootvlei, and Hendrina power stations. These power stations range between 50 - 60 years of age. According

to the 2019 IRP, over a 11-year period Eskom are expected to decommission over 11GW of its coal fired capacity. Power generated from the facility can therefore be used to replace a portion of the generation capacity lost from the decommissioned power stations, and also help replace the some of the jobs that would have been potentially lost due to the decommissioning of the power plants.

5) Road and labour pool accessibility – The Project site can be accessed easily via either the tarred R33 or the N4 national road which run along the northern and western boundaries of the site. The Geluk road runs through the land parcels to allow for direct access to the project development area.
6) Topography- The surrounding landscape has a rolling hill topography which is suitable for the development of a wind project. The Project site itself is located on a flat high lying landscape that has the highest wind resource within the immediate area. The flatter portions of the site are suitable for the development of a solar project.
7) Competition With regards to renewable energy facilities - There is minimal competition in the area. Should the project proceed, it will act as one of the pioneering developments and open opportunities for other renewable developments in the Belfast area. It will also serve as a large scale case study for wind resource in the province, showing that commercially viable wind energy facilities are suitable for certain parts of the Mpumalanga Province.

The site is considered suitable for the reasons provided. The investigation of an alternative site is not proposed within this EIAr

6.6.2 LAYOUT ALTERANTIVES

6.6.2.1 Layout Development

The layout of the Dalmanutha WEF originally had 77 turbines proposed. This layout has since been revised and seven turbines in the northern portion have been dropped in consideration of the sensitive avifaunal nature of the site. The avifaunal specialist has undertaken a risk assessment and ranked each turbine according to its impact on the avifaunal species on site.

The seven WTG that were removed were ranked as the highest risk to the avifaunal species on site according to the specialist risk assessment. **Figure 6-8** below shows the original layout of the WEF with the turbines ranked. Whereas **Figure 6-9** and **Figure 6-10** shows the revised layout with the seven highest risk turbines removed.

It is important to note that the above layout is still in its preliminary stages and still subject to change if need be.

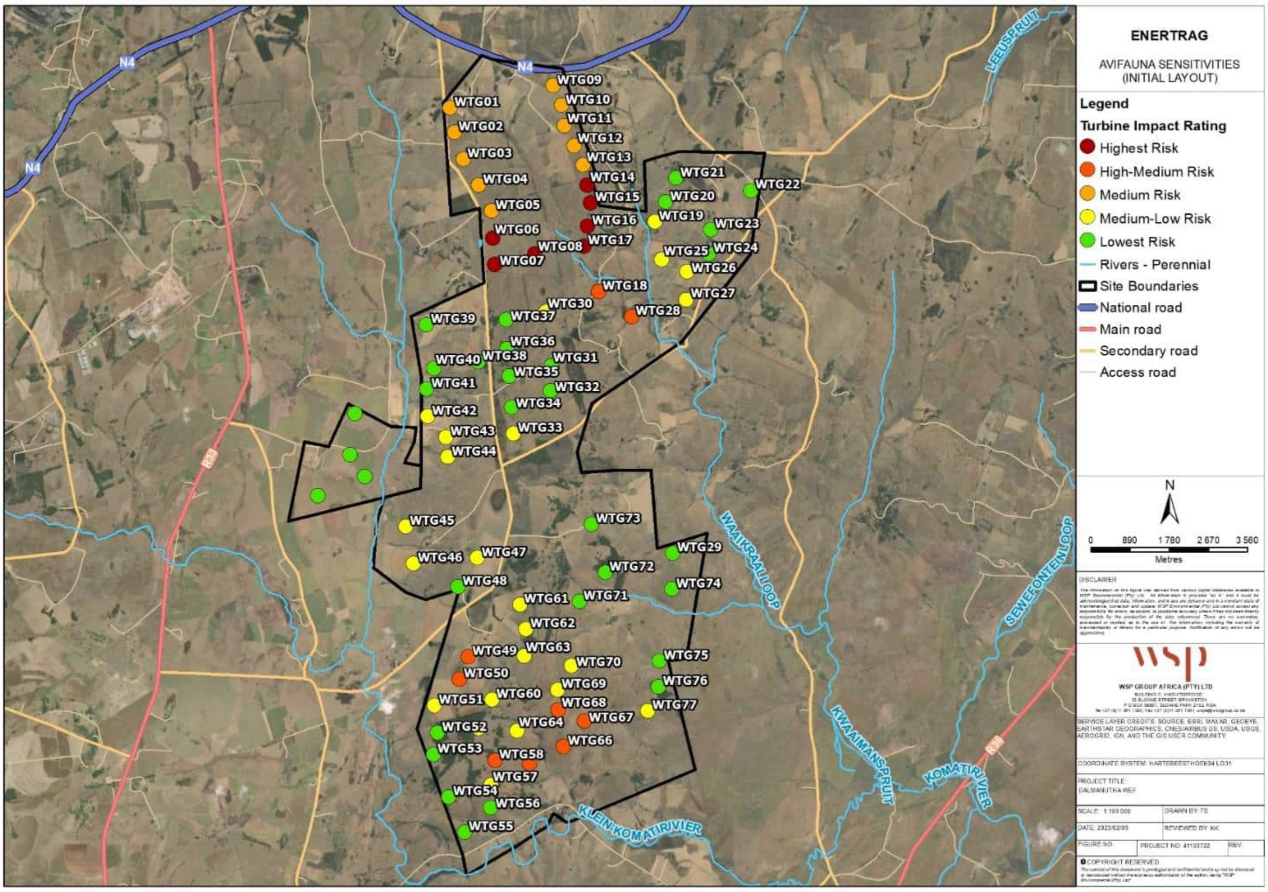


Figure 6-8 - Dalmanutha WEF WTG layout ranked according to avifaunal risk (Pre-optimised 77 turbine layout)

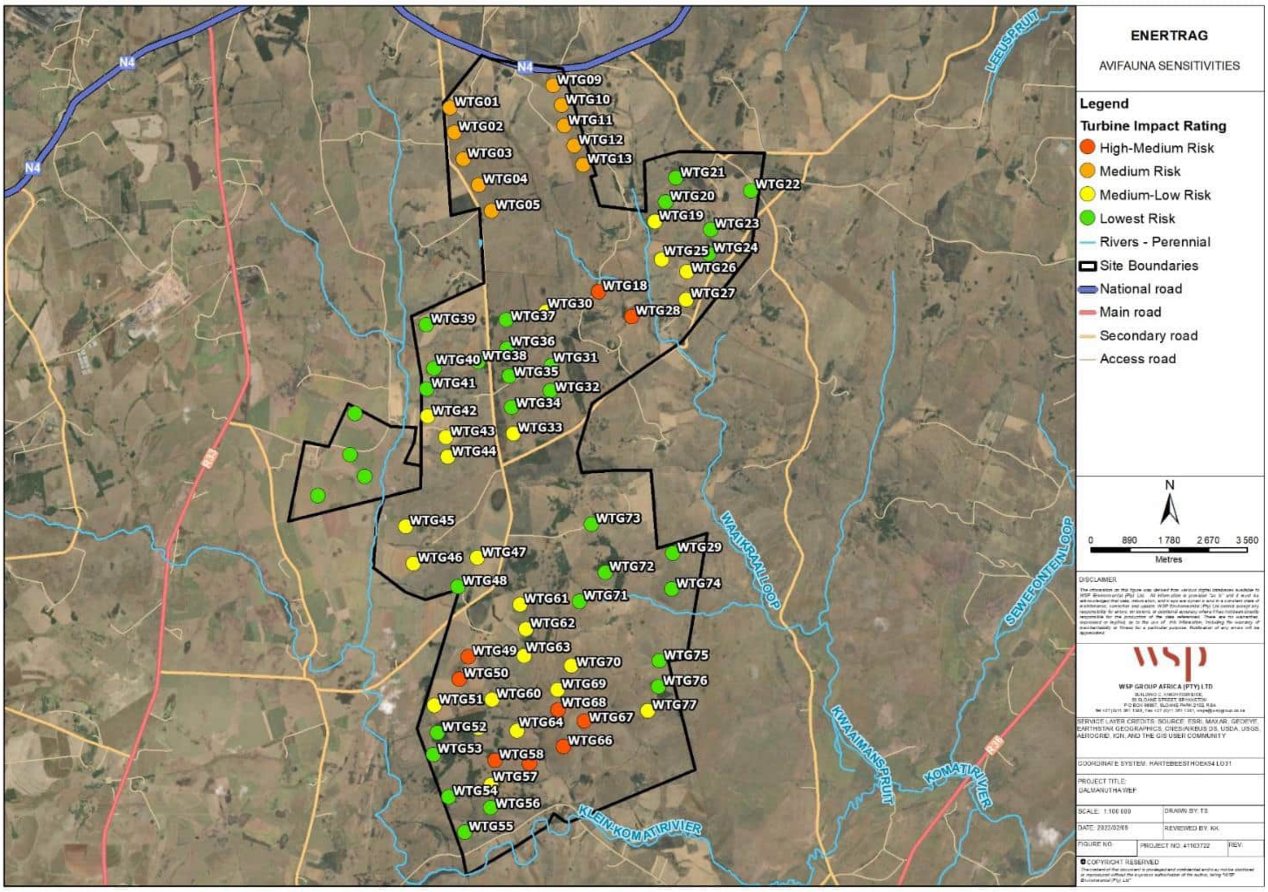


Figure 6-9 - Revised Dalmanutha WEF layout (70 Turbines)

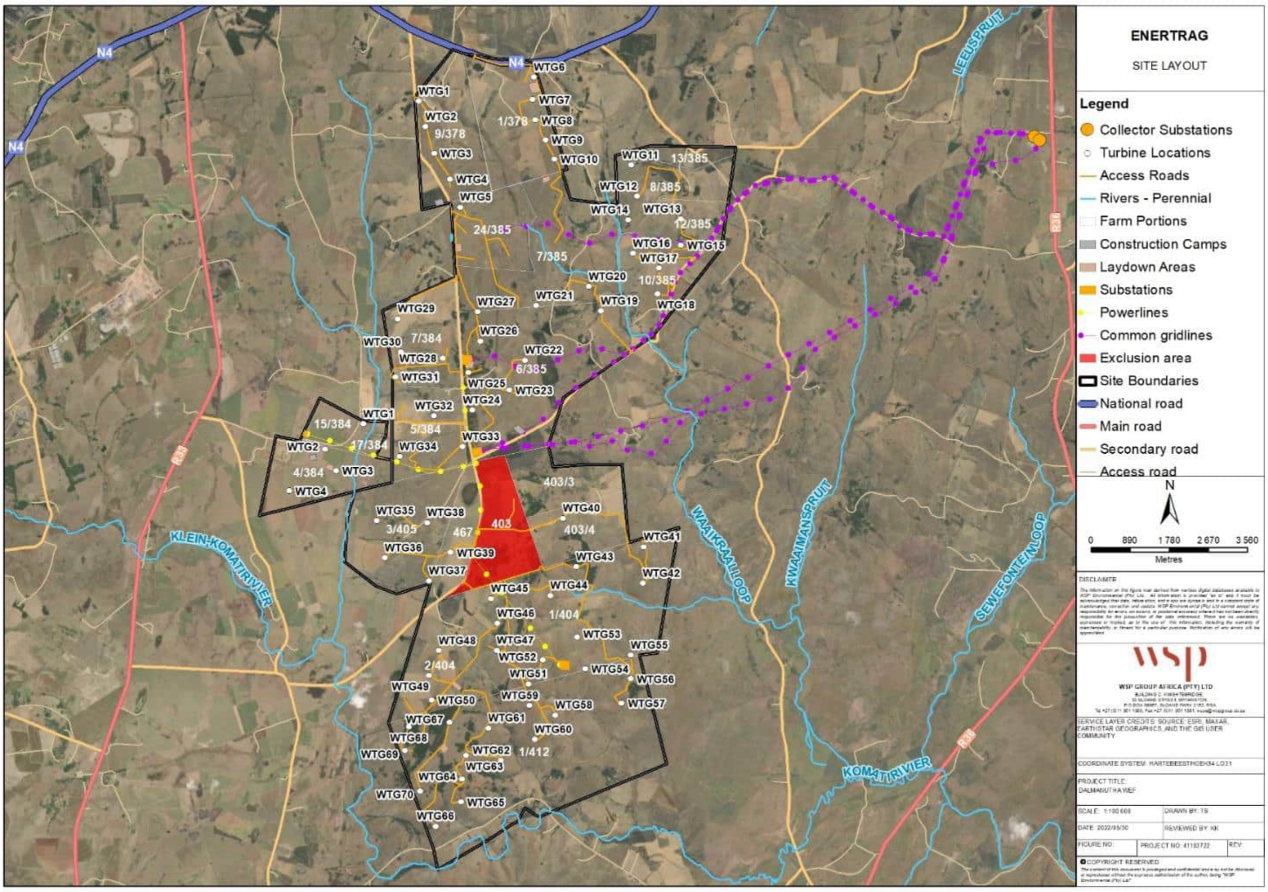


Figure 6-10 - Proposed Dalmanutha WEF and associated infrastructure (70 Turbine Layout)

<u>As a result of the avifaunal sensitivity on site, the option of a hybrid energy facility which includes solar PV technology has been added for consideration during the EIA phase.</u>

6.6.2.2 Layout alternatives to Assessed in this EIA

The Dalmanutha facility has two possible layouts, these being a layout comprising of 70 turbines (**Figure 6-11**), and a layout comprising of 44 turbines as well as the solar PV panels (**Figure 6-12**) to supplement the MW capacity.

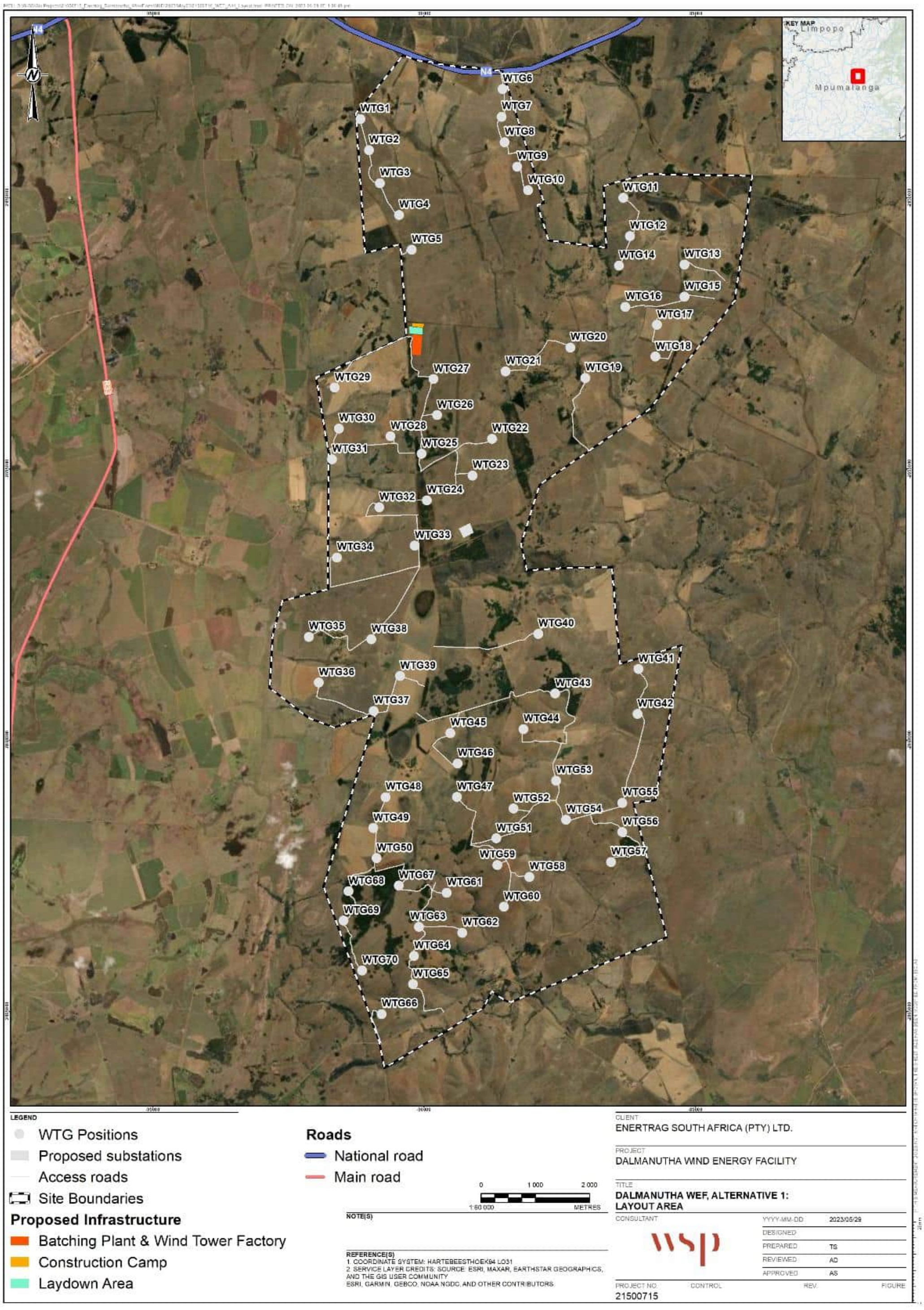


Figure 6-11 – Layout of the proposed Dalmanutha WEF (Alternative 1)

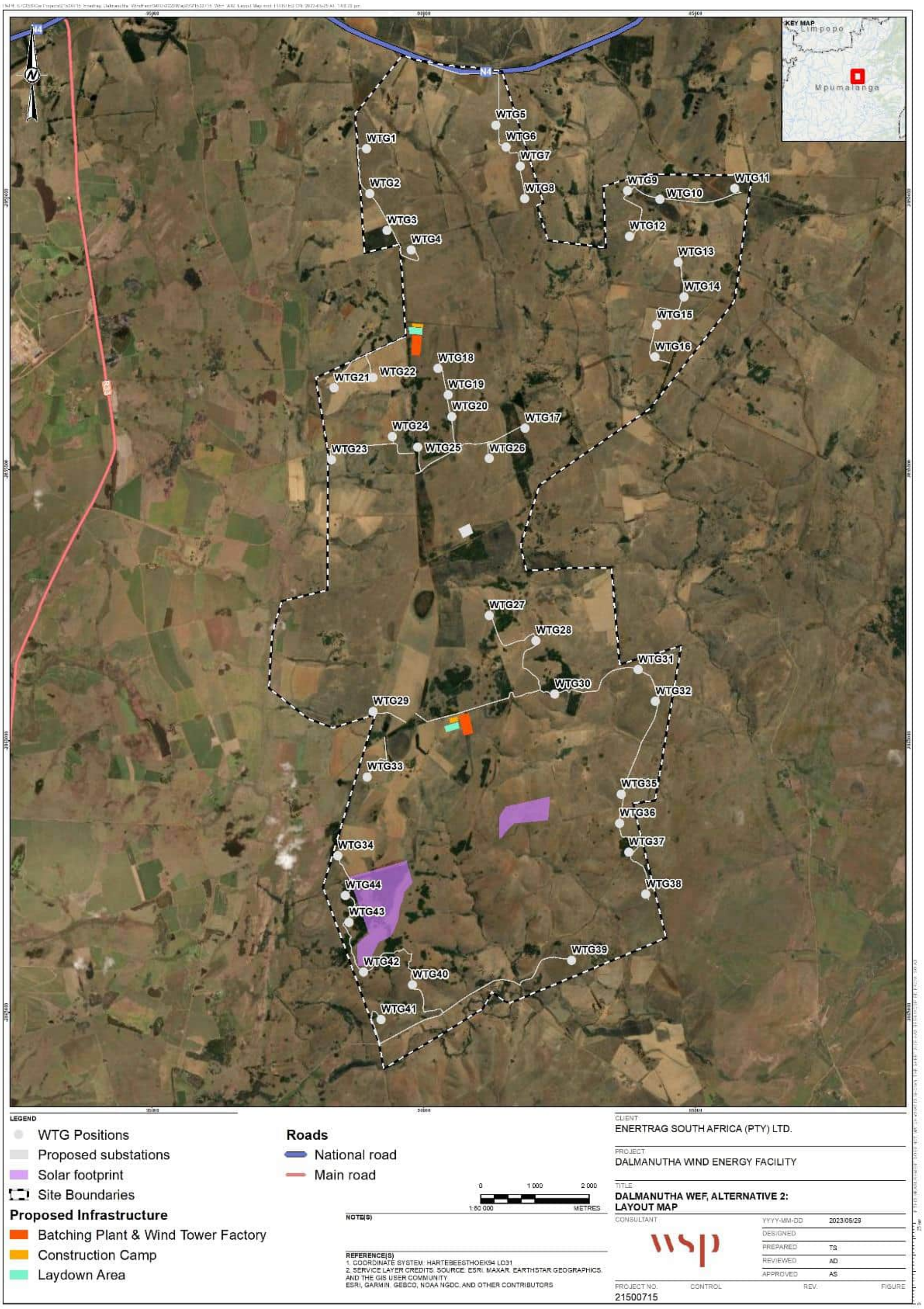


Figure 6-12 – Layout of the proposed Dalmanutha WEF (Alternative 2)

The layout and alignments are likely to be updated and refined as the project progresses, depending on sensitivities and technical inputs during this EIA phase studies.

The Dalmanutha WEF and Hybrid facility layouts are not yet final.

6.6.3 TECHNOLOGY ALTERNATIVES

The Dalmanutha WEF will utilize wind technology to generate power. An alternative option to include Solar PV panels has been added for consideration in this EIA Phase. The motivation for the use of wind, BESS and Solar technology for this project is provided below:

WIND RESOURCE

The Project site was also selected on the availability of wind resources in the Mpumalanga region. The availability of wind resources is the main driver of project viability. The Project site was identified by the developer through a desktop pre-feasibility analysis based on the estimation of the Wind energy resource. The wind resource for the development site has been monitored using on-site monitoring devices for a period of over 2 years and has proven to be sufficient and competitive. This viable resource ensures the best value for money is gained for the economy of South Africa.

BESS TECHNOLOGY

Two types of battery energy storage system technologies are being investigated. One of the types of battery technology being considered for the BESS would be Vanadium Redox Flow batteries (VRF). The project will employ utility scale batteries. These energy storage systems can be supplied either as containerized units or as a fixed installation within a building etc. Due to the proposed size of the facility (up to 300MW) the Dalmanutha WEF is currently envisioned as having units housed within a large battery building.

The other type of battery technology being considered for the BESS would be a Solid-State Lithium-ion Battery system which consists of multiple battery cells that are assembled to form modules. Each cell contains a positive electrode, a negative electrode, and an electrolyte. The BESS will comprise multiple battery units or modules housed in shipping containers and/or an applicable housing structure which is delivered pre-assembled to the project site. Containers are usually raised slightly off the ground and laid out in rows. They can be stacked if required although this may increase the risk of events in one container spreading to another container. Supplementary infrastructure and equipment may include substations, power cables, transformers, power converters, substation buildings & offices, HV/MV switch gear, inverters and temperature control equipment that may be positioned between the battery containers.

SOLAR RESOURCE

As a result of the avifaunal sensitivity on site, the option of solar PV technology as an addition to the Dalmanutha Facility has been added for consideration during the EIA phase. The removal of further wind turbines due to this avifaunal sensitivity, will result in loss of Megawatt generation capacity of the facility therefore the addition of a solar facility is being considered. This will assist to balance the supply of electricity.

The site location provides sufficient solar resource to ensure the economic viability of a solar PV facility. This viable solar resource ensures the best value for money is gained from the project, allowing for competitive pricing and maximum generation potential, with the resulting indirect benefits for the South African economy.

6.6.4 ‘NO PROJECT’ ALTERNATIVE

In the “no project” alternative, the Dalmanutha WEF project will not be developed. In this scenario, there could be a missed opportunity to address the need for increase in renewable energy generation to mitigate against concerns of climate change and exploitation of non-renewable resources. The no-go alternative would not assist in responding to the growing electricity demand in South Africa and would not contribute to the reliability of electricity supply at a national scale. Conversely, negative environmental impacts of the project (as outlined in Section 6) associated with the development of the Dalmanutha WEF would be avoided.

The “no project” alternative will be considered in this EIA phase as a baseline against which the impacts of the Dalmanutha WEF project will be assessed.

7 DESCRIPTION OF BASELINE ENVIRONMENT

7.1 PHYSICAL ENVIRONMENT

7.1.1 CLIMATE AND METEOROLOGY

LOCAL METEOROLOGY OVERVIEW

The climate of the Dalmanutha region can be described as a subtropical highland climate or a temperate oceanic climate with dry winters and falls into Köppen climate type: Cwb. The average temperature for the year in nearby Belfast is 14.4°C and the warmest month on average is January with an average temperature of 18.2°C. The coolest month on average is June with an average temperature of 8.8°C. The mean annual precipitation for Belfast is 838.2mm. The month with the most precipitation on average is January with 162.6mm and the month with the least precipitation on average is July with an average of 5.1mm. These climatic conditions give rise to chemically weathered red and yellow soils that are typical of subtropical upland areas, as was widely seen on site.

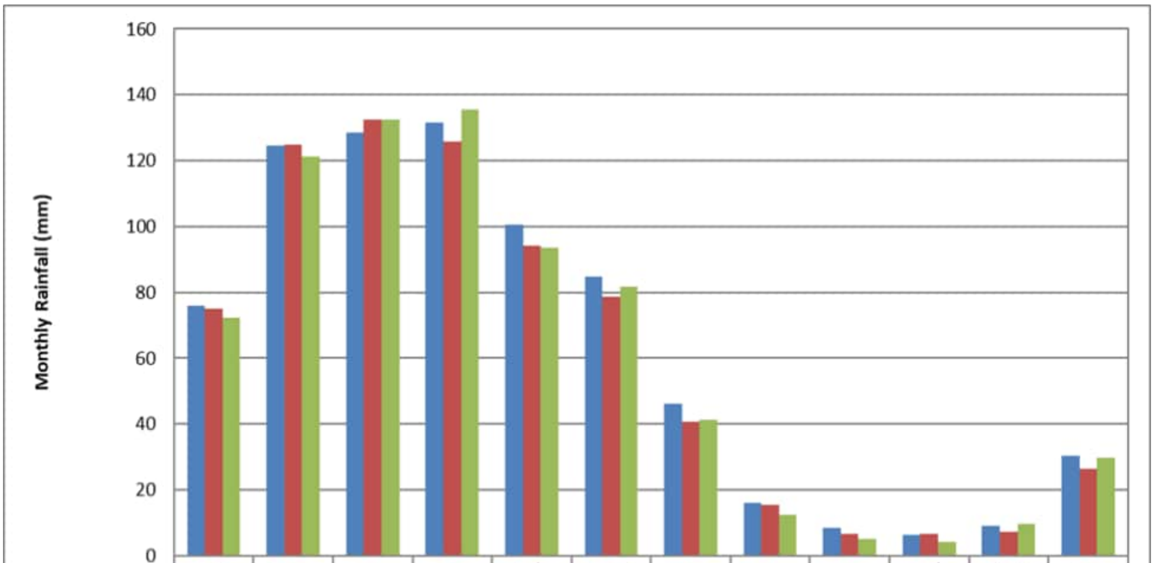
TEMPERATURE AND RAINFALL

As is typical throughout South Africa, there is a distinct seasonal variation in temperature. The mean monthly temperatures are highest between November and February, which are summer months. Temperatures gradually drop with the lowest temperatures being recorded during June and July, which are winter months in South Africa. Temperatures, wind velocities and evaporation are linked. The higher the temperature and the wind velocity, the more likely it is for the evaporation rates to be high. The mean maximum annual temperature for the project area is 25°C and the mean minimum annual temperature is 0°C to 2°C.
The rainfall data was generated using a rainfall simulator which was sourced through the Design Rainfall Estimation Program (Smithers & Schulze, 2002) and the Daily Rainfall Extraction Utility (Kunz, 2004). Data was sourced for rainfall stations that are within close proximity to the study area. The rainfall stations presented in **Table 7-1** summarizes the rainfall data used in the analysis.

Table 7-1 - Metadata for the rainfall stations

Station number	name	distance (km)	record period (years)	period of records	reliability (%)	map(mm)
0517257 W	Waaikraal	6.2	81	1919-2000	15.8	762
0517235 W	Brakspruit	12.2	80	1920-2000	50	733
0517072 W	Belfast (Pol)	13.9	80	1920-2000	39.5	739

The average monthly plot was used to compare the rainfall records as shown in **Figure 7-1**. The rainfall records cover the same time periods, and the average monthly rainfall depths for the different stations have a similar pattern. During the wet season, the highest average rainfall was recorded in the months of December and January. The driest months on average was recorded in June and July.



	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Waaikraal	76	124	129	131	101	85	46	16	8	6	9	30
Brakspruit	75	125	133	126	94	79	41	15	6	6	7	26
Belfast_(POL)	72	121	132	135	93	82	41	12	5	4	10	30

Figure 7-1 - Average monthly rainfall for the stations

The Waaikraal, Brakspruit and Belfast (POL) rainfall stations show a similar increasing trend as shown in **Figure 7-2**. The trends are consistent throughout, with no significant changes in slope. The Waaikraal rainfall station curve overlaps the Brakspruit and Belfast (POL) curves over time, indicating that slightly more rainfall was recorded for the station. However, Waaikraal rainfall station also has the least reliability (more patched data) amongst the three weather stations. **Figure 7-2** shows the total cumulative rainfall over time.

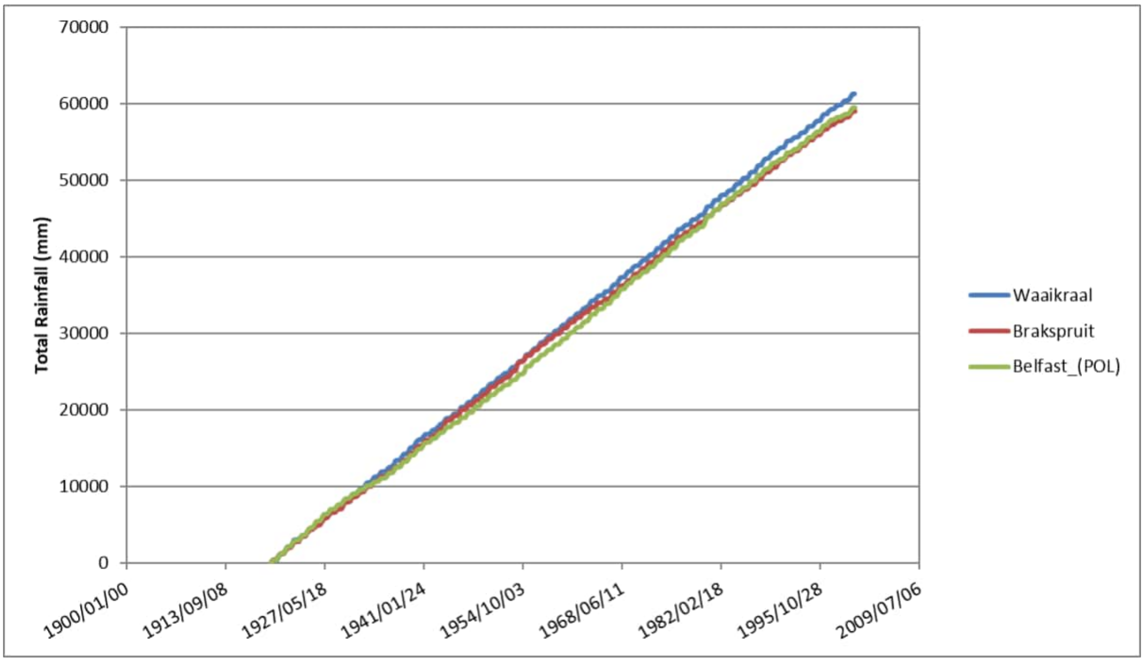


Figure 7-2 - Cumulative rainfall for the stations analysed

The station 0517235 W Brakspruit was chosen as the station used in the study for the following reasons:

- The station is within proximity of the site.
- The station has the highest reliability of the datasets available (having the lowest percentage of patched or missing data).

Brakspruit rainfall station is situated approximately 12 kilometres from the site with 80-years of recorded data. It has the highest reliability (less patched data) of the analysed stations. The maximum recorded 24-hour rainfall depth is 140 mm, recorded on the 16th of December 1953, as shown in **Figure 7-3.**

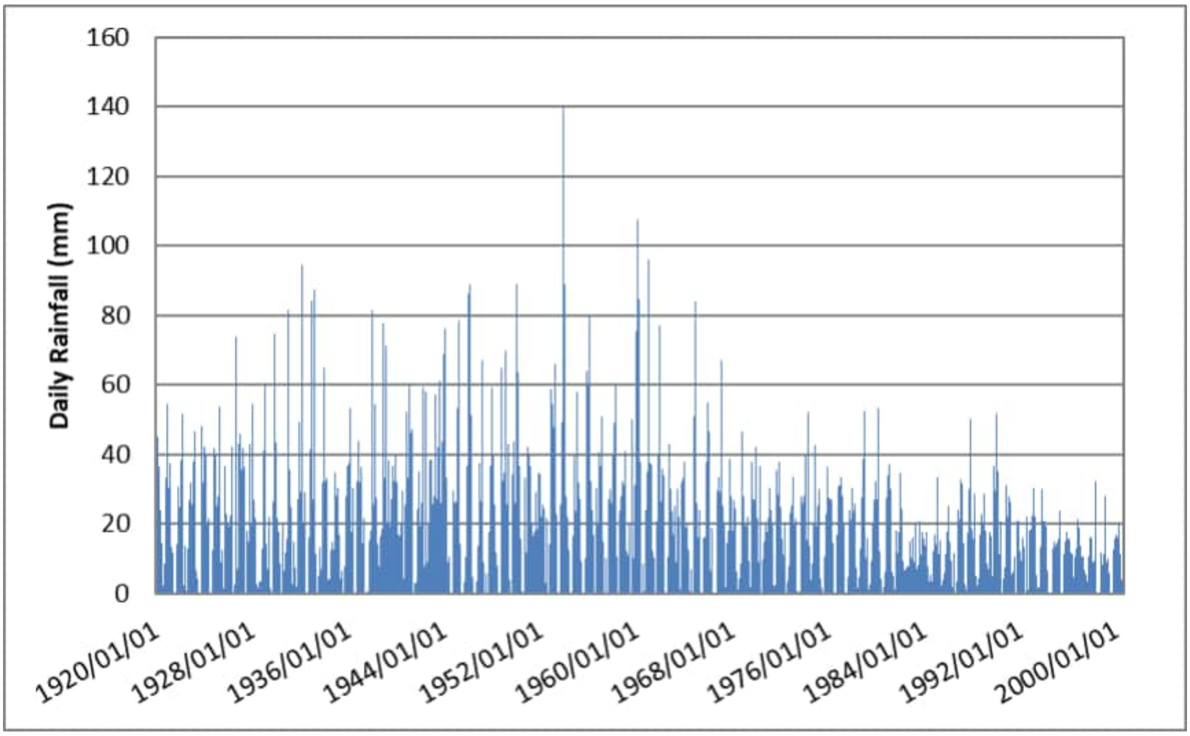


Figure 7-3 - Brakspruit weather station daily rainfall

Figure 7-4 shows the annual rainfall depths. The mean annual precipitation for the station is 733 mm.

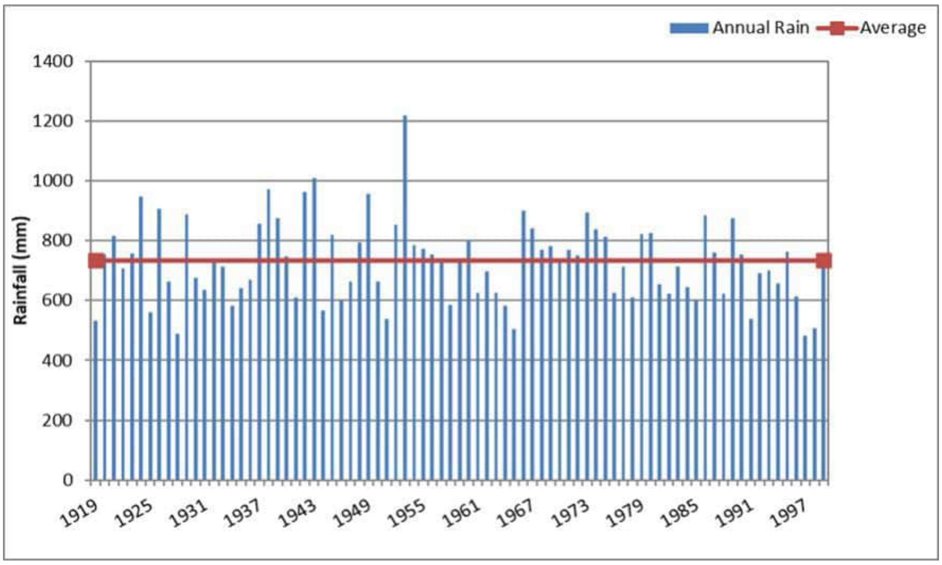


Figure 7-4 - Brakspruit weather station annual rainfall readings and mean annual precipitation (MAP)

The 24-hour rainfall depths for several recurrence intervals at the Brakspruit station were calculated from the data available. To determine the likely magnitude of storm events, a statistical approach, using chi square statistics method (NIST/SEMATECH e-Handbook of Statistical Methods), was applied to the available recorded daily rainfall depths. This method statistically analyses the maximum daily rainfall depths for each year to determine the different recurrence intervals. The probability distribution with the best fit (R2=0.988) was found to be the Log Pearson III distribution (**Figure 7-5**), this was used to estimate the 24-hour storm rainfall depths associated with the various recurrence intervals.

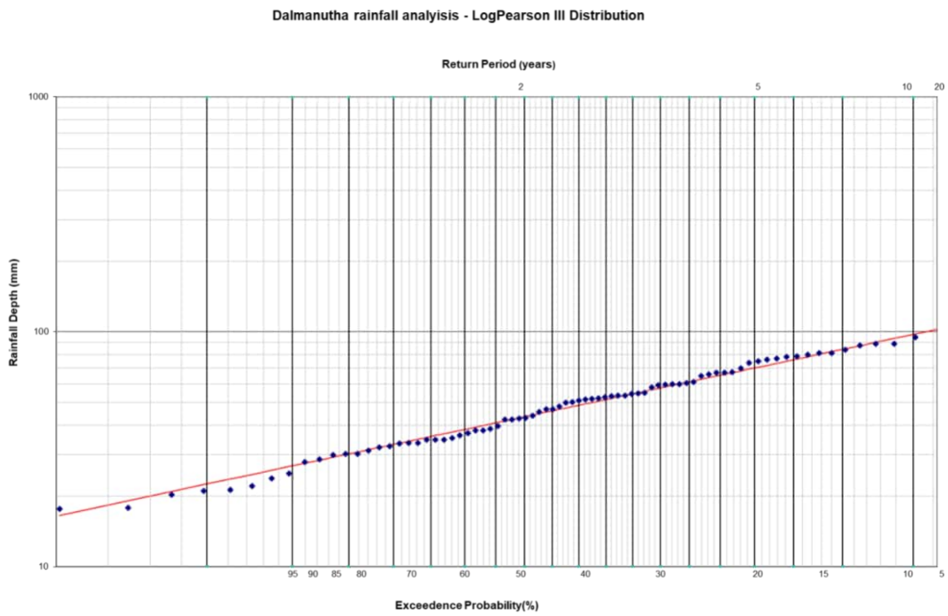


Figure 7-5 - Rainfall analysis from Brakspruit station

EVAPORATION

The average S-Class pan evaporation is 1268.3 mm/year measured at X2E002 station. The station is approximately 14 km away from the site area. The highest average monthly evaporation occurs in December, as shown below in **Figure 7-6** which also plots the monthly average evaporation and the monthly average rainfall readings for the Dalmanutha project area. From the figure, it is observed that the mean annual evaporation is generally higher than the rainfall throughout the year, except for the month of November.

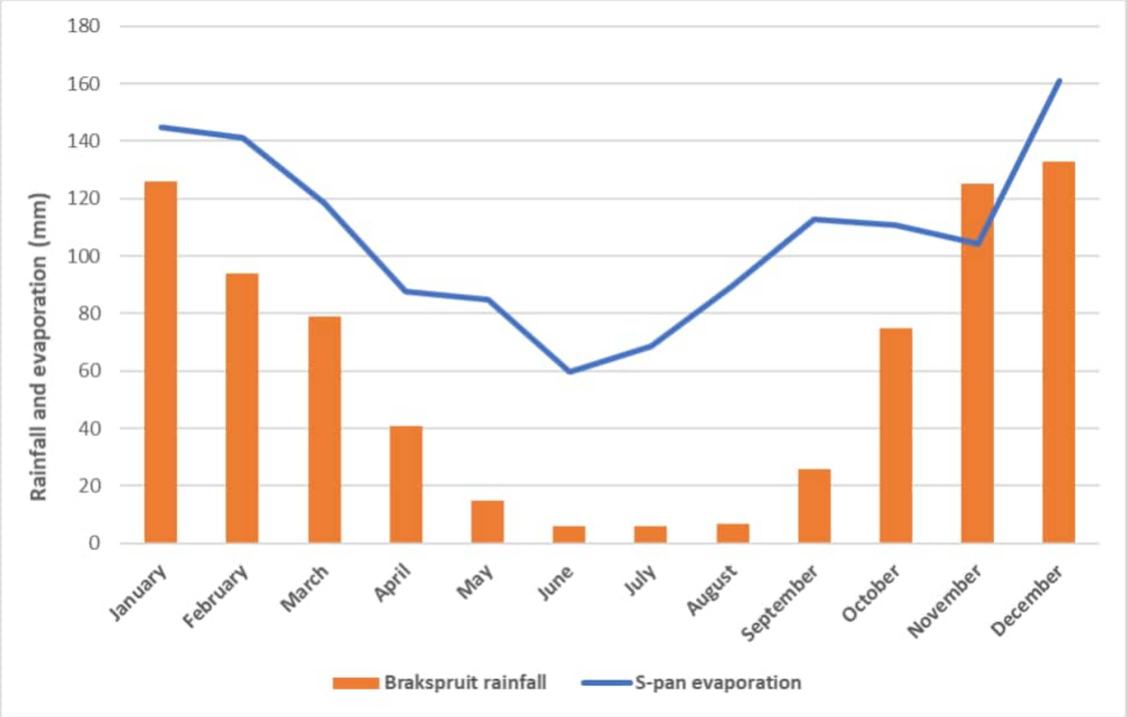


Figure 7-6 - Rainfall and evaporation

WIND

The average hourly wind speed in Belfast experiences mild seasonal variation over the course of the year. The windier part of the year lasts for 3.9 months, from July 26 to November 23, with average wind speeds of more than 11.8 kilometres per hour. The windiest month of the year in Belfast is September, with an average hourly wind speed of 13.6 kilometres per hour. The calmer time of year lasts for 8.1 months, from November 23 to July 26. The calmest month of the year in Belfast is March, with an average hourly wind speed of 10.1 kilometres per hour. The **Figure 7-7** below outlines the average wind speeds in Belfast throughout the year.

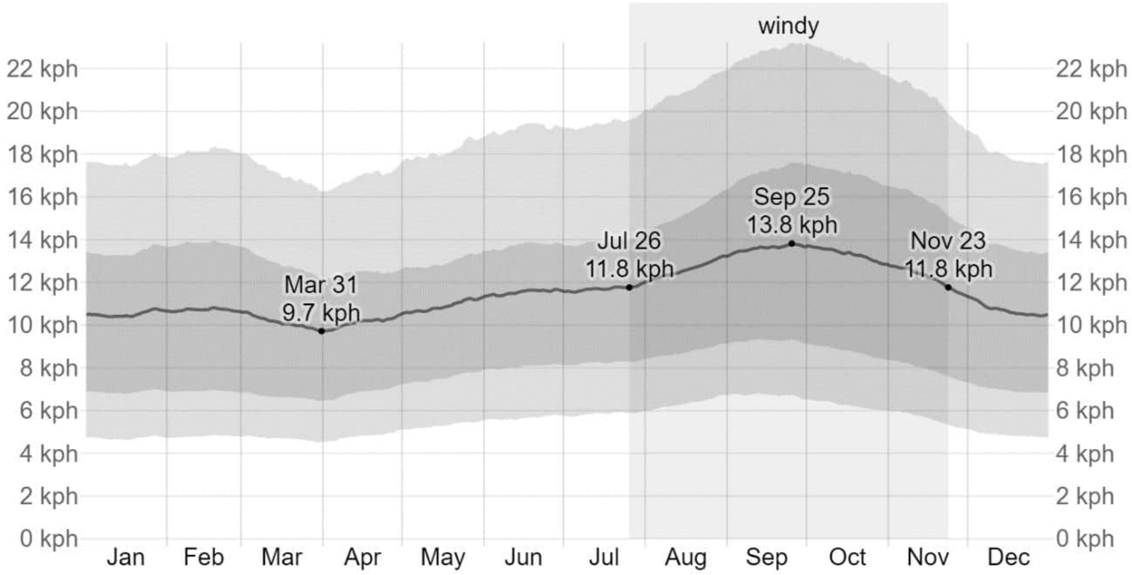


Figure 7-7 - Average wind speed in Belfast

The wind is most often from the west for 4.5 months, from April 17 to September 1, with a peak percentage of 43% on June 11. The wind is most often from the north for 2.9 months, from September 1 to November 29, with a peak percentage of 38% on September 24. The wind is most often from the east for 4.6 months, from November 29 to April 17, with a peak percentage of 43% on January 1. The **Figure 7-8** below outlines the wind direction in Belfast throughout the year.

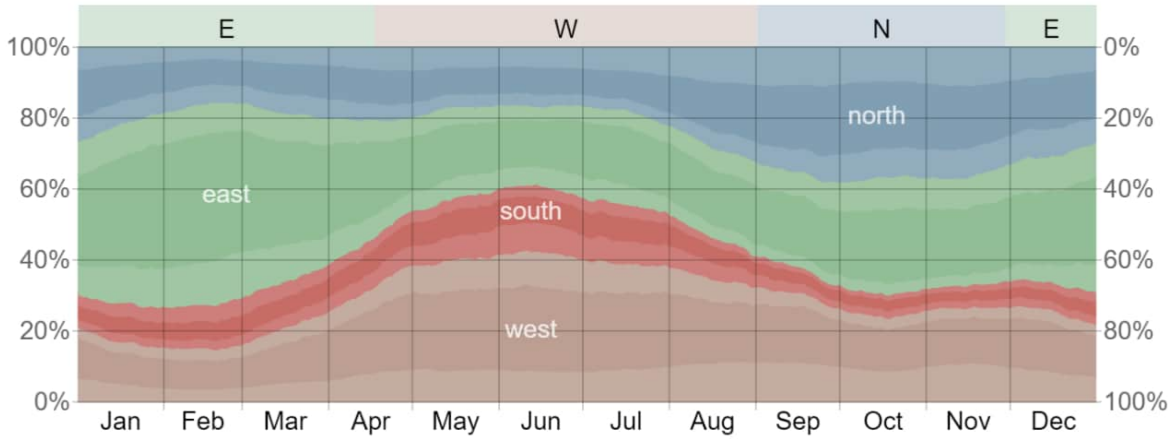


Figure 7-8 - Wind direction in Belfast

7.1.2 BACKGROUND AIR QUALITY

An evaluation of the existing air pollution situation provides an understanding of the potential risk for health impacts. The DFFE has identified District and Metropolitan Municipalities of concern with respect to air quality based on the prevalence of sources of emissions for each source category. The National Framework for Air Quality Management in the Republic of South Africa (hereafter referred to as 'The National Framework') has rated the Gert Sibande and Nkangala District Municipalities, as having "poor" air quality. The district area is thus identified as being in either the upper range of prevalence for one or more emission source categories or middle range in two or more categories relative to other Districts. Municipalities that are classified as having poor air quality require priority attention in terms of air quality management planning.

The development site falls within one of South Africa's key air quality regions known as the Highveld Priority Area (HPA). The Highveld area is associated with poor air quality and elevated concentrations of criteria pollutants due to the high volume of both industrial and non-industrial emission sources. The HPA was declared on 23 November 2007, covers an area of 31,106 km^2 and encompasses multiple municipal jurisdictions including a single metropolitan municipality and nine local municipalities across the Gauteng and Mpumalanga provinces.

The Air Quality Management Plan (AQMP) for the HPA identifies the Gert Sibande District Municipality as one of the HPA's nine air quality hot spot areas. This classification is based on atmospheric dispersion modelling outputs verified by ambient air quality monitoring data. It is highlighted that the HPA AQMP's assessment is limited to criteria pollutants (specifically, SO^2, NO^2, PM10 and O^3) none of which are relevant to the proposed Dalmanutha Renewable Energy Complex.

The nearest AAQM station to the study site is the Carolina station owned and managed by Eskom, approximately 22km to the southern boundary of the proposed site. Pollutants measured by this station include PM10, PM2.5, CO, NO2, SO^2 and O^3. None of these pollutants are relevant to the proposed renewable energy complex.

7.1.3 TOPOGRAPHY

The site lies within the Quaternary catchment X11D. Numerous non-perennial rivers drain in an easterly direction into the perennial Waalkraalloop river and in a westerly and southerly direction into the perennial Klein Komati River. Marsh/vlei features are indicated on **Figure 7-9** to the north and south of the site.

The terrain consists of rolling hills with flat hill tops. The proposed WEF lies at an elevation of approximately 1630m in the northern section to 1888m in the southern section. Areas with a relatively high elevation are shown in green on **Figure 7-9**. whilst areas with a relatively low elevation are shown in pink. The majority of the WEF site has a slope of between 4.4 degrees and 10.2 degrees. The central part of the site is generally flat with a range in slope from 0.0 degrees to 4.4 degrees as shown in **Figure 7-10**. The southern portion is characterized by hills leading to steeper slopes of between 10.2 degrees – 34.4 degrees.

The topography of the site and erosion are interrelated. The slope on site, as well as the soil structure will influence the amount of erosion. Land on steeper slopes will be more prone to erosion. It must be noted that no significant erosion channels were encountered during the reconnaissance with the exception of erosion gullies along the farm road cuttings. The proposed turbine locations are covered with grass and sparse trees, and there is therefore a reduced risk of erodibility problems. The possibility of erosion must be mitigated, at each turbine position, by revegetation after construction.

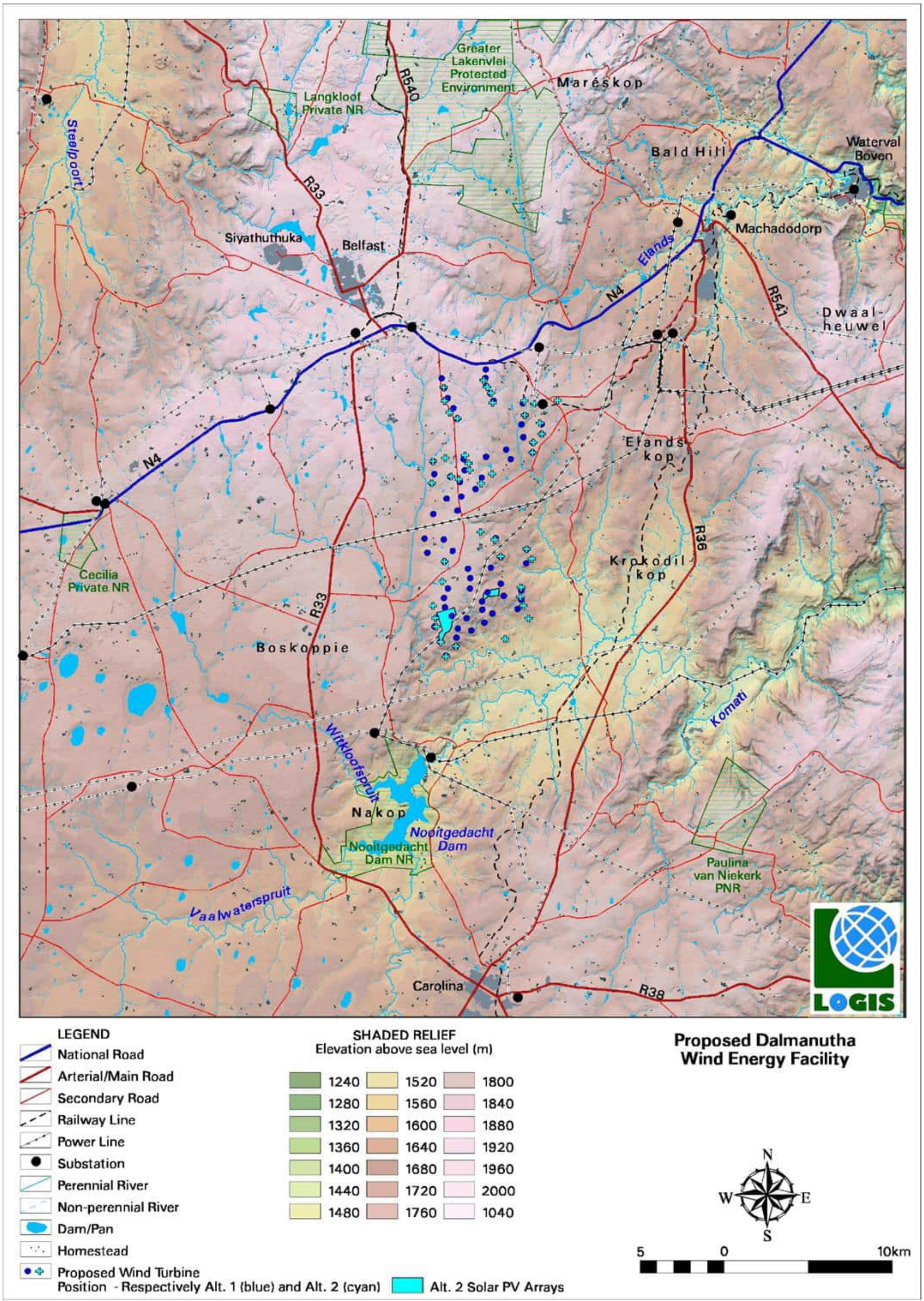


Figure 7-9 - Elevation map of project area indicating both project alternatives

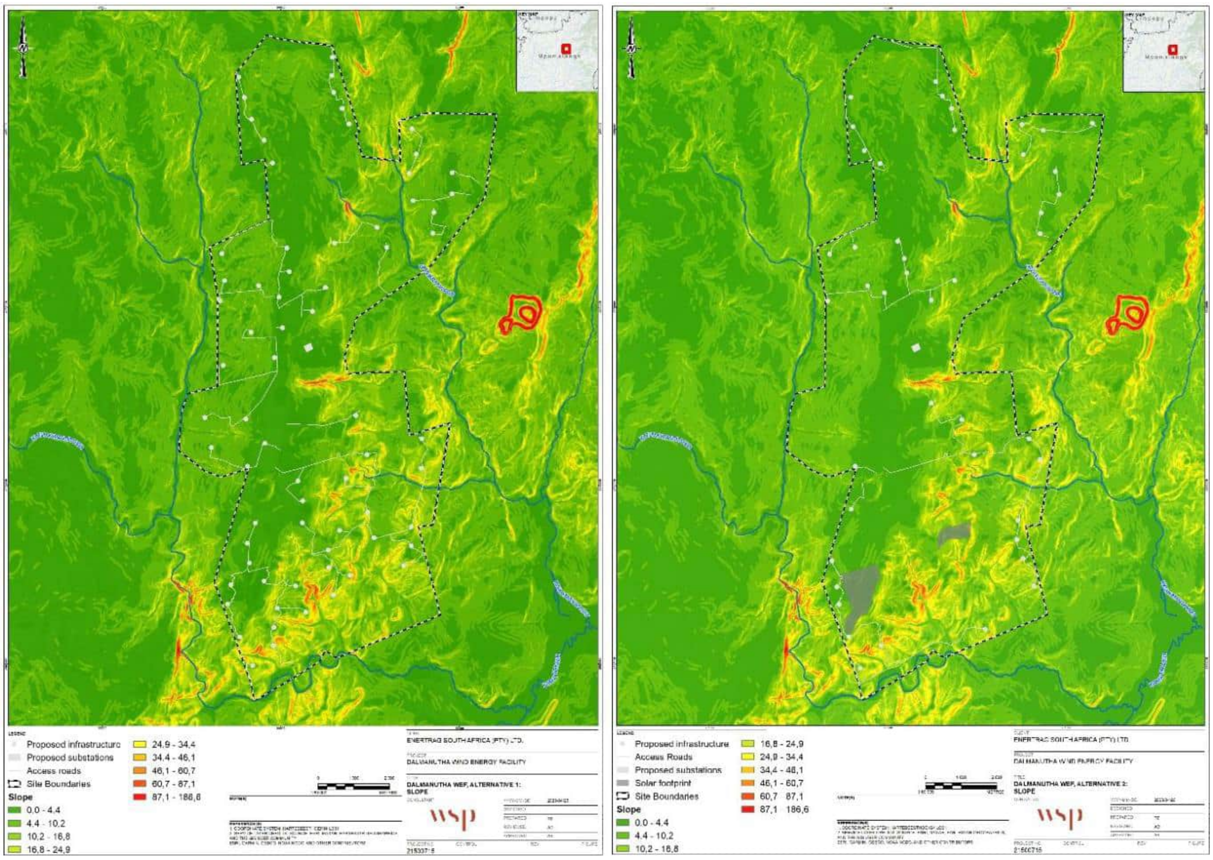


Figure 7-10 - Slope classification of Project Area (Alternative 1 and Alternative 2)

However, all the turbines in this area are located on the flat hill tops. A general view of the site is provided in **Figure 7-11**

Figure 7-11 - Proposed WEF Area Characterized by Hilly Terrain

7.1.4 GEOLOGY

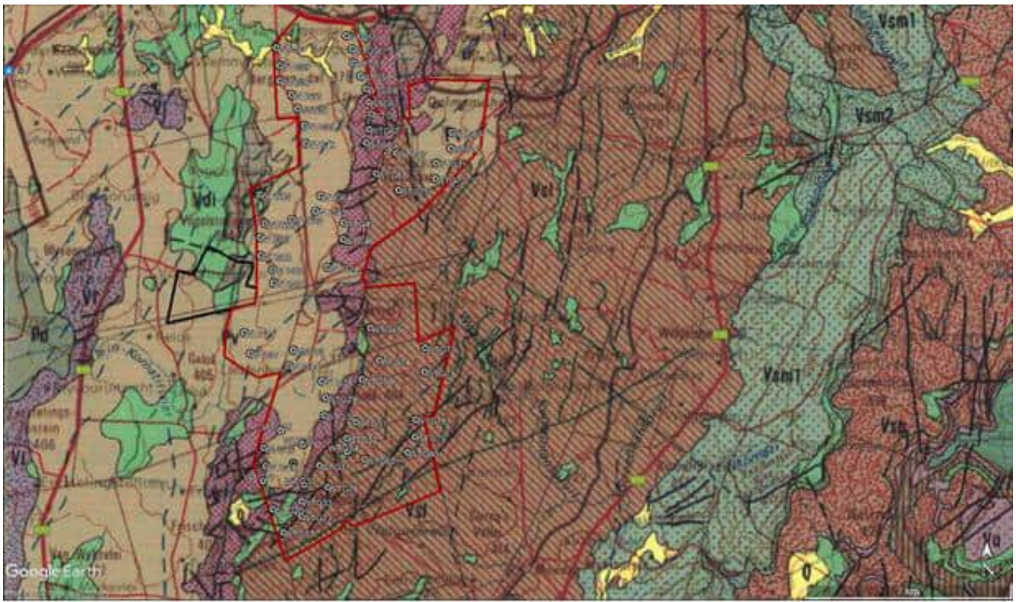
According to the published 1: 250 000 geological map (Sheet 2530 Barberton), the western and north-eastern portions of the study area are underlain by the Vryheid Formation (Pv), Ecca Group, Karoo Supergroup. This comprises quartzitic, cross-bedded sandstone, pebbly near its base, gritty sandstone, and shale. A small portion of the western boundary is underlain by the Vermont Formation (Vv) comprising fine-grained hornfels, with sedimentary structures, near the top and base, layers of silt and sandstone and minor layers of carbonate and calc-silicate rocks, Hornfels was not observed on site during the reconnaissance by the specialist.

However, baked shale was encountered. The central portion of the site is underlain by the Magaliesberg Formation (Vm) which comprises pure, coarse-grained, white quartzite containing sporadic impersistent shale layers in places, upper part comprising interlayered shale, siltstone and quartzite, and lower part shale.

The eastern portion is underlain by the Silverton Formation (Vsl) comprising greenish, fine-grained, laminated shale and subordinate mudstone, interlayered carbonate layers rare, hornfels in places. The Vermont, Magaliesberg and Silverton Formations form part of the Pretoria Group, Transvaal Supergroup. These formations have been intruded by diabase (Vdi). Recent surficial deposits (Q), alluvium and scree blanket a small section of the study area.

It is anticipated that areas of outcrop, shallow rock and relatively thinly developed soil will be present across much of the Dalmanutha site. Rock is expected across much of the site at a depth of less than 3m and, therefore founding in rock is recommended. It is recommended that test pits be excavated at each turbine position during the geotechnical site investigation to determine the depth to rock and the strength characteristics thereof. Some rotary cored boreholes would be required to determine the rock strength with depth in, particularly, the shales. The quartzite is expected to be medium hard to hard from surface or from a shallow depth.

Up to a depth of 3m, all excavations should be excavated at a batter of 1:1 in soil where no water or seepage is evident and to 1:2, or flatter, where water is encountered. Rock can be excavated at a batter of 1:0.5 or vertically in the temporary case up to a depth of 3m. According to the published geological map the regional dip of the shale and quartzite is approximately 8° to the northwest. Instability is, therefore, not expected in rock slopes as the regional dip is less than the expected shear strength parameters of the rock. Depending on the embedment depth, blasting may be required for cable trenches. Alternatively, surface conduits or pole mounted cables may be considered to alleviate the costs of blasting.



Super-group	Group	Formation	Member	Lithology	Map symbol
				Dolerite	Vdi
Karoo	Ecca	Vryheid		Quartzitic, cross bedded, sandstone, gritty sandstone & shale	Pv
Transvaal	Pretoria	Vermont		Fine grained hornfels. Layers of siltstone and sandstone. Minor layers of carbonate and calc-silicate rocks	Vv
		Magaliesberg		Pure, coarse-grained quartzite with some shale layers in places. Upper part comprises interlayered shale, siltstone and quartzite.	Vm
		Silverton	Lydenburg Shale	Greenish, fine grained, laminated shale and subordinate mudstone. Interlayered carbonate layers are rare. Hornfels in places.	Vsl
			Machadadorp	Very fine-grained tuff, coarser grained conglomerate and basic lava. Deeply weathered pillow lava and pale green tuff with pyroclastic layers.	Vsm
			Boven Shale	Greenish fine-grained shale and mudstone with tuff and subordinate carbonate layers. Hornfels in places.	Vsb

Figure 7-12 - Geology of the site

Climate

The climatic regime of the present and of the relatively recent times plays a fundamental role in the development of the soil profile. The site falls within the sub-humid part of South Africa where Weinerts climatic N-value is less than 5 which promotes chemical weathering and results in thick deeply weathered residual soils. Pedocretes, where present, are likely to be in the form of ferricrete. However, during the site reconnaissance, surface and subsurface rock was observed. Thicker soil profiles are anticipated in the valleys.

Undermining

Subsidence at surface in undermined areas is caused by collapse and failure of the underground mining void relatively close to the surface (Heath and Engelbrecht, 2011). The Dalmanutha WEF site is located approximately 8km southeast of the North Block Complex Belfast Coal Mine and approximately 10km east of the Exxaro Belfast Mine. Both mines are operating as open cast mines and, hence, there is no undermining at the WEF site, and no mine related subsidence is expected.

Flooding

Flooding affects flat lying areas, areas confined to drained channels and flood plains. All the turbines are located on flat hill tops where water ponding is a possibility. Stormwater management is recommended at all flat areas to facilitate water run-off and to alleviate the possibility of standing water at the positions of foundations.

Seismicity

According to the published seismic hazard map of South Africa (Kijko, et al., 2003), the probability of a seismic event occurring is low with a value for peak ground acceleration at the site being between 0.08 and 0.12m/s as illustrated in **Figure 7-13**. A 10% probability exists that this value will be exceeded in a 50-year period.

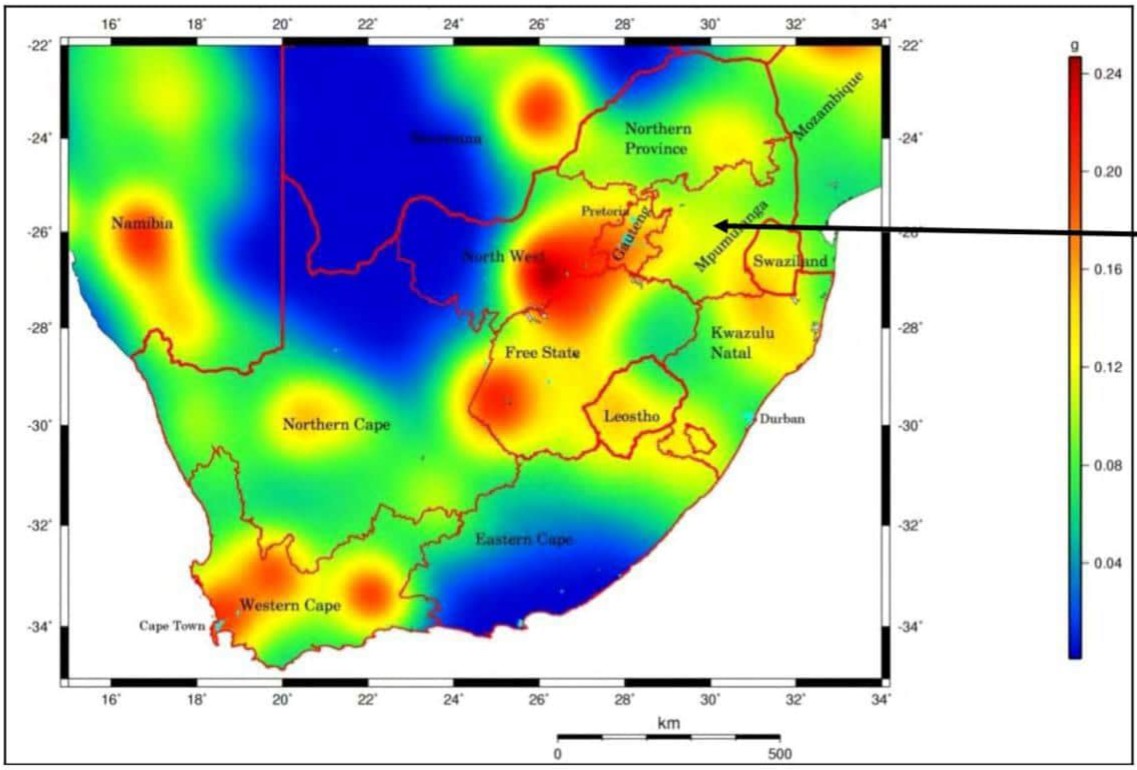


Figure 7-13 - Seismic Hazard Map of South Africa

Turbines

The proposed foundation bases are $25m^2$ in area and the concrete base is 3m deep. The structures exert a static load. However, it is loading as a result of the high wind shear that drives the selection of founding medium.

A high strength material is required for founding to provide sufficient bearing capacity and strength Rock is expected across much of the site at a depth of less than 3m and, therefore founding in rock is recommended. It is recommended that test pits be excavated at each turbine position during the geotechnical site investigation to determine the depth to rock and the strength characteristics thereof. Some rotary cored boreholes would be required to determine the rock strength with depth in, particularly, the shales. The quartzite is expected to be medium hard to hard from surface or from a shallow depth.

Solar Pylons

The structures exert a static load. However, it is loading as a result of the high wind shear that drives the selection of founding medium. A high strength material is required for founding to provide sufficient bearing capacity and strength.

Due to the variation in the geotechnical conditions across the site, the foundation recommendations will vary depending on the geotechnical ground conditions.

In the areas underlain by quartzite, rock is expected on surface or in depth shallower than approximately 1.50m, and conventional founding in rock is recommended. The depth to rock in the areas underlain by mudrock (shales and siltstones) is expected to be >3m.

Proposed foundation types recommended are driven piles (areas with boulders and shallow bedrock excluded) and cast in-situ concrete piles (an appropriate piling method that can pierce through boulders and shallow soft to very soft rock).

7.1.5 SOILS AND AGRICULTURAL CAPABILITY

Land capability is the inherent capacity of land to be productive under sustained use and specific management methods. The land capability of an area is the combination of the inherent soil properties and the climatic conditions as well as other landscape properties, such as slope and drainage patterns that may have resulted in the development of wetlands, as an example.

Using the Scotney et al. (1987) system and based on the soils identified on the Project site, a portion of the site's land capability class is Arable II (underlain by Shortlands and Clovelly soils), a portion is Grazing VI (underlain by Valsrivier soils), a portion is Wildlife VIII (underlain by Mispah and Glenrosa soils) and the watercourse and wetland areas (WSP, 2022a) are Grazing V. Because the site soil classification was undertaken in a freeform manner according to an early version of the turbine layout, and not based on a set grid across the whole site, vegetation community information (WSP, 2022b) has been used to augment the soil forms information in order to better inform the soil capability mapping (see Figures 4-10 and 4-11).

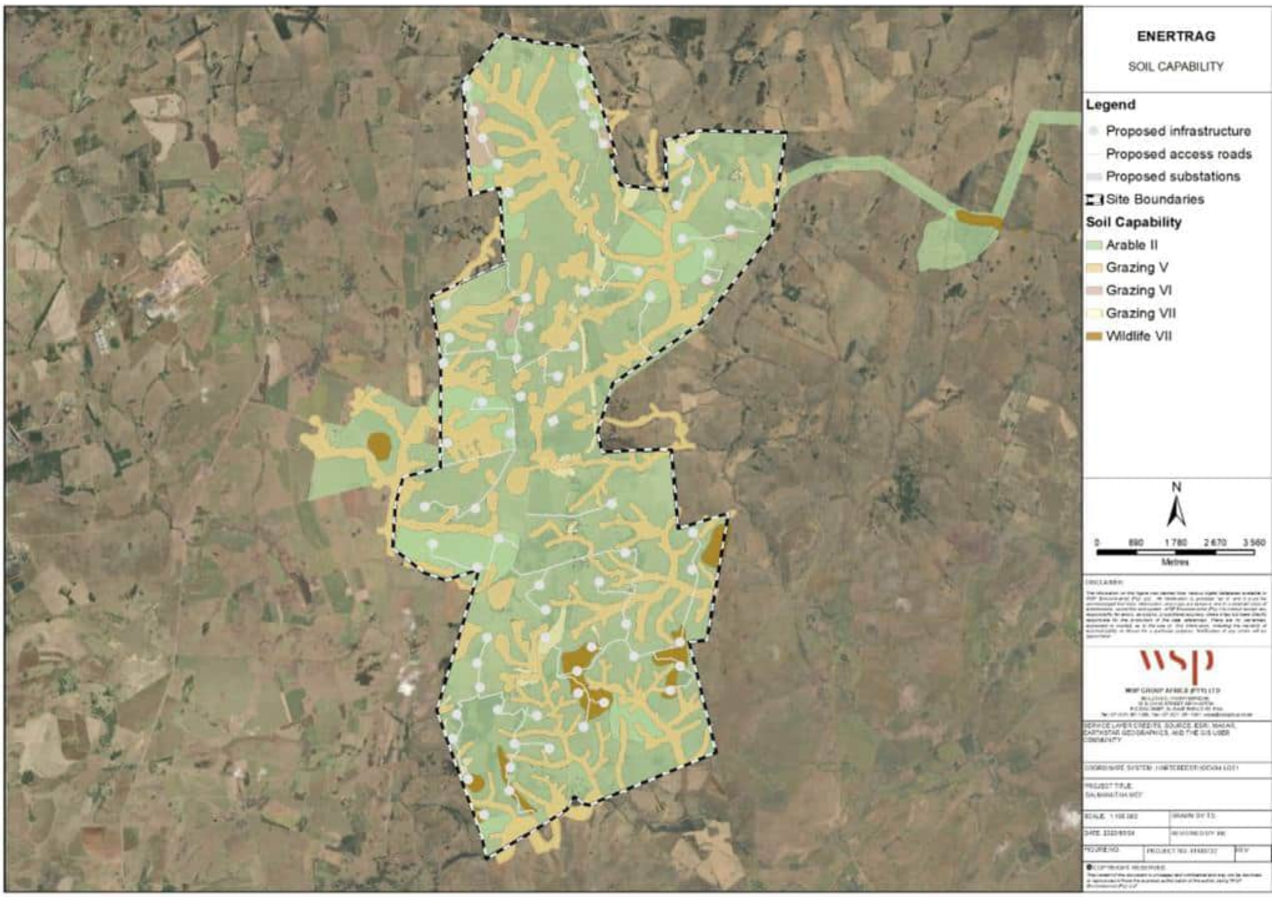


Figure 7-14 - Dalmanutha Site Soil Capability for project Alternative 1 (Scotney et al. 1987)

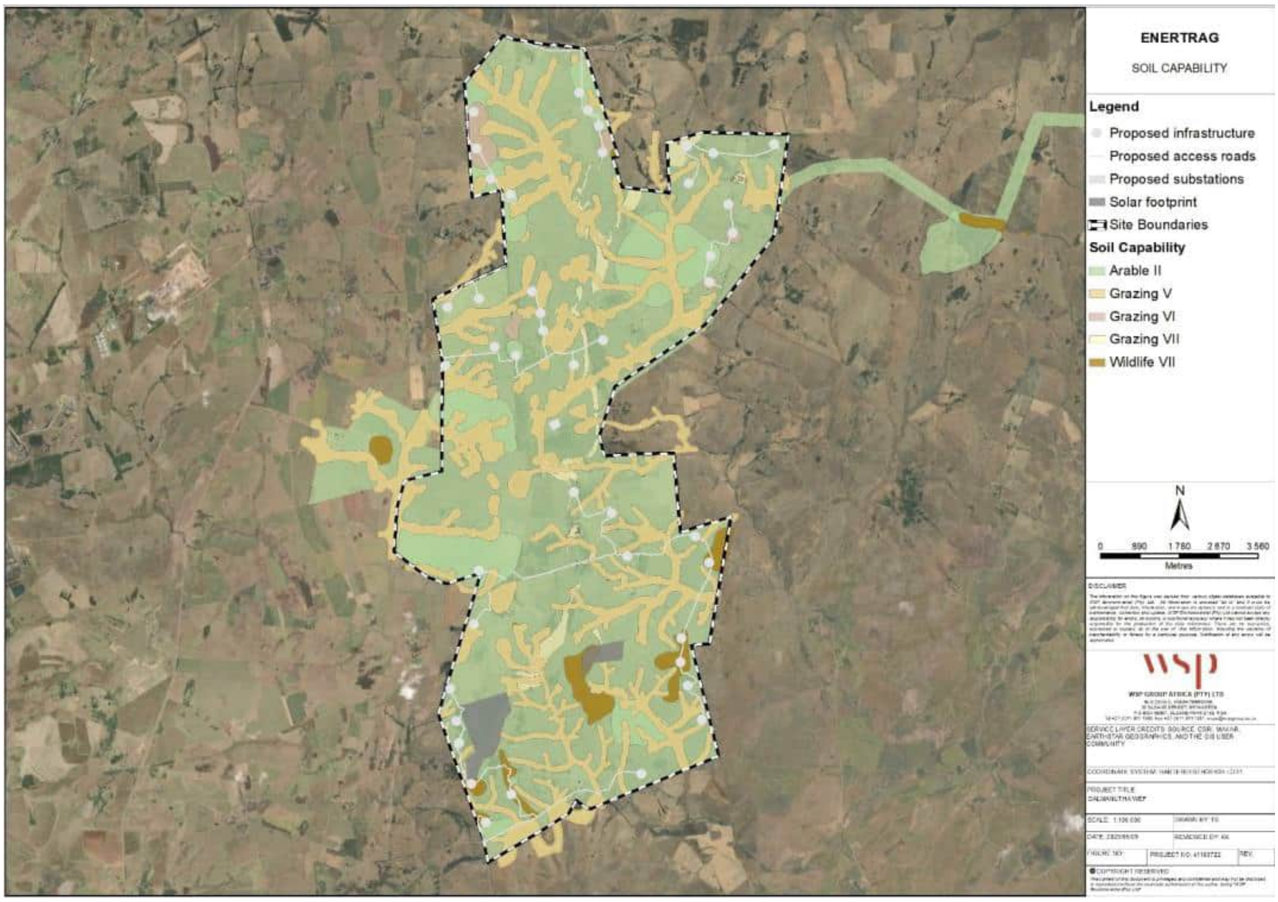


Figure 7-15 - Dalmanutha Site Soil Capability for project Alternative 2 (Scotney et al. 1987)

According to the DFFE 2021 database, the current land use of the site is a combination of cultivated land, forested land, wetland and grassland. A very small portion of the site is built up. Figure 4-11 shows the DFFE land uses of the project area. Further investigation (WSP, 2022b) shows that 16%of the Project area is or has been cultivated, 17% of the Project area comprises wetlands and an area immediately around the wetlands (buffer area), and 57% of the Project area is grasslands (see Figure 4-12). This does not, however, mean that 57% of the land's soil capability is only suited to grasslands or is non-arable (Grazing or below). This area has simply not been cultivated. Less than 3% of the grassland area is rocky grassland, which is the grassland area that is too shallow for cultivation, and its capability would be Grazing or below.

Parts of the site are used for cultivation and parts are used for the grazing of both cattle and sheep. Cultivated crops within the study area include maize, soya beans and the fodder crop, weeping love grass, *Eragrostis curvula*. The area exceeds the national average in terms of agricultural productivity. The site contains cultivation lands that make an important contribution to national food security, within the South African context of a considerable scarcity of arable land. Mpumalanga is the province that produces the second highest amount of maize after the Free State. The area produces long term average maize and soya bean yields that, according to verbal information supplied by farmers in the area, are above average for commercial farmers in South Africa. The long-term grazing capacity across the site is 4 - 5 hectares per large stock unit (Department of Agriculture, Forestry and Fisheries, 2018), which is also high in a South African context.

The soils still to be identified in the field will be classified by form in accordance with the South African soil taxonomic system (Soil Classification Working Group, 1991) and the area's land capability will be assessed and mapped based on the results of the classification study. The South African land capability classification system by Scotney et al. (1987) will be used to classify and map land capability (**Figure 7-16**). This system is useful in that it is able to quickly provide an overview of the agricultural capability and limitations of the soils in question information about the soil potential for alternative uses.

Land Capability Group	Land Capability Class	Increased intensity of use									Limitations
Arable	I	W	F	LG	MG	IG	LC	MC	IC	VIC	No or few limitations. Very high arable potential. Very low erosion hazard
	II	W	F	LG	MG	IG	LC	MC	IC	-	Slight limitations. High arable potential. Low erosion hazard
	III	W	F	LG	MG	IG	LC	MC	-	-	Moderate limitations. Some erosion hazards
	IV	W	F	LG	MG	IG	LC	-	-	-	Severe limitations. Low arable potential. High erosion hazard.
Grazing	V	W	-	LG	MG	-	-	-	-	-	Water course and land with wetness limitations
	VI	W	F	LG	MG	-	-	-	-	-	Limitations preclude cultivation. Suitable for perennial vegetation
	VII	W	F	LG	-	-	-	-	-	-	Very severe limitations. Suitable only for natural vegetation
Wildlife	VIII	W	-	-	-	-	-	-	-	-	Extremely severe limitations. Not suitable for grazing or afforestation.

W - Wildlife
F - Forestry
LG - Light grazing
MG – Moderate grazing
IG - Intensive grazing
LC - Light cultivation
MC - Moderate cultivation
IC - Intensive cultivation.
VIC – Very intensive cultivation

Figure 7-16 - Land capability classification system (Scotney et al., 1987)

7.1.6 SURFACE WATER

Hydrological Catchment

Regionally the area is located in the Komati River catchment of Drainage Region X. Locally, the site lies within the quaternary catchment X11D, as shown in **Figure 7-18**. The catchment is situated within the Komati Water Management Area (WMA). The mean annual runoff (MAR) for the X11D catchment is 88mm (WR2012). This catchment receives 744mm rainfall per year and experiences 1413 mm of evaporation annually. Numerous non-perennial rivers drain in an easterly direction into the perennial Waalkraalloop river and in a westerly and southerly direction into the perennial Klein Komati River. The terrain of the proposed WEF lies at an elevation of approximately 1630m in the northern section, to 1888m in the southern section as shown in **Figure 7-19**. Areas with a relatively high elevation are depicted in green, whilst areas with a relatively low elevation are depicted in pink.

The slope of a catchment is a very important characteristic in the determination of flood peaks. Steep slopes cause faster runoff to shorten the critical duration of flood inducing storms, thus leading to higher rainfall intensities in the runoff formulae. On steep slopes, the vegetation is generally less dense, soil layers are shallower, and there are fewer depressions, all of which cause water to run off more rapidly. The result is that infiltration is reduced, and flood peaks are consequently elevated. For flat catchments such as those encountered on this site, the opposite holds true.

Land use is another critical characteristic as it alters the vegetation present and the degree of soil compaction. Compacted soil is less permeable, and vegetation can slow down stormflows over the land surface. Lastly, the soil type can also be important with some soils allowing quicker infiltration resulting in runoff for each catchment.

Table 7-2 - Conceptual Catchment Characteristics

Catchment	Catchment area (Km^2)	Permeability (desktop assessment, not lab tested)	Flow type	Vegetation
Catchment A	229 km^2	Permeable to Semi-Permeable	Overland Flow	Grasslands, Light Bush, and farmlands
Catchment B	236 km^2	Permeable to Semi-Permeable	Overland Flow	Grasslands, Light Bush, and farmlands

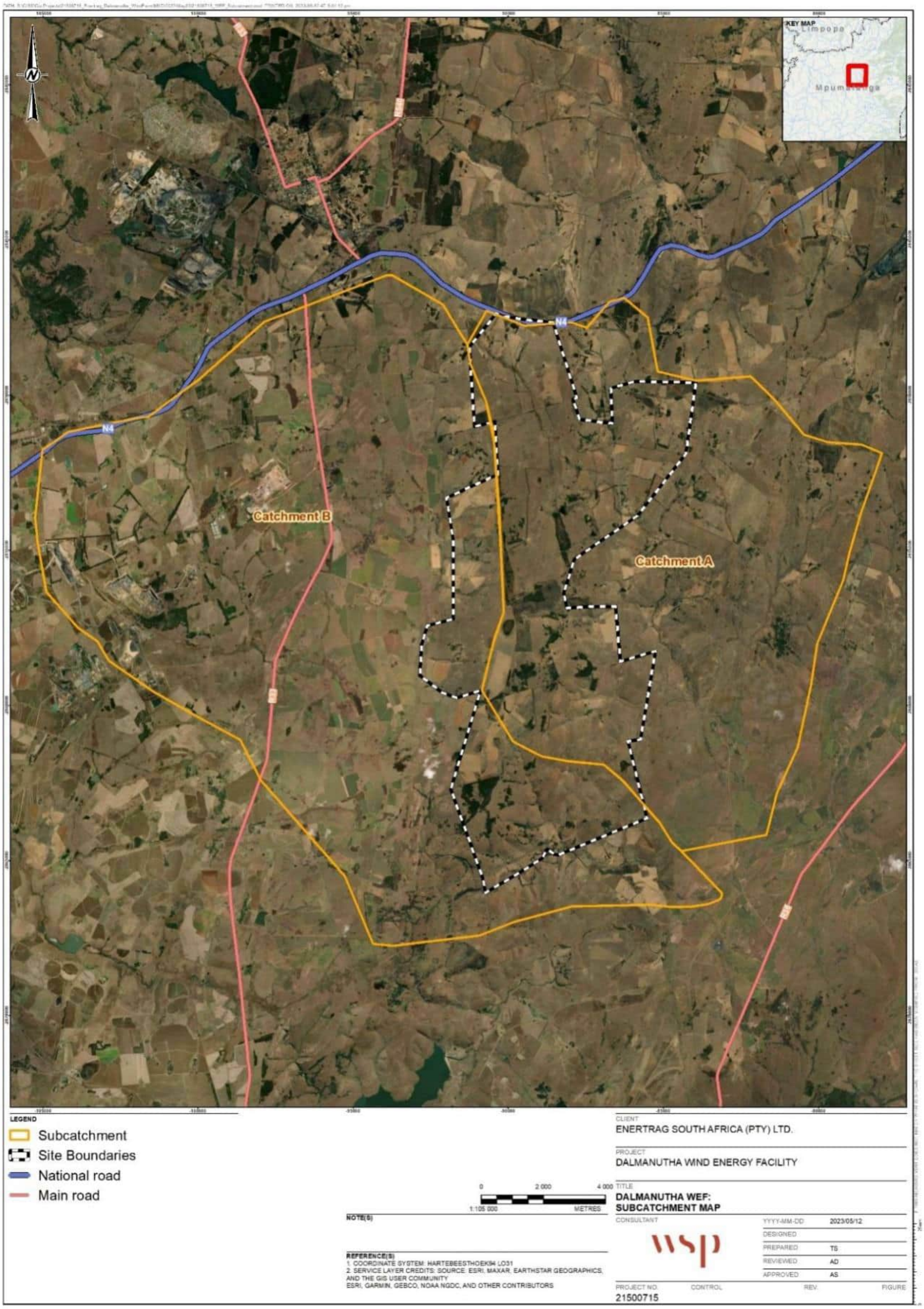


Figure 7-17 - Dalmanutha WEF Sub-catchments

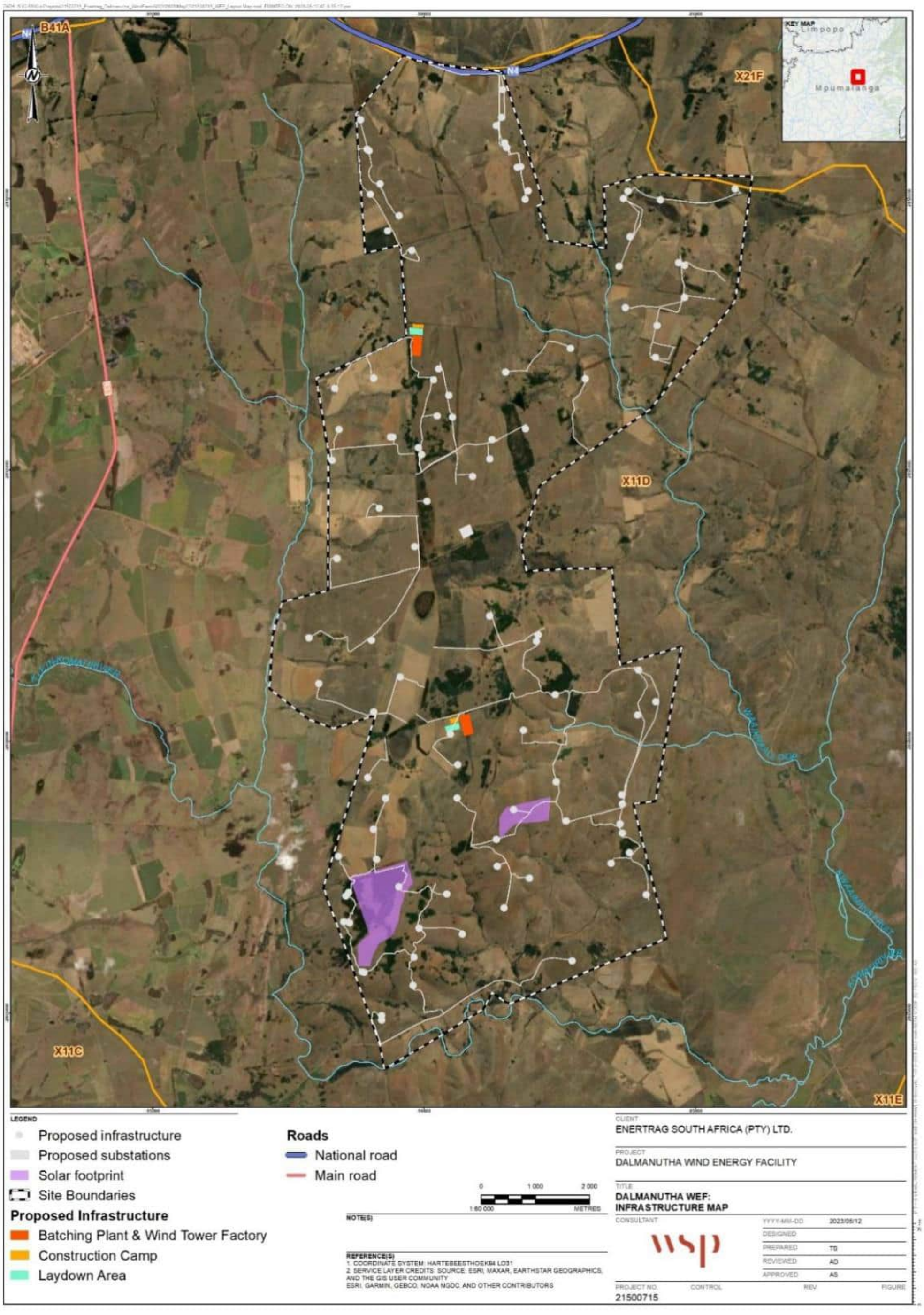


Figure 7-18 - Hydrological map of the area with infrastructure for both alternatives

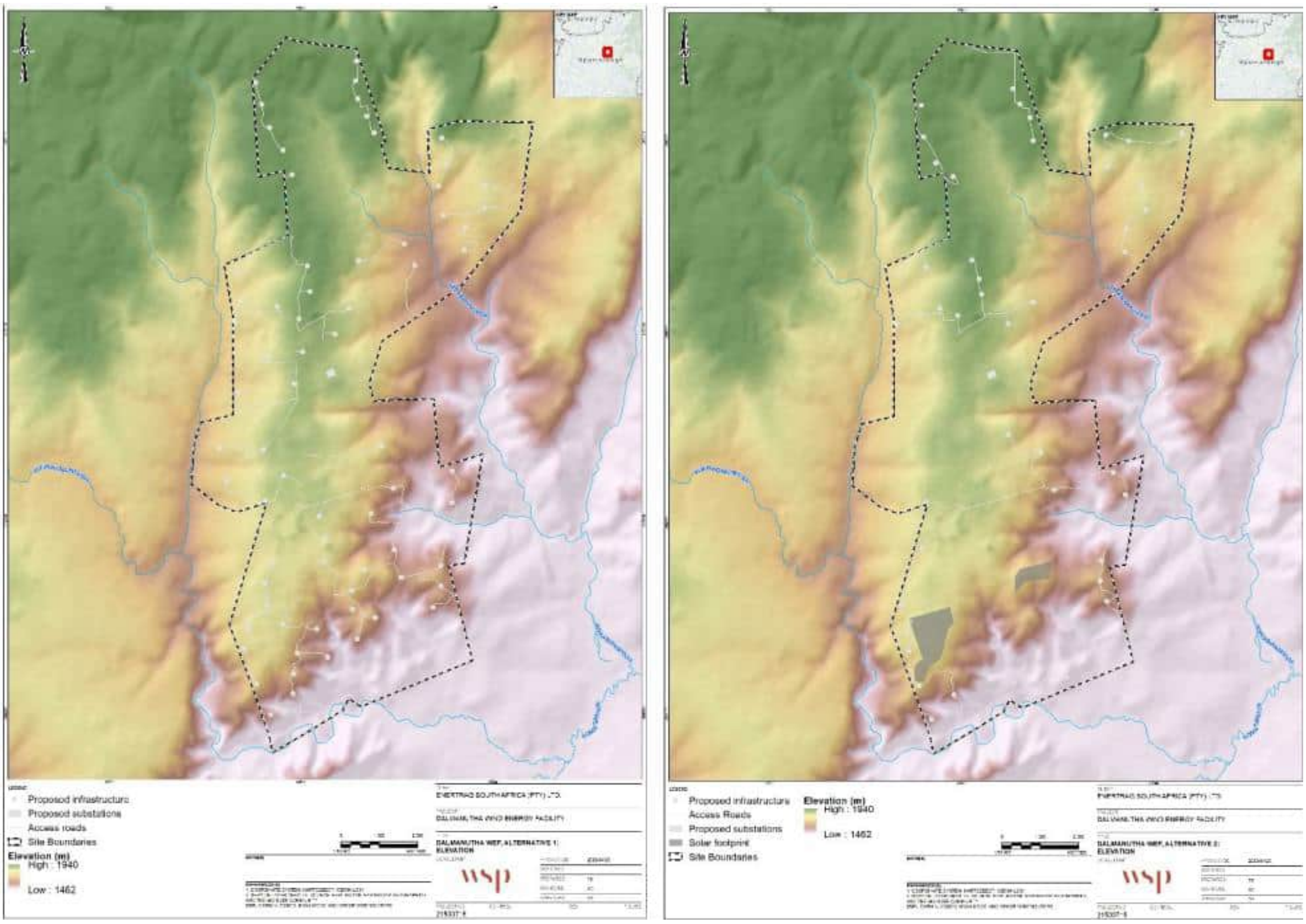


Figure 7-19 - Elevation and watercourses maps (Alternative 1 and 2)

Flood line Determination

It is important to note that although small non-perennial channels may not contribute significantly to the overall flood output, they can still pose a significant risk in localised areas and should not be overlooked in flood risk assessments. Therefore, a more well-defined survey such as 0.5 m to 1 m topographical contours would be required for the next phase of the project.

Through the flood analysis, it is clear that the proposed infrastructure (Construction camp, laydowns, internal access roads and onsite Substations) will not be at risk of damage through flooding from the channels. This is largely due to the general low rainfall in the area and the small catchments on the site, resulting in less accumulated surface runoff. Additionally, the structures are mostly placed on plateau areas, well outside of the flood extent. The post-development state will result in a very slight increased peak flow due to an increase in impervious structures and a resultant increase in storm flow. This has been accommodated through the storm water management plan, Section 8.8 of the EMPr (**Appendix I**). Although the laydown areas and crane pads are on the plateau of the mountain, they do still pose a risk of triggering erosion channels. In similar vein, the roads that traverse up steep slopes need to be secured against erosion.

The 1:100-year flood event, which is used in Water License Application was used to generate the flood lines. The inundation caused by this flood event is shown in

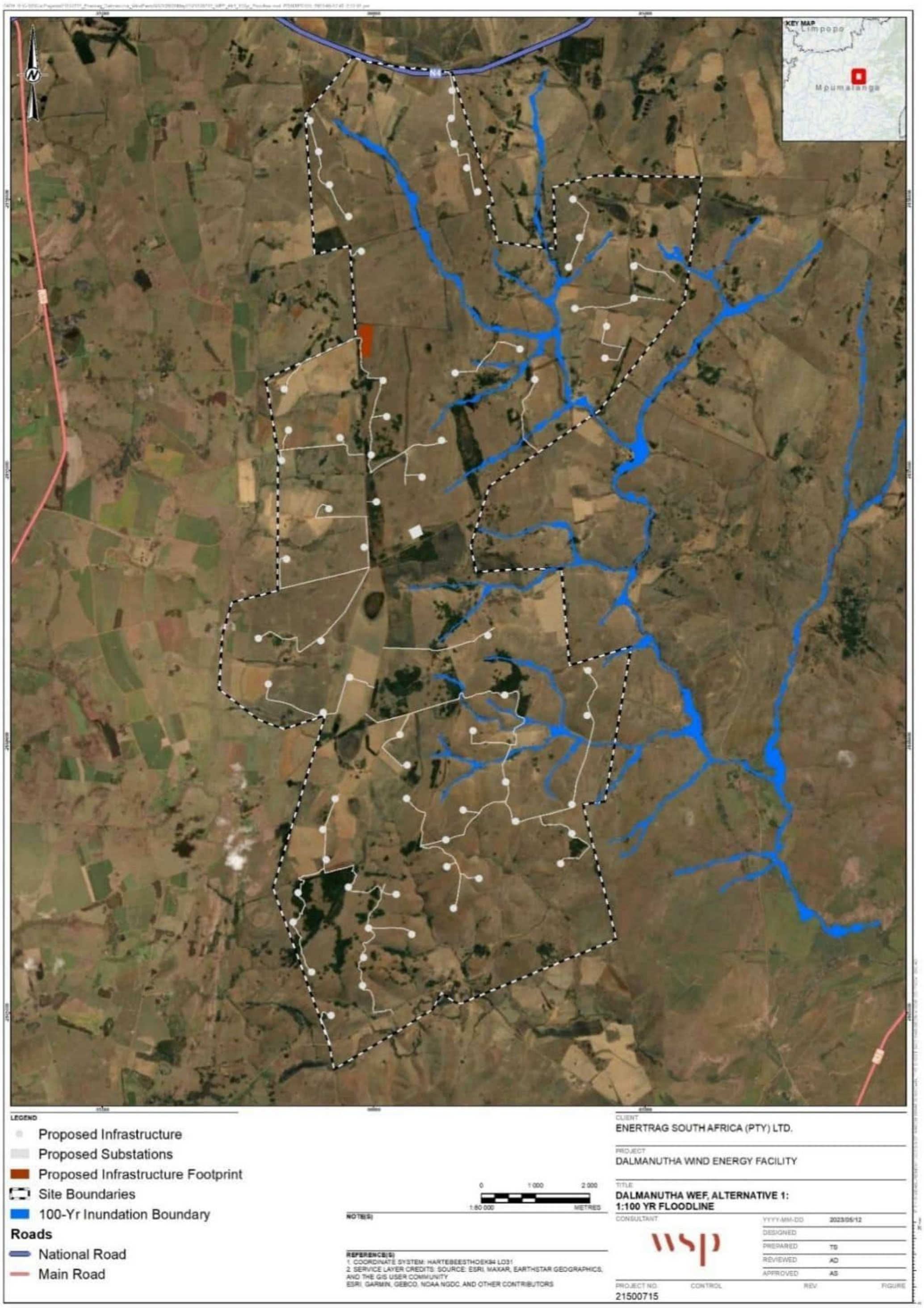


Figure 7-20 - Flooding during a 1:100-year rainfall event

7.2 BIOLOGICAL ENVIRONMENT

7.2.1 HABITATS

Natural Habitat Types

The Terrestrial Biodiversity and Plant Species Specialist Assessment study for the proposed Project identified five natural vegetation communities in the study area, namely Dry Mixed Grassland, Disturbed Grassland, Rocky Grassland, Moist Grassland and Wetland, and Forest Gorge Habitat. For the purposes of this terrestrial fauna study, these communities have been grouped into three primary natural habitat formations, viz. grassland habitats, wetland and river habitats, and forest gorge habitat. These are summarised below.

Grassland Habitats

The majority of the study area is characterised by open terrestrial grassland habitat (comprising the Dry Mixed Grassland, Disturbed Grassland and Rocky Grassland vegetation communities). These range from grasslands occurring on flat or slightly undulating plains (**Figure 7-21**) to rocky grassland occurring along mountain ridges and at rocky outcrops (**Figure 7-22**).

Grassland habitats are critically important and support most of the diverse fauna assemblages that are known from the Highveld region. Large portions of grasslands in the study area are hilly and remote, and have relatively low levels of human accessibility. These areas are particularly important for larger mammal species (e.g., antelope) that may be sensitive to anthropogenic disturbances, such as hunting. Areas of rocky grassland also provide specific niche habitat for *rupicolous* fauna (e.g., reptiles, Rocky hyrax).

Figure 7-21 - Short open grassland, flanked by alien tree plantations

Figure 7-22 - Short, rocky grasslands are often characterised by scattered indigenous woody shrubs and trees favouring rupicolous fauna.

Wetland and River Habitats

These habitats include moist grassland and wetlands, stream and river channels, pans and open farm dams (see **Figure 7-23** and **Figure 7-24**). These habitats are functionally very important, and several aquatic and semiaquatic fauna species (e.g., otters, amphibians) are dependent upon them. Many other fauna species will also use these areas as key resource habitats for grazing (antelope), sheltering and hunting (predators).

Figure 7-23 - Well-vegetated stream located in the west of the study area.

Figure 7-24 - Large farm dam located in the centre of the study area.

Forest Gorge Habitat

This habitat type is confined to a short, deeply-incised river valley in the centre of the study area – shown in **Figure 7-25** and **Figure 7-26**. The valley bottom is dominated by indigenous forest, while the adjacent steep rocky cliffs are generally well-vegetated with grasses, forbs, shrubs and succulents. Forest gorge habitat significantly increases the degree of local-scale habitat heterogeneity in the study area, and this area will support a diverse fauna community, including both forest specialist and *rupicolous* species that are unlikely to be present in adjacent grassland areas.

Figure 7-25 - Well-wooded indigenous forest.	Figure 7-26 - Well-vegetated cliffs enclose the gorge forest.

Modified Habitat Types

Two primary modified habitat types were identified in the study area, namely alien tree plantations and cultivated fields. These are discussed below.

Alien Tree Plantations

Numerous alien tree plantations are present in the study area. These range from small woodlots and windrows, to large plantations and informal thickets/infestations (**Figure 7-27**). Despite being classified as a modified habitat type, alien tree plantations do provide well-wooded refuge areas that are likely to be used by fauna that may be sensitive to hunting and other forms of anthropogenic disturbance. It is also expected that certain nocturnal fauna shelter among the trees during the day and emerge at night to forage in the adjacent open grasslands.

Figure 7-27 - Alien tree plantations provide dense, well-wooded habitat.

Cultivated Fields

Portions of the study area are also characterised by cultivated fields. These are used for maize or soya production (**Figure 7-28**) or maintained as open pastures for grazing livestock. Cultivated fields are regularly disturbed and dominated by non-indigenous vegetation. Although certain fauna species may move through these areas and occasionally forage in them, considering the degree of ongoing disturbance and modification, cultivated fields are not considered important fauna habitat.

Figure 7-28 - Cultivated field under maize production.

7.2.2 REGIONAL ECOSYSTEM AND VEGETATION CHARACTERISTICS

The study area is located in the grassland biome and according to the regional mapping of South Africa's vegetation, it is characterised by three vegetation types Eastern Highveld Grasslands (Gm 12), Steenkampsberg Montane Grassland (Gm 30) and KaNgwane Montane Grassland (Gm 16). These vegetation types, along with the general characteristics of the grassland biome, are discussed in more detail below. A map showing the distribution of the regional vegetation types in the study area, as per 2018 SANBI spatial data, is shown in **Figure 7-29.**

Grassland Biome

The study area is located in the grassland biome, which covers approximately 28% of South Africa and is the dominant biome of the central plateau and inland areas of the eastern subcontinent (SANBI, 2013). Grasslands are typically situated in moist, summer rainfall regions that experience between 400 mm and 2000 mm of rainfall per year. Vegetation consists of a dominant field-layer comprising grasses and herbaceous perennials, with little- to no woody plants present.

South Africa's grassland ecosystems are parsed into five groups, with the study area forming part of the Mesic Highveld Grasslands grouping with possible elements of High-Altitude Grassland (SANBI 2013). Mesic Highveld Grasslands occur at mid-altitudes and experience warm, wet summers (MAP 700-1200 mm) and cold winters. They are typically highly productive sourveld grasslands that are dominated by long-lived perennial grasses (SANBI, 2013). As the name suggests, High-Altitude Grasslands occur at higher altitudes locations and are dominated by slow growing grasses. They experience cold winters, with frequent frost and rainfall ranging between 1200-1500 mm per year. are also sourveld

Fire is common in Mesic Highveld Grasslands, but typically less frequent in High-Altitude Grassland. Coupled with frequent winter frost, fires maintain these ecosystems in a relatively treeless form (SANBI, 2013). Apart from their importance as rich stores of biodiversity, grasslands are critically important water production landscapes, constituting about half of South Africa's Strategic Water Source Areas (SANBI, 2013).

7.2.3 REGIONAL VEGETATION TYPES

Eastern Highveld Grassland

Eastern Highveld Grasslands extend from Johannesburg in the east through to Bethel, Ermelo and Piet Retief in the west. This vegetation type is found on slightly- to moderately undulating plains, low hills and wetland depressions. Grasses are typical Highveld species from the genera *Aristida, Digitaria, Eragrostis and Tristachya*. Indigenous woody species are mainly restricted rocky areas and include *Celtis africana, Protea caffra, Protea welwitschii, Diospyros lycioides, Searsia magalismontana and Senegalia caffra* (Mucina & Rutherford, 2011).

Mucina & Rutherford (2011) note the following species, amongst several others, as important taxa in Eastern Highveld Grassland:

- Shrubs: *Anthospermum rigidum and Seriphium plumosum.*
- Graminoides: *Aristida aequiglumis, Aristida congesta, Aristida junciformis, Cynodon dactylon, Digitaria monodactyla, Eragrostis chloromelas, Eragrostis curvula, Eragrostis plana, Eragrostis racemosa, Heteropogon contortus, Loudetia simplex, Setaria sphacelata, Sporobolus africanus, Themeda triandra, Alloteropsis semialata and Monocymbium ceresiiforme.*
- Herbs: *Berkheya setifera, Haplocarpha scaposa, Euryops gilfillanii, Euryops transvaalensis, Justicia anagalloides, Acalypha angusta, Chamaecrista mimosoides, Dicoma anomala, Kohautia amatymbica, Lactuca inermis, Gladiolus crassifolius, Haemanthus humilis and Selago densiflora.*
- Endemic Taxa: The geophytic herbs *Agapanthus inapertus, Eucomis vandermerwei* and the succulent herb *Huernia insigniflora* are endemic to this region.

KaNgwane Montane Grassland

KaNgwane Montane Grassland occurs along the escarpment from the Phongolo Valley in the south to the Usutu- and Lomati Valleys near Carolina. These grasslands are characterised by undulating hills and plains which form a transitional habitat between the highveld and escarpment. Vegetation comprises short, closed grassland with diverse forbs and scattered woody shrubs on rocky outcrops.

- Graminoides: *Alloteropsis semialata, Brachiaria serrata, Cyperus obtusiflorus, Diheteropogon amplectens, Eragrostis racemosa, Heteropogon contortus, Hyparrhenia hirta, Loudetia simplex, Monocymbium ceresiiforme, Themeda triandra, Rendlia altera, Trachypogon spicatus, Andropogon schirensis, Bewsia biflora, Digitaria diagonalis, Eragrostis chloromelas, Eragrostis plana, Panicum ecklonii, Panicum natalense and Paspalum scrobiculatum.*
- Herbs: *Ipomoea oblongata, Acalypha peduncularis, Acalypha villicaulis, Aster harveyanus, Berkheya setifera, Corchorus confusus, Cyathula cylindrica, Dicoma zeyheri, Eriosema cordatum, Helichrysum adenocarpum, Helichrysum nudifolium, Mohria caffrorum, Ruellia patula, Sonchus wilmsii, Thunbergia atriplicifolia, Vernonia natalensis and Vernonia oligocephala.*
- Geophytic Herbs: *Boophone disticha, Cheilanthes deltoidea, Eucomis montana, Gladiolus ecklonii, Habenaria dregeana, Hypoxis iridifolia, Morea pubiflora, Pteridium aquilinum, Watsonia latifolia and Zantedeschia albomaculata.*
- Shrubs and Trees: *Senegalia caffra, Faurea rochetiana, Pachystigma macrocalyx, Cyathea dregei, Calpurnia glabrata, Cephalanthus natalensis, Diospyros lycioides, Heteromorpha involucrata, Asparagus cooperi, Gymnosporia heterophylla, Myrsine africana, Searsia discolor and Schistostephium rotundifolium.*
- Endemic Taxa: *Lotononis difformis, Lotononis spicata, Streptocarpus occultis and Syncolostemon comptonii.*

Steenkampsberg Montane Grassland

Steenkampsberg Montane Grassland extends along the Steenkampsberg escarpment from the mountains north-west of Lydenburg, southwards to Dullstroom and Belfast and then eastwards towards Elandshoogte. This vegetation type occurs on mountain plateaus and slopes and is characterised by short grassland with a high forb/herb diversity.

- Tree and Shrubs: *Leucosidea sericea, Searsia discolour, Rubus ludwigii and Lopholaena corifolia.*
- Graminoides: *Tristachya leucothrix, Harpochloa falx, Andropogon shirensis and Monocymbium ceresiiforme.*
- Herbs: *Acalypha wilmsii, Argyrolobium tuberosum, Helichrysum adenocarpum and Lobelia flaccida.*
- Endemic Taxa: *Searsia tumulicola, var. meeuseana, Crotalaria monophylla, Indigofera hedyantha var. steenkampianus, Kniphofia rigidifolia, Streptocarpus latens, Gladiolus cataractarum, gladiolus malvinus, Graderia linearifolia, Eucomis vandermerwei, Drimiopsis purpurea and Aloe challisii.*

7.2.4 NATIONALLY THREATENED ECOSYSTEMS

Both Eastern Highveld Grassland and KaNgwane Montane Grassland were previously listed as Vulnerable (Government notice 1002/2011, in terms of section 52(1)(a) of NEMBA). However, both vegetation types have subsequently been up-listed to Endangered, as a result of high rates of habitat loss (refer to the Revised National List of Threatened Terrestrial Ecosystems, 2022) (**Figure 7-29**).

Only a very small fraction of Eastern Highveld Grassland is conserved in statutory reserves (Nooitgedacht Dam and Jericho Dam Nature Reserves) and approximately 44% has been transformed, primarily by cultivation, forestry, mines, urbanisation and the building of dams. Similarly, Mucina and Rutherford (2011) indicate that only 0.4% of KaNgwane Montane Grassland is formally conserved, with forestry and cultivation the main threats to this vegetation type.

It is noted that small portions of the north of the study area also form part of the Dullstroom Plateau Grassland (MP4) ecosystem, which is listed as an Endangered ecosystem under the NEMBA (2011). This ecosystem comprises both the grassland and forest biomes and extends from Die Berg in the north to the town of Belfast in the south. It is delineated based on the presence of breeding and feeding habitat for cranes and Rudd's Lark. Thirty-three threatened and endemic flora and fauna species are known from the ecosystem. Other important ecosystem attributes include escarpment corridors, presence of important caves, pans and wetland and is important for grassland and forest processes the (**Figure 7-29**).

7.2.5 VEGETATION FEATURES OF CONCERN

Eastern Highveld Grassland (Gm12) is characterised by short, dense form of grassland, occurring on to moderately undulating plains, low hills and wetland depressions. It is dominated by the typical Highveld grassland flora including *Aristida, Digitaria, Eragrostis, Themeda, Tristachya* etc.); interspersed with small, scattered rocky outcrops with wiry, sour grasses and some woody species (*Acacia caffra, Celtis africana, Diospyros lycioides subsp. lycioides, Parinari capensis, Protea caffra, Protea welwitschii, and Rhus magaliesmontanum*). It is located almost entirely within the Mpumalanga Province, and a small section of the eastern parts of Gauteng. Eastern Highveld Grassland is considered to be Vulnerable nationally (Government notice 1002/2011, in terms of section 52(1)(a) of NEMBA)), as only a very small fraction is conserved in statutory reserves (Nooitgedacht Dam and Jericho Dam Nature Reserves) and approximately 44% has been transformed, primarily by cultivation, plantations, mines, urbanisation and the building of dams.

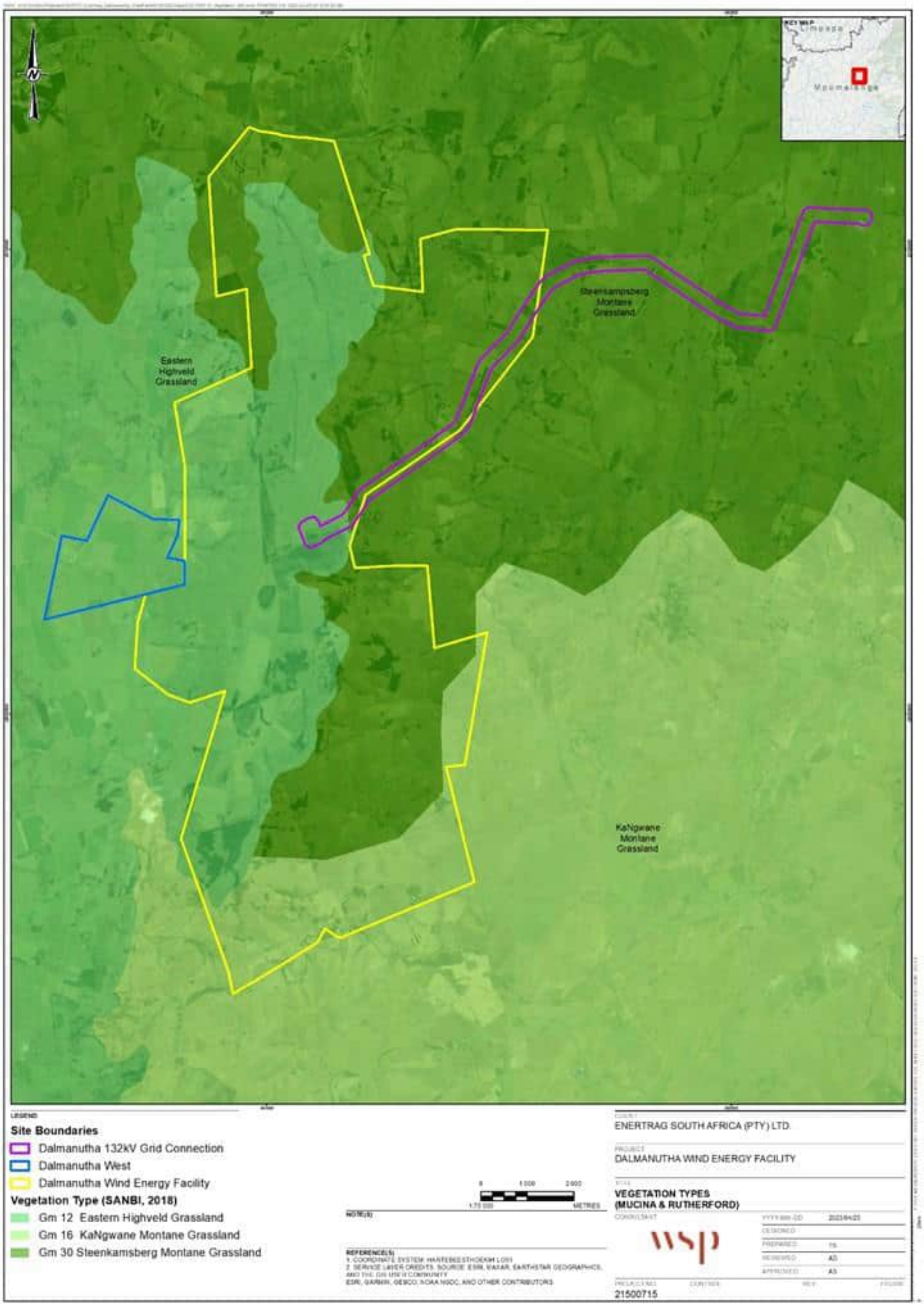


Figure 7-29 - Regional Vegetation Types of the Study Area

7.2.6 FLORA FEATURES OF CONSERVATION CONCERN

The majority of the study area is considered to be of 'Medium sensitivity' in terms of the Plant Species Theme of the National Screening Tool, on account of the potential presence of at least 19 flora species of conservation concern (e.g*., Khadia carolinensis, Asclepias dissona, Miraglossum davyi*). During a meeting held with one of the Project landowners in April 2022, several areas of importance in terms of support of a diverse range of plant species of interest, including various orchids, were identified.

7.2.7 BIODIVERSITY CONSERVATION PLANS

The Mpumalanga Biodiversity Sector Plan (MBSP) technical report (Lotter, 2015) defines five categories of conservation focus: protected areas, critical biodiversity areas (CBA), ecological support areas (ESA), other natural areas, and modified habitats. Definitions for each are listed below. These areas present risks to the Project in terms of impact, as well as opportunities for contribution to achieving provincially set targets for biodiversity conservation, through focused biodiversity management planning and adherence to the mitigation hierarchy during this EIA stage. The project footprint and infrastructure for both alternatives are overlain to the MBSP layers and shown in **Figure 7-30** and **Figure 7-31.**

- **Protected Areas:** protected areas recognised in terms of the National Environmental Management Protected Areas Act, No. 57 of 2003, that are currently considered to meet biodiversity targets in the MBSP.
- **Critical Biodiversity Area:** areas (outside of Protected Areas) that are required to meet biodiversity targets for biodiversity pattern (species and ecosystems) and ecological processes. They should remain in a natural state that is maintained in good ecological condition. The MBSP recognises two CBA ranks, viz, CBA Irreplaceable and CBA Optimal.
- **Ecological Support Area:** play an important role in supporting the ecological functioning of critical biodiversity areas or for generating or delivering important ecosystem services. They support landscape connectivity and resilience to climate change adaptation. They need to be maintained in at least an ecologically functional state.
- **Other Natural Areas:** often retain much of their natural character and may contribute significantly to maintenance of viable species populations and natural ecosystem functioning, and may provide important ecological infrastructure and ecosystem services. They are not, however, prioritized for immediate conservation action in the MBSP.
- **Modified:** often referred to as transformed, these areas have lost a significant proportion (or all) of their natural biodiversity and in which ecological processes have broken down (in some cases irretrievably), as a result of biodiversity-incompatible land-use practices such as ploughing, hardening of surfaces, mining, cultivation and the construction of houses or other built infrastructure.

Much of the LSA is mapped as CBAs and ESAs (**Figure 7-30**), due to the presence of natural grassland and wetland as presented in the national landcover dataset (GTI, 2020). It is noted that some of these areas were observed to be transformed for agriculture during the baseline field programme. A key outcome of the vegetation and flora baseline study which was conducted during the peak (flowering) season (late October 2022) therefore was the development of the vegetation map of the LSA (**Figure 7-48** and **Figure 7-49**), which defines the location and extent of natural and

modified vegetation communities, See Table A-1 Appendix A of the **Terrestrial biodiversity report** (**Appendix H.16**) – including areas mapped as CBA/ESA in **Figure 7-30.**
Some areas of cultivated fields and AIS stands coincide with areas mapped as CBA1, CBA2, and ESAs – these areas are thus not expected to contribute to provincial conservation targets in their current state – although an opportunity for improved management/rehabilitation may exist through the implementation of offsets in the study area to address irreversible and permanent loss of natural habitats.
The predicted loss of natural terrestrial habitats loss (i.e. loss of Disturbed Grassland, Dry Mixed Grassland, and Rocky Grassland) in each vegetation group within the LSA, for each Project alternative, are summarised on Table 6-1. Loss of areas of Alien Tree Plantations, Cultivated Fields, Infrastructure and Transformed areas was not included in target setting, even if they occurred within areas mapped as CBA, since their loss is not considered a significant impact. In addition, loss of areas mapped as 'Moist Grassland and Wetland' in the terrestrial vegetation dataset were not included, since these areas are already accounted for in the wetland habitat loss discussion in the Aquatic Biodiversity Specialist Assessment (WSP, 2023) that accompanies this application.

While it is clear that in its current incarnation, Alternative 2 would result in an increased area of natural habitat loss compared to Alternative 1; it is noted that there is much greater scope to optimise the layout of project components (particularly solar arrays, and BESS infrastructure) to reduce the amount of natural habitat loss within CBA1 and CBA2, which is expected to reduce the initial figures presented in **Table 7-3.** This consideration in the development of final layouts will be of critical importance in the context of the ecosystem threat status - particularly for Eastern Highveld Grassland and KaNgwane Montane Grassland which are already Endangered, and as such additional losses should be avoided to the extent possible.

Table 7-3 – Extent of loss of mapped CBA and ESA

MBSP category and Vegetation Communities	Extent of loss (ha)
Dalmanutha WEF, Alternative 1	**56.39**
CBA Irreplaceable	**23.89**
Eastern Highveld Grassland	17.31
KaNgwane Montane Grassland	5.77
Steenkampsberg Montane Grassland	0.81
CBA Optimal	**4.28**
Eastern Highveld Grassland	0.39
KaNgwane Montane Grassland	1.01
Steenkampsberg Montane Grassland	2.88
ESA Landscape corridor	**11.69**
Eastern Highveld Grassland	0.01
Steenkampsberg Montane Grassland	11.68
ESA Local corridor	**7.70**
Eastern Highveld Grassland	0.00
KaNgwane Montane Grassland	1.47
Steenkampsberg Montane Grassland	6.23

MBSP category and Vegetation Communities	Extent of loss (ha)
ESA Protected Area buffer	**0.10**
KaNgwane Montane Grassland	0.10
Other Natural Areas	**8.73**
Eastern Highveld Grassland	0.02
KaNgwane Montane Grassland	0.01
Steenkampsberg Montane Grassland	8.71
Dalmanutha WEF, Alternative 2	**128.86**
CBA Irreplaceable	**67.39**
Eastern Highveld Grassland	61.13
KaNgwane Montane Grassland	5.93
Steenkampsberg Montane Grassland	0.34
CBA Optimal	**6.23**
Eastern Highveld Grassland	0.32
KaNgwane Montane Grassland	1.56
Steenkampsberg Montane Grassland	4.35
ESA Landscape corridor	**39.89**
KaNgwane Montane Grassland	1.16
Steenkampsberg Montane Grassland	38.73
ESA Local corridor	**7.38**
KaNgwane Montane Grassland	2.20
Steenkampsberg Montane Grassland	5.19
ESA Protected Area buffer	**0.16**
KaNgwane Montane Grassland	0.16
Other Natural Areas	**7.80**
Eastern Highveld Grassland	0.08
KaNgwane Montane Grassland	0.09
Steenkampsberg Montane Grassland	7.63

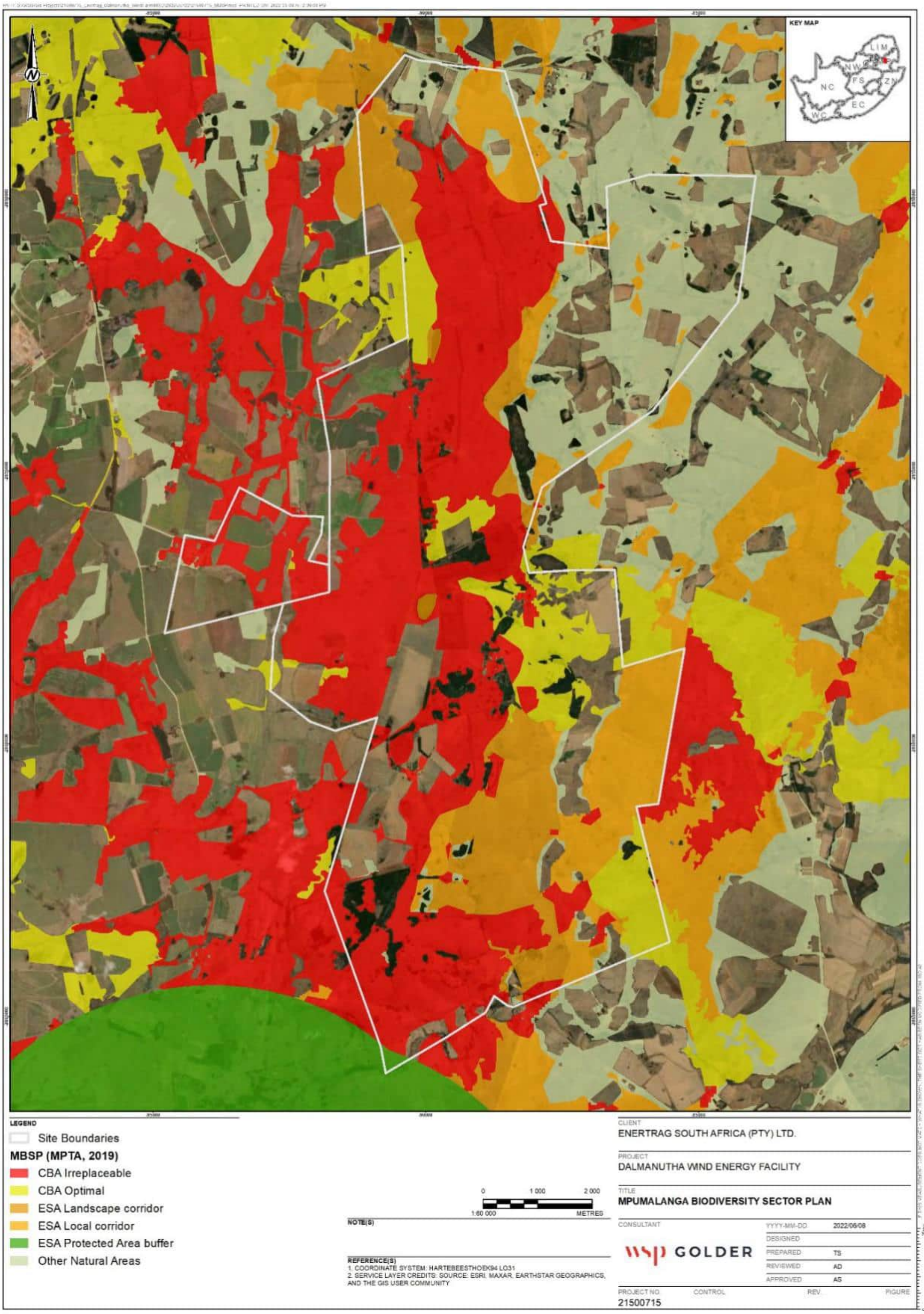


Figure 7-30 - Biodiversity Map of the Project Area according to the MBSP

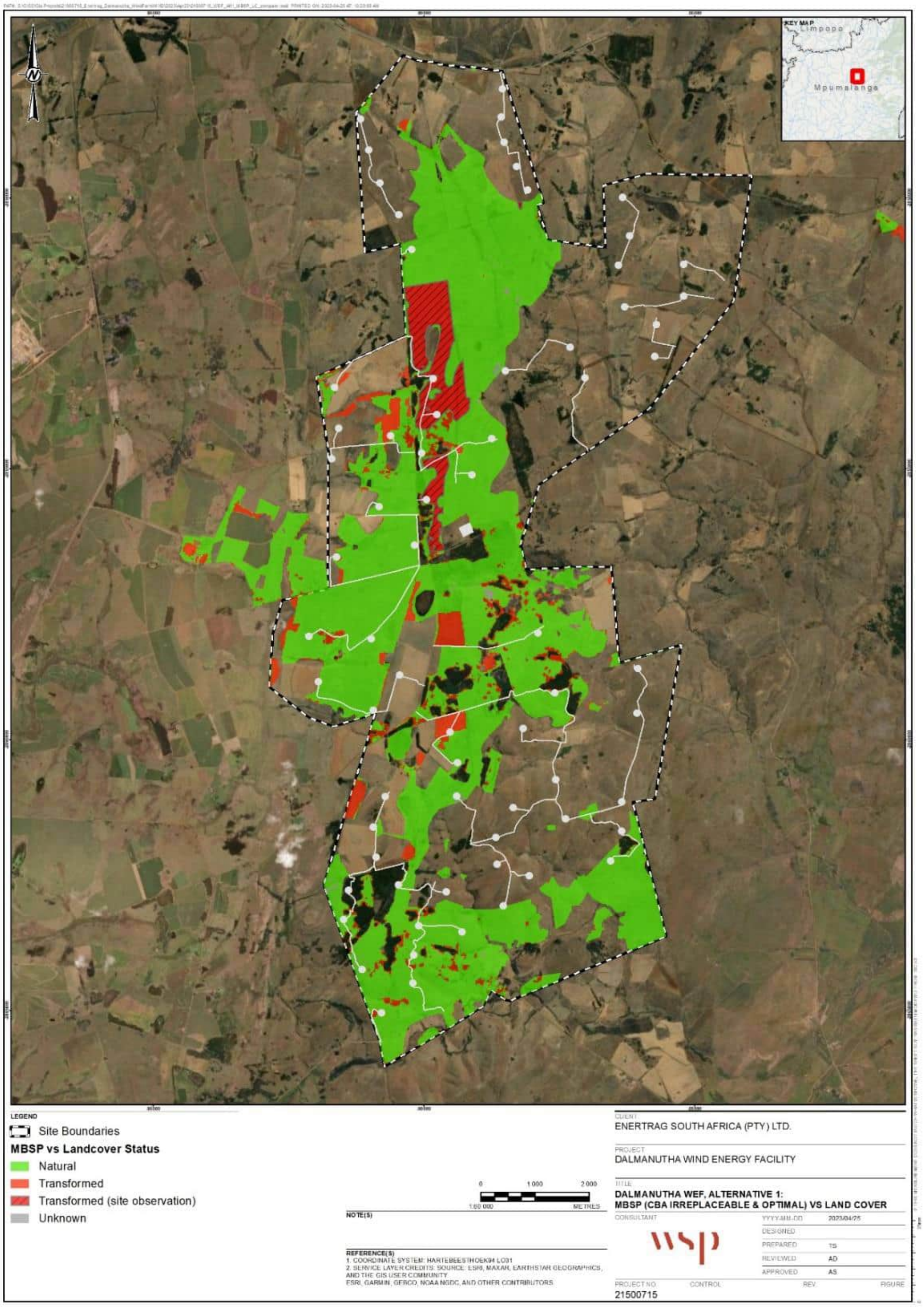


Figure 7-31 - Proposed Alternative 1 infrastructure and areas (red) of land designated CBA Irreplaceable and CBA Optimal designated land that are actually characterised by modified habitat, as determined by a comparison with land cover imagery and/or field observations

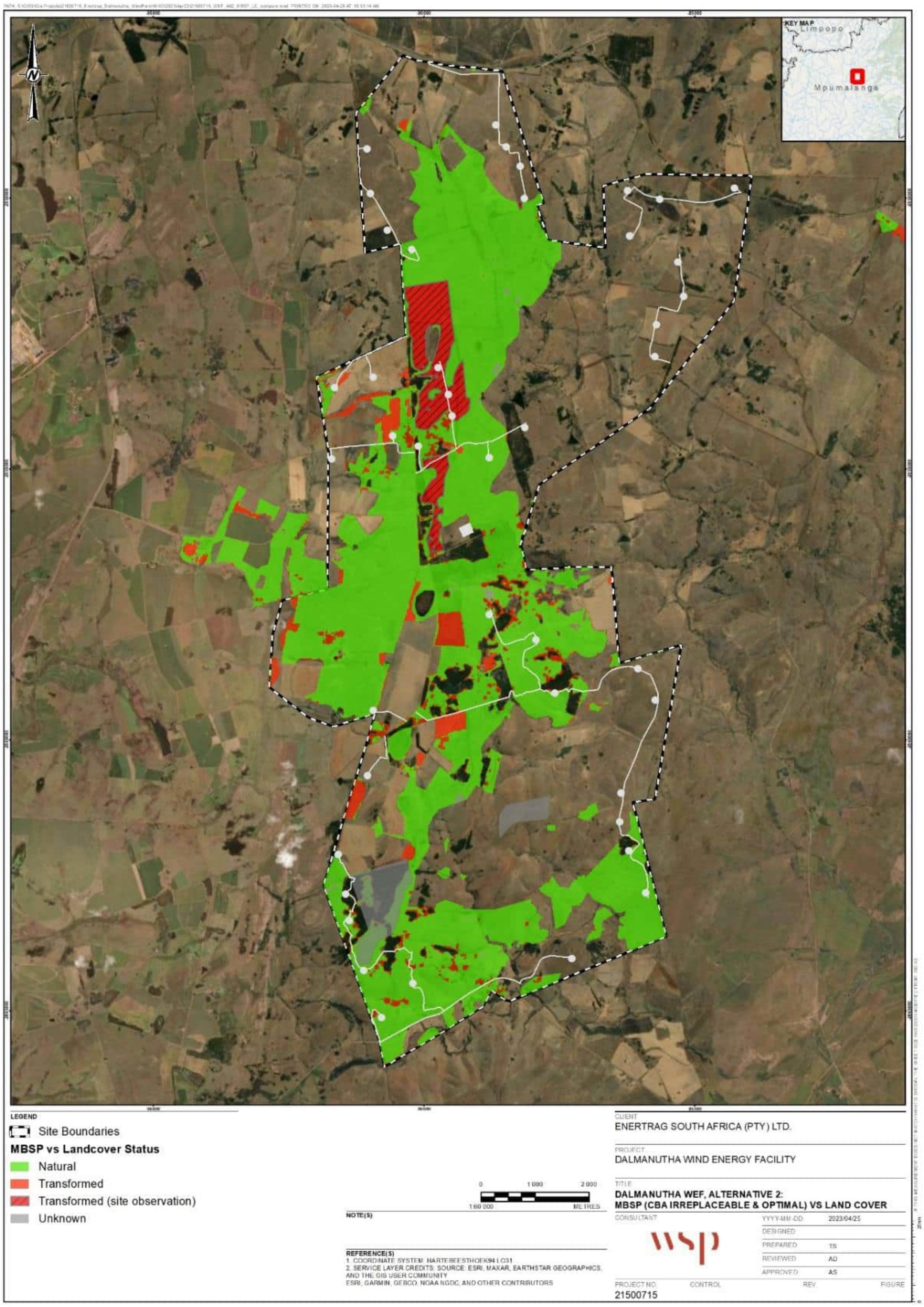


Figure 7-32 - Proposed Alternative 2 infrastructure and areas (red) of land designated CBA Irreplaceable and CBA Optimal designated land that are actually characterised by modified habitat, as determined by a comparison with land cover imagery and/or field observations

7.2.8 VEGETATION COMMUNITIES

Seven vegetation communities were identified in the study area during the field survey. These include two communities that are regarded as modified habitats, and five vegetation communities that are classified as natural habitats - albeit with certain areas displaying varying degrees of disturbance from historic and/or current anthropogenic activities:

Modified Habitats

- Cultivated Fields; and
- Alien Tree Plantations.

Natural Habitats

- Dry Mixed Grassland;
- Disturbed Grassland;
- Rocky Grassland;
- Moist Grassland and Wetland; and
- Forested Gorge Habitat.

These vegetation communities are described with accompanying photographs below.

Cultivated Fields

Large portions of the study area are characterised by cultivated fields. This community includes actively cultivated agricultural fields that, depending on the time of year and rotational cycles, are lying fallow, have recently been ploughed (**Figure 7-33**), or are planted with crops - typically maize or soya. This community also includes cultivated fields that are actively managed as grazing pastures. These fields are dominated by the creeping alien lawn grass *Pennisetum clandestinum* (kikuyu) (**Figure 7-34**) and are actively grazed by cattle and sheep.

During the field survey, it was noted that local farmers have recently ploughed over large tracts of grassland in the north of the study area to create new cultivated fields. These areas may not all be reflected in the most recent available Google Earth satellite imagery used to develop the vegetation community map for the study area.

Sensitivity Aspects

Cultivated fields are considered a modified habitat type, that are denuded of indigenous vegetation and are subject to regular anthropogenic disturbance. When not dominated by a monoculture of crop species, these areas are typically colonised by several declared alien invasive species, including inter alia; *Argemone ochroleuca, Datura stramonium, Solanum sisymbriifolium and Verbena bonariensis*. No flora SCC were recorded in this community and none are considered likely to be present.

Figure 7-33 - Cultivated field, recently ploughed and ready for planting.

Figure 7-34 - A *Pennisetum clandestinum* dominated cultivated field, managed as a grazing pasture.

Alien Tree Plantations

Stands of alien tree species are common throughout the study area and comprise a closed woodland habitat formation (**Figure 7-35**). They range from established wind-rows and timber plantations to informal thickets and infestations. The former category is typically dominated by widely-spaced, large and mature trees comprising alien Eucalyptus, Pinus and Acacia (wattle) species. Conversely, the latter category is generally characterised by young, densely-spaced Acacia (wattle) species – mostly *Acacia dealbata and Acacia mearnsii* trees. These infestations are particularly prevalent in valleys in the study area, where they are spreading into adjacent grassland habitats. This vegetation community also includes stands of *Populus x canescens* trees growing in riparian/wetland areas.

Little indigenous vegetation is present in dense, well-established alien tree stands, with herbaceous flora typically supressed or in most cases, largely absent (**Figure 7-36)**Where herbaceous vegetation does occur, it is dominated by ruderal grasses and alien weedy taxa, such as inter alia; *Biden pilosa, Solanum sisymbriifolium* and *Tagetes minuta.*

Wood harvesting by local communities for charcoal production was observed throughout the study area, but particularly in the south. This practice is noted to be driving changes in tree size structure, with harvested areas characterised by young emergent saplings and coppice regrowth.

Sensitivity Aspects

Alien tree plantations are a modified habitat type, that are characterised by an almost complete dominance of essentially one or two non-indigenous tree species. No flora SCC were observed in these areas, and the probability of such taxa being present is low.

	
Figure 7-35 - A large alien tree plantation in the study area.	**Figure 7-36 - Alien tree plantation dominated by young Acacia dealbata trees and largely denuded of herbaceous vegetation.**

Dry Mixed Grassland

This is a large and variable vegetation community in the study area. Predicated on current and past farming activities, disturbance levels in areas of mixed grassland vary. Upland areas of dry mixed grassland are typically characterised by stony/rocky, shallow soils and less productive herbaceous vegetation, while low lying areas are generally less rocky, have ostensibly deeper soils and higher levels of vegetation productivity. Structurally, this community is characterised by low closed grassland, as per Edwards (1983).

The dry mixed grassland community is characterised by a diverse flora assemblage, comprising a broad mixture of grasses and forb/herb species (**Figure 7-37** and **Figure 7-38**). Common grasses recorded in these areas of this community include inter alia; *Alloteropsis semialata, Ctenium concinnum, Elionurus muticus, Harpochloa falx, Koeleria capensis, Themeda triandra, Tristachya leucothrix* and various *Eragrostis* species.

Common herbs/forbs recorded in dry mixed grassland include inter alia; *Gerbera piloselloides, Haplocarpha scaposa, Hilliardiella aristata,* various *Helichrysum and Hypoxis species, Pelargonium luridum, Pentanisia angustifolia, Ocimum obovatum subsp. obovatum, Lasiosiphon kraussianus, Lasiosiphon capitatus, Senecio coronatus, Syncolostemon pretoriae and Tephrosia capensis.*

Woody species generally occur at low abundances in areas of dry mixed grassland and include dwarf shrubs, such *as Parinari capensis and Ziziphus zeyheriana*, as well as larger taxa commonly including *Diospyros lycioides, Elephantorrhiza elephantina and Seriphium plumosum*. In terms of declared alien invasive species, Acacia dealbata and Acacia mearnsii were noted to be common invaders throughout this community in the study area, while scattered *Pyracantha angustifolia* trees were also observed to be present in the south of the study area. For a list of flora species recorded during the field survey refer to Appendix C of the Terrestrial Flora report (**Appendix H.15**).

Sensitivity Aspects

This is a natural vegetation community that is characterised by a dominance of indigenous flora species. Undisturbed areas of mixed grassland approximate reference conditions. It is noted that areas of dry mixed grassland are susceptible to further colonisation by alien invasive species, particularly wattle trees.

Flora SCC recorded in this community include *Protea parvula* (Near Threatened*), Eucomus autumnalis* (Declining, MP), and several taxa listed as provincially protected, such as Aloe species, *Alsophila dregei, Boophone disticha, Cyrtanthus species, Gladiolus species, Protea caffra subsp. caffra and Watsonia species*. Based on reviewed literature it is also likely that several additional Red List and/or protected flora species are likely to be present.

Figure 7-37 - Typical dry mixed grassland in the study area

Figure 7-38 - Dry mixed grassland, with stands of invasive wattle trees in the background.

Disturbed Grassland

Areas of grassland that have been subject to disturbance – commonly historic cultivation, but also alien species colonisation/clearing - are characterised by secondary grassland vegetation.

Vegetation structure is low closed grassland, as per Edwards (1983). Flora in these areas is less diverse than other vegetation communities, and frequently is characterised by a dominance of *Eragrostis chloromelas and Eragrostis curvula* (**Figure 7-39**). *Eragrostis* species typically proliferate in grasslands that have been heavily grazed and trampled, or that have elevated soil nitrogen levels resulting from artificial nutrient enrichment from cultivation (read Mentis and Huntley, 1982).

Other grasses recorded in this community include inter alia*; Alloteropsis semialata, Aristida junciformis, Hyparrhenia dregeana, Hyparrhenia hirta and Paspalum dilatatum*. Forbs recorded in these areas include indigenous species such as *Helichrysum rugulosum, Monopsis decipiens*, as well as several alien taxa, such as *Hypochaeris radicata*, *Plantago lanceolata, Plantago major, Richardia brasiliensis, Rumex acetosella and Solanum sisymbriifolium* (**Figure 7-40**). For a list of flora species recorded during the field survey refer to Appendix C of the Terrestrial Flora report (Appendix H.15).

Sensitivity Aspects

Despite being previously disturbed, this community is considered natural habitat. Flora SCC recorded in this community include *Eucomus autumnalis* (Declining, MP), and it is possible that other SCC are potentially present.

	
Figure 7-39 - Typical disturbed grassland, dominated by Eragrostis grass species.	**Figure 7-40 - Disturbed grassland - recovering from the clearing of alien wattle trees. Note the presence of the invasive weed Solanum sisymbriifolium.**

Rocky Grassland

Areas of rocky grassland occur along hillside slopes/ridges in the study area (**Figure 7-41**) and are embedded within the broader matrix of dry mixed grassland community. Unlike adjacent areas of dry mixed grassland, this vegetation community is characterised by the prominence of large, protruding rocky outcrops and the relative higher abundance of indigenous woody flora species (**Figure 7-42**). In line with Edwards (1983) structural classification, structurally this community is still defined as low open grassland, although certain sites displaying a higher abundance of woody species approximate a more low- to short sparse shrubland structure. Woody vegetation generally occurs however, as scattered individual small trees and shrubs, or clusters of small trees and shrubs.

In terms of composition, *Diospyros lycioides* is the most common woody species, with several other taxa also frequently recorded, including *Lopholaena coriifolia, Phymaspermum athanasioides, Searsia discolor, Searsia dentata and Searsia tumulicola*. Although not generally abundant, Aloe *arborescens, Cussonia paniculata* and *Halleria lucida* were also recorded in this community. Consistent with all are other vegetation communities in the study area, areas of rocky grassland are susceptible to encroachment from alien wattle species, i.e., *Acacia dealbata and Acacia mearnsii* (shown in **Figure 7-43**).

The herbaceous layer is characterised by various grasses such as inter alia*, Alloteropsis semialata, Aristida aequiglumis, Cymbopogon caesius, Diheteropogon filifolius, Elionurus muticus, Eragrostis chloromelas, Koeleria capensis, Melinis nerviglumis and Tristachya leucothrix*, as well as ferns including *Pellaea calomelanos var. calomelanos, Pteridium aquilinum and Selaginella dregei*, and various forbs/herbs and shrublets, such as *Hypoxis species*, *Indigofera daleoides, Indigofera melanadenia and Syncolostemon eriocephalus*. For a list of flora species recorded during the field survey refer to Appendix C of the Terrestrial Flora report (**Appendix H.15**).

Sensitivity Aspects

Rocky grasslands constitute natural habitat. These areas are characterised by a dominance of indigenous flora species, with many recorded flora taxa showing a particular affinity for rocky areas. Disturbance levels are generally low, although localised sites have been colonised by alien wattle trees. Flora SCC recorded in this community include *Merwilla plumbea* (Near Threatened), and several taxa listed as provincially protected, such as various Aloe species and Gladiolus species.

Based on reviewed literature it is also likely that several additional Red List and/or protected flora species are likely to be present in this vegetation community, including amongst several others, *Riocreuxia aberrans, Aloe reitzii var. reitzii, Streptocarpus denticulatus, Eulophia cooperi and Schizochilus cecilii subsp. culveri.*

Figure 7-41 - Prominent stretch of rocky grassland occurring along a hillside in the study area.

Figure 7-42 - Large rock outcrops and a higher abundance of woody vegetation characterise the rocky grassland vegetation community.

Figure 7-43 - Rocky outcrop with colonised by alien wattle species. The indigenous *Diospyros lycioides* is also present.

Moist Grassland and Wetland

This vegetation community is aligned with vegetation associated with the moist soils that characterise wetland systems and drainage areas, as well as around pans and artificial dams in the study area (**Figure 7-44** and **Figure 7-45**).

Vegetation structure ranges from low- to tall closed grassland (sensu. Edwards 1983). Most areas are grass and sedge dominated, with several grass species common. These include *Agrostis lachnantha, Arundinella nepalensis, Eragrostis gummiflua, Eragrostis plana, Imperata cylindrica, Paspalum dilatatum*.* Other common graminoid taxa recorded in this community include various *Cyperus species, Juncus effusus, Juncus lomatophyllus and Schoenoplectus brachyceras*. The tall reed *Phragmites australis*, as well as the bulrush *Typha capensis* are also abundant in certain areas.

Common forbs recorded in this community include inter alia*, Berkheya setifera, Centella asiatica*, Haplocarpha scaposa, Helichrysum aureonitens, Hypochaeris radicata*, Senecio inornatus, Senecio isatidioides, Rumex acetosella* and Trifolium repens*.*

Common woody species recorded in this community include Seriphium plumosum, as well as the alien species *Populus x canescens and Salix babylonica*. *Populus x canescens* former species is a notable invader of wetland habitats and is capable of forming large dense infestations. For a list of flora species recorded in this community during the field survey refer to Appendix C of the Terrestrial Flora report (**Appendix H.15**).

Sensitivity Aspects

The moist grassland and wetland vegetation community constitutes natural habitat. Several flora SCC have been recorded in this community. These include several protected orchid species, as well as *Eucomus autumnalis* (Declining, MP) and the provincially protected *Cyrtanthus breviflorus* and Watsonia species. Based on reviewed literature it is also likely that several other flora SCC are likely to be present.

Figure 7-44 - Typical area of moist grassland in the study area.

Figure 7-45 - Stream flanked by various reeds, grasses and sedges, as well as scattered alien Salix babylonica trees.

Forested Gorge Habitat

Forested gorge habitat is the smallest vegetation community, and is confined to a short section of a deeply-incised valley bottom along a stream in the centre of the study area – see **Figure 7-46**

Vegetation structure along the stream channel is defined as short- to tall forest or closed woodland, as per Edwards (1983) structural classification. Woody vegetation is characterised by defined lower- and upper strata, while the herbaceous layer is generally poorly developed (**Figure 7-47**).

In terms of composition, common tall tree species recorded in the upper woody stratum include *Celtis africana, Ilex mitis and Kiggelaria africana,* while common species recorded in the lower woody stratum include, inter alia*; Afrocanthium mundianum, Diospyros whyteana, Myrsine africana and Scolopia mundii.* Along the forest fringes, several other woody species were noted including *Buddleja saligna, Buddleja salviifolia, Diospyros lycioides and Rhoicissus tridentata*.

Various shrubs, succulents and small trees grow on the steep rocky cliffs of the gorge above the forest patch, including *Aloe arborescens, Alsophila dregei and Lopholaena coriifolia*. Large stands of alien *Acacia dealbata and Acacia mearnsii* trees are present immediately downstream of the forest patch, and these taxa are present as scattered individual trees in the forest itself. For a list of flora species recorded during the field survey refer to Appendix C of the Terrestrial Flora report (**Appendix H.15**).

Sensitivity Aspects

Unlike alien tree plantations, which constitute the only other woodland formation in the study area, this small community is dominated by indigenous woody species and accordingly, it is unique within the context of the grassland dominated study area. The combination of indigenous forest, flanked by tall, vegetated rocky cliffs, contributes significantly to local-scale habitat heterogeneity, as well as the overall botanical diversity of the study area.

Alien wattle trees are present and are likely to continue to establish and spread into this community. In terms of flora SCC, *Ilex mitis var. mitis* (Declining, MP) was recorded and considering the high degree of micro-habitat diversity associated forested gorge habitat, it is also highly likely that other Red List and/or protected flora species are likely to be present.

Figure 7-46 - Steep, rocky cliffs covered by various shrubs and succulents.	Figure 7-47 - Well-developed indigenous forest along the valley bottom.

Vegetation community maps showing the layout of proposed Alternative 1 and Alternative 2 infrastructure are presented below in **Figure 7-48** and **Figure 7-49** respectively.

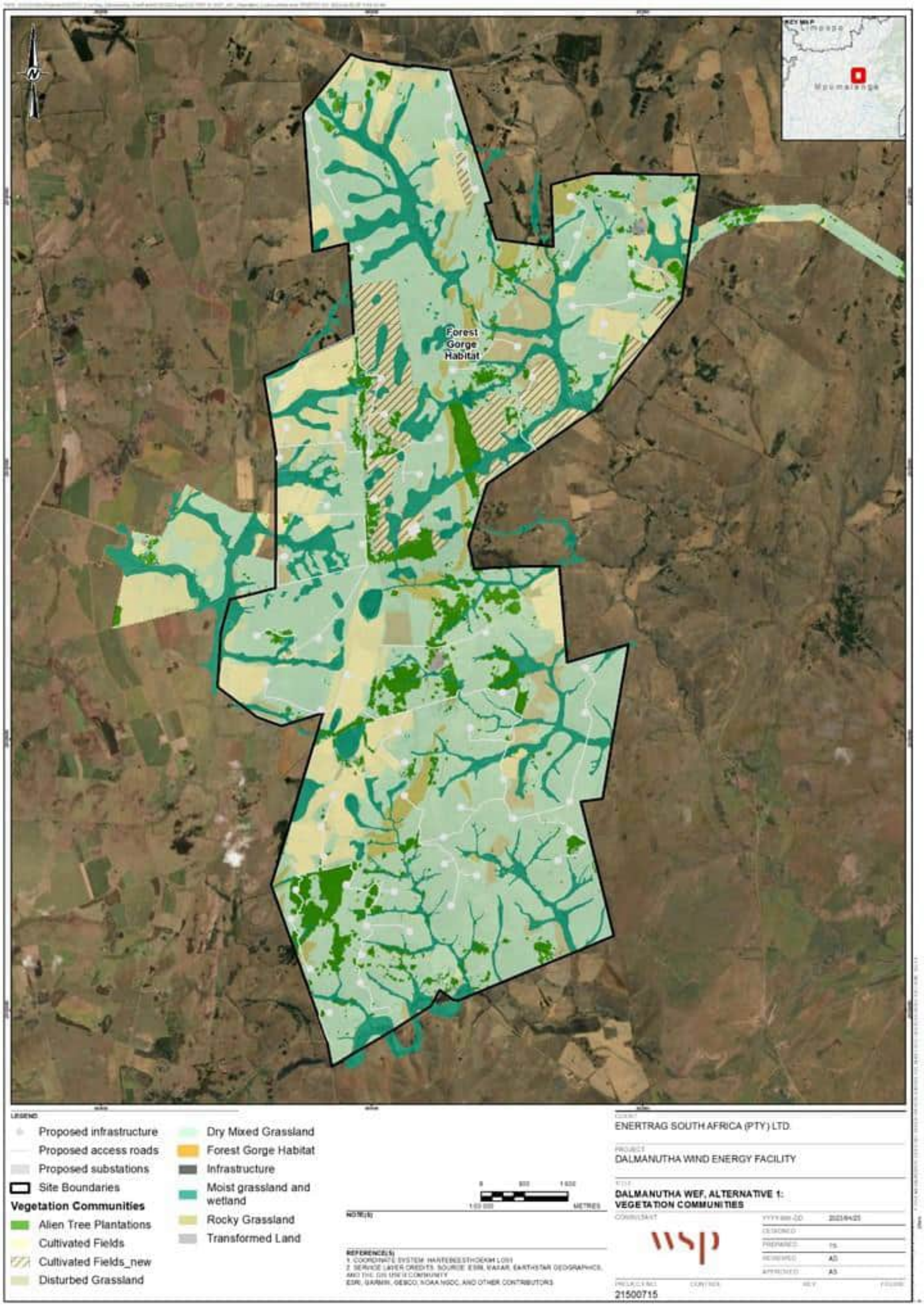


Figure 7-48 - Vegetation community map of the study area and proposed infrastructure for Alternative 1.

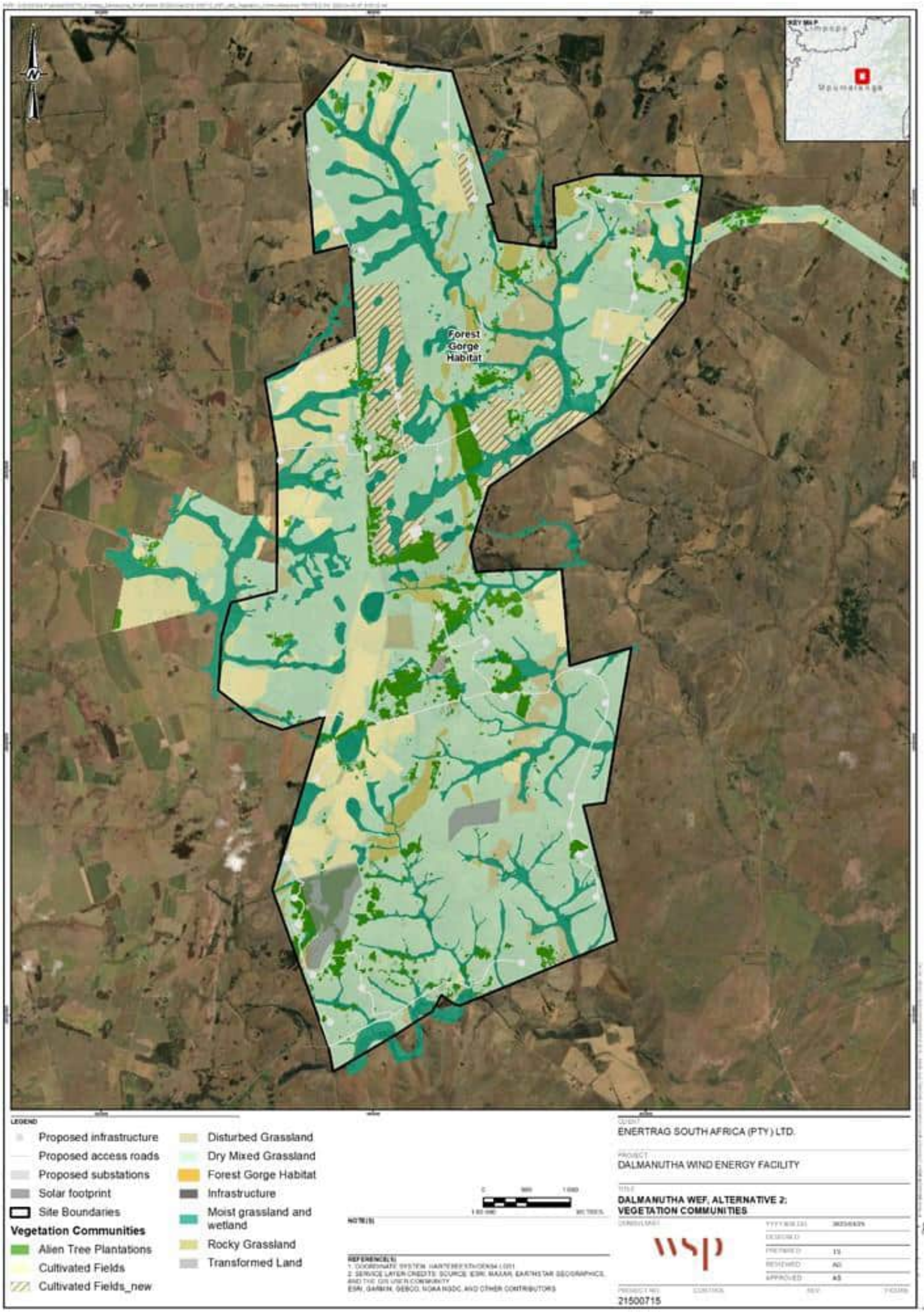


Figure 7-49 - Vegetation community map of the study area and proposed infrastructure for Alternative 2.

7.2.9 TERRESTRIAL FAUNA SPECIES

The area is considered to be of 'Medium' – 'High' sensitivity in terms of the Animal Species Theme, due to the potential presence of the range-restricted Badplaas Black Millipede (*Doratogonus furculifer*) which is listed as Endangered on the IUCN Red List (Rudolf et al., 2021), and the mammals Robust Golden Mole (*Amblysomus robustus* – VU1 (Rampartab & Bronner, 2016)), Rough-haired Golden Mole (Chrysospalax villosus - VU), Maquassie Musk Shrew (*Crocidura maquassiensis* – VU), Spotted-necked Otter (*Hydrictis maculicollis* – VU), and Oribi (*Ourebia ourebi ourebi* - EN).

The fauna biodiversity of the region is relatively well-known. Details of fauna species of conservation concern (SCC) with potential to occur in the study area are summarised below. Birds and bats are excluded, since these are being dealt with in separate studies.

7.2.10 MAMMALS

Twenty-eight mammal species, ranging from small rodents to medium-sized antelope, were recorded in the study area during the field programme – listed in Table 3 of the Terrestrial Fauna report (**Appendix H.3**) Of these, 24 taxa were recorded during the dry season survey and 25 taxa during the wet season survey.

Apart from a single Blesbok (*Damaliscus pygargus phillipsi*), which is likely a reintroduced and actively managed taxon, all the recorded species are free-roaming .

Based on visual observations/encounters, the Common Duiker (*Sylvicapra grimmia*) was the most frequently recorded mammal species, with eight sightings, followed by the Yellow Mongoose (*Cynictis penicillata*) with four sightings and Steenbok (*Raphicerus campestris*) with three sightings. The most frequently caught species in baited Sherman traps was the Xeric Four-striped Mouse (*Rhabdomys pumilio*), with 22 individuals caught during the field programme.

The frequent sighting of a small troop of Vervet Monkey (*Chlorocebus pygerythrus*) in close proximity to stands of alien trees in study area during both the wet- and dry-season surveys is interesting, as it highlights the increased habitat heterogeneity provided by these well-wooded, yet anthropogenic and modified habitats in the study area and surrounding landscape.

The recorded mammal richness of the study area is considered high. The presence of free-roaming medium-sized antelope (e.g., the two Reedbuck species) suggests that the availability, heterogeneity (diversity) and condition (integrity) of suitable habitats on-site are high and that these areas are able to sustain a mammal assemblage that approaches a contemporary reference community for the landscape. It is noted that, based on a review of historic distribution maps in Stuart & Stuart (2007) and Childs et al., (2016) up to 78 mammal species have been documented the region in which the study area is located, and therefore potentially occur in the study area – these are listed in Appendix C of the Terrestrial Fauna report (**Appendix H.3**)

Mammal Species of Conservation Concern

Three mammal species recorded in the study area during the field programme are listed on the national mammal Red List (Child et al., 2016), namely Serval (*Leptailurus serval*), Mountain Reedbuck (*Redunca fulvorufula fulvorufula*) and Grey Rhebok (*Pelea capreolus*).

Protected mammal species recorded in the study area include Steenbok (*Raphicerus campestris*) and Aardvark (*Orycteropus afer*), which are both listed as protected at a provincial level according to the Mpumalanga Nature Conservation Act (Act No. 10 of 1998), and the Southern Reedbuck (*Redunca* *arundinum*), which is listed as protected at both a national level (NEMBA ToPS List, 2007) and provincial level.

Based on historic distribution ranges, an additional 18 SCC (i.e., threatened and/or protected species) are known from the region and potentially occur in the study area. These are listed in Table 4, along with their conservation status, habitat preferences, and a 'probability of occurrence' in the study area based on habitat suitability assessments.

Additional SCC that are likely to be present, based on the authors previous work in the region, include inter alia, the Cape Clawless Otter (*Aonyx capensis*) and the Spotted-necked Otter (*Hydrictis maculicollis*). These species favour riparian habitats, with permanent water and are thus likely to be found close to streams and farm dams in the study area.

Mountain Reedbuck

The Mountain Reedbuck (Endangered) is a medium-sized grazing antelope that inhabits rolling grassy hillsides and mountain slopes above 1 500m (Estes, 1991). This species is territorial and gregarious and is found in small herds ranging from 3 to 6 individuals (Estes, 1991). The estimated regional population size of Mountain Reedbuck is between 10 217 and 13 669 mature individuals, with purported densities in protected areas ranging from 10 to 1 150 individuals per 100 km^2 (Taylor *et al*., 2016a). It is noted that no data are cited for private agriculture land. Moreover, no data are available on the EOO or AOO of this species. The primary threats to Mountain Reedbuck include poaching, increased natural predation, and disturbance from cattle herders and livestock (Taylor *et al*., 2016a).

Mountain Reedbuck were photographed on a camera trap in montane grassland in the far south of the study area (co-ordinates S25 52.607 E30 06.173). These data indicated the presence of at least two individuals, and it is expected that they form part of a small breeding herd. It is also anticipated that additional breeding herds may be present in similar habitat in the north of study area (*Pers. Comm. G. Lockwood).* The local Mountain Reedbuck population is therefore considered viable. Considering the Red List status of this species (i.e., Endangered), the conservation importance of the Mountain Reedbuck population observed in the study area is considered high. Important habitat for this species includes montane grassland and wetland areas.

Grey Rhebok

Grey Rhebok (Near Threatened) are medium-sized, territorial browsing antelope. They are gregarious, living in herds comprising one adult male and 1 to 15 females and young (Estes, 1991). They favour sourveld grassland and scrubland in hills and mountainous areas (Estes, 1991). The regional population size of Grey Rhebok is thought to be about 10 000 individuals, with an estimated density in protected areas of 0.5 to 1.7 individuals per km^2 (Taylor *et al.,* 2016b). Threats to Grey Rhebok include increased levels of bush-meat and sport hunting (Taylor *et al.,* 2016b).

A single male Grey Rhebok was observed while conducting a walked-transect in an area of grassland in the centre of the study area (co-ordinates S25 46.773 E30 07.209) during the dry season survey, and a pair of female antelope was observed at approximately the same location during the wet season field survey. This suggests the presence of a small breeding herd. It is probable that other individuals/herds are present in similar habitat in the study area, and therefore the local population of Grey Rhebok is also considered viable. Important habitat for this species also includes montane grassland and wetland areas.

Serval

The Serval (Near Threatened) is a small feline predator. They are solitary and territorial, and favour wetland, tall grassland and well-watered savanna habitats (Estes, 1991). Population densities range from 0.1 to 1.5 individuals per km^2, with a regional population estimated at 10 264 ±812 individuals (Ramesh, *et al*., 2016). This species is able tolerate relatively high levels of anthropogenic activity and is frequently found in farmland and mining/industrial land, provided sufficient suitable habitat is present and levels of persecution remain low (Ramesh, *et al.,* 2016). The loss and degradation of wetland and associated grassland habitats is the primary threat to Serval.

During the wet season field programme, this species was recorded on two camera traps and via direct visual observation. Considering the abundance of favourable hunting habitat (grassland and wetland) and the presence of ample refuge habitat (alien tree stands), it is expected that this species is fairly abundant in the study area with a viable population.

7.2.11 REPTILES

Four reptile species were documented in the study area during the field programme. The presence of two species, viz., the Puffadder (*Bitis arietans arietans*) and Rinkhals (Hemachatus haemachatus), are based on anecdotal evidence provided by a local farmer. Spotted Grass Snake (*Psammophylax rhombeatus*) was observed while driving in the study area during both the dry- and wet season surveys , while the Speckled Rock Skink (*Trachylepis punctatissima*) was recorded during the wet season survey. These are common species with widespread distributions, and are not of conservation concern.

Based on historic distribution ranges presented in Bates *et al.* (2014) and ReptileMAP records for the relevant QDS, up to 84 reptile species have been documented the region in which the study area is located, and therefore potentially occur in the study area – these are listed in Appendix D of the Terrestrial Fauna report (**Appendix H.3**). Considering the high degree of habitat availability and heterogeneity in the study area - particularly the presence extensive rocky grassland areas and the area forested gorge habitat - it is anticipated that several additional reptile species are likely to be present.

Reptile Species of Conservation Concern

Ten reptile SCC potentially occur in the study area Table 5 of the Terrestrial Fauna report (**Appendix H14**). None of these species are listed as threatened or protected nationally. They are however, listed as threatened/near threatened at a provincial level. It noted that according to the Mpumalanga Nature Conservation Act (Act No. 10 of 1998) all species of reptiles, excluding the monitors (e.g., *Varanus niloticus*) and all snakes, are considered ‘protected’ in Mpumalanga Province.

Data records from the Mpumalanga Tourism and Parks Agency (MPTA) indicate that Northern Dwarf Chameleon (*Bradypodion transvaalense*) was previously recorded in the study area. This endemic species is not listed as threatened on the national Red List, but it is listed as Vulnerable in Mpumalanga Province. Northern Dwarf Chameleon favour forest patches along the escarpment and in deep gorges. A small patch of forested gorge habitat is present in the study area, and it is therefore probable that this species is present (Bates *et al*., 2014).

Apart from the several reptiles of conservation concern that are potentially present and that favour typical grassland species, SCC that are likely to occur in rocky grassland areas include Large-scaled

Grass Lizard (*Chamaesaura macrolepis*) (Near Threatened, MP) and Breyer's Long-tailed Seps (*Tetradactylus breyeri*) (Vulnerable, MP), while a species such as the Many-spotted Snake (*Amplorhinus multimaculatus*) (Near Threatened, MP) is likely to be occur in wetlands and areas of riparian vegetation.

7.2.12 AMPHIBIANS

Six amphibian species was recorded during the field survey - these are listed in Table 6. All six species are common amphibians with widespread distributions and are not of conservation concern. Based on historic distribution ranges, up to 20 amphibian species are known from the region and potentially occur in the study area – these are listed in Appendix D of the Terrestrial Fauna report (**Appendix H.3**)

Considering the abundance and varied aquatic habitats present in the study area, it is anticipated that several additional amphibian species are likely to be present. Apart from the Giant Bullfrog (*Pyxicephalus adspersus*), which is discussed below, all other species that potentially occur in the study area are also common and widespread species and not of conservation concern.

Amphibian Species of Conservation Concern

The Giant Bullfrog is the only amphibian of conservation concern potentially occurring in the study area. This species is listed as 'protected' on the NEMBA ToPs list (2007), as well as 'protected' in Mpumalanga Province according to the Mpumalanga Nature Conservation Act, 1998). It is also listed as Vulnerable on the Mpumalanga Red List. Giant Bullfrog inhabit seasonally shallow pans, wetland and rained-filled depressions in savanna and grassland ecosystems. These habitats are present in the study area, and it is therefore probable that Giant Bullfrog are present.

7.2.13 INVERTEBRATES SPECIES OF CONSERVATION CONCERN

The national environmental screening tool highlighted the potential presence of the range restricted Badplaas Black Millipede (*Doratogonus furculifer*) – Endangered (Rudolf, et al., 2017). This species is endemic to Mpumalanga and has an extent of occurrence (EOO) estimated at 580 km^2. It is known from a few sites near Belfast, Ndubazi and at an unspecified location between Barberton and Badplaas (Rudolf, *et al.,* 2017). The habitat requirements of the Badplaas Black Millipede are poorly documented, but it is presumed to favour open grassland and potentially savanna type habitats. Similarly, the population densities of this species are unknown, although it is likely they occur at low densities (Rudolf, *et al.,* 2017).

A juvenile *Doratogonus sp*. millipede was recorded in a pitfall trap in the far north of the study area (S25 44.985 E30 05.863) during the wet season field survey. As it was a juvenile, it is not possible to confirm its identity to species-level (Pers. Comms. M. Hamer). However, is possible that this individual is the more widespread and common *Doratogonus rugifrons* millepede (Pers. Comms. M. Hamer). This notwithstanding, considering the extent of open grassland habitat in the study area, it is considered possible that the Badplaas Black Millipede is present.

The OdonataMAP platform published by the FitzPatrick Institute of African Ornithology (2022) documents the presence of the three threatened dragonfly species in the QDS that encompasses the study area.

The ecology of these taxa, along with a habitat suitability assessment, is provided below:

- Balinsky's Sprite (*Pseudagrion inopinatum*) - Near Threatened, is a dragonfly species. It is known from sizeable populations at localities in Mpumalanga and KwaZulu-Natal, and is not immediately threatened. This species favours meandering open rivers and streams with abundant marginal vegetation (Samways, 2017a). These habitats are present in the study area, and it is possible that the Balinsky's Sprite is present.
- Harlequin Sprite (*Pseudagrion newtoni*) – Vulnerable, is a range-restricted dragonfly species that is known from only one location where it is considered abundant. Samways (2017b) indicates that this species is expected to occur elsewhere in the area. It favours tall grass riparian habitats at 1 300 m asl (above sea level) (Samways, 2017b). These habitats are present in the study area, and it is possible that the Harlequin Sprite is present.
- Dwarf Percher (*Diplacodes pumila*) – Endangered. Little information about this dragonfly species is available. Samways (2017c) indicates that it is known from occasional records in KwaZulu-Natal and Limpopo Province, but no details are provided as to its presence in Mpumalanga Province. Its preferred habitat is listed as 'swamps or marshy pools' (Samways, 2017c). Notwithstanding the paucity of additional information, such habitats are present in the study area and following the precautionary principle, it is considered possible that the Dwarf Percher is present.

7.2.14 REGIONAL AQUATIC BIODIVERSITY

The proposed infrastructure footprint was assessed at desktop level using the National Web-based Environmental Screening Tool. According to the Tool, the Aquatic Biodiversity Theme for the study area is rated 'Very High Sensitivity' due to its situation within areas defined as FEPA quinary catchments, and the presence of 'Aquatic CBAs' and extensive areas of wetland habitat.

The proposed Dalmanutha WEF is located within the Southern Temperate Highveld freshwater ecoregion, which is delimited by the South African interior plateau sub-region of the Highveld aquatic ecoregion, of which the main habitat type, in terms of watercourses, is regarded as Savannah-Dry Forest Rivers. Aquatic biotas within this bioregion have mixed tropical and temperate affinities, sharing species between the Limpopo and Zambezi systems. The Southern Temperate Highveld freshwater ecoregion is considered to be bio-regionally outstanding in its biological distinctiveness and its conservation status is regarded as Endangered. The ecoregion is defined by the temperate upland rivers and seasonal pans (Nel *et al.,* 2004; Darwall *et al*., 2009; Scott, 2013).

The study area falls within the upper reaches of the Inkomati Water Management Area, and the quaternary catchment X11D (Komati River) (**Figure 7-50**). The catchment is situated within the Inkomati Water Management Area (WMA). The mean annual runoff (MAR) for the X11D catchment is 88 mm (WR2012). This catchment receives 744 mm rainfall per year and experiences 1,413 mm of evaporation annually. Numerous non-perennial rivers drain in an easterly direction into the perennial Waalkraalloop river and in a westerly and southerly direction into the perennial Klein Komati River. The terrain of the proposed WEF lies at an elevation of approximately 1,630 m in the northern section, to 1,888 m in the southern section. (**Figure 7-19**)

The Komati River catchment is ecologically severely stressed due to the water demands imposed by Eskom and agriculture, with various abstraction weirs creating serious obstructions to fish migrations and return flows from irrigation affecting downstream water quality as a result of input of chemicals such as pesticides, fertilizers and salts (MPTA). Alien invasive fish species that have been introduced into the numerous dams are also present in the rivers (MPTA, 2015). Nevertheless, the ecological status of some sections of the upper Komati River catchment (within which the study area is situated) is still considered to be in a relatively good condition (MPTA, 2015).

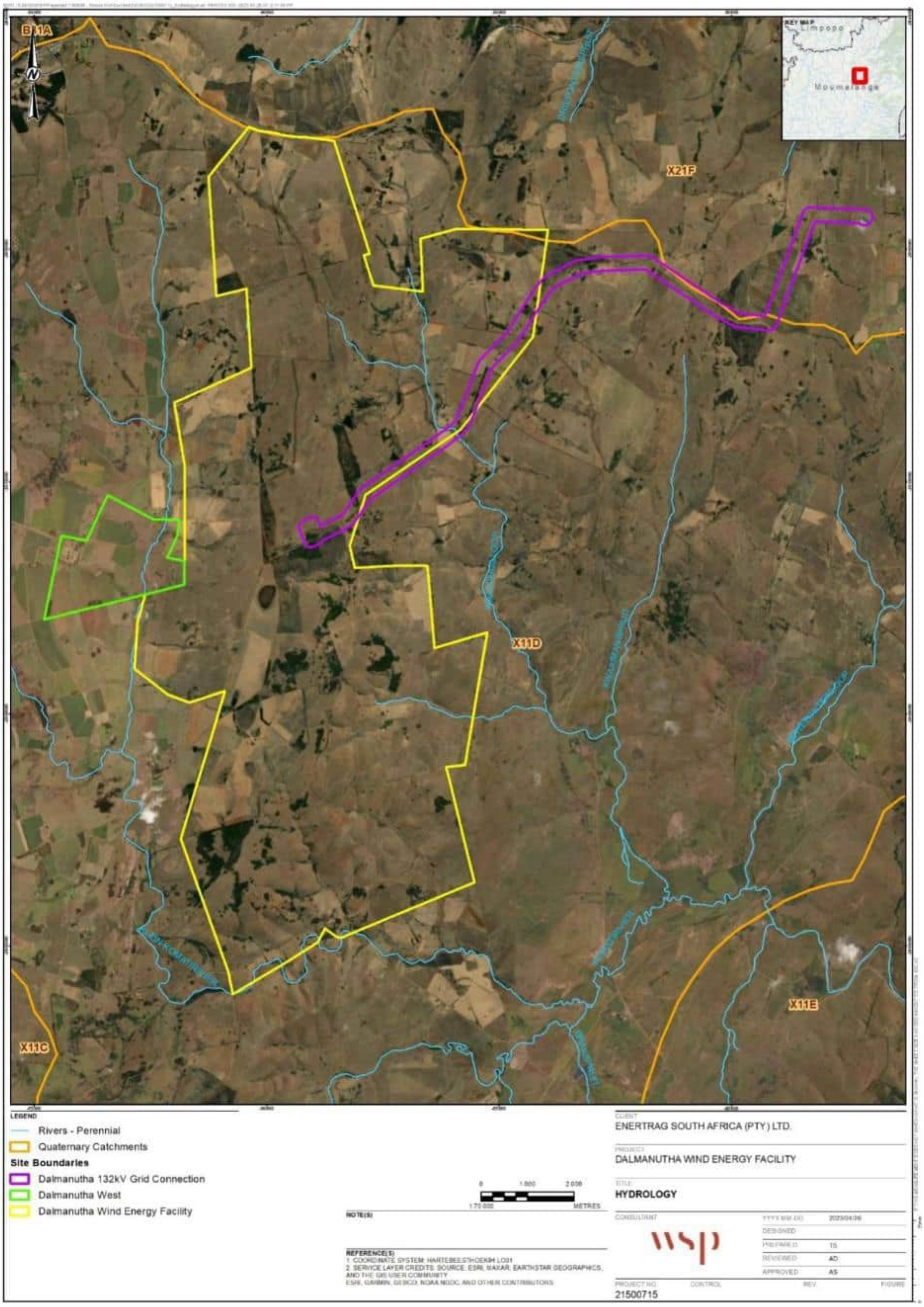


Figure 7-50 - Quaternary catchments associated with the project area

7.2.15 AQUATIC CBA'S AND ESA'S

According to the latest revision of the freshwater component of the provincial biodiversity sector plan (Mpumalanga Tourism and Parks Agency, 2019), the wetlands associated with the western half of the study area may be regarded as ESAs as part of the identified FEPA wetlands and wetland clusters. These areas and their surrounds are considered important FEPA sub-catchments. The Klein-Komati River and its tributaries are further classified as CBAs as the Klein-Komati River is classified as a FEPA river. One CBA wetland was also identified in the north-western portion of the study area. The eastern portion of the study area is dominated by Other Natural Areas, however, this excludes the southern portion of the study area, which once again forms part of the Klein-Komati River sub-catchment areas and are classified as ESAs (**Figure 7-51).**

The Study Area was compared to relevant available spatial biodiversity planning datasets, i.e. the Mpumalanga Biodiversity Sector Plan freshwater assessment (2017) (**Figure 7-51**) in order to assess the local and regional biodiversity context of the site. Depression wetlands that occur throughout the study area are mapped as CBAs, while the western extent of the Project Area, which coincides with the Klein-Komati River FEPA sub-catchment (**Figure 7-52**) is mapped as an ESA. The MBSP (2017) freshwater assessment spatial dataset also shows the majority of the eastern extent of the Project Area mapped as 'other natural areas'.

It is noted that the MBSP freshwater assessment was based largely on remotely-sensed satellite imagery, and thus some wetlands are not included (e.g. historic wetlands lost through drainage or ploughing), particularly hillslope seeps which can be difficult to distinguish from grasslands based on satellite imagery alone. Similarly, some features have been mapped as wetlands, which, once examined in the field, are not defined as wetlands. The most up-to-date spatial dataset at the national level is now considered to be the National Wetland Map 5 (see **Figure 7-53** and **Figure 7-54)** which displays a more accurate representation of actual wetland conditions on site; however hillslope seep wetlands are assumed to be under-represented, and are a focus point for the ongoing baseline data collection to inform the wetland delineation and classification of hydrogeomorphic units located within the study area.

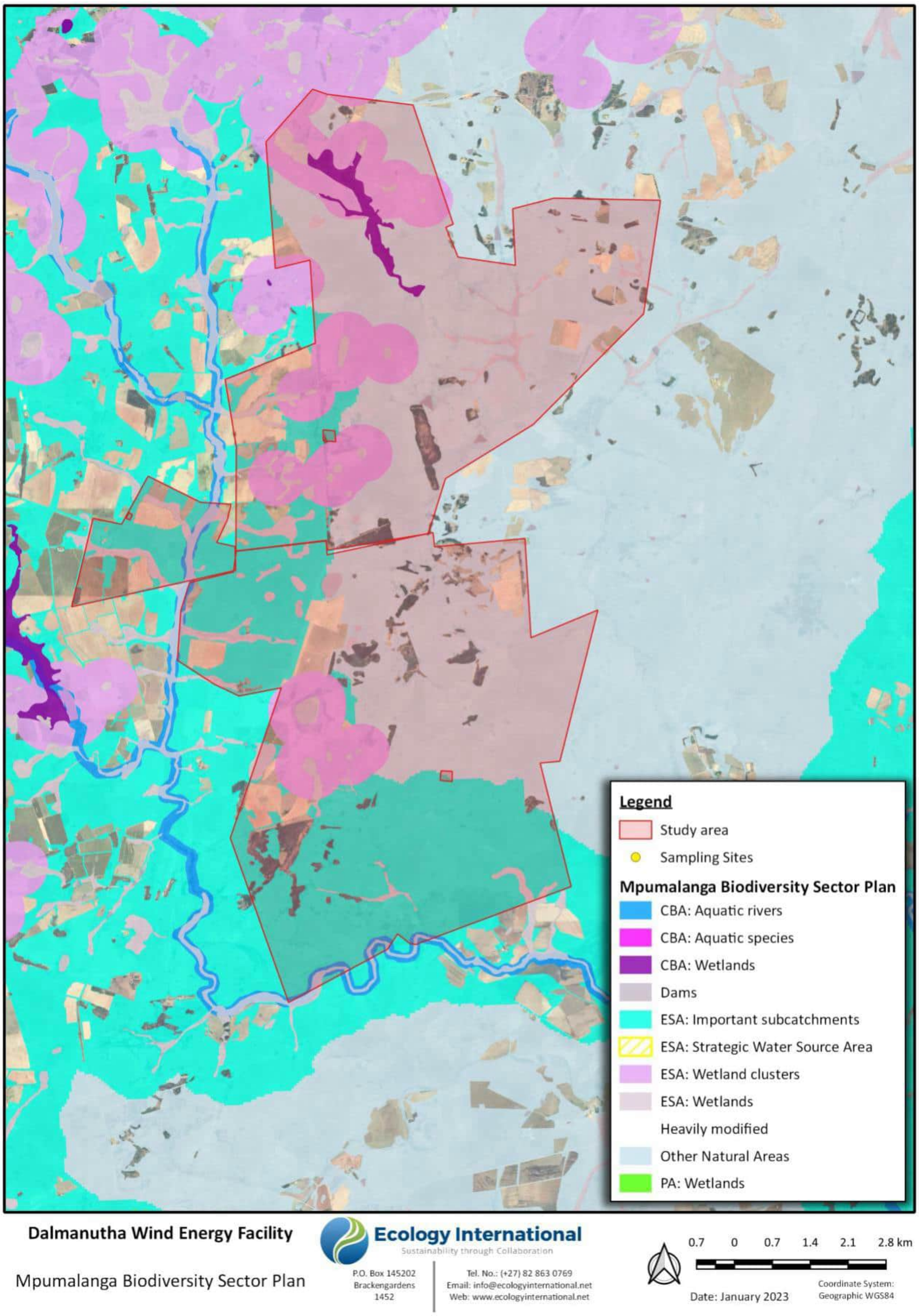


Figure 7-51 - Mpumalanga Biodiversity Sector Plan classification of the study area

Depression wetlands that occur throughout the area are mapped as CBAs, while the western extent of the study area, which coincides with the Klein-Komati River FEPA sub-catchment, is mapped as an ESA. The MBSP (2017) freshwater assessment spatial dataset also shows the majority of the eastern extent of the area mapped as 'other natural areas' as shown above in **Figure 7-51.**

7.2.16 NATIONAL FRESHWATER ECOSYSTEM PRIORITY AREAS

The National Freshwater Ecosystem Priority Areas (NFEPA) project represents a multi-partner project between the Council for Scientific and Industrial Research (CSIR), South African National Biodiversity Institute (SANBI), Water Research Commission (WRC), Department of Water Affairs (DWA; now Department of Water and Sanitation, or DWS), Department of Environmental Affairs (DEA), Worldwide Fund for Nature (WWF), South African Institute of Aquatic Biodiversity (SAIAB) and South African National Parks (SANParks). More specifically, the NFEPA project aims to:

- Identify Freshwater Ecosystem Priority Areas (hereafter referred to as 'FEPAs') to meet national biodiversity goals for freshwater ecosystems; and
- Develop a basis for enabling effective implementation of measures to protect FEPAs, including free-flowing rivers.

The first aim uses systematic biodiversity planning to identify priorities for conserving South Africa's freshwater biodiversity, within the context of equitable social and economic development. The second aim comprises a national and sub-national component. The national component aims to align DWS and DEA policy mechanisms and tools for managing and conserving freshwater ecosystems. The sub-national component aims to use three case study areas to demonstrate how NFEPA products should be implemented to influence land and water resource decision-making processes at a sub-national level (Driver *et al*., 2011). The project further aims to maximize synergies and alignment with other national level initiatives such as the National Biodiversity Assessment (NBA) and the Cross-Sector Policy Objectives for Inland Water Conservation.

According to the current outputs of the NFEPA project (Nel *et al*., 2011), the study area falls within three wetland vegetation groups: Mesic Highveld Grassland Group 4, Mesic Highveld Grassland Group 5 and Mesic Highveld Grassland Group 6. The western portion of the study area falls within the Klein-Komati River catchment, which is designated as a River FEPA and encompasses all of its associated sub-catchment areas. Four designated wetland cluster areas are also associated with this area (**Figure 7-52**). According to Driver *et al*. (2011), wetland clusters are groups of wetlands embedded in a relatively natural landscape. This allows for important ecological processes such as migration of frogs and insects between wetlands.

Further, SANBI recently undertook a wetland mapping exercise for the Mpumalanga Highveld region in order to expand on the detailed wetland delineations undertaken in adjacent catchments, for inclusion into the NFEPA project (Mbona *et al.,* 2015). Mpumalanga Tourism and Parks Agency (MPTA) recognises that wetlands are specialised systems that perform various ecological functions and play an integral role in biodiversity conservation. The project sought to map the extent, distribution, condition and type of freshwater ecosystems in the Mpumalanga Highveld coal belt. The delineations were based on identifying wetlands on Spot 5 imagery within the Mpumalanga Highveld boundary and supported by Google Earth imagery, 1:50 000 contour lines, 1:50 000 river lines, data from previous studies in the area, and data from the original NFEPA wetlands layer. Hydrogeomorphic (HGM) units were identified at a desktop level and confirmed by means of ground-truthing. These refined layers will eventually be incorporated into the atlas of high-risk freshwater ecosystems and guidelines for wetland offsets, currently being developed by SANBI, in order to improve the scientific robustness of these tools (Mbona *et al.,* 2015). According to Mbona *et al.* (2015), approximately twenty-four FEPA-designated wetlands are associated with the proposed Dalmanutha WEF based on the revised wetland mapping inventory for the Mpumalanga Highveld region (**Figure 7-52**).

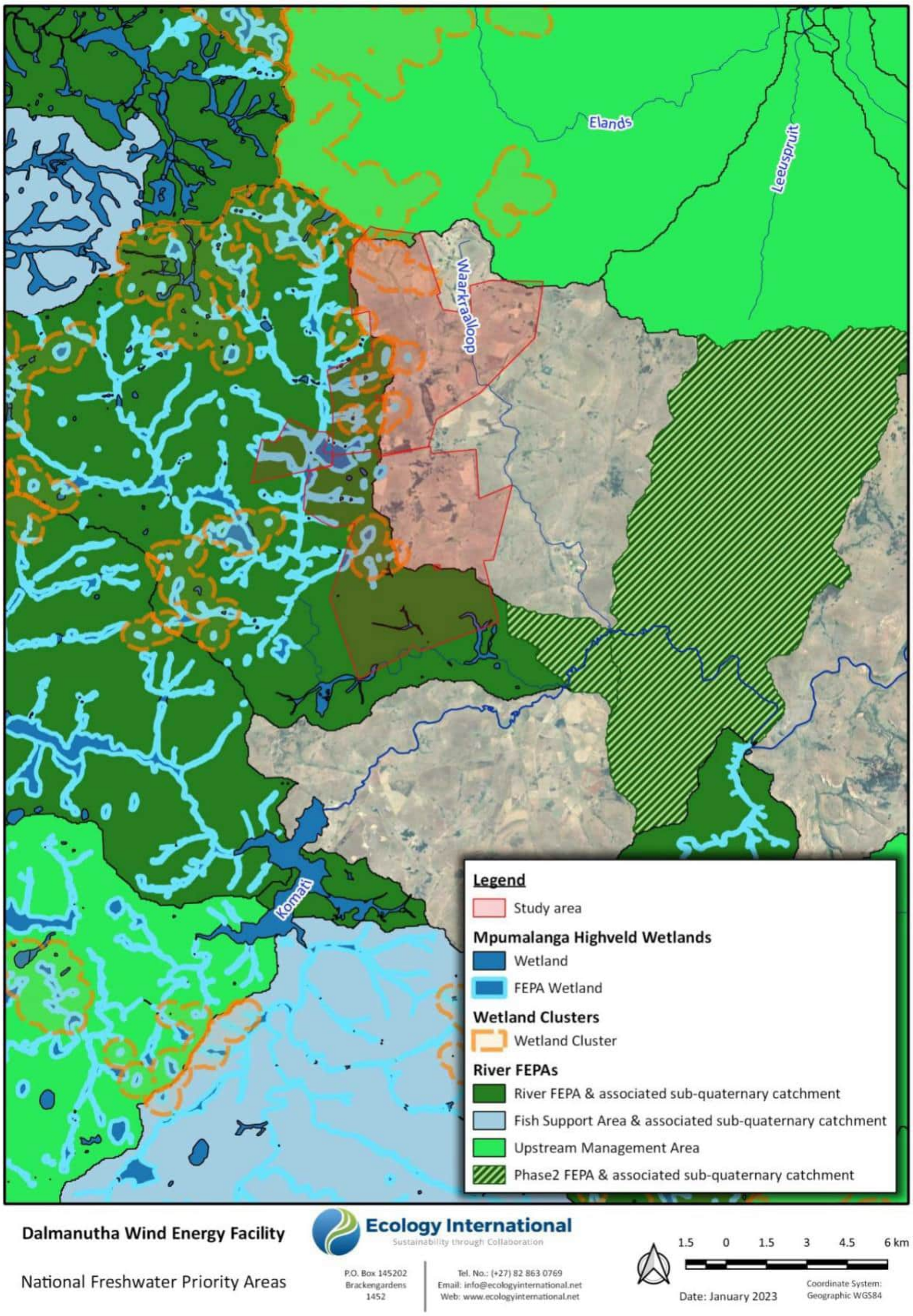


Figure 7-52 - National Freshwater Ecosystem Priority Areas associated with the study area

7.2.17 NATIONAL WETLAND MAP

It is noted that the MPSBP freshwater assessment was based largely on remotely sensed satellite imagery, and thus some wetlands are not included (e.g. historic wetlands lost through drainage or ploughing), particularly hillslope seeps which can be difficult to distinguish from grasslands based on satellite imagery alone. Similarly, some features have been mapped as wetlands, which, once examined in the field, are not defined as wetlands. The most up-to-date spatial dataset at the national level is now considered to be the National Wetland Map 5 (NWMM5) (**Figure 7-53** and **Figure 7-54**.), which displays a more accurate representation of actual wetland conditions on site; however hillslope seep wetlands are assumed to be under-represented, and are a focus point for the ongoing baseline data collection to inform the wetland delineation and classification of hydrogeomorphic units located within the area.

The South African National Wetland Map version 5 portrays the most up-to-date spatial data for the extent and types of estuarine and inland aquatic (freshwater) ecosystems of South Africa (Van Deventer et al., 2019). The proposed development footprint in relation to wetlands mapped as part of the National Wetland Map 5 project is illustrated on **Figure 7-53** and **Figure 7-54.** As mentioned, the extent of hillslope seep wetlands within the area are likely to be under-represented in this dataset, as such the key objective of the ongoing wetland baseline data gathering studies is defining the extent and condition of this (and other) wetland habitat in the area.

The extent and classification of wetlands within the Project Area are shown on **Table 7-4**, **Figure 7-53** and **Figure 7-54.** The majority consist of relatively steep-profiled valley bottom wetlands with linked hillslope seepages in their upper catchment; with a number of depression wetlands situated in the central area of the Dalmanutha Complex. Channelled Valley Bottom wetlands, Unchanneled Valley Bottom (UVB) wetlands and a Floodplain wetland also occur in the Project Area.

Table 7-4 -Wetlands identified within the Project area

Wetland type	Area (Ha)
Channelled Valley Bottom	89.91
Channelled Valley Bottom	87.02
Channelled Valley Bottom	3.61
Channelled Valley Bottom	300.84
Channelled Valley Bottom	36.47
Channelled Valley Bottom	9.08
Depression	15.16
Depression	15.99
Depression	28.28
Depression	22.64

Wetland type	Area (Ha)
Hillslope Seepage	45.90
Hillslope Seepage	116.24
Hillslope Seepage	17.78
Hillslope Seepage	139.70
Hillslope Seepage	193.06
Hillslope Seepage	35.92
Hillslope Seepage	0.11
Unchanneled Valley Bottom	86.93
Unchanneled Valley Bottom	92.67
Unchanneled Valley Bottom	94.54
Unchanneled Valley Bottom	9.93
Unchanneled Valley Bottom	23.85

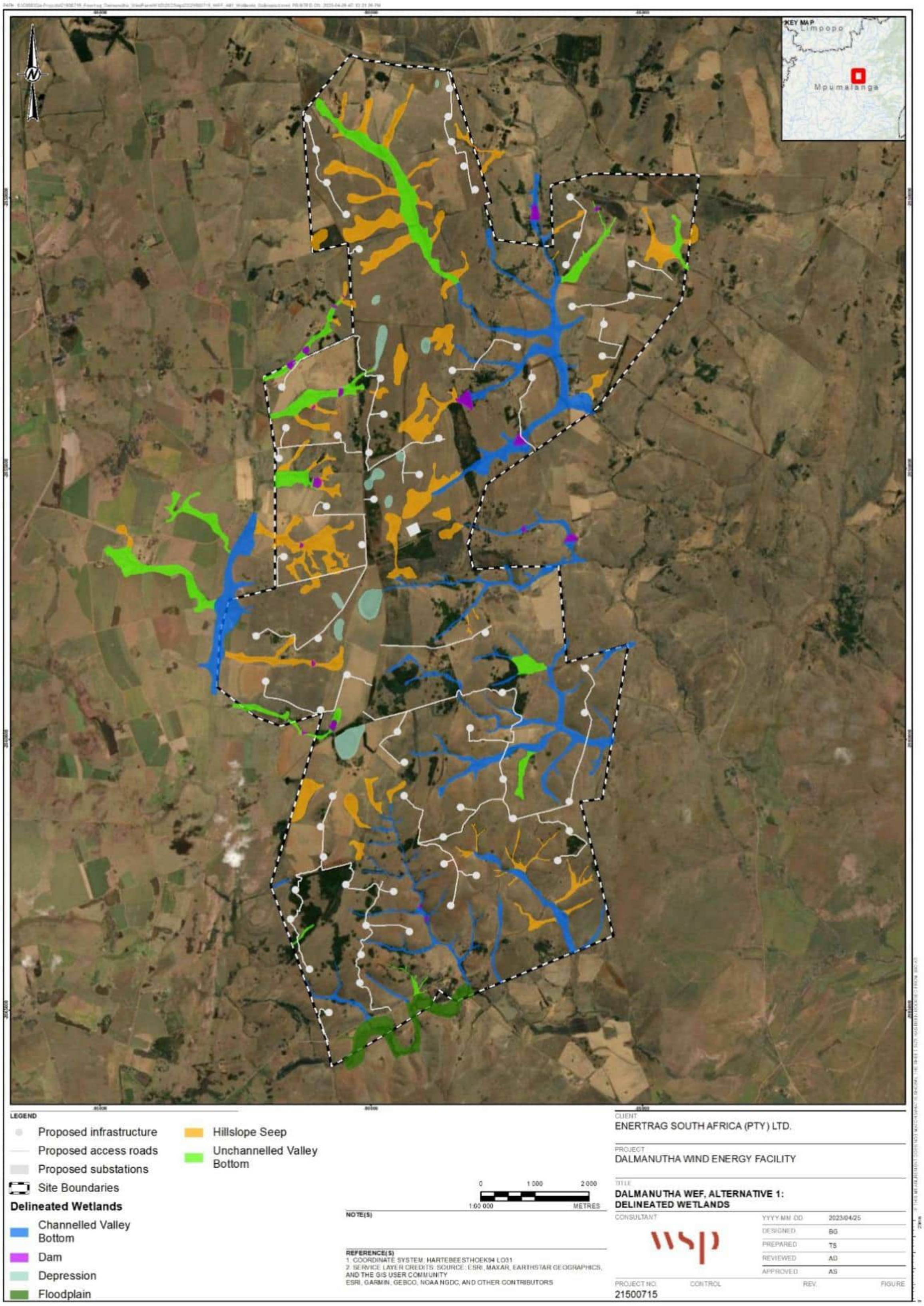


Figure 7-53 – Wetlands delineated within the Project Area - Alternative 1

The delineation and classification of wetlands within the study area, that were surveyed during April and May 2022, is shown on **Figure 7-53** and **Figure 7-54**. The majority consist of relatively steep-profiled valley bottom wetlands with linked hillslope seepages in their upper catchment; with several depression wetlands situated in the central area of the Dalmanutha Complex.

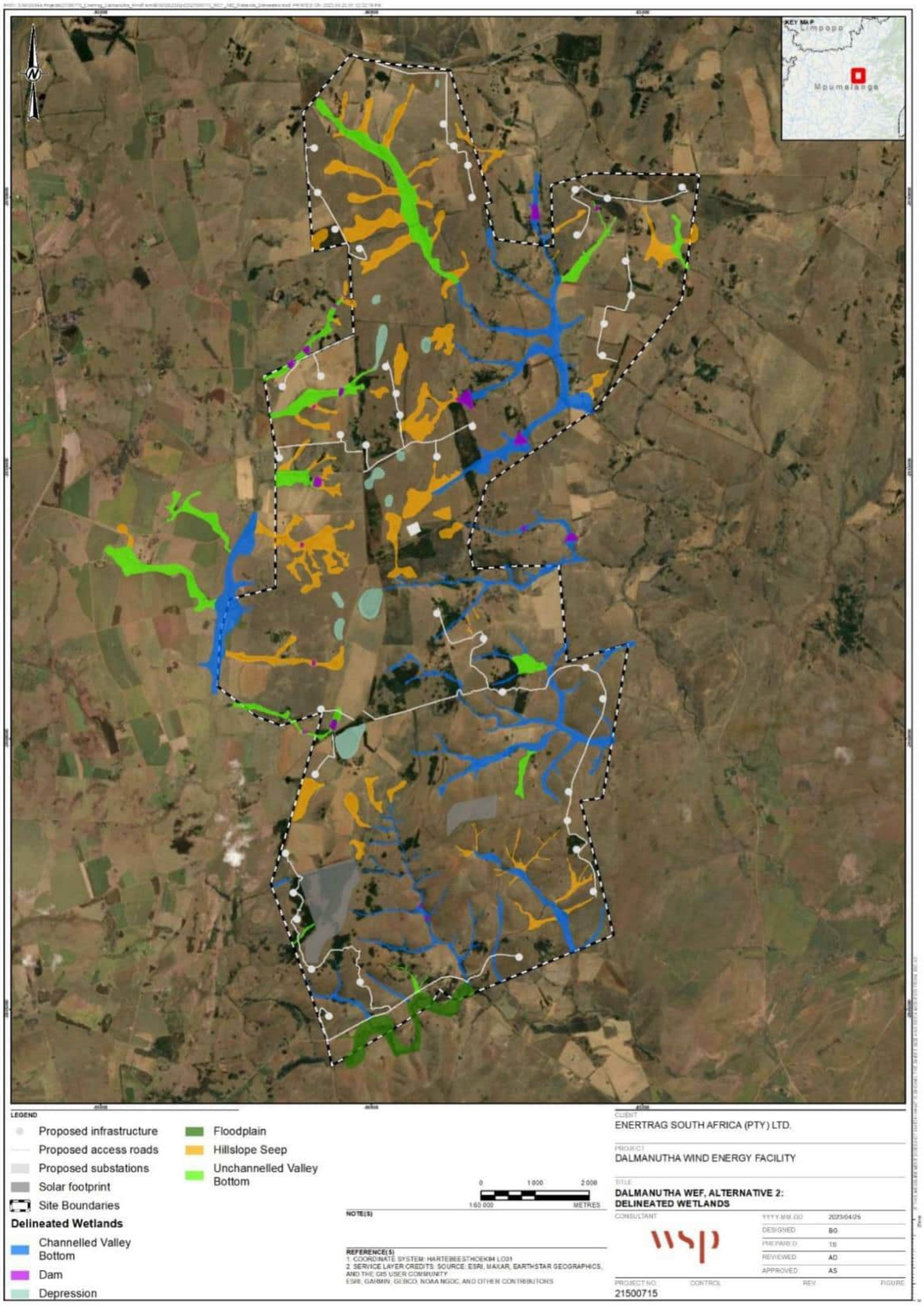


Figure 7-54 -Wetlands delineated within the Project Area - Alternative 2

7.2.18 PRESENT ECOLOGICAL IMPORTANCE

The wetlands within the study area exist in a landscape that is characterised by agricultural activities predominantly livestock grazing, with some intensive crop production. The bulk of the wetlands within the Project Area are in a Moderately Modified (PES C) to Largely Modified (PES D) condition, with just a few wetlands considered to be in Good (PES B) to Pristine (PES A/B) condition. In the south of the study area, channelled valley bottom wetlands are considered to be in a Seriously/Critically Modified state (PES E).

Impact Category	Description	Impact Score Range	Present Ecological State Category
None	Unmodified, or approximates natural condition	0 – 0.9	A
Small	Largely natural with few modifications, but with some loss of natural habitats	1 – 1.9	B
Moderate	Moderately modified, but with some loss of natural habitats	2 – 3.9	C
Large	Largely modified. A large loss of natural habitat and basic ecosystem function has occurred	4 – 5.9	D
Serious	Seriously modified. The losses of natural habitat and ecosystem functions are extensive	6 – 7.9	E
Critical	Critically modified. Modification has reached a critical level and the system has been modified completely with almost complete loss of natural habitat	8 – 10.0	F

Figure 7-55 -Impact scores and categories of Present Ecological State used by WET-Health for describing the integrity of wetlands (Macfarlane et al., 2008)

The distribution of the wetlands in the study area, in relation to their PES score for both alternative 1 and 2 are, is shown in **Figure 7-53** and **Figure 7-54.**

The degradation of wetland habitat that has occurred in these systems is mostly associated with the intensive cultivation practises in the catchments of the wetlands and in some instances in the wetlands themselves, large impoundments as a result of farm dams and less intense impoundments as a result of farm access tracks, drainage gullies and subsequent erosion, plantations of eucalyptus and wattle, and in-wetland infestations by alien and invasive weed species.

The relatively steep valley-side gradient of parts of the study area make the hillslope seep and unchanneled valley bottom wetlands susceptible to erosion, especially where those wetlands are also subject to grazing by livestock, partially dammed, or traversed by dirt tracks. These factors lead to the formation of preferential flow paths, resulting in desiccation of adjacent wetland habitat.

7.2.19 ECOLOGICAL IMPORTANCE AND SENSITIVITY

The EIS of the wetlands in the Project area varies widely (**Table 7-5**), largely as a function of their size and ecological integrity, which affects their capacity to deliver biodiversity and water-related ecosystem services. The distribution of the wetlands in the study area in relation to their EIS score for both alternative 1 and alternative 2, is shown in **Figure 7-57** and **Figure 7-58** respectively.

The bulk of the wetlands are considered to be of Moderately-Low to Moderate EIS. A few wetlands were considered to be in a moderately high EIS. There are also a few seepage wetlands in the centre of the Project area that area considered to have a very-high EIS. The high to very high EIS of some of the wetlands in the Project area is largely due to the presence of red listed water birds species such as Wattled Crane and the Grey-crowned Crane (Taylor *et al,* 2015 as cited in WildSkies Ecological Services, 2022).

Ecological Importance and Sensitivity Category Description	Range of EIS score
Very high: Wetlands that are considered ecologically important and sensitive on a national or even international level. The biodiversity of these systems is usually very sensitive to flow and habitat modifications. They play a major role in moderating the quantity and quality of water of major rivers	> 3 and ≤ 4
High: Wetlands that are considered to be ecologically important and sensitive. The biodiversity of these systems may be sensitive to flow and habitat modifications. They play a role in moderating the quantity and quality of water of major rivers.	> 2 and ≤ 3
Moderate: Wetlands that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these systems is not usually sensitive to flow and habitat modifications. They play a small role in moderating the quantity and quality of water of major rivers	> 1 and ≤ 2
Low/marginal: Wetlands that are not ecologically important and sensitive at any scale. The biodiversity of these systems is ubiquitous and not sensitive to flow and habitat modifications. They play an insignificant role in moderating the quantity and quality of water of major rivers.	> 0 and ≤ 1

Figure 7-56 -Ecological importance and sensitivity categories

Table 7-5 - Wetland identified within the Project area with associated PES and EIS scores

Wetland Type	PES Class	EIS Class	Wetland Size (Area in ha)
Channelled Valley Bottom	C	Moderate	89.91
Channelled Valley Bottom	C	Moderately-High	87.02
Channelled Valley Bottom	C	Moderately-Low	3.61
Channelled Valley Bottom	D	Moderate	300.84
Channelled Valley Bottom	D	Moderately-Low	36.47
Channelled Valley Bottom	E	Moderately-Low	9.08
Depression	A	Very High	15.16
Depression	B	High	15.99

Wetland Type	PES Class	EIS Class	Wetland Size (Area in ha)
Depression	B	Very High	28.28
Depression	C	High	22.64
Floodplain	C	Moderately-High	93.25
Hillslope Seepage	B	High	45.90
Hillslope Seepage	B	Moderately-High	116.24
Hillslope Seepage	B	Very High	17.78
Hillslope Seepage	C	Moderate	139.70
Hillslope Seepage	C	Moderately-High	193.06
Hillslope Seepage	D	Moderate	35.92
Hillslope Seepage	D	Moderately-Low	0.11
Unchanneled Valley Bottom	B	High	86.93
Unchanneled Valley Bottom	C	Moderate	92.67
Unchanneled Valley Bottom	C	Moderately-High	94.54
Unchanneled Valley Bottom	D	Moderate	9.93
Unchanneled Valley Bottom	D	Moderately-Low	23.85

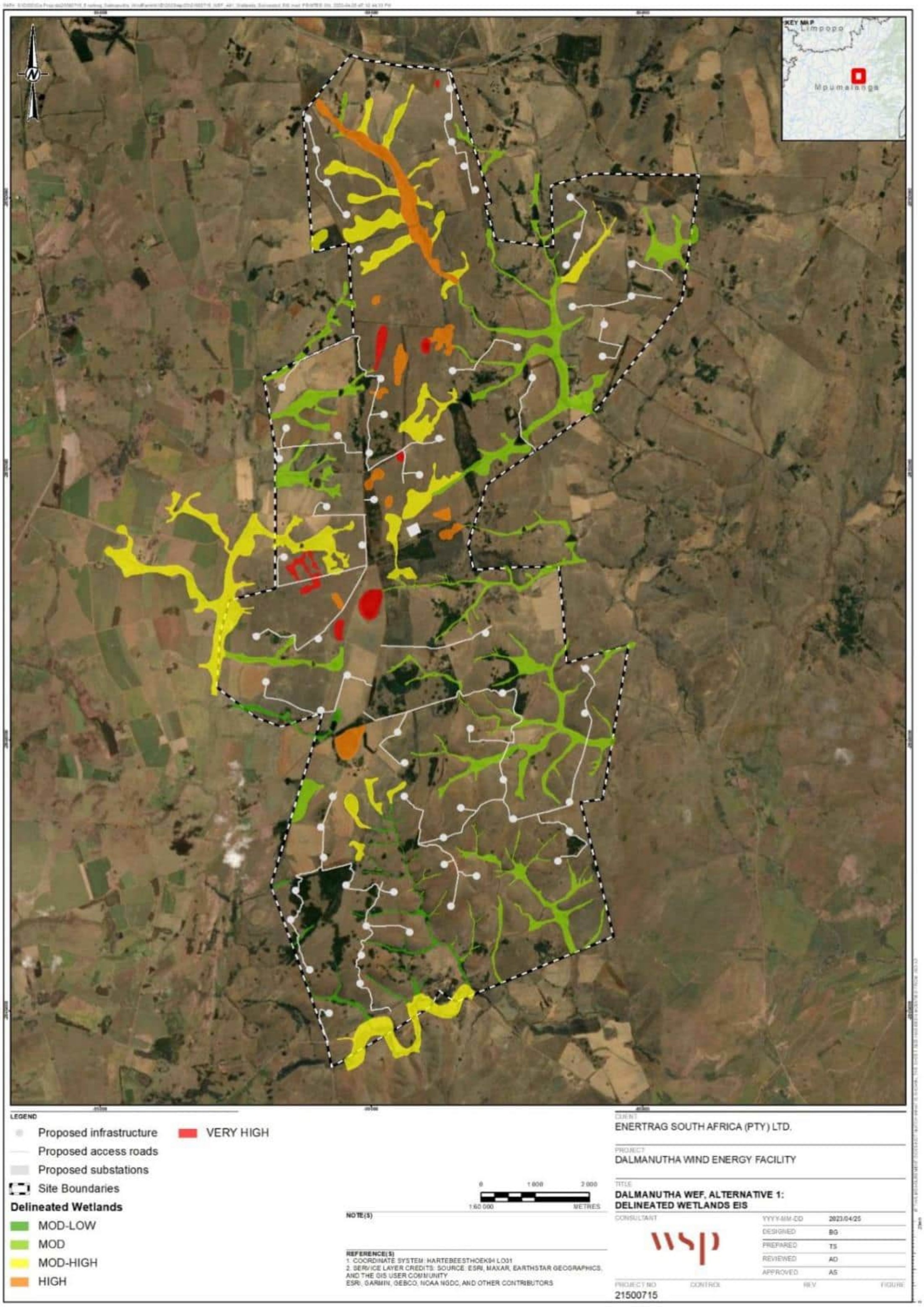


Figure 7-57 -Wetlands EIA category - Alternative 1

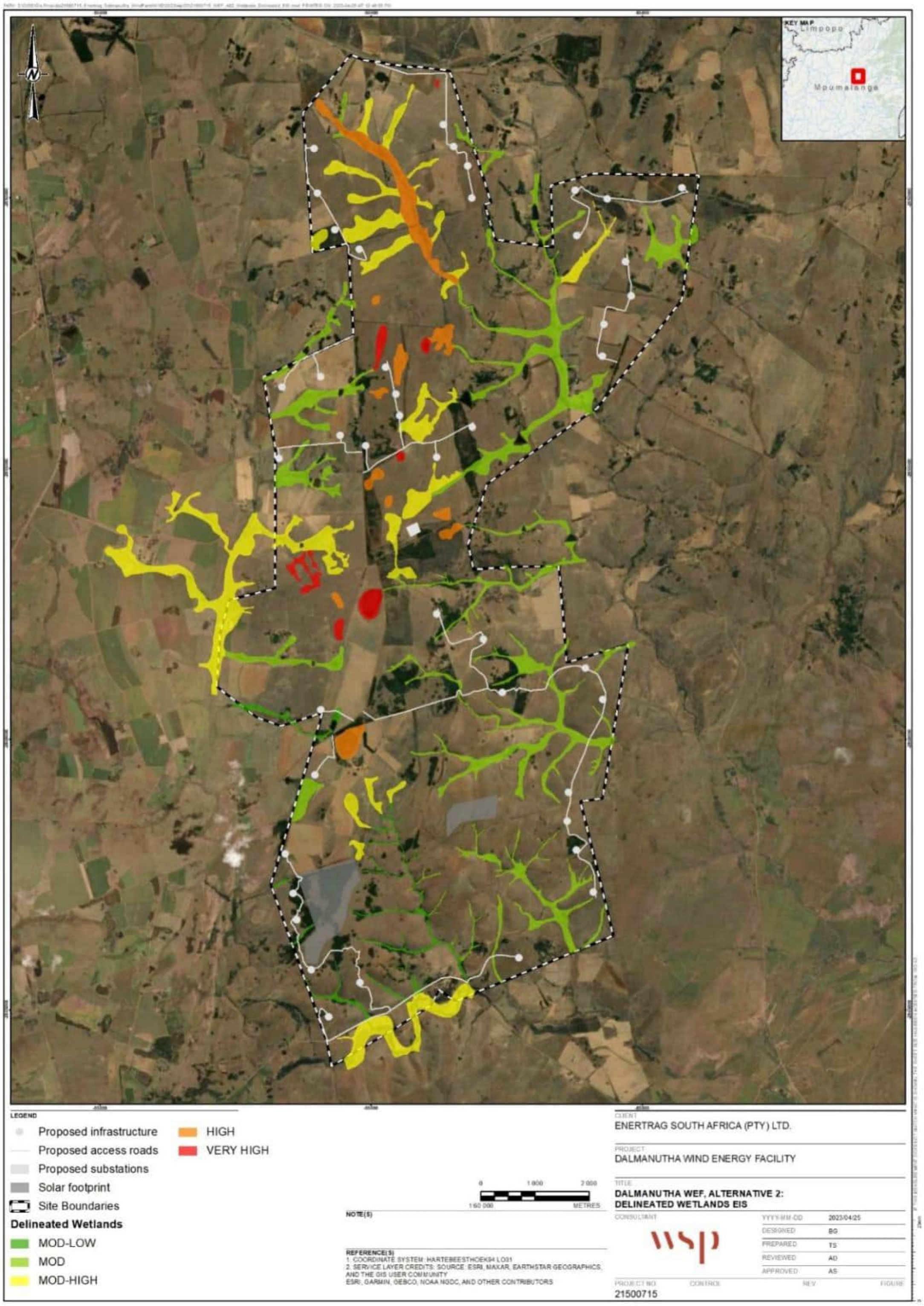


Figure 7-58 -Wetlands EIS Category- Alternative 2

Baseline aquatic biomonitoring locations for the study area have been selected based on the proposed positioning of WEF infrastructure and access roads, and the future need to measure and monitor potential impacts on the various surface water systems that coincide and interact with the proposed infrastructure and activities. The baseline aquatic monitoring locations are shown on **Figure 7-59**. High-flow baseline surveys have already been completed, the results of which are presented in the overall Aquatic Biodiversity Specialist Assessment (**Appendix H.4**)

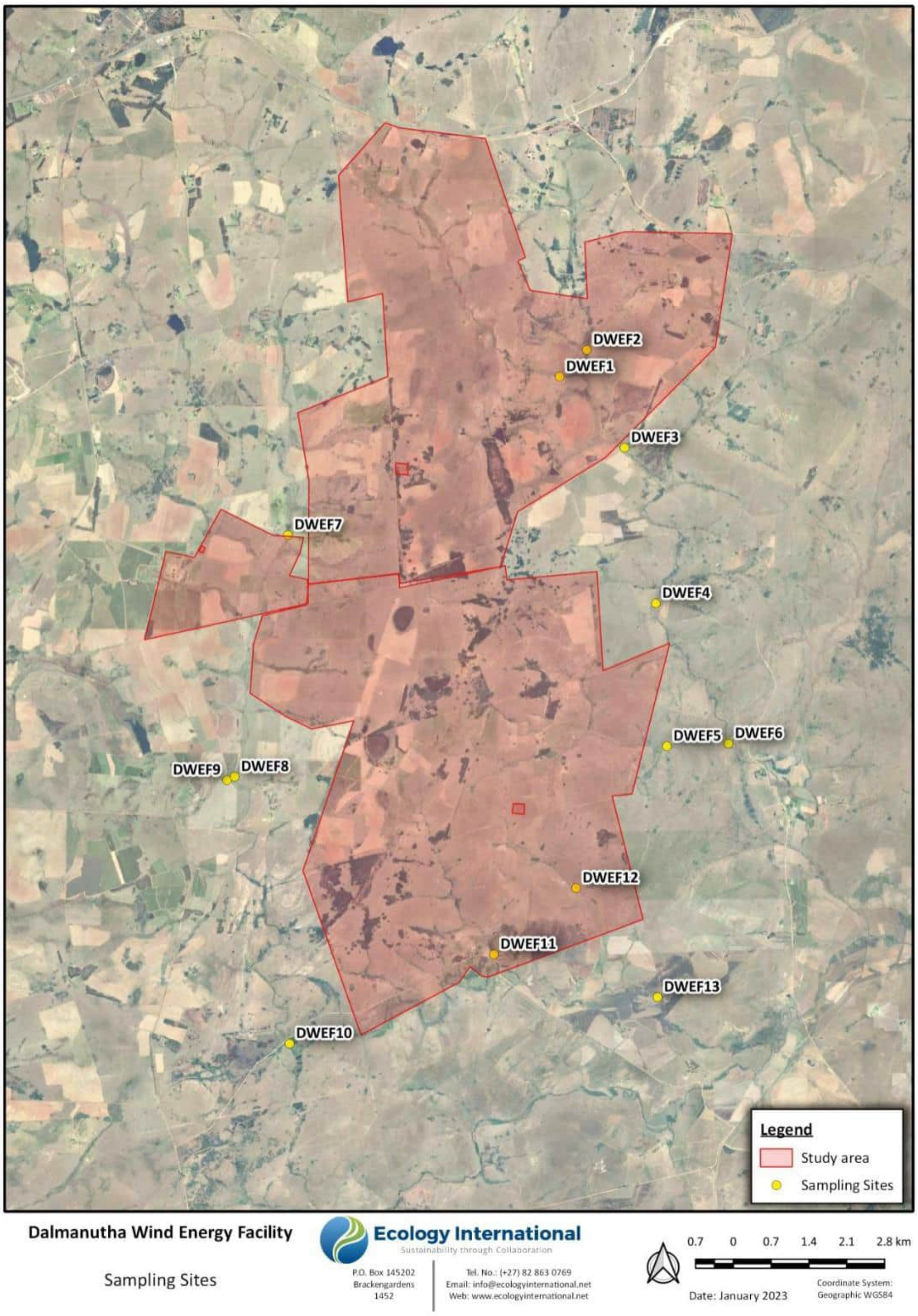


Figure 7-59 - Aquatic sampling sites utilised during the aquatic specialist assessment

7.2.20 TERRESTRIAL BIODIVERSITY

The study area and Project infrastructure are situated in a high biodiversity value landscape, interacting with extensive areas of natural habitats, areas mapped as terrestrial and aquatic CBAs according to the MBSP, and an IBA, and supports numerous flora and fauna SCC. Despite localised areas of modified and disturbed habitat (mostly associated with cultivation and alien tree plantations), and the presence of linear infrastructure, such as farm roads, powerline servitudes, railways and farm fences, habitat connectivity in the study area and across the broader landscape remains relatively high.

Key habitats associated with the high levels of landscape-scale connectivity include the large areas of grassland and wetland habitats that span the LSA. These areas provide a large network of dispersal corridors for flora propagules as well as ground-dwelling fauna species, and also have importance for a variety of bird species, and particularly migrating waterbirds which rely on a network of connected wetland sites as stopovers and for navigation purposes during migration (Deboelpaep et al., 2022).

The area of forested gorge habitat is also considered a site of importance in the study area. Considering the overall dominance of grassland habitat and modified habitats, the presence of this fine-scale indigenous forest habitat, flanked by vegetated rocky cliffs, is unique within the study area and increases local-scale habitat heterogeneity, which reflects in overall flora diversity.

7.2.21 AVIFAUNA

IMPORTANT BIRD AREAS

The proposed facility partially overlaps the Steenkampsberg Important Bird and Biodiversity Area (IBA - Marnewick et al, 2015) (**Figure 7-60**).

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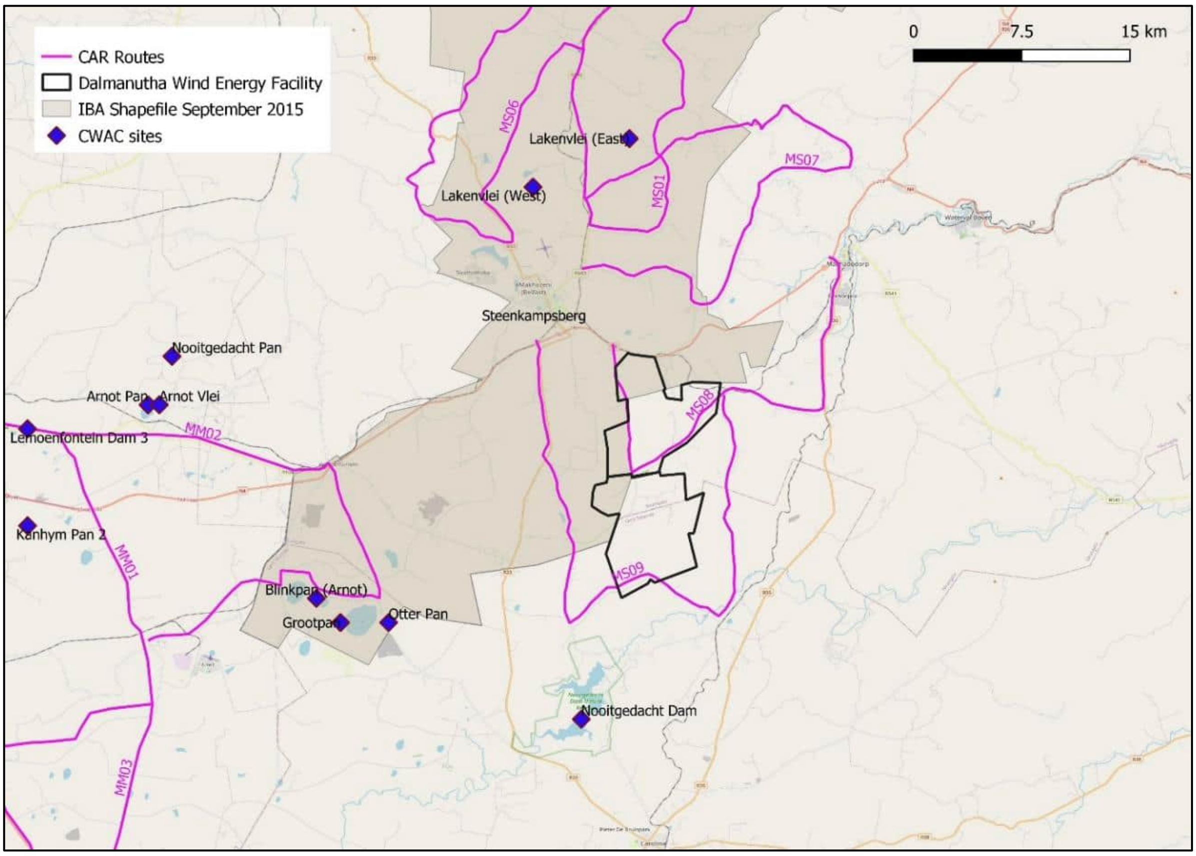


Figure 7-60 - IBA in relation to project area (Wildskies, 2022)

This IBA consists primarily of rolling high-altitude (1 700–2 100 m a.s.l.) grassland interspersed with rocky outcrops. The area receives an average rainfall of 1 025 mm p.a. Annual average minimum and maximum temperatures are 5 °C and 20 °C respectively, with a range from -8 °C to 39 °C. Two wetland systems are particularly important in the Steenkampsberg area. The first is Lakensvleispruit, which lies 8 km north-east of Belfast. The second is Verloren Valei. Lying approximately 9 km north of Dullstroom. The proposed facility is not in close proximity to either of these systems (although smaller wetlands exist on site).

The core area of the IBA, especially along Steenkampsberg towards Dullstroom, is covered by Endangered Dullstroom Plateau Grassland. Globally threatened species found in this IBA include:

- Southern Bald Ibis *Geronticus calvus,*
- Wattled Crane *Grus carunculata,*
- Blue Crane,
- Grey Crowned Crane *Balearica regulorum,*
- White-winged Flufftail *Sarothrura ayresi,*
- Rudd's Lark *Heteromirafra ruddi,*
- Yellow-breasted Pipit,
- Denham's Bustard *Neotis denhami,*
- Blue Korhaan *Eupodotis caerulescens*
- Secretary bird *Sagittarius serpentarius.*

Regionally threatened species are:

- African Marsh Harrier *Circus ranivorus,*
- Black-rumped Buttonquail *Turnix nanus,*
- Striped Flufftail *Sarothrura affinis,*
- White-bellied Korhaan *Eupodotis senegalensis,*
- African Grass Owl *Tyto capensis,*
- Black Stork *Ciconia nigra*
- Lanner Falcon *Falco biarmicus.*

Restricted-range and biome-restricted species are:

- Kurrichane Thrush *Turdus libonyanus*
- Buff-streaked Chat *Campicoloides bifasciatus*, both of which are common.
- Rudd's Lark,
- Yellow-breasted Pipit and Gurney's Sugarbird *Promerops gurneyi* are uncommon,
- White-bellied Sunbird *Cinnyris talatala* is fairly common.

BIRD HABITAT

Whilst much of the distribution and abundance of the bird species in the project site can be explained by the dominant biomes and vegetation types, it is also important to examine the modifications which have changed the natural landscape, and which may have an effect on the distribution of avifauna. These are sometimes evident at a much smaller spatial scale than the biome or vegetation types and are determined by a host of factors such as topography, land use and man-made infrastructure.

Figure 7-61 shows that the northern part of the site falls in the highest sensitivity categories in terms of avifauna (darker colours indicate higher risk) The site falls partially within an IBA (Marnewick *et al,* 2015). This IBA has already been described above.

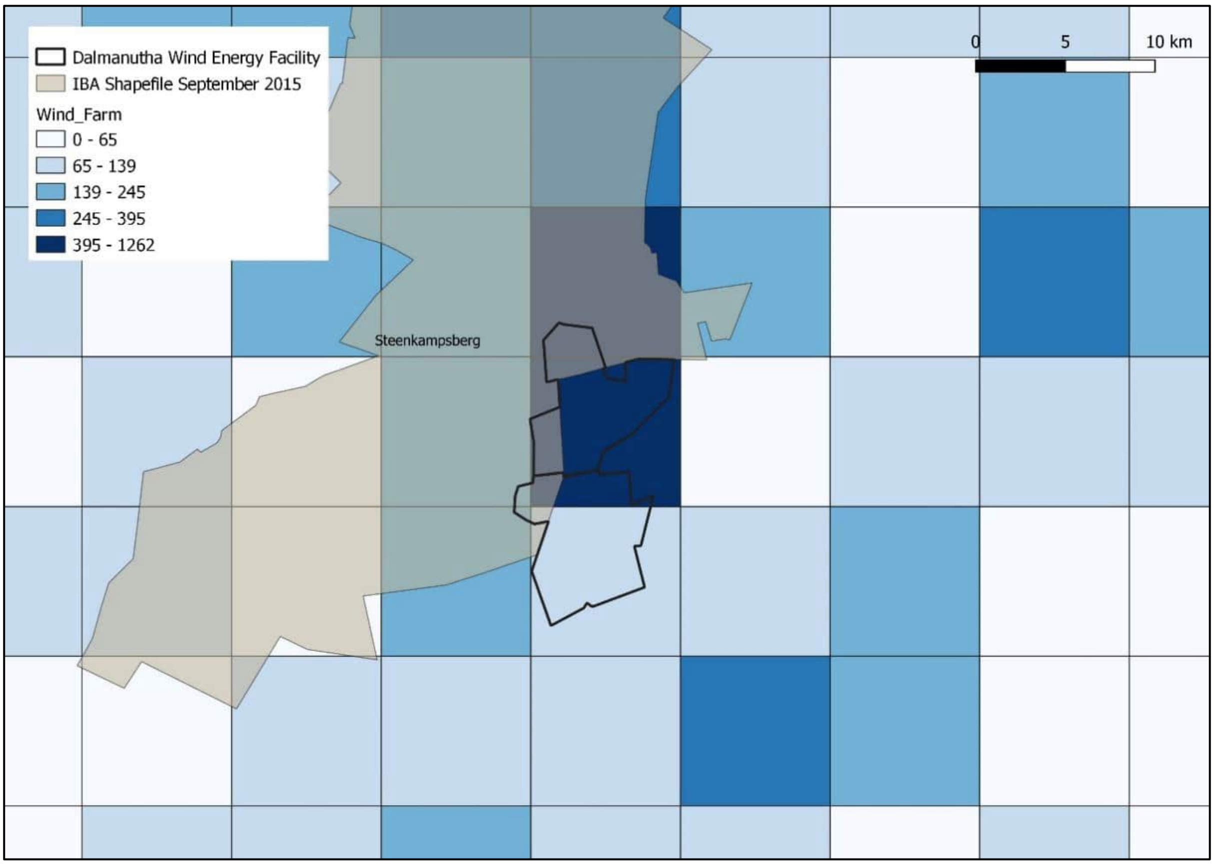


Figure 7-61 - The position of the site relative to the Avian wind farm sensitivity map (Retief *et al,* 2011) & Important Bird Areas (Marnewick *et al* 2015).

The following bird habitat classes were identified in the project site:

GRASSLAND

The majority of the habitat in the project site comprises grassland. The grassland varies from dense stands of relatively high grass to areas of heavily grazed short grass. The priority species which could potentially use the natural grassland in the project site on a regular basis are the following:

- Secretary bird
- White-bellied Bustard
- Common Buzzard
- Jackal Buzzard
- Buff-streaked Chat
- Blue Crane
- Grey Crowned Crane
- Black-chested Snake Eagle
- Long-crested Eagle
- Spotted Eagle-Owl
- Amur Falcon
- Lanner Falcon
- Grey-winged Francolin

- African Harrier-Hawk
- Southern Bald Ibis
- Black-winged Kite
- Blue Korhaan
- Black-winged Lapwing
- African Grass Owl
- Marsh Owl
- Black Sparrowhawk
- White Stork

The priority species which could occasionally use the natural grassland in the project site are the following:

- Black-bellied Bustard
- Denham's Bustard
- Brown Snake Eagle
- Martial Eagle
- Peregrine Falcon
- African Marsh Harrier
- Black Harrier
- Montagu's Harrier
- Northern Black Korhaan
- Cape Vulture

DRAINAGE LINES AND WETLANDS

There are several wetlands in the project site, most of which are associated with drainage lines. The priority species which could potentially use the wetlands in the project site on a regular basis are the following:

- Blue Crane
- Grey Crowned Crane
- African Grass Owl
- Marsh Owl

The priority species which could occasionally use the wetlands in the project site are the following:

- African Marsh Harrier
- Montagu's Harrier
- Wattled Crane

AGRICULTURAL LANDS

The project site contains a patchwork of agricultural fields, where maize, soya beans and pastures are cultivated. Some fields are lying fallow or are in the process of being re-vegetated by grass. The priority species which could potentially use the agricultural fields in the project site on a regular basis are the following:

- Blue Crane
- Grey Crowned Crane

- Common Buzzard
- Spotted Eagle-Owl
- Amur Falcon
- Lanner Falcon
- Southern Bald Ibis
- Black-winged Kite

The priority species which could occasionally use the agricultural lands in the project site are the following:

- Peregrine Falcon
- African Marsh Harrier
- Montagu's Harrier
- Wattled Crane
- Black Harrier
- Black-bellied Bustard
- Denham's Bustard
- Brown Snake Eagle
- Martial Eagle
- Northern Black Korhaan
- Cape Vulture

DAMS

There are numerous ground dams at the project site, located in drainage lines. The priority species which could potentially use the dams in the project site on a regular basis are the following:

- African Fish Eagle

The priority species which could occasionally use the dams in the project site are the following:

- Western Osprey

PANS

The project site contains one large pan, and another large pan is located approximately one kilometre south of the site. These pans are a potential drawcard for many priority species. Lesser and Greater Flamingos could use these pans for foraging and roosting. Large raptors and vultures could use the pans for bathing and drinking, and Blue Cranes could roost there on occasion. The priority species which could potentially use the pans in the project site on a regular basis are the following:

- Common Buzzard
- Jackal Buzzard
- Blue Crane
- Black-chested Snake Eagle
- Long-crested Eagle
- Lanner Falcon
- Greater Flamingo
- Lesser Flamingo
- African Harrier-Hawk

The priority species which could occasionally use the pans in the project site are the following:

- Brown Snake Eagle
- Martial Eagle
- Peregrine Falcon
- African Marsh Harrier
- Montagu's Harrier
- Black Harrier
- Cape Vulture
- Black-bellied Bustard
- Denham's Bustard
- Wattled Crane
- Northern Black Korhaan
- Western Osprey

PRIORITY SPECIES

Throughout the two years of avifaunal monitoring and studies on site, we have recorded 244 bird species on site across all methodologies, and incidentally. Total species diversity per Site Visit is shown in Appendix 1 of the Avifaunal impact assessment (**Appendix H.2**) and ranges from a minimum of 106 species in S10 (autumn 2023) to 174 species in S4 (summer 2022).

The South African Bird Atlas Project 2 (SABAP 2) reports an additional 75 species which were absent from the species lists but present in the SABAP 2 data, albeit often at low reporting rates, or submitted as ad hoc accounts (Appendix 1 of the Avifaunal impact assessment (**Appendix H.2**)). These species include a number of Vulnerable, Near-threatened and/or near endemic species, the most notable of which include: Yellow-breasted Pipit *Anthus chloris* (0.5%), Verreaux's Eagle (0.9%), Abdim's Stork *Ciconia abdimii* (0.5%), Red-footed Falcon *Falco vespertinus* (1.4%) and Lesser Flamingo *Phoeniconaias minor* (0.5%).

Fifteen species recorded on the site are regionally Red Listed: Wattled Crane *Grus carunculata* and White-backed Vulture *Gyps africanus* are Critically Endangered; Grey Crowned Crane *Balearica regulorum,* African Marsh Harrier *Circus ranivorus*, Cape Vulture, Martial Eagle and Black-rumped Buttonquail *Turnix nanus* are Endangered; White-bellied Bustard *Eupodotis senegalensis*, Southern Bald *Ibis Geronticus calvus*, Denham's Bustard *Neotis denhami*, Crowned Eagle *Stephanoaetus coronatus,* Lanner Falcon *Falco biarmicus*, and Secretarybird *Sagittarius serpentarius* are Vulnerable, and Blue Crane and Pallid Harrier *Circus macrourus* are Near-Threatened. An additional two species are Regionally Least Concern although listed Globally as Near Threatened: Blue Korhaan *Eupodotis caerulescens* and Forest Buzzard *Buteo trizonatus*. Twenty-three of the 318 species recorded by our observers or additional SABAP 2 records are either near endemic to South Africa, or endemic to South Africa, Lesotho and eSwatini.

SMALL TERRESTRIAL BIRD SPECIES

A total of 134 bird species were recorded on the Walked Transects on the site through the two years of monitoring. This included 2 511 records of 6 670 individual birds. Walked Transects totalled 102km overall, averaging 10.2km per Site Visit. The number of species recorded each Site Visit ranged from 40 (S10) to 83 (S3). Appendix 2 of the Avifaunal impact assessment (**Appendix H.2**) shows the full species set and the breakdown across all of the Site Visits. In each case the number of birds, number of records, and number of birds per kilometre of transect are presented, although the index of birds per kilometre is relatively crude. However, since this will be used primarily to compare the effects of the facility on these species post-construction, this index is considered adequate at this stage. If more complex analysis is required during post-construction monitoring in order to demonstrate effects, the raw data is available for this purpose.

The most abundant species encountered on the Walked Transects were not surprisingly all species already known to be common in the area, such as: Southern Red Bishop *Euplectes orix* (80 records of 1064 birds), Long-tailed Widowbird *Euplectes progne* (97 records of 546 birds), Cape Longclaw *Macronyx capensis* (225 records of 428 birds), Wing-snapping *Cisticola Cisticola ayresii* (201 records of 420 birds) and Barn Swallow *Hirundo rustica* (72 records of 311 birds). These species share the traits of either flocking in large numbers or performing aerial displays or frequent, recognisable vocalisations which increases their detectability in the landscape.

Of the 134 species identified on the Walked Transects, ten are endemic or near endemic to South Africa, Lesotho and eSwatini: Pied Starling *Lamprotornis bicolor*, Eastern Long-billed Lark *Certhilauda semitorquata*, Fiscal Flycatcher *Melaenornis silens*, Cloud Cisticola *Cisticola textrix*, Cape White-eye *Zosterops capensis*, Drakensberg *Prinia Prinia hypoxantha*, Buff-streaked Chat *Campicoloides bifasciatus*, Cape Grassbird *Sphenoeacus afer*, South African Cliff Swallow *Petrochelidon spilodera* and Cape Weaver *Ploceus capensis.*

The small terrestrial bird community on site is as expected for the highveld grassland vegetation that occurs on site. Seeding grasses and abundant insect prey (specifically in the warmer months) provide adequate food for a relatively diverse assemblage of both granivorous and insectivorous birds. There are no particularly concerning species present on site from this sector of the avifauna. Black-rumped Buttonquail, a small Endangered species, was not detected on dedicated walks, but was recorded by other methodologies during the monitoring program, generally when flushed from the side of the road.

LARGE TERRESTRIAL & RAPTORS

A total of 23 large terrestrial, raptor or threatened species were recorded across the Driven Transects totalling approximately 400 kilometres on the site through the two years of monitoring. This included 209 individual birds from 95 records. Appendix 3 of the Avifaunal impact assessment (**Appendix H.2**), has the breakdown per Site Visit. Eight of these species are regionally or globally Red Listed. Additionally, Jackal Buzzard is near endemic to South Africa, and Forest Buzzard and Southern Bald Ibis are endemic to SA, Lesotho and eSwatini. In terms of the number of individuals sighted, the most abundant species recorded by this method was Amur Falcon, with 26 records made of 90 birds. Amur Falcon was followed by Cape Vulture (9 records of 36 birds) and Black-winged Kite (10 records of 12 birds) in terms of abundance.

These data represent a good diversity of target species recorded by this method although at relatively low abundance. Although Secretarybird (one pair throughout 2 years) korhaans and cranes are generally conspicuous in the landscape because of their greater size, or readily flush when approached, the method was not particularly effective at detecting them in the landscape. Many of the species detected on Driven Transects were only recorded singly, or in pairs, and infrequently. Their density (or abundance) in the area could be considered fairly low if only this methodology were considered, although they were encountered incidentally as well on VP sessions on numerous occasions. Very good visibility to further than 1-2km during these transects was often compromised by thick vegetation, obstructing Black Wattle stands, or by smoke hanging in the air from frequent burning regimes. When considering other methods (Incidental Observations and VP) it becomes clearer that our target species are more abundant than these DT data suggest.

The large terrestrial birds and raptors are the most important sector of the avifauna on this site, with a number of regionally Red Listed species included. Most of the priority species for the site come from this sector

FOCAL SITES

Nests

Raptor nests are typically the most sensitive receptor in avifaunal studies for renewable projects such as this. Perhaps surprisingly, no raptor nests have been located on site, although the large number of suitable trees (often in inaccessible kloofs and valleys) certainly does not preclude their existence on site.

Dams

Focal Site dams were designated as FS 1-5. A typical assortment of waterfowl has been recorded at these five dam Focal Sites across the Site Visits during our monitoring. Species recorded (to name the most abundant) included: African Darter *Anhinga rufa*; African Snipe *Gallinago nigripennis*; African Swamphen *Porphyrio madagascariensis*; Blacksmith Lapwing *Vanellus armatus*; Common Moorhen *Gallinula chloropus*; Egyptian Goose *Alopochen aegyptiaca*; Hadeda *Ibis Bostrychia hagedash*; Little Grebe *Tachybaptus ruficollis*; Intermediate Egret *Ardea intermedia*; Purple Heron *Ardea purpurea*; Red-knobbed Coot *Fulica cristata*; Reed Cormorant *Microcarbo africanus*; Spur-winged Goose *Plectropterus gambensis*; South African Shelduck *Tadorna cana*; Whiskered Tern *Chlidonias hybrida* and Yellow-billed Duck *Anas undulata*. Cryptic, reed-dwelling species such as African Rail *Rallus caerulescens*, Red-chested Flufftail *Sarothrura rufa* and Black Crake *Amaurornis flavirostra* have also been recorded at a low incidence.

These wetland and dam areas also provide important habitat for reed-dwelling species such as warblers, nesting habitat for a variety and great abundance of weaver species, aerial foraging space for swifts, swallows, terns and martins, and the margins provide resources for lapwings, waders, wagtails and many other species.

During S5, a pair of Grey-crowned Crane was seen at FS 1, and a lone Wattled Crane at FS 2. In S7, a number of Southern Bald Ibis were recorded at FS 4 and FS 5, otherwise none of the species listed above is regionally Red Listed.

A pair of Grey Crowned Crane nested in the FS 5 wetland at the end of Year 1 monitoring; they were seen with three chicks judged to be between 4-5 weeks of age. No Grey Crowned Crane breeding activity was recorded at FS 5 in Year 2, however. Observers noted that this area was heavily disturbed at the time it was surveyed the Focal Site during S7, with in excess of 100 cattle drinking from the banks and grazing in the area. It appeared that many large trees had recently been logged immediately south of this wetland area which highlights just one example of the anthropogenic impact of farming practices across the site. Limited birdlife was present here at the time, although FS 4 (approximately 2km north) was surveyed on the same morning and birdlife was very diverse and abundant here. There is surely a lot of passage between these water bodies and other such features in the vicinity which were not formally surveyed. Our Focal Site dams will each receive at least a 500m No-go turbine buffer, and up to 750m for FS 4 on account of Blue and

Wattled Cranes reportedly breeding here. Sensitive aquatic features must also be avoided according to the NFEPA database.

Roosts

A small gorge with cliffs has been identified as being used as a roost by Southern Bald Ibis. This was designated as FS 6. Up to 10 birds have been recorded roosting here by our own surveys. The specialist survey of the cliffs revealed no evidence of breeding, although it cannot be ruled out in the future, and Lockwood (pers. comm) reports five active nests at this location. It appears that the roost may not be used every evening and it is conceivable that it is used for breeding in some years and not others. This location site has been buffered by 1km to provide protection for these birds flying in and out of the roost. During the latest Site Visit (S8), flight paths on VP 1 sessions followed a very consistent flyway towards/from this kloof, and birds were photographed perching on the steep walls upon closer inspection Appendix 4 of the of the Avifaunal impact assessment (**Appendix H-2**).

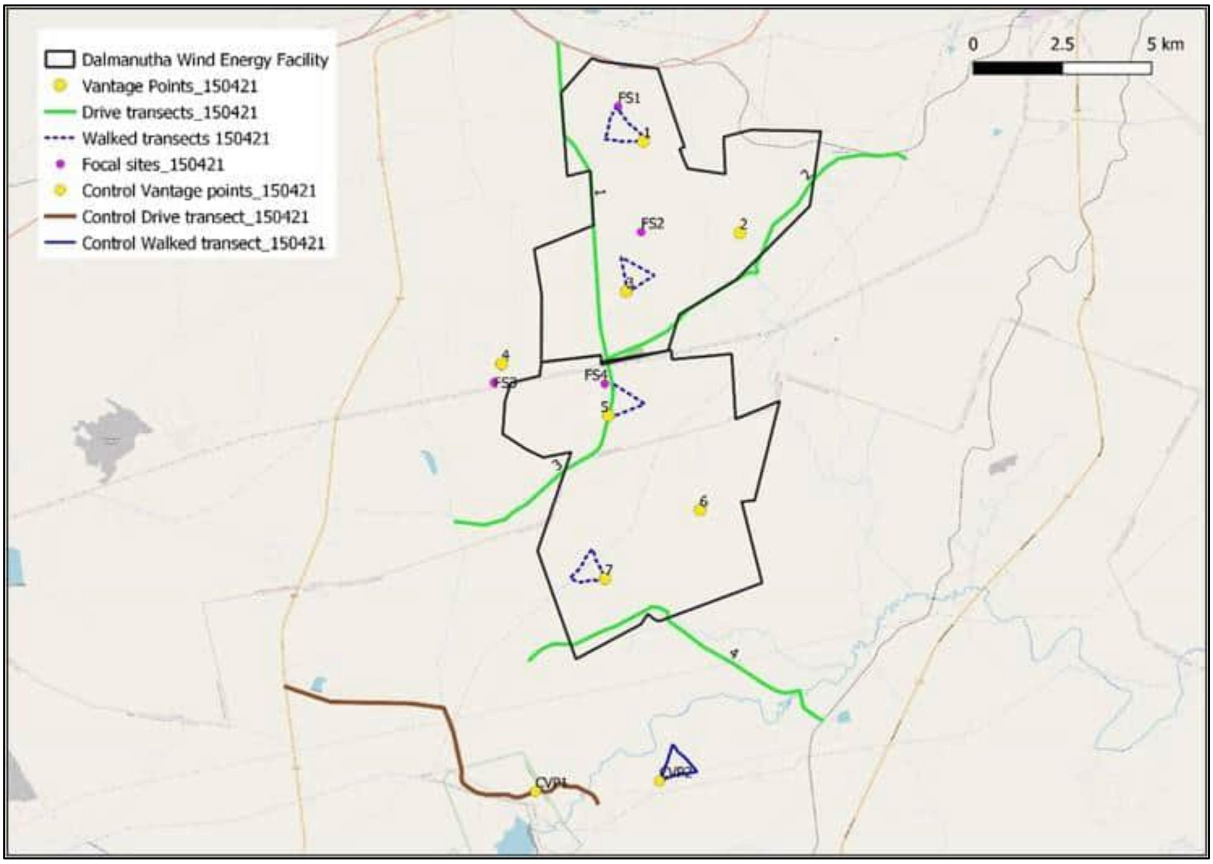


Figure 7-62 – Layout of Bird monitoring activities

INCIDENTAL OBSERVATIONS

A total of 35 species were recorded on the site as Incidental Observations. Appendix 5 of the Avifaunal impact assessment (**Appendix H.2**) presents the findings per Site Visit. The most abundant species (by a significant margin) recorded by this method was Cape Vulture, with 44 records made of 292 birds. Common Buzzard was the second most abundant species with 17 records of 179 birds. Observers made 21 incidental records of 148 individual Southern Bald Ibis in the two years of monitoring. Thirteen of the species recorded by this method are regionally or globally Red Listed. These include one Critically Endangered species (Wattled Crane); four Endangered species (Cape Vulture, Grey Crowned Crane, Black-rumped Buttonquail and African Marsh Harrier); five Vulnerable species (Lanner Falcon, Secretarybird, Southern Bald Ibis, White-bellied Bustard and Denham's Bustard); and one Near-threatened species (Blue Crane). In addition, Forest Buzzard and Blue Korhaan were recorded and are regionally Least Concern, but Globally Near-threatened. Since these data are not the product of systematic data collection methods, they should be used cautiously and we do not discuss these findings any further here other than presenting the summarised data.

BIRD FLIGHT ACTIVITY

A total of 768 hours of bird flight observation was completed on site over the course of the two years of monitoring. Overall, 32 target bird species were recorded flying on the site during the Vantage Point surveys. These data are shown in the breakdown per Site Visit is shown in Appendix 6 of the Avifaunal impact assessment (**Appendix H.2**). Twelve of these 32 species are regionally Red Listed (Taylor *et al*. 2015): White-backed Vulture and Wattled Crane are Critically Endangered; Cape Vulture, Martial Eagle and are Endangered; Lanner Falcon, Southern Bald Ibis, White-bellied Bustard, Denham's Bustard, Crowned Eagle and Secretarybird are all Vulnerable, and Blue Crane and Pallid Harrier are Near-Threatened. Jackal Buzzard is near endemic to South Africa.

The species recorded flying most frequently and in the largest numbers on site during dedicated Vantage Point sessions was by quite a large margin Cape Vulture, with 554 individual birds recorded across 224 records. Common Buzzard was the second most frequent flyer with 67 records of 342 birds. Most of these records were in late February in 2023, including one single record of approximately 200 buzzards flying at once. These records provide some indication that possibly this species is migrating over the site, as this is the prime time for the species to start migrating northwards. The third most frequent flyer (in terms of overall number of birds) was Black-winged Kite, with 105 records of 114 individuals. It is concerning how prevalent Cape Vulture are in the airspace on site, given their risky flight behaviour in which a large proportion of their flight height is well within the rotor swept area (RSA) of the proposed turbines.

- Wattled Crane is regionally Critically Endangered (Taylor *et al,* 2015). A single bird appears to be resident on site and has been recorded in all seasons, always in the same wetland (on Berg en Dal farm). The wetland was surveyed for a nest, but no such nest was identified. At a second wetland the farmer has advised that Wattled Crane normally breed, however this was not confirmed. Lockwood (pers comm – Appendix 8 of the Avifaunal impact assessment (**Appendix H.2**)) reports up to 4 Wattled Cranes being seen together over the last 12 years in this area. We recorded the species flying 5 times in our 768 hours of vantage point monitoring. Although this species does not typically fly frequently or for long periods, it does commute around the landscape within which it is foraging. This species is anticipated to be highly susceptible to wind turbine collision when in flight. No fatalities have been recorded to date in South Africa since no wind farms are operating within the species' range (Ralston-Paton *et al*, 2017; Perold *et al*, 2020).
  The specialist does not believe the likelihood of a turbine collision is very high with only one bird flying on site occasionally. However, the consequences if such a collision does occur for a Critically Endangered species are very significant. The spatial avoidance of risk through a buffer around the wetland is not anticipated to be sufficient for such an endangered species, and the collision risk will

also need to be mitigated through measures described in Section 9, such as observer led shutdown on demand.

- White-backed Vulture *Gyps africanus*. White-backed Vulture is regionally Critically Endangered (Taylor *et al,* 2015). Several records of small numbers (<5) of birds flying on site were made in Season 1 but not again in subsequent seasons. It is considered that the species is an occasional visitor to the area.
- Cape Vulture *Gyps coprotheres*. Cape Vulture is regionally Endangered (Taylor *et al,* 2015). Multiple records of up to a maximum of 52 birds on site have been made in all seasons. A total of 554 birds were recorded flying during 768 hours of vantage point observation – which equates to a passage rate of 0.72 birds / hour. Birds have been found roosting at night on Eskom transmission lines on site. One of the landowners of the farm Leeuwkloof, has a vulture restaurant, and reports seeing up to 100 vultures on and around his property. This regular feeding of vultures would need to be closed if the project proceeds. The risk of attracting vultures onto site would be too high. Lockwood (pers comm) reports up to 43 vultures being seen in the area over the last 12 years. We consider the species to forage and roost regularly on the site. During the second year of monitoring the specialist surveyed (with the help of the Dullstroom Birds of Prey Centre) the two sections of overhead power line used as roosts by the species monthly to investigate the extent of usage of these roosts. We recorded no vultures at these roosts on 8 of 11 surveys, and a maximum of 4 birds (In June 2022 & March 2023). Although these surveys indicate low numbers, on a precautionary basis (and considering all survey methods) we conclude that up to 50 vultures could utilise the site at times, and occasionally roost on the power lines. A map was of the movement of four Cape Vultures fitted with satellite tracking devices from the Dullstroom Birds of Prey Centre (and the Endangered Wildlife Trust). These birds all spent considerable time moving across the Dalmanutha site in their foraging movements (**Figure 7-63**)

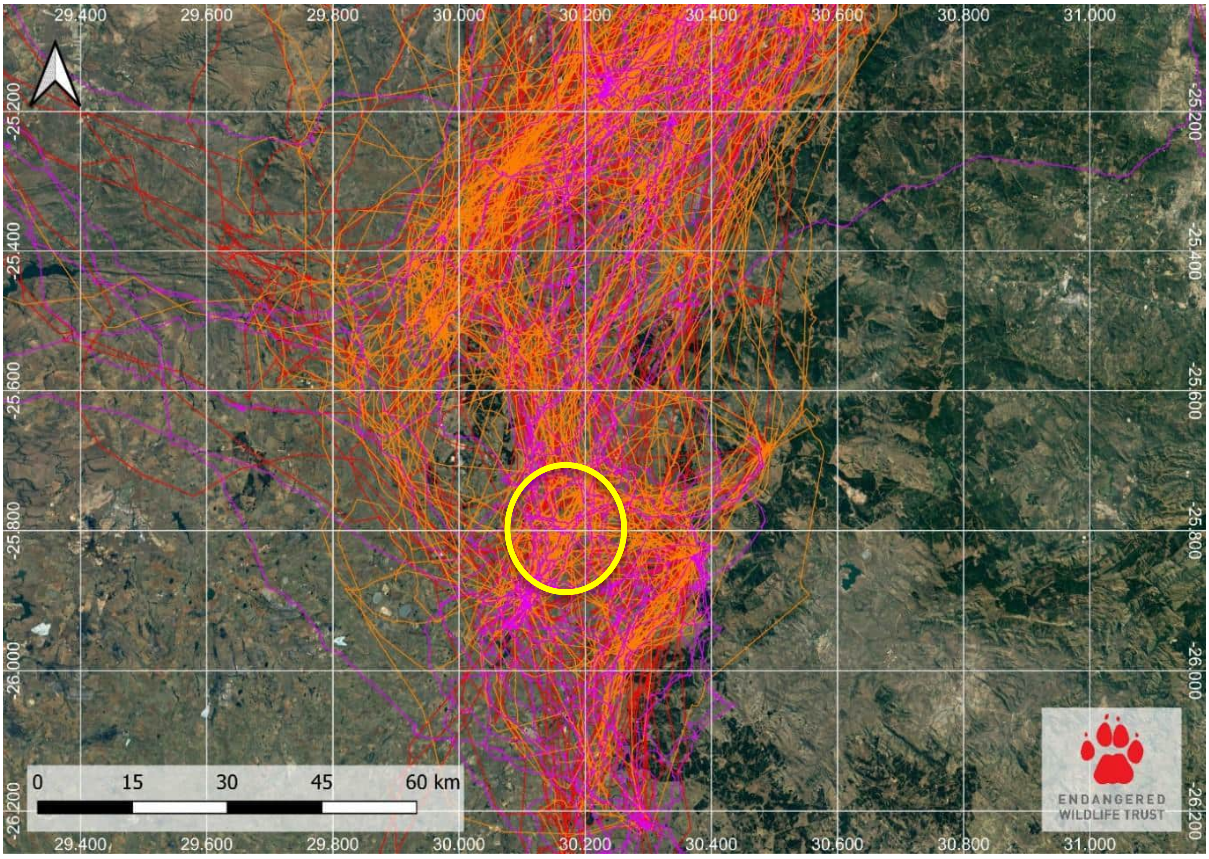


Figure 7-63 - Movement of four tracked Cape Vultures since January 2021 relative to the site (map and data from Endangered Wildlife Trust). Approximate project location shown in yellow polygon

The main driver of vulture activity in any given area is the location of roosting, breeding and supplementary feeding sites. Cervantes *et al.* (2023) has very recently mapped the population utilisation distribution (PUD) of the Cape Vulture across its range, considering these factors, and identified areas in which it is particularly prone to collisions with wind turbines. The current reliance on SABAP2 data as a Screening Tool for wind energy is limited by uneven data coverage, whereas PUD maps provide finer resolution modelling of spatial risk as a complementary tool.

Figure 7-64 shows the Cape Vulture map overlaid on the Dalmanutha site boundary. The proposed site is in an area of low utilisation or risk for the species according to Cervantes *et al* (2023). However as mentioned above one of the main input data into the Cervantes model was roost locations. It is possible that the power line roost at Dalmanutha was not known to these authors, resulting in the model not identifying high utilisation in the area.

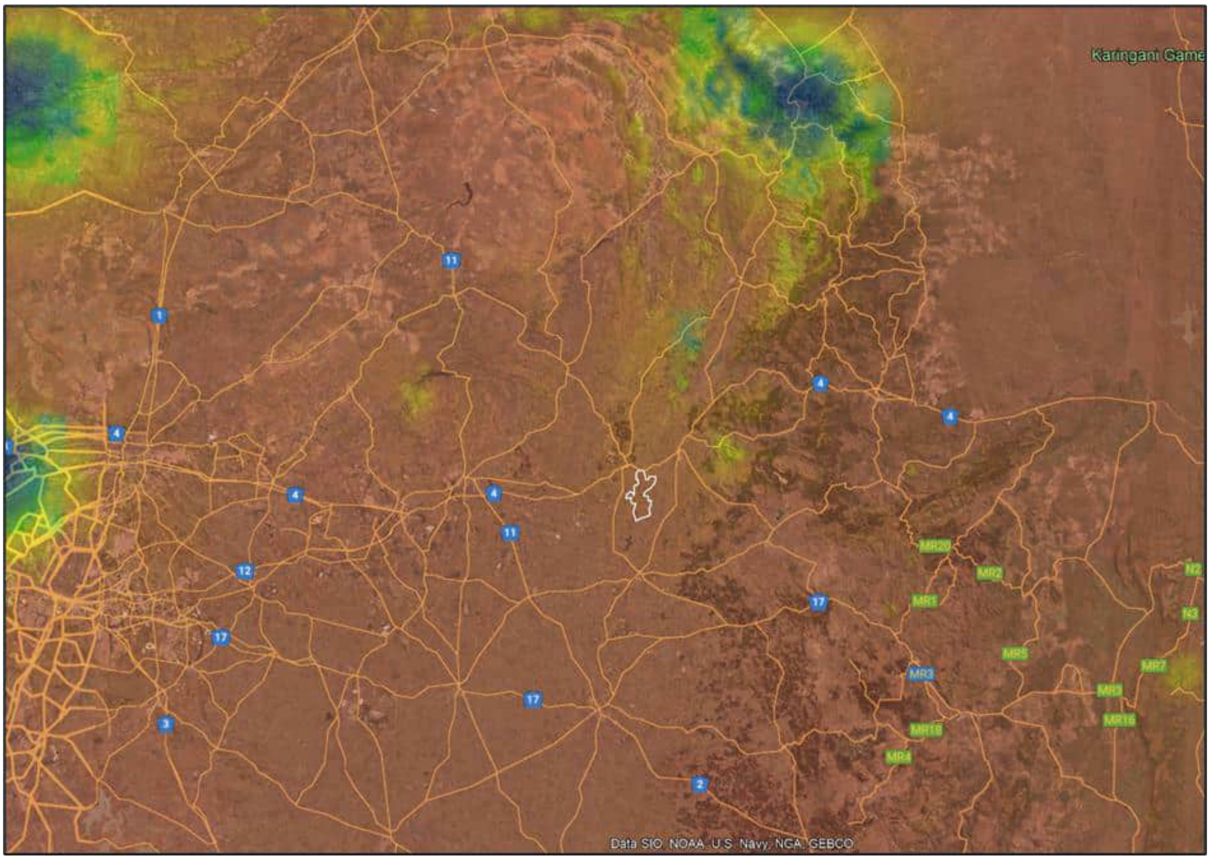


Figure 7-64 - Cape Vulture population utilisation distribution map (from Cervantes 2023). (Dalmanutha site boundary shown in white).

The Cape Vulture was identified by Retief et al (2011) as the second highest risk species for interactions with wind energy facilities and was then elevated to the number one species in the 2014 revision of this list. The species' large physical size, gregarious nature, high wing loading (which makes it less able to fly with great agility) and significant time spent in flight make it a species that is believed likely to be highly vulnerable to collision with wind turbines. A number of wind turbine collision fatalities have been recorded at operational wind farms in South Africa (Ralston-Paton *et al,* 2017; Perold *et al,* 2020). The spatial protection provided for this species around the power line roosts is not sufficient for a wide ranging species such as this, and extensive mitigation will be required (**Section 9.9**).

- Martial Eagle *Polemaetus bellicosus.* Martial Eagle is regionally Endangered (Taylor *et al,* 2015). Single records of single birds of this species were made in S1 and S2. It can be concluded that the proposed site falls marginally within the home range of a pair of this species and that the eagles forage occasionally on the site.
- Grey Crowned Crane *Balearica regulorum*. Grey Crowned Crane is regionally Endangered (Taylor *et al,* 2015). A pair has been seen foraging at a pan at Leeukloof several times, and in May 2021 two adults were seen with a juvenile, indicating breeding took place in this area. The species was not recorded flying at all during vantage point sessions. Spatial protection has been provided around the presumed breeding wetland. However further mitigation will be required as described in **Section 9.9**. The species has not yet been recorded as a turbine fatality at operational wind

farms, although few exist in the species' range to date (Ralston-Paton *et al,* 2017; Perold et al, 2020).

- Denham's Bustard *Neotis denhami*. Denham's Bustard is regionally Vulnerable (Taylor et al, 2015). The species was recorded infrequently singly and in pairs during 5 of the 10 seasonal surveys. Five flight records were made during the vantage point sessions. It can be concluded that this is probably an occasional visitor to the site. This species has been killed through collision with wind turbines elsewhere in South Africa (Ralston-Paton et al, 2017; Perold et al, 2020).
- White-bellied Bustard *Eupodotis senegalensis*. White-bellied Korhaan is regionally Vulnerable (Taylor *et al,* 2015). Several records of up to four birds together have been made in all seasons. Lockwood (pers comm) reports 'fairly regular' records in the area. A small population is probably more or less resident on site.
- Secretary bird *Sagittarius serpentarius*. Secretarybird is regionally Vulnerable (Taylor *et al*, 2015). Several records of single birds have been made in all seasons, and one record of a pair in S3. A nest has been found approximately 4.5km off site to the east, too far to be relevant for sensitivity mapping. Six flight records were made for the species. Lockwood (pers comm) reports 'fairly regular' records in the area. This species has been killed through collision with wind turbines elsewhere in South Africa (Ralston-Paton *et al,* 2017; Perold *et al*, 2020).
- Southern Bald Ibis *Geronticus calvus*. Southern Bald Ibis is regionally Vulnerable (Taylor *et al,* 2015). Several records of small groups have been made across all seasons. A roost site was identified on site, where up to 10 birds roost at night. Lockwood (pers comm) reports that up to 18 birds and 5 active nests have been recorded at this location. This roost was protected with a spatial buffer (Section 8.6). The species has not yet been recorded as a turbine fatality at operational wind farms, although no wind farms exist in the species' range to date (Ralston-Paton *et al*, 2017; Perold *et al,* 2020).
- Lanner Falcon *Falco biarmicus*. Lanner Falcon is regionally Vulnerable (Taylor *et al,* 2015). Records of single birds have been in each season. Twenty-four single bird records were made of the species flying on site, for a passage rate of 0.03 birds / hour. This species has previously been recorded killed by wind turbines at operational wind farms elsewhere in South Africa (Ralston-Paton *et al*, 2017; Perold *et al,* 2020).
- Blue Crane *Grus paradisea.* Blue Crane is regionally Near-threatened (Taylor *et al,* 2015). The species has been recorded in several seasons on site. A group of three birds was recorded on site in S3. Landowners have anecdotally reported to the specialist's field team that Blue Cranes reed on site but this remains unconfirmed during the specialist own monitoring period. Lockwood (pers comm) has several records for the species, including a nest site (the grassland around which has subsequently been ploughed up). This species has been killed through collision with wind turbines elsewhere in South Africa (Ralston-Paton *et al,* 2017; Perold *et al*, 2020).
- African Marsh-Harrier (Endangered). One record of a pair of marsh-harriers was made in August 2022. It is quite conceivable that one or more pairs of birds utilise wetland areas on the site from time to time. However, it would have been expected to have recorded them for regularly if breeding was taking place on site. It is expected that the spatial protection given to wetlands will provide protection for this species.
- Black-rumped Buttonquail (Endangered). Black-rumped Buttonquail is regionally Endangered (Taylor *et al,* 2015). Several records of pairs of birds flushed from the side of the road were made during the monitoring. Lockwood (pers comm) reports 'fairly regular' records of the species in the area. The primary risk to this species will be through destruction of habitat and disturbance.

White-winged Flufftail (Critically Endangered). We did not record this species during our two years of monitoring on site. The DFFE Online Screening Tool identifies the species as possibly occurring on site. BirdLife South Africa (BLSA) has also suggested in comments on the scoping phase of this study that the species could occur on site. A second stakeholder (Ms Burke pers comm) has stated that it is suspected to occur on her property in the area. Based on the methods used during pre-construction bird monitoring (as prescribed by best practice) we cannot confirm whether the species occurs on site or not. This is a very shy, cryptic species, which has in most cases only been recorded elsewhere in its range through absolute chance, or through the use of acoustic recorders (to record it calling) and camera traps. Specialised methods are required to survey for the species (using trail cameras and acoustic recorders), and there are ethical considerations around disturbing such a rare bird through the surveys. BLSA are the experts in this field, but were not available to assist us conduct the specialised surveys. The primary reason for suspecting that the species could occur on site is a BLSA developed habitat suitability model (HSM). The specialist applied to BLSA for access to this model to investigate it in more detail, but were referred to the DFFE online screening tool, where the model should apparently be available. It appears that the species has been categorised as sensitive information and the HSM cannot be used in any meaningful way or mapped for the purpose of the specialists report.
If the species does occur on site, there is little doubt that it would be at high risk of collision with turbines. Other flufftail species have shown to be very susceptible to turbine collision (Ralston-Paton et al, 2017; Perold et al, 2020). There is good reason to suspect that White-winged Flufftail turbine collisions could occur, and if they did this would have high consequence for the species. In the case of the other flufftail species which have been recorded as turbine fatalities elsewhere at operational wind farms, these birds are almost never recorded flying, but are then found dead beneath turbines. This suggests the possibility of nocturnal movement by these species. If this were the case, traditional mitigation measures such as blade painting and observer led shutdown on demand may not mitigate the risk to this species.
Although the specialist has not recorded the species, Lockwood (pers comm) reports three records over 12 years of Yellow-breasted Pipit (regionally Vulnerable).

This is a high diversity of Red Listed species, collectively utilising almost the full component of micro habitats on site: wetlands; grasslands; dams; arable lands; pans. The only micro habitat not considered useful is the exotic tree stands (wattle and eucalyptus). Although not recorded the species, Lockwood (pers comm) reports three records over 12 years of Yellow-breasted Pipit (regionally Vulnerable).

Of particular concern is the Critically Endangered Wattled Crane & Endangered Cape Vulture. For both of these species, spatial avoidance of turbine collision risk is not considered sufficient. If the significance of the impact of turbine collision on these species is to be reduced to acceptable levels extensive and effective mitigation measures will need to be implemented for the full project lifespan. These will likely include Shutdown on Demand, on site vulture food management, and blade painting. Also of concern is the sheer diversity of regionally Red listed birds on this site. Whilst the risk to most of them can be managed in various ways, the 'whole risk' to avifauna is almost certainly greater than the 'sum of the parts'.

Table 7-6 lists all the species that have been identified on site and in which season they were noted. The following abbreviations and acronyms are used:

- NT = Near threatened
- VU = Vulnerable
- EN = Endangered
- CR = Critically Endangered
- LC = Least Concern

Table 7-6 - Bird species data for the site

Common name	Taxonomic name	Status (Regional, Global, Endemic)	S1	S2	S3	S4
Wattled Crane	*Grus carunculata*	CR, VU	1	1	1	1
White-backed Vulture	*Gyps africanus*	CR, CR	1			
Martial Eagle	*Polemaetus bellicosus*	EN, VU	1	1		1
Black-rumped Buttonquail	*Turnix nanus*	EN, LC	1			1
Cape Vulture	*Gyps coprotheres*	EN, EN	1	1	1	1
Grey Crowned Crane	*Balearica regulorum*	EN, EN			1	1
Southern Bald Ibis	*Geronticus calvus*	VU, VU, SLS	1	1	1	1
Secretary bird	*Sagittarius serpentarius*	VU, VU	1	1	1	1
Crowned Eagle	*Stephanoaetus coronatus*	VU, NT				1
Denham’s Bustard	*Neotis denhami*	VU, NT	1	1		
Lanner Falcon	*Falco biarmicus*	VU, LC	1	1	1	1
White-bellied Korhaan (Bustard)	*Eupodotis senegalensis*	VU, LC	1	1	1	
Blue Crane	*Grus paradisea*	NT, VU			1	1
Greater Flamingo	*Phoenicopterus roseus*	NT, LC				1
Blue Korhaan	*Eupodotis caerulescens*	LC, NT, SLS				1
Cape Grassbird	*Sphenoeacus afer*	NE	1	1	1	1
Cape Weaver	*Ploceus capensis*	NE	1	1	1	1
Cape White-eye	*Zosterops virens*	NE	1	1	1	
Cloud Cisticola	*Cisticola textrix*	NE			1	1
Fiscal Flycatcher	*Melaenornis silens*	NE	1	1	1	1
Jackal Buzzard	*Buteo rufofuscus*	NE	1	1	1	1

Common name	*Taxonomic name*	Status (Regional, Global, Endemic)	S1	S2	S3	S4
Southern Double-collared Sunbird	*Cinnyris chalybeus*	NE		1		
Buff-streaked Chat	*Campicoloides bifasciatus*	SLS	1	1	1	1
Drakensberg Prinia	*Prinia hypoxantha*	SLS	1	1	1	1
Eastern Long-billed Lark	*Certhilauda semitorquata*	SLS	1	1	1	1
Greater Double-collared Sunbird	*Cinnyris afer*	SLS				1
Pied Starling	*Lamprotornis bicolor*	SLS	1	1	1	1
South African Cliff Swallow	*Petrochelidon spilodera*	BSLS	1	1	1	1
African (Purple) Swamphen	*Porphyrio madagascariensis*		1	1	1	1
African Black Duck	*Anas sparsa*					1
African Black Swift	*Apus barbatus*		1		1	1
African Darter	*Anhinga rufa*		1			1
African Dusky Flycatcher	*Muscicapa adusta*		1			
African Firefinch	*Lagonosticta rubricata*		1			
African Fish Eagle	*Haliaeetus vocifer*		1	1	1	1
African Goshawk	*Accipiter tachiro*		1	1	1	
African Harrier-Hawk	*Polyboroides typus*		1	1	1	1
African Hoopoe	*Upupa africana*		1	1	1	1
African Olive Pigeon	*Columba arquatrix*				1	
African Palm Swift	*Cypsiurus parvus*				1	1
African Paradise Flycatcher	*Terpsiphone viridis*				1	1
African Pipit	*Anthus cinnamomeus*		1	1	1	1
African Quail-finch	*Ortygospiza atricollis*		1	1	1	
African Rail	*Rallus caerulescens*		1		1	1

Common name	*Taxonomic name*	Status (Regional, Global, Endemic)	S1	S2	S3	S4
African Reed Warbler	*Acrocephalus baeticatus*					1
African Sacred Ibis	*Threskiornis aethiopicus*		1	1	1	1
African Snipe	*Gallinago nigripennis*		1	1	1	1
African Spoonbill	*Platalea alba*				1	
African Stonechat	*Saxicola torquatus*		1	1	1	1
African Wattled Lapwing	*Vanellus senegallus*		1		1	1
Alpine Swift	*Tachymarptis melba*		1		1	1
Amethyst Sunbird	*Chalcomitra amethystina*				1	1
Amur Falcon	*Falco amurensis*					1
Ant-eating Chat	*Myrmecocichla formicivora*		1	1	1	1
Baillon's Crake	*Porzana pusilla*		1			
Banded Martin	*Riparia cincta*		1			1
Barn Swallow	*Hirundo rustica*		1		1	1
Bar-throated Apalis	*Apalis thoracica*		1	1	1	1
Black Crake	*Amaurornis flavirostra*		1	1	1	1
Black Cuckoo	*Cuculus clamosus*				1	
Black Saw-wing	*Psalidoprocne pristoptera*					1
Black Sparrowhawk	*Accipiter melanoleucus*		1	1	1	
Black-chested Prinia	*Prinia flavicans*					1
Black-chested Snake Eagle	*Circaetus pectoralis*		1	1	1	1
Black-collared Barbet	*Lybius torquatus*		1	1	1	1
Black-headed Heron	*Ardea melanocephala*		1	1	1	1
Black-headed Oriole	*Oriolus larvatus*		1	1	1	1
Blacksmith Lapwing	*Vanellus armatus*		1	1	1	1

Common name	*Taxonomic name*	Status (Regional, Global, Endemic)	S1	S2	S3	S4
Black-throated Canary	*Crithagra atrogularis*				1	1
Black-winged Kite	*Elanus caeruleus*		1	1	1	1
Black-winged Lapwing	*Vanellus melanopterus*		1	1	1	1
Black-winged Stilt	*Himantopus himantopus*			1		
Blue Quail	*Excalfactoria adansonii*					1
Bokmakierie	*Telophorus zeylonus*		1	1	1	1
Brimstone Canary	*Crithagra sulphurata*			1		
Brown Snake Eagle	*Circaetus cinereus*		1	1	1	1
Brown-backed Honeybird	*Prodotiscus regulus*		1	1	1	
Brown-throated Martin	*Riparia paludicola*		1		1	1
Buffy Pipit	*Anthus vaalensis*		1	1	1	1
Cape Bunting	*Emberiza capensis*		1	1		1
Cape Canary	*Serinus canicollis*		1	1	1	1
Cape Crow	*Corvus capensis*		1	1	1	1
Cape Longclaw	*Macronyx capensis*		1	1	1	1
Cape Robin-chat	*Cossypha caffra*		1	1	1	
Cape Sparrow	*Passer melanurus*		1	1	1	
Cape Turtle (Ring-necked) Dove	*Streptopelia capicola*		1	1	1	1
Cape Wagtail	*Motacilla capensis*		1	1	1	1
Capped Wheatear	*Oenanthe pileata*		1	1	1	
Cardinal Woodpecker	*Dendropicos fuscescens*				1	
Chinspot Batis	*Batis molitor*					1
Cinnamon-breasted Bunting	*Emberiza tahapisi*					1
Common (Kurrichane) Buttonquail	*Turnix sylvaticus*		1		1	

Common name	*Taxonomic name*	Status (Regional, Global, Endemic)	S1	S2	S3	S4
Common (Steppe) Buzzard	*Buteo buteo*				1	1
Common House Martin	*Delichon urbicum*					1
Common Moorhen	*Gallinula chloropus*		1	1	1	1
Common Myna	*Acridotheres tristis*		1	1		1
Common Quail	*Coturnix coturnix*		1	1	1	
Common Sandpiper	*Actitis hypoleucos*			1	1	
Common Square-tailed Drongo	*Dicrurus ludwigii*					1
Common Swift	*Apus apus*				1	
Common Waxbill	*Estrilda astrild*		1	1	1	1
Crested Barbet	*Trachyphonus vaillantii*			1	1	1
Crowned Lapwing	*Vanellus coronatus*		1	1	1	1
Dark-capped (African) Yellow Warbler	*Iduna natalensis*					1
Dark-capped Bulbul	*Pycnonotus tricolor*		1	1	1	1
Diederik Cuckoo	*Chrysococcyx caprius*				1	1
Eastern Clapper Lark	*Mirafra fasciolata*		1	1	1	1
Egyptian Goose	*Alopochen aegyptiaca*		1	1	1	1
European Bee-eater	*Merops apiaster*				1	
European Honey Buzzard	*Pernis apivorus*					1
Familiar Chat	*Oenathe familiaris*			1		
Fan-tailed Widowbird	*Euplectes axillaris*				1	1
Fiery-necked Nightjar	*Caprimulgus pectoralis*		1			1
Fork-tailed Drongo	*Dicrurus adsimilis*		1	1	1	
Giant Kingfisher	*Megaceryle maxima*			1	1	1
Glossy Ibis	*Plegadis falcinellus*			1	1	1

Common name	*Taxonomic name*	Status (Regional, Global, Endemic)	S1	S2	S3	S4
Golden-breasted Bunting	*Emberiza flaviventris*				1	1
Goliath Heron	*Ardea goliath*					1
Great Egret	*Ardea alba*		1		1	
Great Sparrow	*Passer motitensis*					1
Greater Honeyguide	*Indicator indicator*		1	1	1	
Greater Kestrel	*Falco rupicoloides*			1		
Greater Striped Swallow	*Cecropis cucullata*		1		1	1
Grey Heron	*Ardea cinerea*		1	1	1	1
Groundscraper Thrush	*Turdus litsitsirupa*		1	1		1
Hadeda (Hadada) Ibis	*Bostrychia hagedash*		1	1	1	1
Hamerkop	*Scopus umbretta*		1	1	1	1
Harlequin Quail	*Coturnix delegorguei*					1
Helmeted Guineafowl	*Numida meleagris*		1	1	1	1
Horus Swift	*Apus horus*					1
House Sparrow	*Passer domesticus*		1	1	1	1
Karoo Scrub Robin	*Cercotrichas coryphoeus*					1
Laughing Dove	*Spilopelia senegalensis*		1	1		1
Lazy Cisticola	*Cisticola aberrans*		1		1	1
Lesser Striped Swallow	*Cecropis abyssinica*				1	1
Lesser Swamp Warbler	*Acrocephalus gracilirostris*		1	1	1	1
Levaillant's Cisticola	*Cisticola tinniens*		1	1	1	1
Little Egret	*Egretta garzetta*			1	1	
Little Grebe	*Tachybaptus ruficollis*		1	1	1	1
Little Rush Warbler	*Bradypterus baboecala*		1		1	1
Little Swift	*Apus affinis*		1	1	1	1

Common name	*Taxonomic name*	Status (Regional, Global, Endemic)	S1	S2	S3	S4
Long-crested Eagle	*Lophaetus occipitalis*				1	1
Long-tailed Widowbird	*Euplectes progne*		1	1	1	1
Malachite Kingfisher	*Corythornis cristatus*		1			1
Malachite Sunbird	*Nectarinia famosa*		1	1	1	1
Marsh Owl	*Asio capensis*		1			1
Mocking Cliff Chat	*Thamnolaea cinnamomeiventris*					1
Mountain Wheatear	*Myrmecocichla monticola*		1	1	1	1
Namaqua Dove	*Oena capensis*		1		1	
Natal Spurfowl	*Pternistis natalensis*		1	1	1	1
Neddicky	*Cisticola fulvicapilla*		1	1	1	1
Nicholson's Pipit	*Anthus similis*		1	1	1	
Olive Thrush	*Turdus olivaceus*		1		1	1
Olive Woodpecker	*Dendropicos griseocephalus*					1
Pale-crowned Cisticola	*Cisticola cinnamomeus*				1	1
Pearl-breasted Swallow	*Hirundo dimidiata*			1		
Peregrine Falcon	*Falco peregrinus*			1	1	
Pied Crow	*Corvus albus*			1	1	1
Pied Kingfisher	*Ceryle rudis*					1
Pin-tailed Whydah	*Vidua macroura*		1	1	1	1
Plain-backed Pipit	*Anthus leucophrys*			1		
Purple Heron	*Ardea purpurea*		1		1	1
Red-billed Oxpecker	*Buphagus erythrorynchus*				1	1
Red-billed Quelea	*Quelea quelea*		1	1	1	1
Red-billed Teal	*Anas erythrorhyncha*		1			1

Common name	*Taxonomic name*	Status (Regional, Global, Endemic)	S1	S2	S3	S4
Red-capped Lark	*Calandrella cinerea*		1	1	1	1
Red-chested Cuckoo	*Cuculus solitarius*				1	
Red-chested Flufftail	*Sarothrura rufa*		1	1	1	1
Red-collared Widowbird	*Euplectes ardens*		1		1	1
Red-eyed Dove	*Streptopelia semitorquata*		1	1	1	1
Red-faced Mousebird	*Urocolius indicus*		1			
Red-knobbed coot	*Fulica cristata*		1	1	1	1
Red-throated Wryneck	*Jynx ruficollis*		1		1	1
Red-winged Francolin	*Scleroptila levaillantii*		1	1	1	1
Red-winged Starling	*Onychognathus morio*		1	1	1	1
Reed Cormorant	*Microcarbo africanus*		1	1	1	1
Rock Dove	*Columba livia*		1	1		
Rock Kestrel	*Falco rupicolus*			1	1	1
Rock Martin	*Ptyonoprogne fuligula*		1	1		1
Rufous-naped Lark	*Mirafra africana*		1	1		1
Sedge Warbler	*Acrocephalus schoenobaenus*					1
South African Shelduck	*Tadorna cana*		1	1		
Southern (Common) Fiscal	*Lanius collaris*		1	1	1	1
Southern Black flycatcher	*Melaenornis pammelaina*					1
Southern Boubou	*Laniarius ferrugineus*		1	1	1	1
Southern Grey-headed Sparrow	*Passer diffusus*		1	1	1	1
Southern Masked Weaver	*Ploceus velatus*		1	1	1	1
Southern Red Bishop	*Euplectes orix*		1	1	1	1

Common name	*Taxonomic name*	Status (Regional, Global, Endemic)	S1	S2	S3	S4
Southern Yellow White-eye	*Zosterops senegalensis*					1
Speckled Mousebird	*Colius striatus*		1	1	1	1
Speckled Pigeon	*Columba guinea*		1	1	1	1
Spike-heeled Lark	*Chersomanes albofasciata*		1	1	1	1
Spotted Eagle-Owl	*Bubo africanus*		1			1
Spotted flycatcher	*Muscicapa striata*					1
Spotted Thick-knee	*Burhinus capensis*				1	1
Spur-winged Goose	*Plectropterus gambensis*		1	1	1	1
Streaky-headed Seedeater	*Crithagra gularis*		1	1	1	1
Swainson's Spurfowl	*Pternistis swainsonii*		1	1	1	1
Temminck's Courser	*Cursorius temminckii*		1		1	
Three-banded Plover	*Charadrius tricollaris*		1	1		1
Wailing Cisticola	*Cisticola lais*			1	1	1
Western Cattle Egret	*Bubulcus ibis*		1		1	1
Whiskered Tern	*Chlidonias hybrida*		1		1	1
White Stork	*Ciconia ciconia*					1
White-breasted Cormorant	*Phalacrocorax lucidus*			1	1	
White-browed Sparrow-Weaver	*Plocepasser mahali*					1
White-fronted Bee-eater	*Merops bullockoides*		1	1	1	1
White-rumped Swift	*Apus caffer*		1	1	1	1
White-throated Swallow	*Hirundo albigularis*		1		1	1
White-winged Tern	*Chlidonias leucopterus*					1
White-winged Widowbird	*Euplectes albonotatus*				1	1

Common name	*Taxonomic name*	Status (Regional, Global, Endemic)	S1	S2	S3	S4
Willow Warbler	*Phylloscopus trochilus*				1	1
Wing-snapping Cisticola	*Cisticola ayresii*		1	1	1	1
Wood Sandpiper	*Tringa glareola*					1
Yellow-billed (Intermediate) Egret	*Ardea intermedia*			1	1	1
Yellow-billed Duck	*Anas undulata*		1	1	1	1
Yellow-billed Kite	*Milvus aegyptius*					1
Yellow-crowned Bishop	*Euplectes afer*			1		1
Yellow-fronted Canary	*Crithagra mozambica*		1	1	1	1
Zitting Cisticola	*Cisticola juncidis*		1	1	1	1

7.2.22 BATS

Bats are heavily reliant on sources of open water and will visit at least one such source during the course of a night. Numerous sources of open water and one stream that runs through the eastern section of the project area were found. Based on data obtained from the static bat detector DAL2, it is quite clear that water sources are important to bats, both as a source of water and a foraging area, and should be considered as a Medium Sensitivity area, and a 200m buffer should be applied around them.

While there are many patches of large exotic trees found across the project area these have been deemed to be of lesser importance to bats considering data obtained from static bat detector, DAL3. As such no buffers have been implemented around these trees. All trees were also inspected during roost surveys for bats but no roosts were found.

There are several bat species in the vicinity of the site that occur commonly in the area. Some of these species are of special importance based on their likelihood of being impacted by the proposed project, due to high abundances and certain behavioural traits. They have also been dominating records of fatalities at wind energy facilities in South Africa. The relevant species are discussed below.

TADARIDA AEGYPTIACA

The Egyptian free-tailed bat, *Tadarida aegyptiaca*, is a Least Concern species (SANBI Red List 2016) as it has a wide distribution and high abundance throughout South Africa and is part of the free-tailed bat family (Molossidae). It occurs from the Western Cape of South Africa, north through to Namibia and southern Angola; and through Zimbabwe to central and northern Mozambique (Monadjem et al. 2020). This species is protected by national legislation in South Africa (ACR 2020).

Egyptian free-tailed bats roost communally in small (dozens) to medium-sized (hundreds) groups in caves, rock crevices, under exfoliating rocks, in hollow trees and behind the bark of dead trees. It has also adapted to roosting in buildings, in the roofs of houses in particular (Monadjem *et al*. 2020). Thus, man-made structures and large trees on the site would be important roosts for this species.

Tadarida aegyptiaca forages over a wide range of habitats, flying above the vegetation canopy. It appears that the vegetation has little influence on foraging behaviour as the species forages over desert, semi-arid scrub, savannah, grassland and agricultural lands. Its presence is strongly associated with permanent water bodies due to concentrated densities of insect prey (Monadjem *et al.* 2020).

After a gestation of four months, a single pup is born, usually in November or December, when females give birth once a year. In males, spermatogenesis occurs from February to July and mating occurs in August. Maternity colonies are apparently established by females in November.

The Egyptian free-tailed bat is considered to have a high risk of fatality on wind energy facilities due to turbine collisions (MacEwan *et al.* 2020). Due to the high abundance and widespread distribution of this species, high mortality rates due to wind turbines would be a cause for concern as these species have more significant ecological roles than the rarer bat species and are currently displaying moderate to high numbers of mortalities at nearby operating wind farms.

LAEPHOTIS CAPENSIS

Laephotis capensis is commonly called the Cape serotine (formerly *Neoromicia capensis*) and has a conservation status of Least Concern (SANBI Red List 2016) as it is found in high numbers and is widespread over much of Sub-Saharan Africa. High mortality rates of this species due to wind turbines would be a cause for concern as precisely because of its abundance. As such, it has a more significant role to play within local ecosystems than the rarer bat species, since they can consume larger numbers of nocturnal insects.

The Cape serotine roosts individually or in small groups of two to three bats in a variety of shelters, such as under the bark of trees, at the base of aloe leaves, and under the roofs of houses. They will use most man-made structures as day roosts which can be found throughout the site and surrounding areas (Monadjem *et al.* 2020). They do not undertake migrations and thus are considered residents of the site.

Mating takes place from the end of March until the beginning of April. Spermatozoa are stored in the uterine horns of the female from April until August, when ovulation and fertilisation occur. They give birth to twins during late October and November, but single pups, triplets and quadruplets have also been recorded (van der Merwe 1994 and Lynch 1989).

They are tolerant of a wide range of environmental conditions as they survive and prosper across arid and semi-arid areas to montane grasslands, forests, and savannas; indicating that they may occupy several habitat types across the site and are amenable towards habitat changes. They are however clutter-edge foragers, meaning they prefer to hunt on the edge of vegetation clutter, but can occasionally forage in open spaces. They are thought to have a low to high likelihood of fatality due to wind turbines (MacEwan *et al.* 2020) and are currently displaying moderate to high numbers of mortalities at operational wind farms in South Africa. This species being the most common species across the site and is most likely breeding in the area.

MINIOPTERUS NATALENSIS

Miniopterus natalensis, commonly referred to as the Natal long-fingered bat, occurs widely across the country but mostly within the southern and eastern regions, and is listed as Least Concern (Monadjem et al. 2020). This bat is a cave-dependent species and identification of suitable roosting sites may be more important in determining its presence in an area than the presence of surrounding vegetation. It occurs in large numbers when roosting in caves with approximately 260 000 bats observed making seasonal use of the De Hoop Guano Cave in the Western Cape, South Africa. Culverts and mines have also been observed as roosting sites for either single bats or small colonies. Separate roosting sites are used for winter hibernation activities and summer maternity behaviour, with the winter hibernacula generally occurring at higher altitudes in more temperate areas and the summer hibernacula occurring at lower altitudes in warmer areas of the country (Monadjem *et al*. 2020).

Mating and fertilisation usually occur during March and April and is followed by a period of delayed implantation until July/August. Birth of a single pup usually occurs between October and December as the females congregate at maternity roosts (Monadjem *et al*. 2020 & van de Merwe 1979).

The Natal long-fingered bat undertakes short migratory journeys between hibernaculum and maternity roosts. Due to this migratory behaviour, they are considered to be at high risk of fatality from wind turbines if a wind farm is placed within a migratory path (MacEwan et al. 2020). The mass movement of bats during migratory periods could result in mass casualties if wind turbines are positioned over a mass migratory route and such turbines are not effectively mitigated. Very little is known about the migratory behaviour and paths of *M. natalensis* in South Africa with migration distances exceeding 150 kilometres. If the site is located within a migratory path, the bat detection systems should detect higher numbers and activity of the Natal long-fingered bat in spring and autumn; this will be examined over the course of the 12-month monitoring survey.

A study by Vincent et al. (2011) on the activity and foraging habitats of *Miniopteridae* found that the individual home ranges of lactating females were significantly larger than that of pregnant females. It was also found that the bats predominately made use of urban areas (54%) followed by open areas (19.8%), woodlands (15.5%) orchards and parks (9.1%) and water bodies (1.5%) when selecting habitats. Foraging areas were also investigated with the majority again occurring in urban areas (46%), however a lot of foraging also occurred in woodland areas (22%), crop and vineyard areas (8%), pastures, meadows and scrubland (4%) and water bodies (4%).

MacEwan et al. (2020) advise that *M. natalensis* faces a medium to high risk of fatality due to wind turbines. This evaluation was based on broad ecological features and excluded migratory information. The species is currently displaying low to moderate numbers of mortalities at operational wind farms in South Africa.

A total of nine bat species were recorded during the site survey period, all of Least Concern based on the IUCN Red Data list and are not endemic to South Africa, not (Convention on International Trade in Endangered Species of Wild Fauna and Flora) CITES listed and not (Threatened or Protected Species) ToPS species. These species were detected with varying degrees of frequency with *L. capensis (*Cape Serotine*)* being the most commonly recorded species across the area. All species that were detected has a medium to high or high risk of collision with wind turbines. The species are from four different families of varying risk of impact with turbines. The dominant species observed in the area was the Cape Serotine which has a large influence on activity patterns observed across the site.

Table 7-7 indicates the species of bat which have been confirmed to occur on site. For each species, the risk of impact by wind energy infrastructure was assigned by MacEwan *et al.* (2020) based on their distributions, altitudes at which they fly, and foraging ecology.

Table 7-7 - List of bat species that has been detected on the area including their conservation status, foraging habits and risk of impact with wind turbines

Species	Common name	Conservation status (SANBI & EWT, 2016)	Possible foraging habitat utilised on site	Risk of impact (MacEwan et al. 2020 for wind)
Family: Vespertilionidae				
Laephotis capensis	Cape serotine	Least concern	Clutter-edge	High
Scotophilus dinganii	Yellow-bellied house bat	Least concern	Clutter-edge	Medium to high
Myotis bocagii	Rufous myotis	Least concern	Clutter-edge & Clutter	Medium to high
Pipistrellus rusticus	Rusty pipistrelle	Least concern	Clutter-edge	Medium to high
Pipistrellus hesperidus	Dusky pipistrelle	Least concern	Clutter-edge	Medium to high
Family: Miniopteridae				
Miniopterus natalensis	Natal long-fingered bat	Least concern	Clutter-edge	High
Family: Emballonuridae				
Taphozous mauritianus	Mauritian tomb bat	Least concern	Open-air	High
Family: Molossidae				
Mops midas	Midas free-tailed bat	Least concern	Open-air	High
Tadarida aegyptiaca	Egyptian free-tailed bat	Least concern	Open-air	High

All potential roosts were inspected for signs of bats during the winter and summer survey periods, including large trees, any significant rock formations and buildings. Three confirmed *L. capensis* roosts were located on the project area, all within occupied houses. It is suspected that this large roost is shared between *L. capensis* and *S. dinganii* based on data collected during driven transects and by the bat detector DAL 4, however no call records from *S. dinganii* were detected during roost surveys. More potential roosts were identified across the project area, but the presence of bats could not be confirmed at any of these locations. A thorough investigation into the mining activities close to the project area was also conducted. Although old mine shafts have been shown to provide suitable roosting habitats, most of the neighbouring mine activities make use of open cast mining (Miller-Butterworth et al., 2003; Pretorius et al., 2020). There were no reports of active bat roosts at these mining facilities, but this does not exclude them as potential roosting locations as migrating bats may make use of them during specific months of the year.

No caves were found within the boundaries of the project area, and there are no known caves present within 20km of any sites. The landowners were asked about caves on their properties, but they were not aware of any.

7.3 SOCIAL ENVIRONMENT

7.3.1 LAND USE

The study area is embedded within a rural agricultural landscape, characterised by a complex landcover matrix comprising patches of modified habitat and tracts of natural habitat. The following notes describe the preeminent existing impacts (anthropogenic activities and infrastructure) observed in the study area:

Farming is the main land use in the study area. Large areas are under dryland crop cultivation, with maize and soy the most prominent crop types. Apart from the more established and old cultivated fields, it was noted during the field programme that local farmers in the north of the study area have recently cleared and ploughed large tracts of natural grassland and are converting these to cultivated fields.

Livestock farming with cattle, sheep and pigs was also observed in the study area. Cattle are grazed widely throughout grassland and wetland habitat in the study area, while sheep and pigs are more closely managed and restricted to pasture areas.

Large portions of the study area are characterised by stands of alien invasive trees. These include formal wind-rows and plantations, as well as informal spreading infestations. The latter form is typically dominated by wattle species which are aggressive invaders.

Felling of alien trees for charcoal production (and possibly building material) was noted to be occurring at several areas in the study area. This is likely to cause shifts in the type (mature vs. young tree stands) and extent of alien tree stands.

The study area, as well as the surrounding landscape, are fragmented by linear infrastructure including numerous gravel roads and informal vehicle tracks, farm fences, powerline corridors and railway lines.

Other anthropogenic activities and infrastructure in the study area that have resulted in habitat loss and disturbance include inter alia, farm residences and agriculture structures (barns).

Mining / quarrying Mining/quarrying areas (coal and black granite are other leading industries in the study area), have been delineated towards the west, north-west, north-east and south of the proposed Dalmanutha WEF. In terms of the South African National Land Cover dataset, the site is classified as Grassland interspersed with cultivation areas, small sections of forested land and numerous wetlands/water bodies throughout the project site (**Figure 7-65**).

SURROUNDING AREAS

The study area is located approximately 7km south-east of the town of Belfast. Commercial agriculture is the dominant activity in the study area, with the main focus being maize cultivation and livestock grazing. There are multiple farm portions in the study area, resulting in a relatively moderate density of rural settlement with many scattered farmsteads in evidence. Built form in much of the study area comprises farmsteads, ancillary farm buildings and workers' dwellings, gravel access roads, telephone lines, fences, and windmills.

The towns of Belfast (north of the site, with a population of 200.7 people per km^2), Emgwenya or Waterval Boven and Machadodorp (north-east of the site, with Waterval Boven having 153.0 people per km^2 and Machadadorp having 152.1 people per km^2), and Carolina (south of the site, having 1,150 people per km^2) lie within the study area. The town of Carolina therefore, therefore, accounts for the highest population concentration within the region.

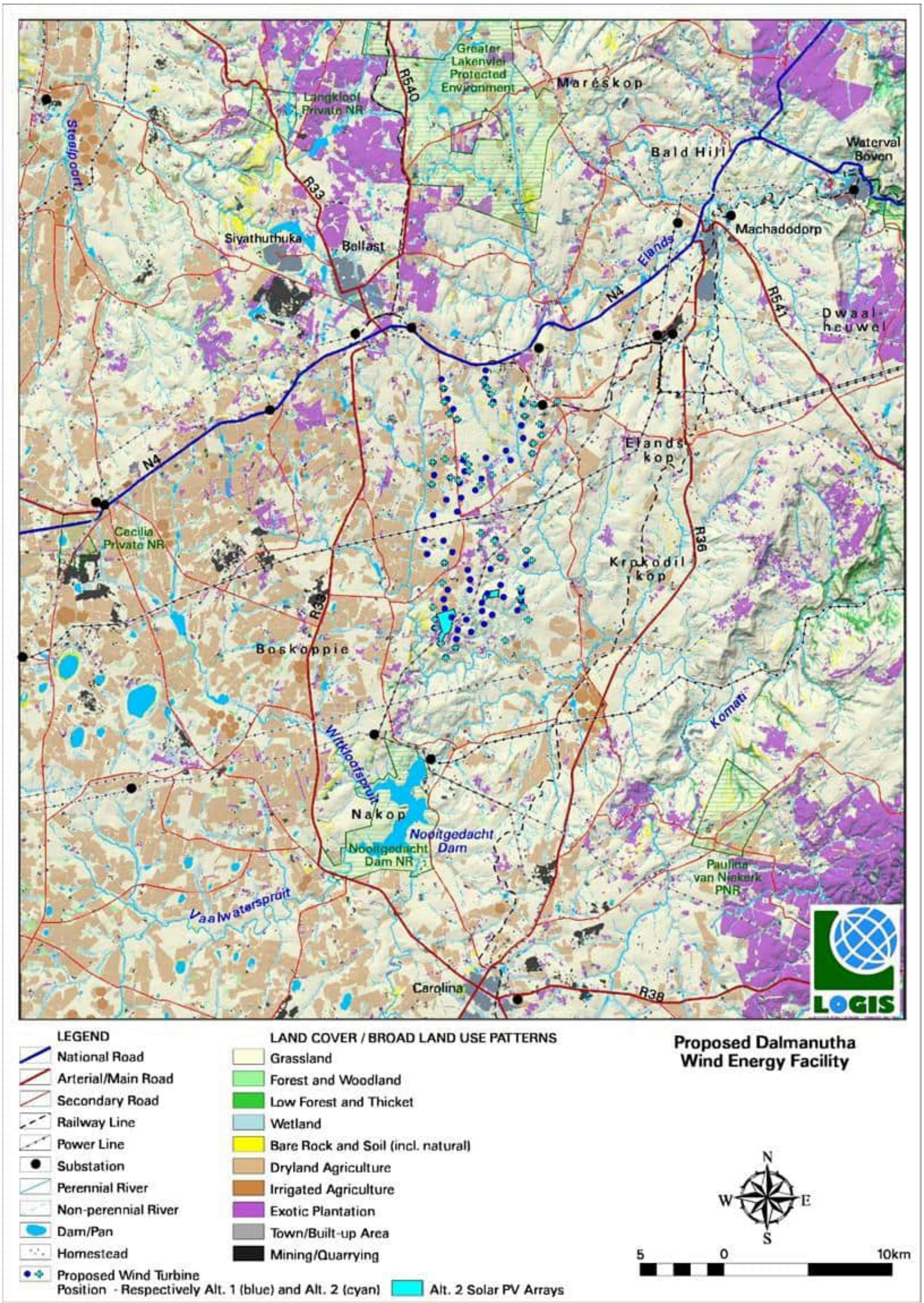


Figure 7-65 - Broad land cover classification indicating both project alternatives (LoGIS, 2023)

7.3.2 NOISE CLIMATE

The existing noise climate surrounding the Dalmanutha WEF is predominantly rural with very low baseline noise levels anticipated. Noise sources may include birds, insects, livestock, and the activities of resident farmers. Vehicular influences may include traffic on local roads and the nearby N4 National Road and R33 Regional Road.

Sensitive receptors are identified as areas that may be impacted negatively due to noise associated with the proposed WEF. Examples of receptors include, but are not limited to, schools, shopping centres, hospitals, office blocks and residential areas. Being such a remotely located site, dominant receptors in the area surrounding the site include small farmsteads and farmhouses. Fifty sensitive receptors (farmhouses) were identified within 2km of the site. The specific sensitive receptors (farmhouses) considered in this study are presented in **Figure 7-66.**

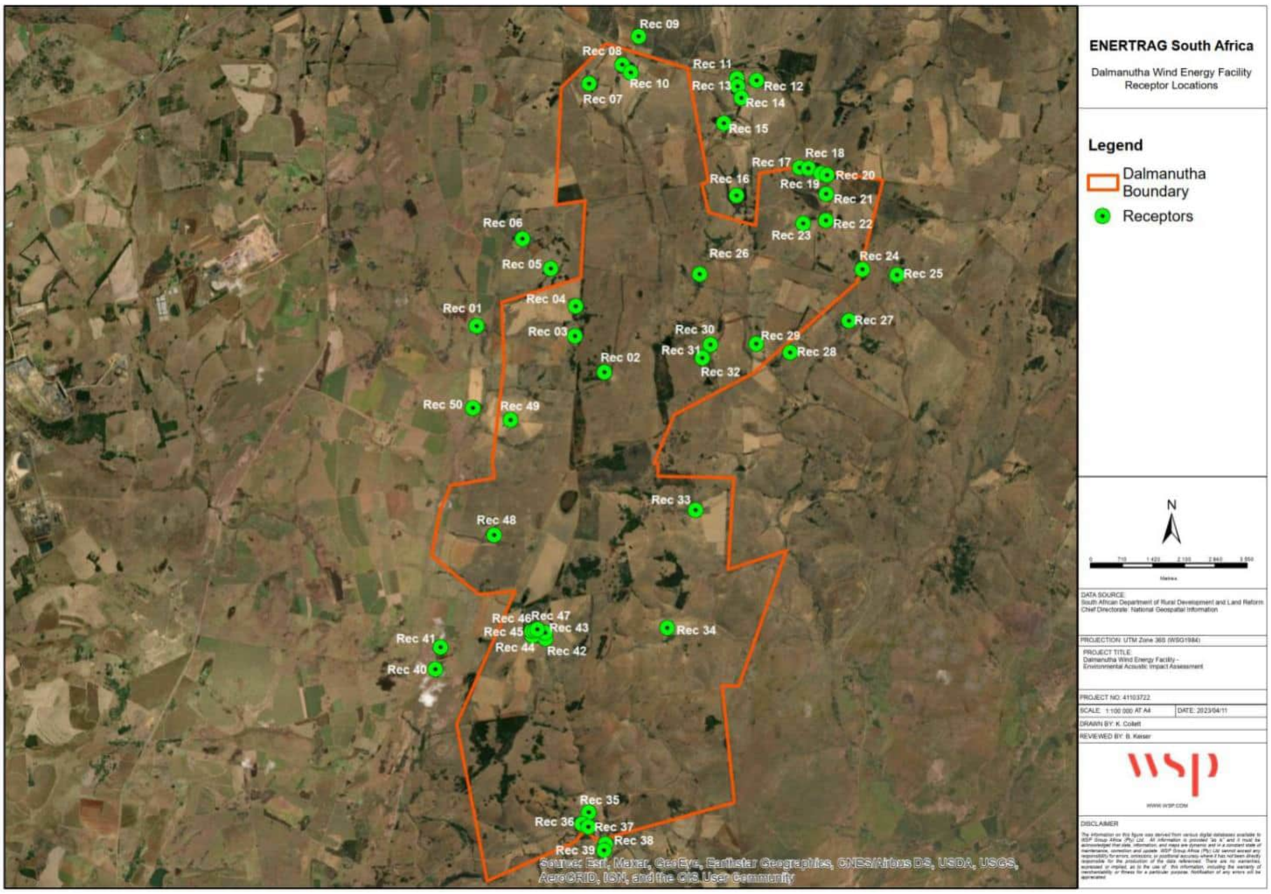


Figure 7-66 - Sensitive receptors surrounding the Dalmanutha WEF

The resultant environmental acoustic risks associated with the construction phase of the Project are anticipated to be “low” to “very low” with general mitigation options employed. For the operational phase (Alternative 1), impacts are anticipated to be “low” as it is understood that the direct surrounding receptors are all vested in the Project. For the operational phase (Alternative 2), impacts are anticipated to be “moderate” especially at Rec 17 and Rec 18. Should the nearby turbines be relocated slightly, impacts are anticipated to become “low”.

From previous experience, turbines within such a close distance of sensitive receptors may cause impacts and complaints. Additionally, based on the number of wind turbines being proposed, the cumulative impact of many turbines on other receptor locations may result in impacts and complaints.

Noise from wind turbines can be classified into two categories, namely mechanical noise generated from the turbine's mechanical components and aerodynamic noise, produced by flow of air over the turbine blades.

MECHANICAL NOISE

The mechanical noise generated by a wind turbine is predominantly tonal (dominated by a narrow range of frequencies), but may also be broadband in character, displaying a wide range of frequencies (Council of Canadian Academics, 2015). Such noise is produced by the physical movement of the following components:

- Gearbox;
- Generator;
- Yaw drives;
- Cooling fans; and
- Auxiliary equipment.

Over time, appropriate design and manufacturing have reduced the mechanical noise produced from wind turbines. As such, the aerodynamic noise from the blades has become the dominant source of noise for modern turbines, however, low frequency tones associated with mechanical sources are audible for some turbines (Hau, 2006; Manwell et al., 2009; Oerlemans, 2011).

AERODYNAMIC NOISE

Aerodynamic noise is typically broadband in nature and is generated by the interaction between air flow and different parts of the turbine blades. These interactions depend on the speed and turbulence of the wind; the shape of the blade; the angle between the blade and relative wind velocity flowing over the blade; and the distance from the hub. The noise levels produced are relative to the velocity of the air flow, with higher rotor speeds resulting in higher noise levels. Specifically, parts of the blade closer to the tips move faster than those closer to the hub, resulting in faster relative air velocities and create higher aerodynamic noise levels. As such, most of the aerodynamic noise is produced near (but not at) the blade tips. This is partly why turbines with longer blades have a higher sound power level (Oerlemans, 2011).

Aerodynamic noise from wind turbines also has a strong directional component, projecting primarily downward, upward, or even perpendicular depending on the dominant mechanism (Oerlemans, 2011). As such, noise levels measured at a particular location can vary depending on the direction, speed and turbulence of the prevailing wind. Furthermore, as the rotor turns, the orientation of each blade changes in relation to a stationary receiver. As such, the noise levels at the receiver will vary as the blades rotate, resulting in periodic regular changes in noise levels over time (Renewable UK, 2013).

As wind speed increases, the aerodynamic noise of the turbines also increases. At low speeds the noise created is generally low and increases to a maximum at a certain speed (around 10 m/s) where it either remains constant or can even slightly decrease.

LOW FREQUENCY NOISE AND INFRASOUND

In addition to the noise discussed above, wind turbines also produce some steady, deep, low frequency sounds (between 1 – 100 Hz), particularly under turbulent wind conditions. Sound waves below 20 Hz are called infrasound. These infrasound levels are only audible at very high sound pressure levels. Older wind turbines that had downwind rotors created noticeable amounts of infrasound. Levels produced by modern-day, up-wind style turbines are below the hearing threshold for most people (Jakobsen, 2005).

The human ear is substantially less sensitive to sound at very low or very high frequencies. For most people, a very low pitch sound (20 Hz) must have a sound pressure level of 70 dB to be audible. Levels of infrasound near modern commercial wind turbines are far below this level and are generally not perceptible to people (Leventhall, 2006).

Low frequency sound, like all other sound, decreases as it travels away from the source. Siting wind turbines further away from sensitive receptors will therefore decrease the risk of infrasound. It is, however, important to note that in flat terrain, low frequency sound can travel more effectively than high frequency sound. Most environmental sound measurements and noise regulations are based on the A-weighed decibel scale (dB(A)), which under-weights low frequency sounds in order to mimic the human ear. Thus, noise limits based on the dB(A) levels do not fully regulate infrasound. The dB(C) scale offers an alternative of measuring sound that provides more weight to lower frequencies (Jakobsen, 2005; Bolin *et al.,* 2011).

SANS 10103 proposes a methodology to identify whether low frequency noise could be an issue. The method suggests that if the difference between Equivalent continuous sound pressure level (LAeq) and LCeq is greater than 10 dB, then a predominant low frequency component may be present. However, in all cases the existing acoustic energy in low frequencies associated with wind must be considered.

SUBSTATION AND TRANSFORMER NOISE

In addition to the noise from wind turbines, wind farms require a substation and transformers, which produce a characteristic "hum" or "crackle" noise. Utility companies have experience with building and siting such sources to minimise their impact. Substation-related noise is relatively easy to mitigate should this be required, based on the use of acoustic shielding and careful planning regarding placement away from sensitive receptors. As such, noise associated with this source is not considered in this assessment.

7.3.3 TRANSPORT AND TRAFFIC NETWORK

The site is located directly south of National Road N4, and in between the Provincial Road R33 to the west and the R36 to the east. The N4 is the primary east-west road link from the Botswana border via Pretoria and Mbombela to the Mozambique border. In the vicinity of the site, the N4 is a single carriageway with 1 lane per direction and gravel shoulders. Refer to **Figure 7-67**

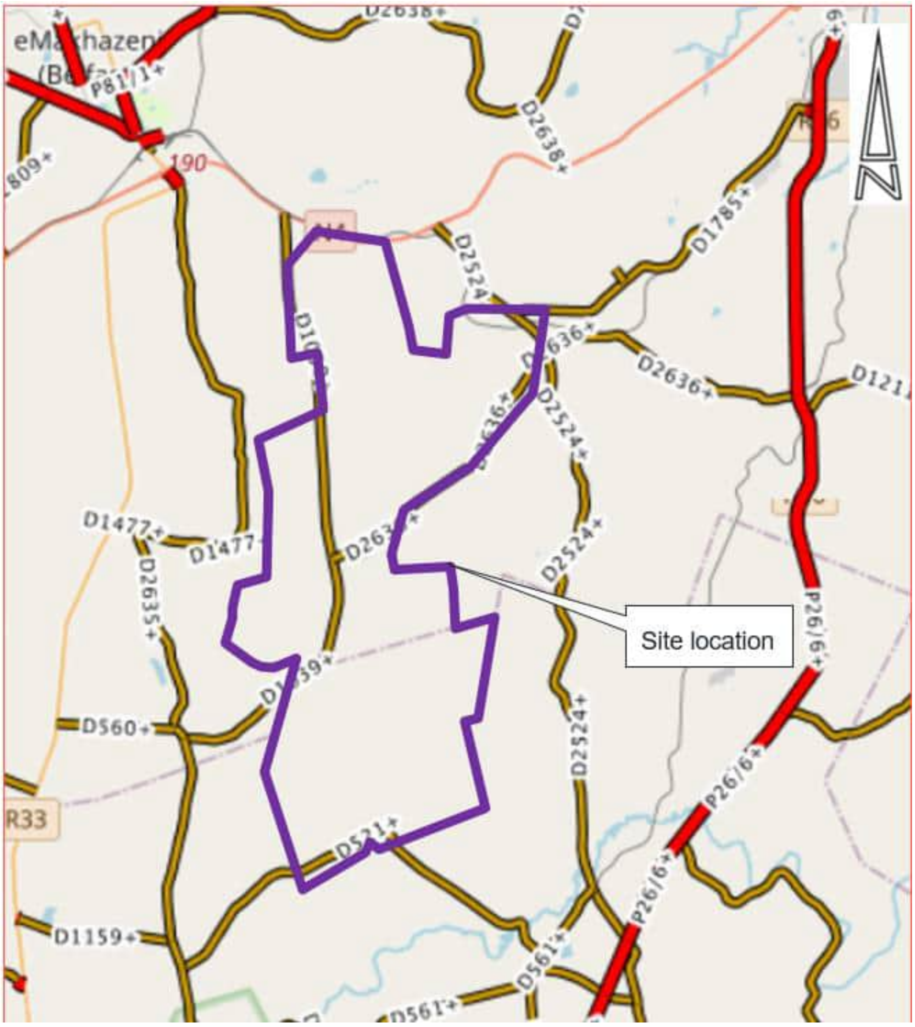


Figure 7-67 - National and Provincial Road network & site location

SITE ACCESS

Refer to **Figure 7-68** for the Alternative 1 provisional alignment of the site access roads, and to **Figure 7-69** for the Alternative 2 provisional alignment of the site access roads. The planned site accesses are as follows:

- Site access roads off the D1039, a district unsurfaced road that takes access off the N4 at a formal junction.
- Site access roads off the D2636, a district unsurfaced road that connects to the D2524, which takes direct access off the N4 at a formal junction.
- A site access road that will connect to the access road to the Berg-en-Dal memorial. This road takes direct access off the N4 at a formal junction. The provisional site access roads indicate a new direct access off the N4 west of the Berg-en-Dal memorial. This proposed access will not be utilised. Refer to **Figure 7-70**

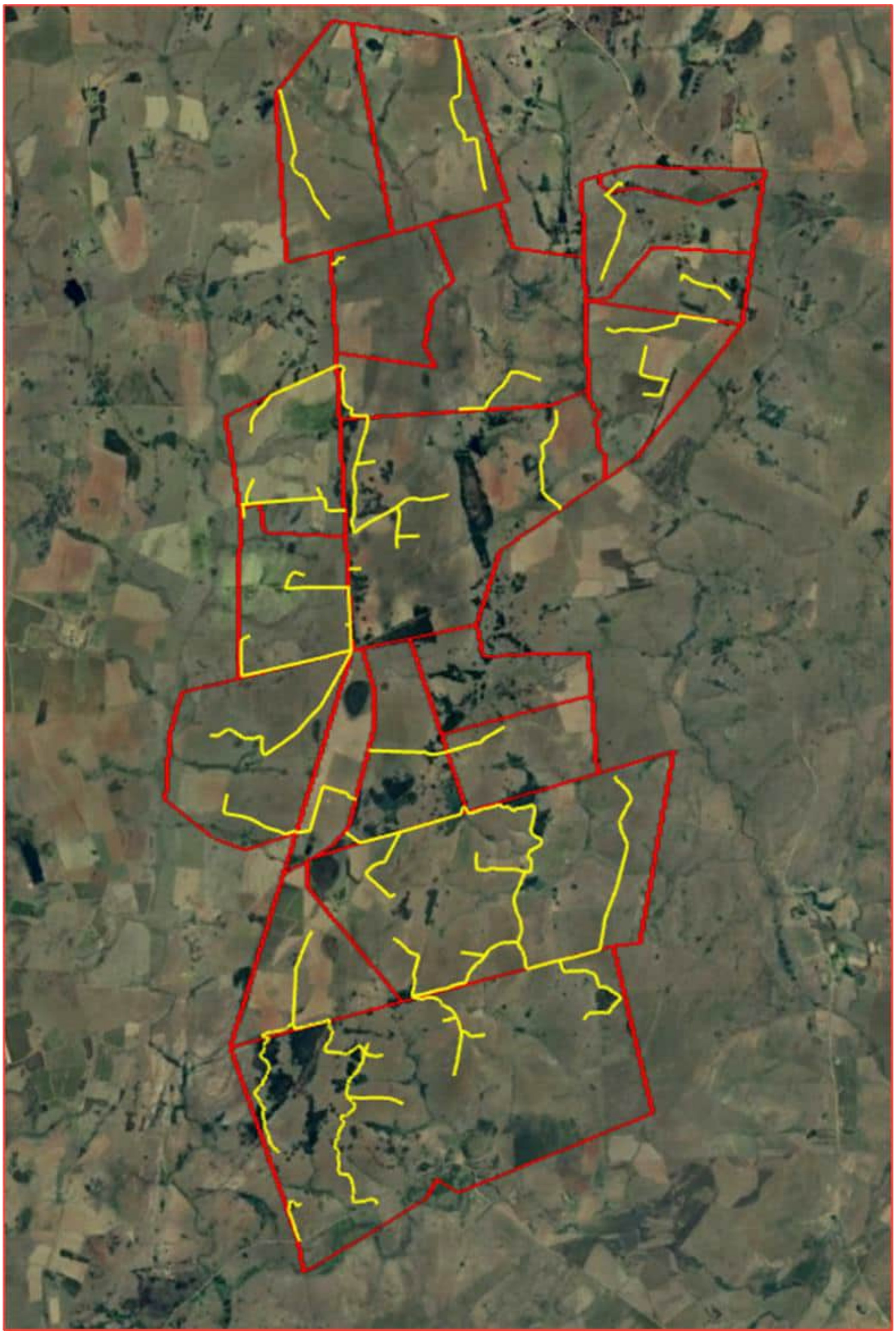


Figure 7-68 - Alternative 1 - On-site access roads (provisional alignments) & farm portions

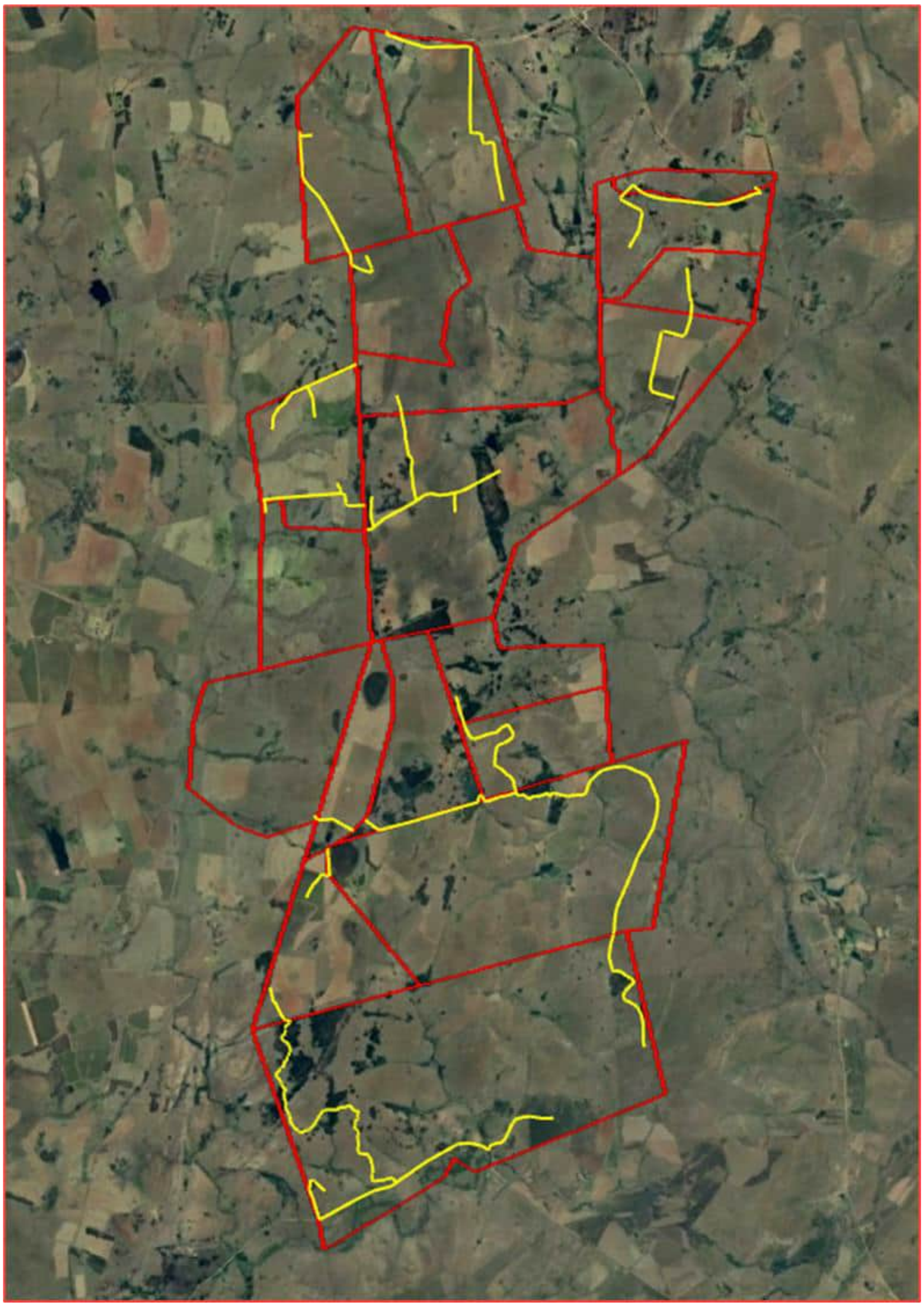


Figure 7-69 - Alternative 2 - On-site access roads (provisional alignments) & farm portions

Figure 7-70 - Access via Berg-en-Dal memorial access road

The N4 is a single carriageway with 2 lanes per direction, surfaced with unmade shoulders in the vicinity of the access intersections detailed above.

Due to the low expected construction traffic volumes, the intersections off the N4 do not require capacity analysis.

The expected traffic increase on the N4 during the construction and later operation phase is not expected to cause deterioration of the road, as it is surfaced, and the abnormal and heavy vehicle volumes are expected to be low.

The expected heavy and abnormal traffic on the unsurfaced district roads (D1039, D2524 and D2636) during the construction phase, may result in deterioration of the roads, as they are not designed for abnormal loads. The cost of maintaining and repairing these roads during the construction phase should be borne by the developer.

7.3.4 PALAEONTOLOGY

The palaeontological sensitivity of the area under consideration is presented in **Figure 7-71**. The site for development is in the Vryheid Formation (red: very highly sensitive), Silverton, Magaliesberg and Rooihoogte Members (orange: highly sensitive) and non-fossiliferous Jurassic dolerite (grey).

The Vryheid Formation lies on the uneven topography of pre-Karoo or Dwyka Group rocks in the northern and north-western margins but lies directly on the Pietermaritzburg Formation in the central and eastern part. The lithofacies show several upward-coarsening cycles, some very thick, and they are essentially deltaic in origin. There are also delta-front deposits, evidence of delta switching, and fluvial deposits with associated meandering rivers, braided streams, back swamps or interfluves and abandoned channels (Cadle *et al.,* 1993; Cairncross, 1990; 2001; Johnson *et al.,* 2006). Coal seams originated where peat swamps developed on broad abandoned alluvial plains, and less commonly in the backswamps or interfluves. Most of the economically important coal seams occur in the fluvial successions (ibid). In the east (Mpumalanga and northern KwaZulu Natal), the Vryheid formation can be subdivided into a lower fluvial-dominated deltaic interval, a middle fluvial interval, and an upper fluvial-dominated deltaic interval again (Taverner-Smith et al., 1988).

Fossil plants of the Glossopteris flora occur in the Vryheid Formation. This flora includes Glossopteris leaves, seeds, fructifications, roots and wood, as well other groups such as the lycopods, sphenophytes, ferns, cordaitaleans and early gymnosperms (Plumstead, 1969; Anderson and Anderson, 1985; Bamford, 2004).

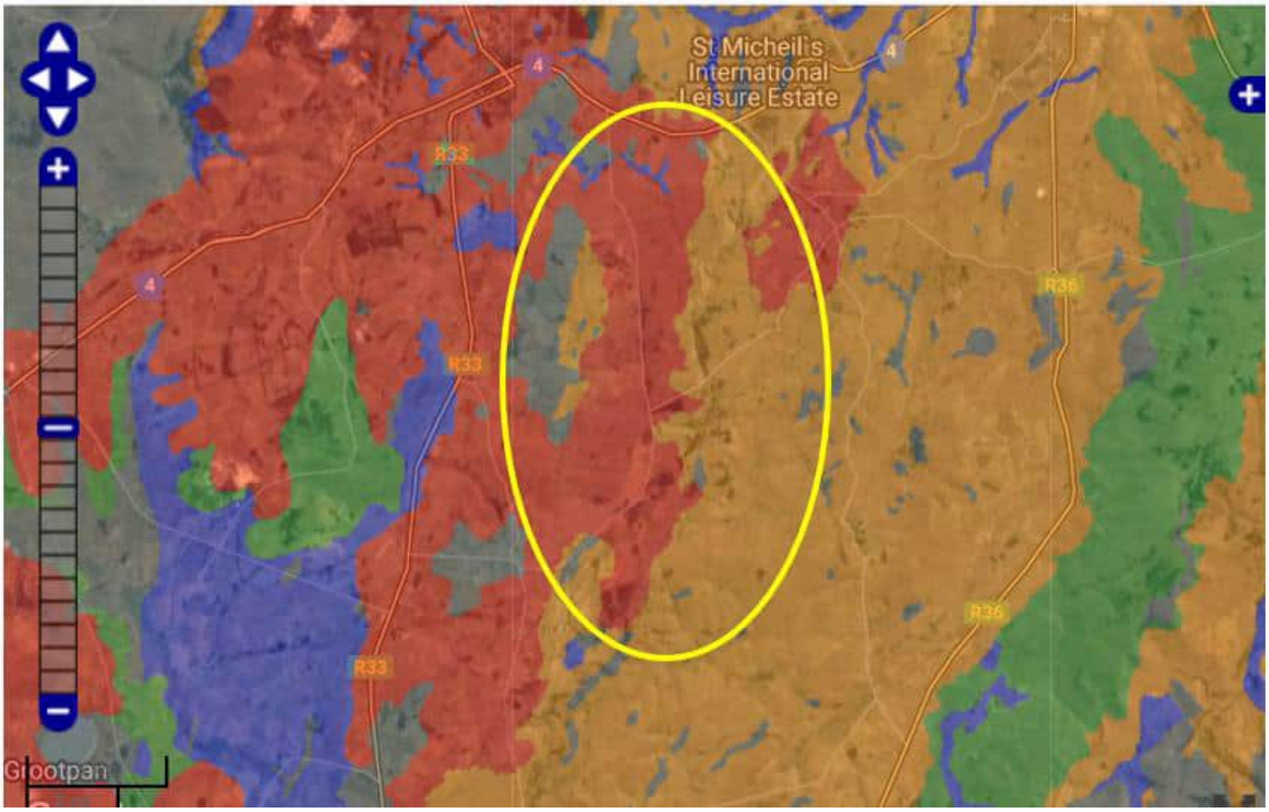


Figure 7-71 - SAHRIS palaeosensitivity map for the site for the proposed Dalmanutha facility shown within the yellow outline. Background colours indicate the following degrees of sensitivity: red = very highly sensitive; orange/yellow = high; green = moderate; blue = low; grey = insignificant/zero.

The area was visited in December 2022 and February 2023 and where the roads and field were dry enough for access the turbine sites were inspected. There had been heavy rains prior to the site visit so not all locations were accessible. The project area consists of largely agricultural landscape consisting of various farms with mixed farming activities that include cattle, sheep and goat farming as well as the cultivation of various crops. The surrounding landscape consists of rolling hills covered in a thick growth of ground vegetation. The soil is fairly rocky around these hills with reddish sandy soil situated on the flatter areas. Scattered thickets of trees are situated across the landscape. These include 'black wattle', 'eucalyptus', 'conifer' and a shrublike tree that tends to grow in thickets on the various packed stone features across the landscape. The landscape becomes progressively mountainous towards the southern portions of the project area

7.3.5 HERITAGE AND CULTURAL RESOURCES

The proposed site for the Dalmanutha WEF and associated infrastructure is located approximately 7km southeast of the Belfast town within Emakhazeni and Chief Albert Luthuli Local Municipalities, Mpumalanga Province. The archaeological record for the greater study area consists of the Stone Age and Iron Age as well as Battlefield historical sites.

STONE AGE

The Stone Age of southern Africa starts when hominins (ancestral to modern-day humans) first started to produce crude tools made with stone. The Earlier Stone Age (2 million - 200 000 years ago) is associated with hominins such as Homo habilis and Homo erectus (Dusseldorp *et al.* 2013). Mpumalanga currently does not have an extensive Early Strone Age (ESA) archaeological record, at Maleoskop on the farm Rietkloof, only a few ESA artefacts have been found and stone tools consisted of choppers (Oldowan), hand axes, and cleavers (Acheulean) (Esterhuysen & Smith 2007) and some surface scatters have been recorded near Piet Retief (Nel & Karodia 2013).

Middle Stone Age (MSA) artefacts represents archaic and modern humans that occupied the landscape between 300 000 to 40 000 before present. Later Stone Age (LSA) occupational sequences reflect San and Khoisan communities from 40 000 years ago until recently (Dusseldorp et al. 2013). Although the MSA and LSA has not been extensively studied in Mpumalanga, evidence for these periods has been excavated from Bushman Rock Shelter in the Ohrigstad District (Esterhuysen & Smith 2007; Lombard et al. 2012) and it is known that San communities lived near Lake Chrissie as recently as the 1950s (e.g., Schlebusch et al. 2016). MSA and LSA surface scatters have also been investigated in the vicinity of Piet Retief, and De Wittekrans is a Later Stone Age archaeological rock art site complex (Nel & Karodia 2013).

IRON AGE

The archaeology of farming communities of southern Africa encompasses three phases. The Early Iron Age (200-900 CE) represents the arrival of Bantu-speaking farmers in southern Africa. Living in sedentary settlements often located next to rivers, these farmers cultivated sorghum, beans, cowpeas, and kept livestock. The Middle Iron Age (900-1300 CE) is mostly confined to the Limpopo Valley in southern Africa with Mapungubwe Hill probably representing the earliest 'state' in this region (Huffman 2007).

The Late Iron Age (1300-1840s CE) marks the arrival and spread of ancestral Eastern Bantu-speaking Nguni and Sotho-Tswana communities into southern Africa. The location of Late Iron Age settlements is usually on or near hilltops for defensive purposes. The Late Iron Age as an archaeological period ended by 1840 CE, when the Mfecane caused major socio-political disruptions in southern Africa (Huffman 2007).

Dates from Early Iron Age sites indicated that by the beginning of the 5th century CE Bantu-speaking farmers had settled in the Mpumalanga lowveld. Subsequently, farmers continued to move into and between the lowveld and highveld of Mpumalanga. Iron Age sites such as Welgelegen Shelter, Robertsdrift and Tafelkop dates from the 12th to the 18th century (Derricourt & Evers 1973; Esterhuysen & Smith 2007).

During the mid-17th century Europeans started to settle in modern-day Cape Town. During and after the conflict caused by the Mfecane (1820-1840), during the reign of king kaSenzangakhona Zulu, known as Shaka, Dutch-speaking farmers started to migrate to the interior regions of South Africa. A period that is marked by various skirmishes and battles between the local inhabitants, Dutch settlers and the British (Giliomee & Mbenga 2007).

BATTLEFIELDS AND WAR HISTORY

The discovery of diamonds and gold in the northern provinces had very important consequences for South Africa. After the discovery of these resources, the British, who at the time had colonised the Cape and Natal, had intensions of expanding their territory into the northern Boer republics. This eventually led to the Anglo-Boer War, which took place between 1899 and 1902 in South Africa, and which was one of the most turbulent times in South Africa's history.

Even before the outbreak of war in October 1899 British politicians, including Sir Alfred Milner and Mr. Chamberlain, had declared that should Britain's differences with the Z.A.R. result in violence, it would mean the end of republican independence. This decision was not immediately publicised, and republican leaders based their assessment of British intentions on the more moderate public utterances of British leaders. Consequently, in March 1900, they asked Lord Salisbury to agree to peace on the basis of the status quo ante bellum. Salisbury's reply was, however, a clear statement of British war aims (Du Preez, 1977).

During the British advance between February to September 1900, Lord Roberts replaced Genl. Buller as the supreme commander and applied a different tactic in confronting the Boer forces instead of a frontal attack approach he opted to encircle the enemy. This proved successful and resulted for instance in the surrender of Genl. Piet Cronje and 4000 burghers at Paardeberg on 27 February 1900.

This was the start of several victories for the British and shortly after they occupied Pretoria on 5 June 1900, a skirmish at Diamond Hill resulted in the Boer forces under command of Louis Botha, retreated alongside the Delagoa Bay railway to the east. Between the 21-27 August, Botha and 5000 burghers defended their line at Bergendal but were overwhelmed by superior numbers and artillery. This resulted in the Boer forces retreating even further east and three weeks later the British reached Komatipoort and thus the whole of the Eastern Transvaal south of the Delagoa Bay railway line was now occupied by British Forces.

At the time of the War, several Blockhouses were located alongside the existing railway, including one near Wonderfontein in the vicinity of the Belfast area.

The "Scorched earth" policy implemented by Roberts led to the establishment of a number of camps where Boer women and children were harboured as a result of their homes being burnt and food reserves destroyed. This policy was also imposed on black people who stayed on Boer farms but also on their own pieces of land and homesteads. Maladministration, bad planning, insufficient medical assistance, malnutrition and exposure led to many deaths among people in these camps both white and black. An estimated 27 927 Boer women and children and a further 14 154 black people succumbed in these camps (Bergh, 1999). Belfast was the location of two camps for black people during the war (Bergh, 1999).

The Project area is vast and situated in an expansive landscape known to be culturally significant with a cultural layering dating from the Stone Age, through the Iron Age to the historical period. This was confirmed during the survey of the Dalmanutha WEF cluster, and many sites were recorded and were grouped into four categories based on site type. Category A sites are burial sites, Category B sites consists of standing structures like farmsteads (some that could be older than 60 years) and farming infrastructure like kraals etc as well as ruins that could date to the recent past or be historical. Category C sites are archaeological sites and findspots dating to the Late Iron Age and Middle Stone Age and Category D sites that relate or could potentially relate to the Anglo Boer War battlefields in the area. The study area is vast and some sites were recorded during remote sensing and will require field verification.

CATEGORY A – BURIAL SITES

Burial sites are expected to occur throughout the landscape. Recorded burial sites consist of stone packed grave dressings close to and sometimes within Iron Age settlements (Category C sites) possibly indicating direct descendants of community who have a direct link to these type sites, as well as informal graves and graves with formal headstones associated with farmsteads at Category B sites. Recorded burial sites are listed in **Table 7-8** with selected sites illustrated in **Figure 7.72** to **Figure 7.75**

Table 7-8. Burial sites identified in the study area.

Graves/Cemetery	Description
DN001	Small historical cemetery situated next to the main road running along the southern edge of the proposed project area. 9 Graves
DN004	Various historical graves scattered throughout the large Iron-age site. 7 – 10 Graves.
DN005	Various historical graves scattered throughout the large Iron-age site. 12 Graves
DN007	Historical graves scattered throughout the large Iron-age site. 3 Graves
DN009	Possible grave situated near a historical farmstead. 1 Grave
DN010	Historical cemetery situated near a historical farmstead. The cemetery has been enclosed with a tall stone and cement-built wall. The cemetery contains a small monument dedicated to Jacob de Clercq. 13 Graves.
DN018	Small cemetery situated within a large Iron-age site. 16 Graves
DN020	1 Grave situated within an Iron- age site.

Graves/Cemetery	Description
DN028	3 Graves situated with an Iron- age site.
DN029	Small cemetery situated with an Iron-age site. 8-10 Graves
DN039	Small cemetery situated within a historical site. 5 Graves.
DN043	Small historical cemetery situated near a historical farmstead. 6 Graves.
DN045	Small cemetery containing various graves. The cemetery is fenced off with some modern graves present. The site is near a historical farmstead. 25 – 30 Graves.
DN049	Small cemetery situated with an Iron-age site. 15 – 20 Graves.
DN059	Small historical cemetery situated near the Bergendal Monument. 15 Graves.
DN062	Small cemetery situated near various historical sites. 11 Graves.
DN075	Small historical cemetery situated near the main road. 3 Graves.
DN076	Large fenced off cemetery situated near historical sites. 20 – 30 Graves.
DN078	Various graves scattered around a large Iron-age site. 5 – 10 Graves.
DN081	Possible graves. Requires field verification.
DN114	Possible graves. Requires field verification.
DN115	Possible graves. Requires field verification.
DN118	Possible graves. Requires field verification.
DN120	Possible burial site. Requires field verification.

Figure 7.72. DN010 – Jacob de Clercq Memorial

Figure 7.73. DN018 – Burial site with in multi component site.

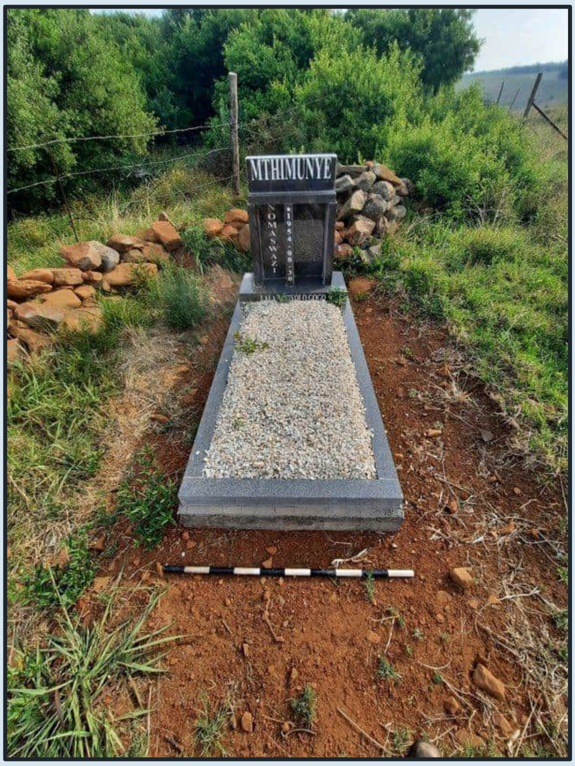


Figure 7.74. Formal grave with headstone at DN039

Figure 7.75. Small cemetery with formal and informal graves at DN049.

Significance – High Social significance

Field Rating – GP 3A

CATEGORY B – BUILT ENVIRONMENT.

The study area is characterised by intensive farming dating from at least the 20th century and recorded features include various structures such as farmsteads, storerooms, labourer houses and associated agricultural structures such as kraals, and stables. Many of these can be described as vernacular stone architecture where mostly dolerite ('blouklip') where used to construct farmsteads and kraals and date to the second half of the 19th century well into the early 20th century in the Eastern Highveld. Some of the recorded structures are modern while others are historical (older than 60 years). Category B structures are often found constructed on top or near Category D LIA sites where the stone walls were dismantled and used to build recent structures. Recorded sites are listed in **Table 7-9** with selected sites illustrated in **Figure 7-76** to **Figure 7-79**.

Table 7-9. Recorded structures in the study area.

Historical	Description
DN002	Possible historical kraal that has been modified by modern construction.
DN008	Large historical farmstead situated near the main road. The farmstead contains various structures including a large historical house.
DN011	Large, degraded stone-built structure situated on top of a small hill. Possibly a historical house.
DN015	Section of a historical packed stone wall.
DN016	Historical packed stone wall running along the edge of a large hill. This feature may have been part of a wall to keep cattle from roaming too far.
DN017	Large historical structure situated on the edge of a large hill near the long stone wall feature at DN016.
DN022	Small historical packed stone circle situated at a fairly high elevation. Possibly part of historical battle fields.
DN023	Small historical packed stone circle situated at a fairly high elevation. Possibly part of historical battle fields.
DN024B	Remnants of a small historical settlement situated on the remains of a possible archaeological site. The site includes various stone built degraded structures among circular packed stone enclosures. Some historical artefacts were also identified such as a lower grindstone.
DN032	Possible loosely packed stone cairn situated near various historical and iron-age sites.

Historical	Description
DN035	Large series of historical packed stone features and structures. The site contains the remnants of various square structures as well as a rondavel. The site may have been built using the stones from nearby archaeological sites.
DN040	Remnants of a historical stone-built feature. The foundation and small section of walling are the only visible remnants.
DN044	Large historical and degraded farmstead that contains various structures including a large kraal structure as well as a large stone-built farmhouse.
DN047	Natural spring that has been fenced off with some packed stones around the edge. May possibly be of cultural significance.
DN048	Large historical kraal structure.
DN051	Large historical kraal structure.
DN055	Remnants of a stone-built structure. Only the foundation and section of walling is still visible.
DN056	Large historical farmstead that contains various structures including a large kraal structure as well as the farmhouse.
DN057	Small historical structure situated near agricultural fields. The structure is fairly degraded.
DN058	Small series of packed stone walling running along the top of a rocky ridge line. The features are possibly part of a historical agricultural structure.
DN060	Small, packed stone enclosure situated near a rocky ridge line.
DN061B	Large, packed stone walled features scattered across a small area. These include a large circular enclosure as well as a square structure. These structures may be from various time periods.
DN065	Remnants of a large historical packed stone structure.
DN066	Historical metal artefact found near a historical site.
DN067	Remnants of a small, packed stone structure. The feature is fairly degraded and overgrown.
DN071	Remnants of the historical railroad that runs alongside the new modern railroad.
DN072	Remnants of a historical farmstead located near the newer structures within a thicket of trees. The site includes multiple degraded foundations.
DN073	Large degrading historical farmstead including large, packed stone walling as well as a large stone built structure.
DN077B	Remnants of an Iron-age settlement. The site includes various circular packed stone enclosures and features. The site extent is fairly large and scattered across a wide area. Some of the packed stone features within the site seem to have been built more recently using the stones from the archaeological features. Various graves were also identified within the site.

Historical	Description
DN079	Remnants of various square structure-built form stone. Possibly part of a historical settlement.
DN080	Large historical farmstead. The site is fairly degraded with some of the features being used currently. The site includes a degraded farmhouse as well as various packed stone kraal structures.
DN083	Series of possible historical stone-built features.
DN089	Large square historical structure built of archaeological enclosures. Stones used for the square structure were possibly sourced from the iron-age settlement.
DN093	Possible historical structure. Requires field verification.
DN094	Possible historical structure. Requires field verification.
DN096	Possible historical structure. Requires field verification.
DN097	Possible historical structure. Requires field verification.
DN098	Possible historical structure. Requires field verification.
DN099	Possible historical structure. Requires field verification.
DN100	Possible historical structure. Requires field verification.
DN101	Possible historical structure. Requires field verification.
DN102	Possible historical structure. Requires field verification.
DN104	Possible historical structure. Requires field verification.
DN105	Possible historical structure. Requires field verification.
DN106	Possible historical structure. Requires field verification.
DN108	Possible historical structure. Requires field verification.
DN109	Possible historical structure. Requires field verification.
DN111	Possible historical structure. Requires field verification.
DN112	Large historical farmstead.
DN116	Large historical farmstead.
DN117	Large square historical structure built of archaeological enclosures. Stones used for the square structure were possibly sourced from the iron-age settlement.
DN121	Possible historical structure such as a large kraal. Requires field verification.

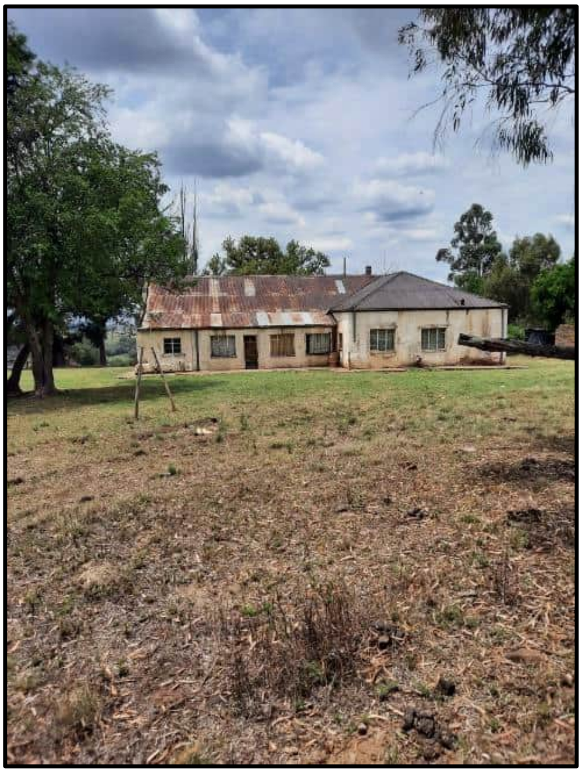
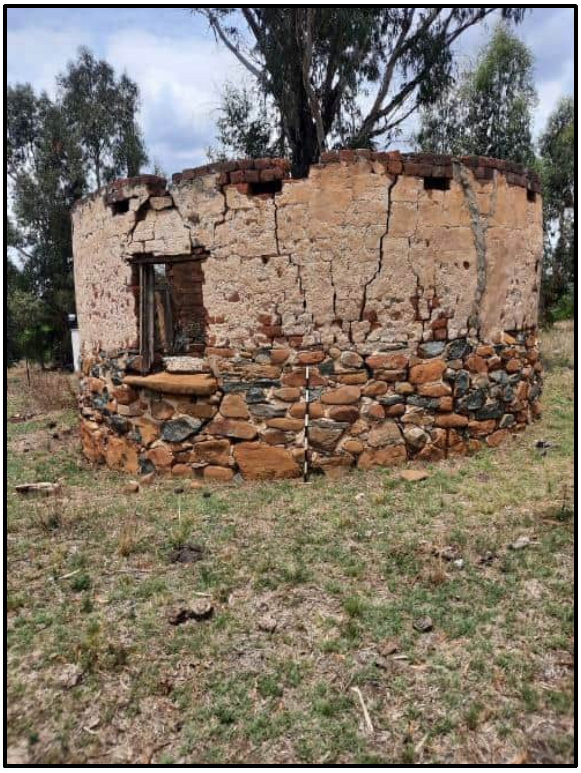
	

Figure 7.76. Farmstead at DN008	**Figure 7.77. Structure at DN008**

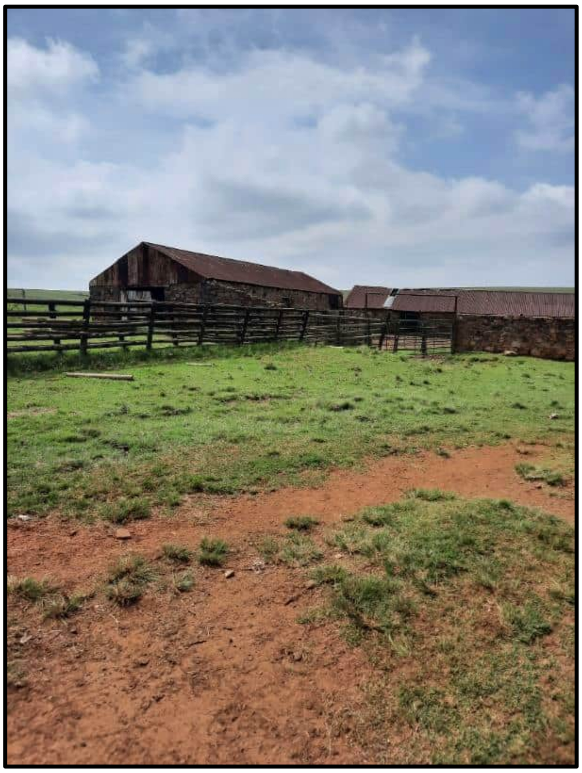



Figure 7.78. Farming infrastructure at DN056	**Figure 7.79. Structure at DN073**

Significance – Low to Medium significance

Field Rating – GP B

CATEGORY C – ARCHAEOLOGICAL SITES/ FINDSPOTS

The archaeological record of the area consists of isolated Stone Age artefacts dating to the MSA and LSA mostly made on quartzite (briefly described in Table 8-3) as well as Later Iron Age stone walled settlements. These Late LIA farming communities were the ancestors of modern Sotho-Tswana and Nguni societies. The north-western and southern portions of the region came to be broadly occupied by the Kgatla (Bakgatla), Rolong (Barolong), Ntwane (Bantwane), Koni (Bakone), Kopa (Bakopa) and Southern Ndebele mixed farming communities. The settlements in the study area are likely associated with the Koni and these settlements are marked by low stone walls with enclosures and terraces that is described as simple and complex ruins (Evers 1975 and Collett 1982) dating to (AD 1600-1800's). Recorded sites are listed in **Table 7-10** and **Table 7-11** with selected Stone Age sites illustrated in **Figure 7.80** and **Figure 7.81**. Photographs of LIA sites with plan drawings of simple and complex ruins (LIA) are illustrated in **Figure 7.82** to **Figure 7.86**

Table 7-10. Stone age Features in the Project area.

Stone-Age	Description
DN042	Large MSA cores located next to an active agricultural field.
DN054	Series of MSA lithic artefacts scattered across a wide area around a large rocky cliff and waterfall. The artefacts were scattered along the high edges of the cliff.
DN063	Various large MSA artefacts situated around an active agricultural field.

Figure 7.80. Stone Age artefacts from DN054.

Figure 7.81. Weathered artefact from DN063.

Significance – Low significance

Field Rating – GP

Table 7-11. Recorded Iron Age features in the Project Area.

Iron-Age	Description
DN003	Remnants of a large iron-age settlement situated on the side of a hill. The site consists of various stone-built features and enclosures scattered across a wide area. Various graves were also identified among the enclosures.
DN006	Small stone packed feature situated near the top of a small hill. The feature may be part of the larger iron-age settlement nearby.
DN012	A small section of packed stone walling situated on the side of a large thickets of trees. The site possibly extends into the thicket of trees.
DN013	
DN014	The remnants of a large circular iron-age settlement situated on a large open field. The site is fairly degraded with only some of the walling still visible. The site is overgrown with small shrubs and grasses.
DN019	The remnants of an extensive iron-age settlement situated around a large rocky hill. This site includes various circular packed stone enclosures, cleared agricultural fields as well

Iron-Age	Description
	as a section of the site that seems to have been historically occupied. A small cemetery is also situated within the site. The site extends across the hill with various packed stone features scattered across the area.
DN021	The remnants of a large circular iron-age settlement situated on a large open field. The site is fairly degraded with only some of the walling still visible. The site is fairly overgrown with small shrubs and grasses.
DN024A	Remnants of a small historical settlement situated on the remains of a possible archaeological site. The site includes various stone built degraded structures among circular packed stone enclosures. Some historical artefacts were also identified such as a lower grindstone.
DN025	Remnants of an Iron-age settlement. The site includes various circular packed stone enclosures and features.
DN026	Remnants of an Iron-age settlement. The site includes various circular packed stone enclosures and features.
DN027	Remnants of an Iron-age settlement. The site includes various circular packed stone enclosures and features.
DN030	Remnants of an Iron-age settlement. The site includes various circular packed stone enclosures and features.
DN031	Remnants of an Iron-age settlement. The site includes various circular packed stone enclosures and features.
DN033	Remnants of an Iron-age settlement. The site includes various circular packed stone enclosures and features.
DN034	Remnants of an Iron-age settlement. The site includes various circular packed stone enclosures and features.
DN038	Remnants of an Iron-age settlement. The site includes various circular packed stone enclosures and features. The site extent is large and scattered across a wide area. Some of the packed stone features within the site seem to have been built more recently using the stones from the archaeological features. Various graves were also identified within the site.
DN041	Remnants of a packed stone structure. The feature is extremely degraded with only the foundation still visible.
DN046	Small series of circular Iron-Age stone walled features. The small iron-age settlement also includes modern graves that have been constructed among the stone walled features.
DN061A	Large stone packed, walled features scattered across a small area. These include a large circular enclosure as well as a square structure. These structures may be from various time periods.
DN064	Remnants of an Iron-age settlement. The site includes various circular packed stone enclosures and features.

Iron-Age	Description
DN068	Large series of packed stone enclosures and structures. These features are possibly part of an iron-age settlement scattered across the immediate area. Various packed stone walling is still visible.
DN069	Large series of packed stone enclosures and structures. These features are possibly part of an iron-age settlement scattered across the immediate area. Various packed stone walling is still visible.
DN070	Series of packed stone foundations as well as the remnants of circular stone enclosures. The site is possibly part of an iron-age site.
DN074	Large lower grindstone situated near a loose stone bridge. The artefact may have been moved out of context when the bridge was built by recent farmers.
DN077A	Remnants of an Iron-age settlement. The site includes various circular packed stone enclosures and features. The site extent is fairly large and scattered across a wide area. Some of the packed stone features within the site seem to have been built more recently using the stones from the archaeological features. Various graves were also identified within the site.
DN082	Series of circular stone walled enclosures.
DN084	Series of circular stone walled enclosures.
DN085	Series of circular stone walled enclosures with some features that seem historical in shape.
DN086	Series of circular stone walled enclosures.
DN087	Series of circular stone walled enclosures.
DN088	Series of circular stone walled enclosures.
DN090	Series of circular stone walled enclosures.
DN091	Series of circular stone walled enclosures.
DN092	Series of circular stone walled enclosures. Part of a much larger series of archaeological sites.
DN095	Series of circular stone walled enclosures.
DN103	Possible stone walled settlement site. Requires field verification.
DN107	Series of circular stone walled enclosures.
DN110	Series of circular stone walled enclosures. Large site extent.
DN113	Series of circular stone walled enclosures. Large site extent.
DN119	Series of circular stone walled enclosures. Large site extent.

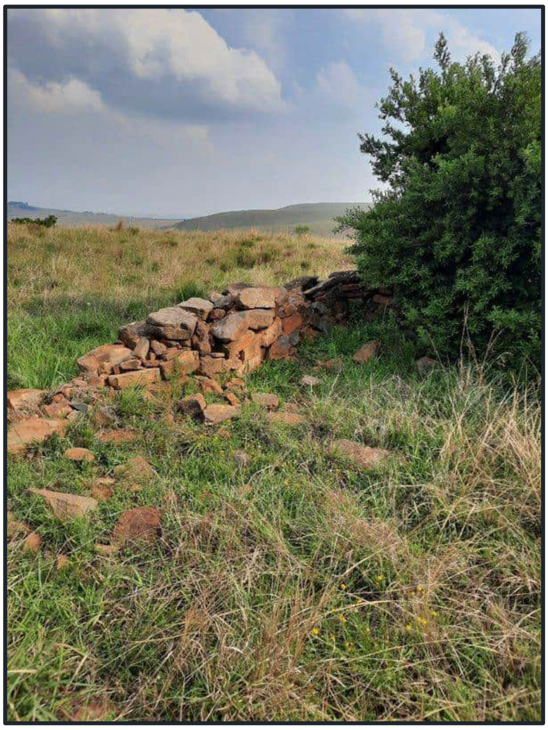


Figure 7.82. Stone walls at DN038.

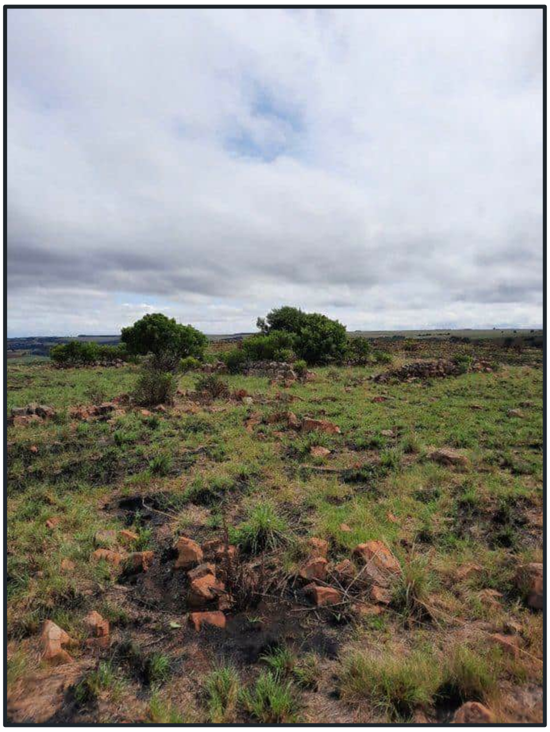


Figure 7.83. General site conditions at DN064.

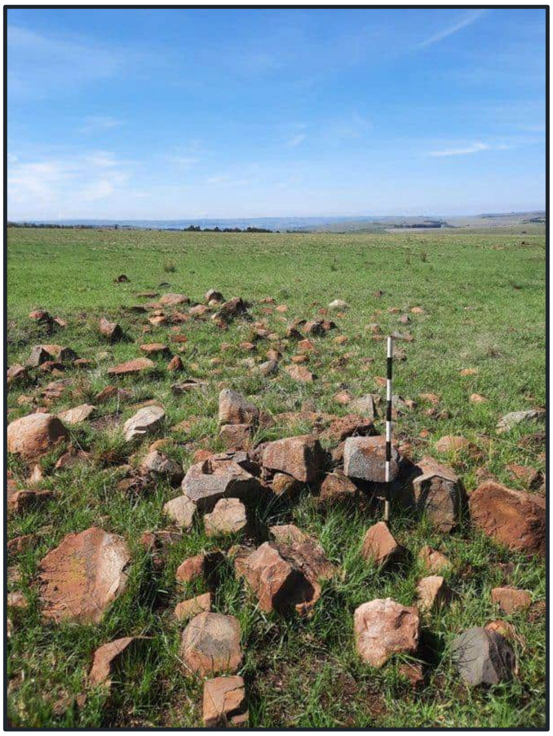


Figure 7.84. Dilapidated stone packed features at DN041.

Figure 7.85. Lower Grindstone at DN074.

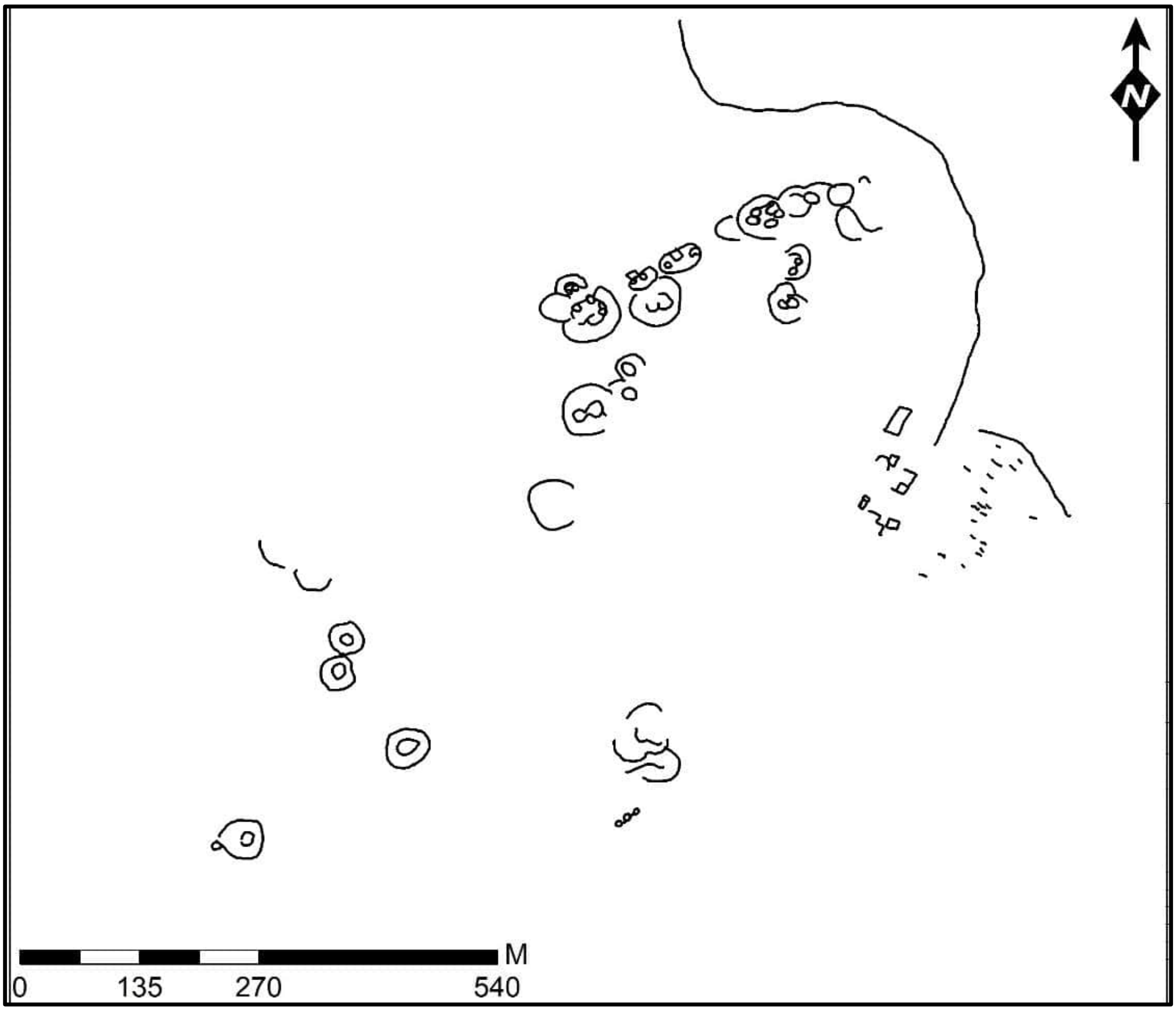


Figure 7.86. Plan drawing of complex LIA settlement DN018 to DN0220

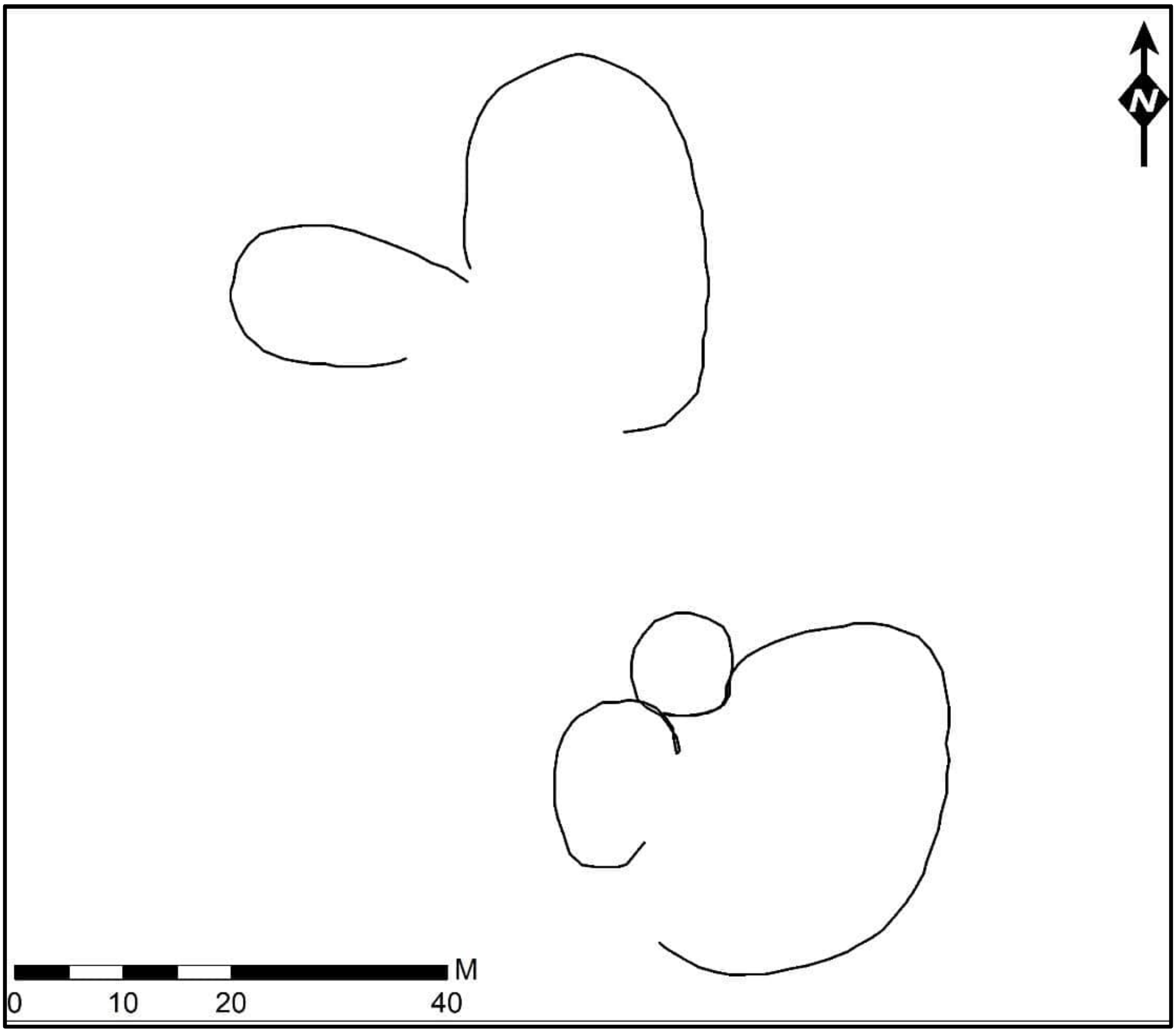


Figure 7.87. Plan drawing of simple ruins at LIA site DN028.

Significance –Medium to high significance

Field Rating – GP B

CATEGORY D- BATTLEFIELD FEATURES

The greater study area also forms part of the Anglo Boer war ‘Berg en Dal/Dalmanutha’ battlefield. Multiple associated features are scattered across the landscape including possible stone packed fortifications or sangers situated along the tops of some of the hills, the historical railroad from the Project area towards Machadodorp, the ‘Berg en Dal’ memorial situated on the northern boundary of the Project area along the N4 and possibly some of the historical farmsteads in the larger Project area.

Small stone packed fortifications that are situated at the tops of various ridge lines or hills are generally placed at sites where they have a good view of the landscape towards the southwest of the project area. These ‘sangers’ are usually built from packed stones forming a crude wall of about half a meter and are shaped as half circles. Recorded sites are listed in **Table 7-12** with selected sites illustrated in **Figure 7.88** to **Figure 7.93** Plan drawing of selected features are illustrated in **Figure 7.94**

Table 7-12. Recorded battlefield sites in the Project area.

Possibly Battlefield related	Description
DN022	Small historical packed stone circle situated at a high elevation. Possibly part of historical battle fields.
DN023	Small historical packed stone circle situated at a high elevation. Possibly part of historical battle fields.
DN036	Small series of packed stone walled features scattered across a wide area. These features are possibly part of an historical battlefield. These features are built along a rocky ridge line at high elevations.
DN037	Small series of packed stone walled features scattered across a wide area. These features are possibly part of an historical battlefield. These features are built along a rocky ridge line at high elevations.
DN050	Small series of packed stone walled features scattered across a wide area. These features are possibly part of an historical battlefield. These features are built along a rocky ridge line at high elevations.
DN052	Small series of packed stone walled features scattered across a wide area. These features are possibly part of an historical battlefield. These features are built along a rocky ridge line at high elevations.
DN053	Small series of packed stone walled features scattered across a wide area. These features are possibly part of an historical battlefield. These features are built along a rocky ridge line at high elevations.
DN060	

Figure 7.88. DN022 - Possible gun placement/ fortification

Figure 7.89. DN023 - Possible gun placement/ fortification

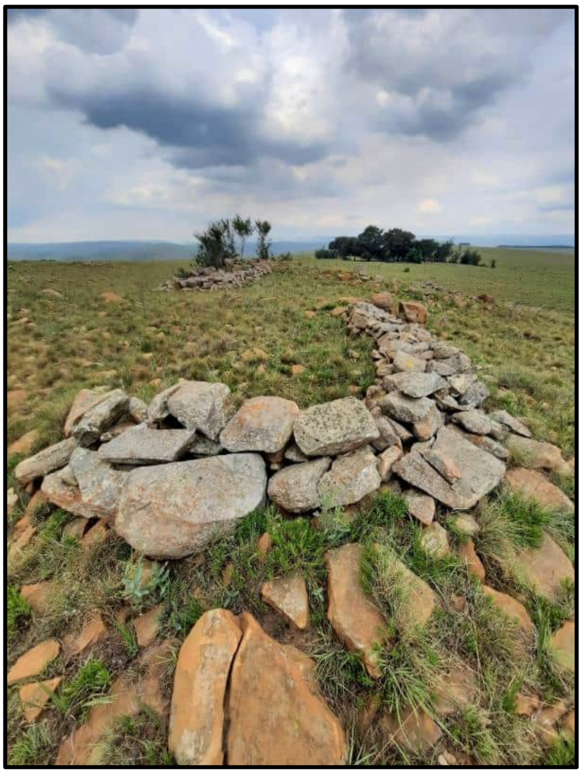


Figure 7.90. DN036 – Packed stone fortification/ sanger

Figure 7.91. DN036 – Packed stone fortification/ sanger

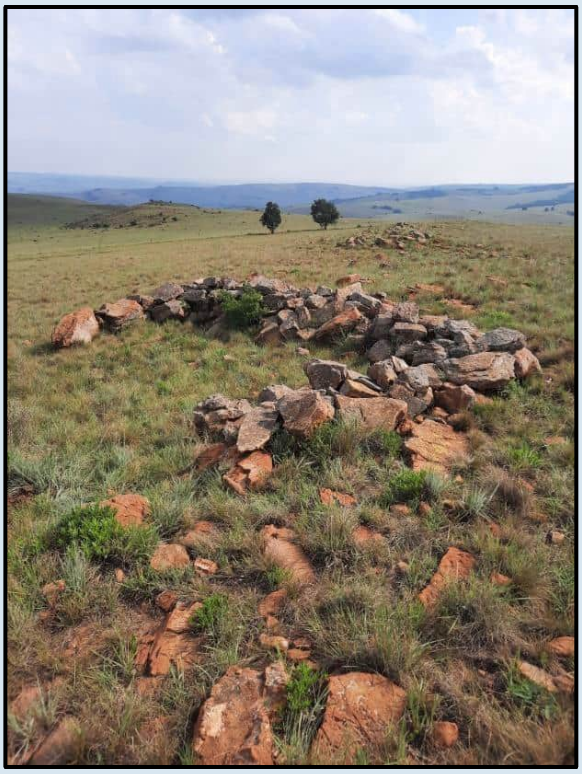


Figure 7.92. DN037 – Packed stone fortification/ sanger.

Figure 7.93. DN071 – Remnants of the historical railroad.

Figure 7.94. Plan drawing of stone packed features at Site DN036 and DN037.

Significance –High significance

Field Rating – GP A

The various sites are on record for the project area and are shown below. The features are spatially indicated in **Figure 7-95**

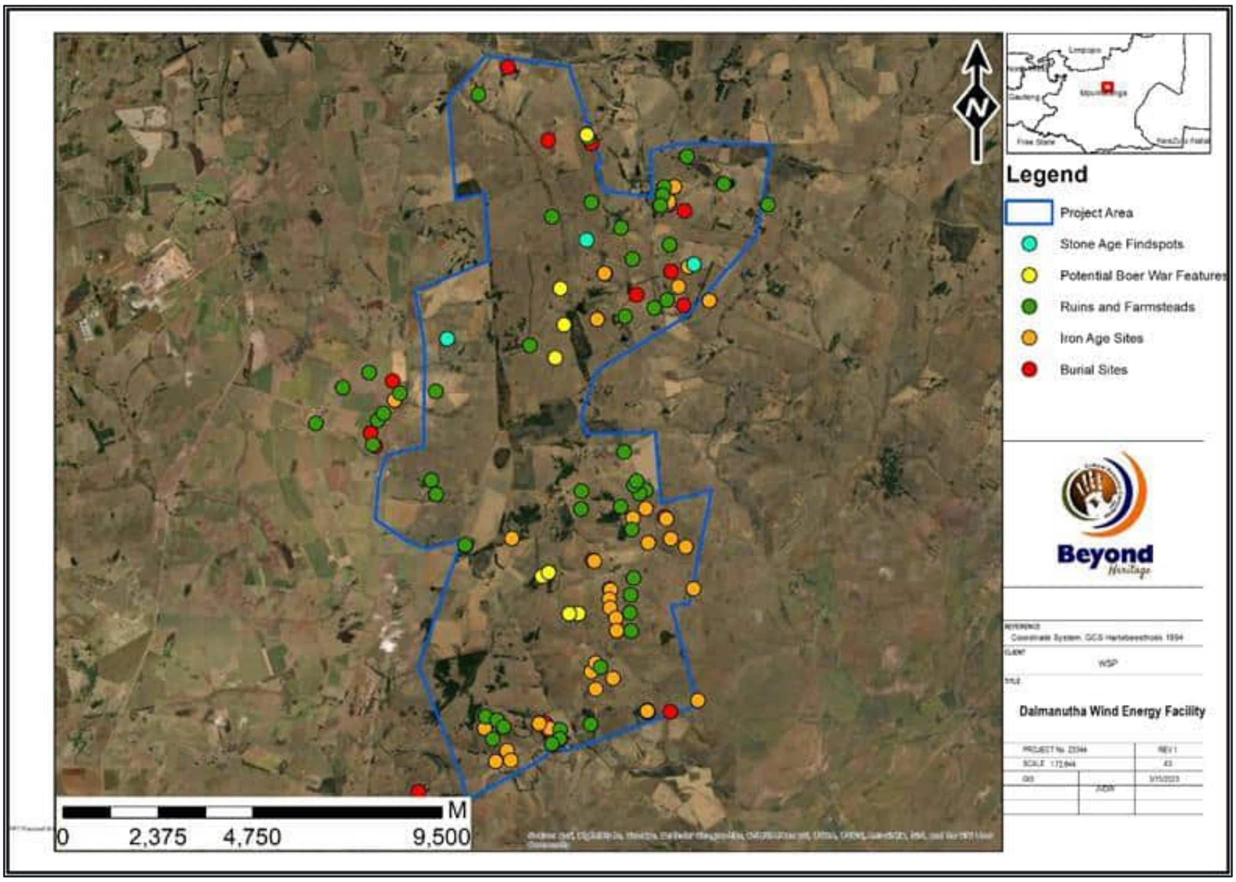


Figure 7-95 - Project area in relation to known Cultural and Heritage sites

CULTURAL LANDSCAPE

Regionally the area is mostly cultivated, and forms part of a landscape characterised by wide scale cultivation and mining activities. Development in the study area is limited to farming infrastructure such as access roads, fences, and agricultural developments. The study area is part of a large cultural landscape that include battlefield sites, cemeteries and an intensive Later Iron Age occupation.

7.3.6 VISUAL CHARATER AND SENSITIVITY

VISUAL CHARACTER AND CULTURAL VALUE

The physical and land use-related characteristics of the study area as described above contribute to its overall visual character. Visual character largely depends on the level of change or transformation from a natural baseline in which there is little evidence of human transformation of the landscape. Varying degrees of human transformation of a landscape would engender differing visual characteristics to that landscape, with a highly modified urban or industrial landscape being at the opposite end of the scale to a largely natural, undisturbed landscape. Visual character is also influenced by the presence of built infrastructure including buildings, roads, and other objects such as telephone or electrical infrastructure. The visual character of an area largely determines the sense of place relevant to the area. This is the unique quality or character of a place, whether natural, rural or urban which results in a uniqueness, distinctiveness or strong identity.

Lamb and mutton farming dominate the land-use character in the western part of the study area, as well as dairy and maize farming. Timber is a leading industry in the district, therefore exotic plantations are located throughout the study area, but are more concentrated in areas towards the north, north-east and southeast south-east of the site.

Mining / quarrying Mining/quarrying areas (coal and black granite are other leading industries in the study area), have been delineated towards the west, north-west, north-east and south of the proposed Dalmanutha WEF. In terms of the South African National Land Cover dataset, the site is classified as Grassland interspersed with cultivation areas, small sections of forested land and numerous wetlands/water bodies throughout the project site

The scenic quality of the landscape is also an important factor that contributes to the visual character or inherent sense of place. Visual appeal is often associated with unique natural features or distinct variations in form. As such, the pastoral landscape and rolling hills in parts of the study area are important features that could increase the visual appeal and visual interest in the area.

Cultural landscapes are becoming increasingly important concepts in terms of the preservation and management of rural and urban settings across the world. The concept of 'cultural landscape' is a way of looking at a place that focuses on the relationship between human activity and the biophysical environment (Breedlove, 2002). In this instance, the rural / pastoral landscape represents how the environment has shaped the predominant land use and economic activity practiced in the area, as well as the patterns of human habitation and interaction. The presence of small towns, such as Ermelo, engulfed by an otherwise rural / pastoral environment, form an integral part of the wider landscape.

In light of this, it is important to assess whether the introduction of a WEF and/or SEF into the study area would be a degrading factor in the context of the prevailing character of the cultural landscape. Broadly speaking, visual impacts on the cultural landscape in the area around the proposed development would be reduced by the fact that the visual character in much of the area has been significantly transformed and degraded by urban, industrial, mining, and infrastructural development.

Industrial infrastructure is quite prominent throughout the study area. There is a large network of existing high voltage power lines that traverse the study area and connect to the numerous substations that dot the landscape. Additionally, mining/quarrying areas (coal and black granite are other leading industries in the study area), have been delineated towards the west, north-west, north-east and south of the proposed Dalmanutha WEF.

7.3.7 POTENTIAL VISUAL EXPOSURE

Alternative 1: Dalmanutha Wind Facility

A visibility analysis was undertaken from each of the wind turbine positions (70 in total) at an offset of 300m (approximate tip-height) above ground level. The result of the visibility analysis is displayed on **Figure 7-96.**

The viewshed analysis does not include the effect of vegetation cover or existing structures on the exposure of the proposed WEF, therefore signifying a worst-case scenario.

The result of the viewshed analysis displays the potential areas of visual exposure, as well as the potential frequency of exposure. The frequency of exposure indicates the number of turbines that may be exposed i.e. more turbines may be visible in the darker orange areas than in the yellow areas. Land that is more elevated is typically more exposed to the proposed WEF, whilst lower lying areas such as valleys are shielded, or not as exposed.

The core, uninterrupted area of visual exposure of the wind turbines is likely to be experienced by sensitive receptors within a 5km radius of the structures with a reduced frequency of exposure to the south and north along lower lying drainage lines and perennial rivers. Between 5-10 Km, the visual exposure is still highly concentrated with small pockets of visually screened areas found along Elandskop and Krokodilkop in the east. Frequency of exposure is reduced to the north-west near Belfast, north and north-east owing to the hilly topography, as well as in the south-west along Boskoppie. It is expected that the wind turbine structures will be highly visible from homesteads within this zone, as well as from portions of the N4, R 33, R36 and various secondary roads traversing the project site.

Additional visual exposure on the undulating plains between 10 – 20km of the turbine structures is largely reduced and concentrated to the west, south-west, south and north and north-east. Visually screened areas are found to the north-west and east. The frequency of visual exposure (number of turbines visible) is reduced somewhat to then north and it is expected that some wind turbines may only be partially visible i.e. mainly the blades. This is due to the hilly topography to thereby largely restricting the visual exposure to the plains beyond these mountains.

The frequency of visual exposure beyond 20km from the turbine structures is expected to subside and may be exposed though it is expected that most turbines will only be partially visible. Visibility of the turbine structures will be scattered throughout this area.

The homesteads and roads expected to be visually influenced are listed below. It should be noted that this section of the report focusses only on the potential visual exposure at varying distances and it does not yet refer to visual impact significance or any correlation thereto.

- **Less than 5km** from the wind turbines:
- Frisgewaagd [3]
- Clercqsvallei
- Welgevonden
- Frisgewaagd
- Drenthe
- Geluk
- Leeukloof
- Blyvooruitsig
- Vogelstruispoort
- Driekop
- Waaikraal
- De Rust
- Wemmershuis
- Bergendal
- Green Pastures
- Moreson

[3] The names listed here are of the homestead or farm dwelling as indicated on the SA 1: 50 000 topographical maps and do not refer to the registered farm name.

- Weltevreden
- Weltevreden
- Observers travelling along the N4 national road
- Observers travelling along the R33 arterial road
- Observers travelling along the Geluk/Dalmanutha secondary roads

Located within a **5 - 10km radius:**

- Hartebeespruit
- De Kroon
- Connievale
- Rietvlei
- Vlakfontein
- Brakspruit
- Mislukt
- Van Wyksvlei
- Eerstelingsfontein
- Blyvooruitzicht
- Zoekop
- Leeuwbank
- Zoekop
- Outer lying areas of Belfast
- Parts of the Nooitgedacht Dam and Lakenvlei Protected areas
- Observers travelling along the N4 National road
- Observers travelling along the R33 and R36 arterial roads
- Secondary roads

Located within a **10 - 20km radius:**

- Du Elsarik
- Winchester
- Vaalkop
- Klipfontein
- Weltevrede
- Elgin
- Lakenvlei
- Elandfontein
- Groenvlei
- Rietvlei
- Zevenfontein
- Sewefontein
- Bloemfontein
- Suikerbosfontein
- Leeuwpoort
- Kwaggafontein
- Hawerfontein
- Berg-en-Dal
- Leliefontein

- Twyfelaar
- Goedehoop
- Blesbokspruit
- Grootpan
- Blesbokspruit
- Parts of the Cecilia, Nooitgedacht Dam, Lakenvlei Protected areas, Paulina van Niekerk PNR and Langkloof PNR
- Southern outlying parts of Siyathuthuka
- Observers travelling along the R33, R36, R541, R540 arterial roads
- Various secondary roads
- Observers travelling along portions of the N4 national road

Located **beyond 20km:**

- Klippan
- Uitvlug
- Vlakplaas
- Nooitgedacht
- Brahmanica Park
- Vaalbult
- Helpmekaar
- Leeupan
- Cecilia PNR
- Observers travelling along the R36, R38, R541 and R540 arterial roads

It is envisaged that the structures, where visible from short to medium distances (e.g. less than 10km), may constitute a high visual prominence, potentially resulting in moderate to high visual impacts.

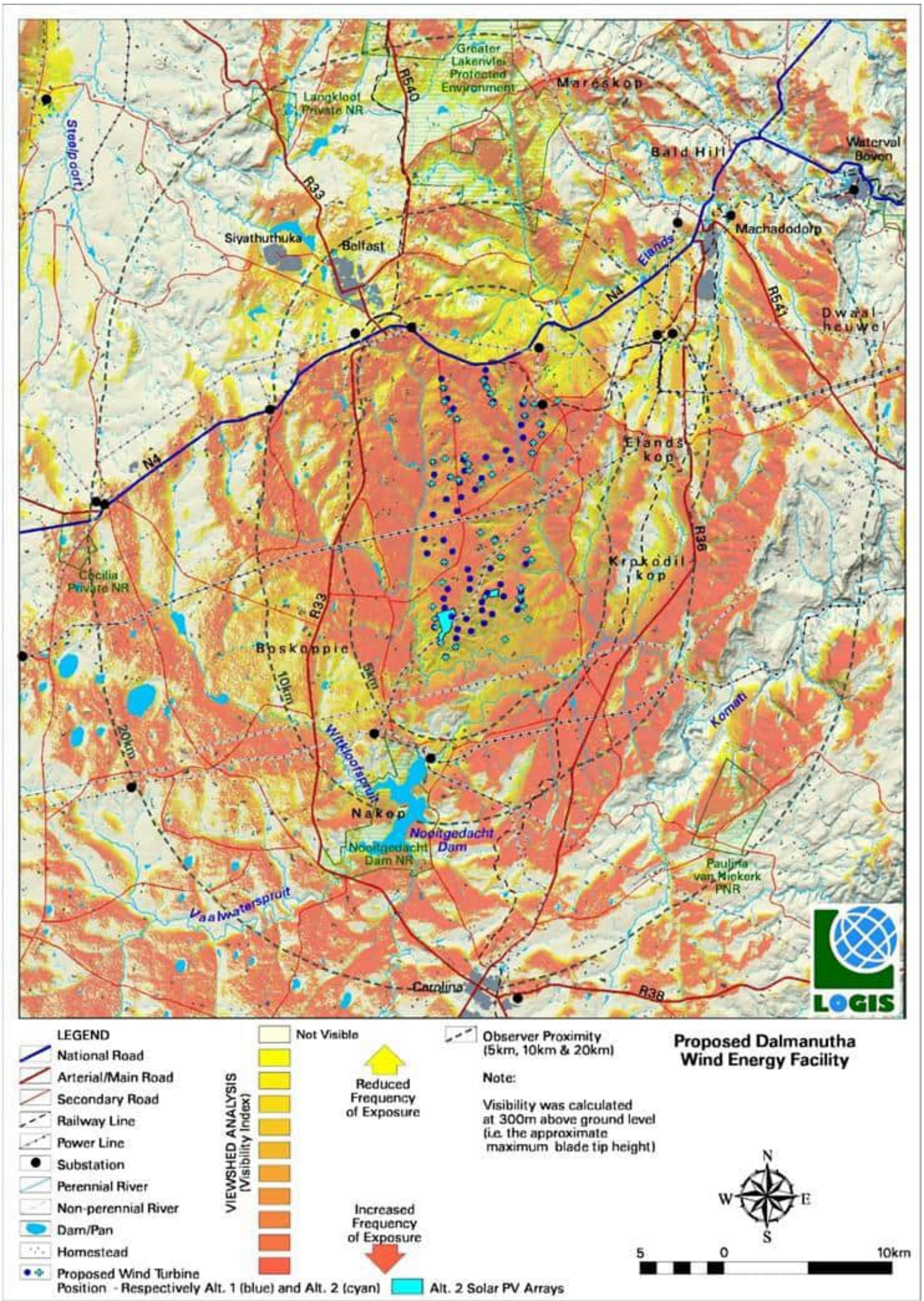


Figure 7-96 - Viewshed analysis for Alternative 1: Dalmanutha Wind Facility

Alternative 2: Dalmanutha Wind and Solar Facility

A visibility analysis was undertaken from each of the wind turbine positions (44 in total) at an offset of 300m (approximate tip-height) above ground level, while the for the solar facility, the viewshed analysis was undertaken from a representative number of vantage points within the development footprint at an offset of 9m above ground level. The result of the visibility analysis is displayed on **Figure 7-97.**

The viewshed analysis does not include the effect of vegetation cover or existing structures on the exposure of the proposed Wind and solar facility, therefore signifying a worst-case scenario.

It must be noted that the visual exposure of the PV arrays falls entirely within the areas of exposure of the wind turbines.

The result of the viewshed analysis displays the potential areas of visual exposure, as well as the potential frequency of exposure. The frequency of exposure indicates the number of turbines that may be exposed i.e. more turbines may be visible in the darker orange areas than in the yellow areas. Land that is more elevated is typically more exposed to the proposed WEF, whilst lower lying areas such as valleys are shielded, or not as exposed.

The core, uninterrupted area of visual exposure of the wind turbines and PV arrays is likely to be experienced by sensitive receptors within a 5km radius of the structures with a reduced frequency of exposure to the south and north along lower lying drainage lines and perennial rivers. Between 5-10 Km, the visual exposure is still highly concentrated with small pockets of visually screened areas found along Elandskop and Krokodilkop in the east. Frequency of exposure is reduced to the north-west, north and north-east owing to the hilly topography, as well as in the south-west along Boskoppie. It is expected that the wind turbine structures will be highly visible from homesteads within this zone, as well as from portions of the N4, R 33, R36 and various secondary roads traversing the project site.

Additional visual exposure on the undulating plains between 10 – 20km of the turbine structures is largely reduced and concentrated to the west, south-west, south and north and north-east. Visually screened areas are found to the north-west and east. The frequency of visual exposure (number of turbines visible) is reduced somewhat to then north and it is expected that some wind turbines may only be partially visible i.e. mainly the blades. This is due to the hilly topography to thereby largely restricting the visual exposure to the plains beyond these mountains.

The frequency of visual exposure beyond 20km from the turbine structures is expected to subside and may be exposed though it is expected that most turbines will only be partially visible. Visibility of the turbine structures will be scattered throughout this area.

The homesteads and roads expected to be visually influenced are listed below. It should be noted that this section of the report focusses only on the potential visual exposure at varying distances and it does not yet refer to visual impact significance or any correlation thereto.

Less than 5km from the wind turbines:

- Frisgewaagd [4]
- Clercqsvallei
- Welgevonden
- Frisgewaagd
- Drenthe
- Geluk
- Leeukloof
- Blyvooruitsig
- Vogelstruispoort
- Driekop
- Waaikraal
- De Rust
- Wemmershuis
- Bergendal
- Green Pastures
- Moreson
- Weltevreden
- Weltevreden
- Observers travelling along the N4 national road
- Observers travelling along the R33 arterial road
- Observers travelling along the Geluk/Dalmanutha secondary roads

Located within a **5 - 10km radius:**

- Hartebeespruit
- De Kroon
- Connievale
- Rietvlei
- Vlakfontein
- Brakspruit
- Mislukt
- Van Wyksvlei
- Eerstelingsfontein
- Blyvooruitzicht
- Zoekop
- Leeuwbank
- Zoekop
- Outer lying areas of Belfast
- Parts of the Nooitgedacht Dam and Lakenvlei Protected areas
- Observers travelling along the N4 National road
- Observers travelling along the R33 and R36 arterial roads

[4] The names listed here are of the homestead or farm dwelling as indicated on the SA 1: 50 000 topographical maps and do not refer to the registered farm name.

- Secondary roads

Located within a **10 - 20km radius:**

- Du Elsarik
- Winchester
- Vaalkop
- Klipfontein
- Weltevrede
- Elgin
- Lakenvlei
- Elandfontein
- Groenvlei
- Rietvlei
- Zevenfontein
- Sewefontein
- Bloemfontein
- Suikerbosfontein
- Leeuwpoort
- Kwaggafontein
- Hawerfontein
- Berg-en-Dal
- Leliefontein
- Twyfelaar
- Goedehoop
- Blesbokspruit
- Grootpan
- Blesbokspruit
- Parts of the Cecilia, Nooitgedacht Dam, Lakenvlei Protected areas, Paulina van Niekerk PNR and Langkloof PNR
- Southern outlying parts of Siyathuthuka
- Observers travelling along the R33, R36, R541, R540 arterial roads
- Various secondary roads
- Observers travelling along portions of the N4 national road

Located **beyond 20km:**

- Klippan
- Uitvlug
- Vlakplaas
- Nooitgedacht
- Brahmanica Park
- Vaalbult
- Helpmekaar
- Leeupan
- Cecilia PNR
- Observers travelling along the R36, R38, R541 and R540 arterial roads

It is envisaged that the structures, where visible from short to medium distances (e.g. less than 10km), may constitute a high visual prominence, potentially resulting in moderate to high visual impacts.

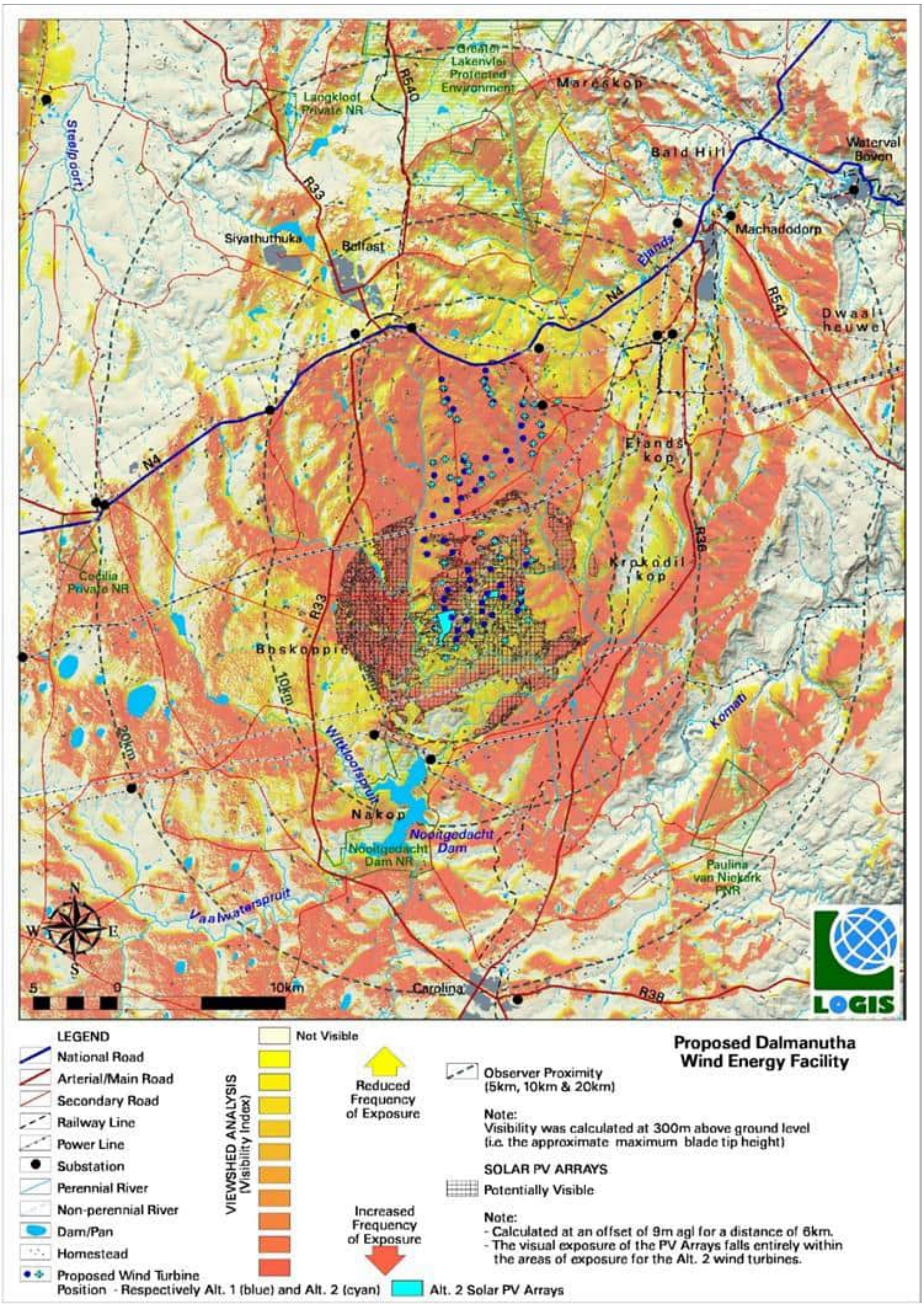


Figure 7-97 - Viewshed analysis for Alternative 2: Dalmanutha Wind and Solar Facility

7.3.8 SHADOW FLICKER

Shadow flicker is an effect which is caused when the shadow of an object repeatedly passes or pulsates over the same point in the landscape. Shadow flicker can be caused by the wind turbines when the sun passes behind the hub or rotor blades of a wind turbine and casts a shadow that continually passes over the same point as the rotor blades of the wind turbine rotate. Shadow flicker only occurs when the sky is clear, and when the turbine rotor blades are between the sun and the receptor.

De Gryse in Scenic Landscape Architecture (2006) notes that “shadow flickering associated with the rotation of the rotor blades has the potential to alter the viewed landscape, and to detract from the experience of people …”. Therefore, the effect of shadow flicker is likely to be experienced by people situated directly within the shadow cast by the rotor blades of the wind turbine. As such, shadow flicker is expected to have an impact on people residing in homesteads located within close proximity of a wind turbine and at a specific orientation, particularly in areas where there is little screening present.

Since the proposed Dalmanutha Wind is located in the Southern Hemisphere it can be expected that shadow flicker will be experienced by sensitive receptors who are predominately located on the southern half of the potential flicker zones, namely to the west, south-west, south, south-east and east following the traction of the sun from east to west. It is expected that the shadow flicker zone of influence will be its greatest early in the mornings and later afternoons when the sun is at its lowest casting a longer shadow.

Shadow flicker may also be experienced by, and impact on motorists, if a wind turbine is located in close proximity to an existing road. It is however expected that the shadow flicker experienced by motorist traveling along roads will be fleeting and not constitute a shadow flicker visual impact of concern.

The impact of shadow flicker can be effectively mitigated by choosing the correct site and layout for the wind turbines, taking the orientation of the turbines relative to the nearby homesteads / roads and the latitude of the site into consideration. Tall structures and trees will also obstruct shadows and prevent the effect of shadow flicker from impacting on surrounding sensitive receptors, however, since this is not a consistent factor or given to occur around any of the structures within the study area it will not be considered in this assessment.

De Gryse found that “most shadow impact is associated with 3-4 times the height of the object. While shadows may extend further than this, they become insignificant in their visual intrusion because of the reduced intensity of the shadow at such distances.” Based on this research, the shadow flicker assessment for the proposed Dalmanutha Wind was undertaken on a likely 70 turbine layout for Alternative 1 and 44 turbine layout for Alternative 2 using a 300m blade tip height. As such, sensitive receptors are considered to be affected where shadows are predicted to occur within 1.2km of a turbine. Therefore, a 1km zone around each turbine has been identified as the zone within which there is a risk of shadow flicker occurring. These zones and turbines located near sensitive receptors have been labelled on **Figure 7-98** and **Figure 7-99**

Alternative 1: Dalmanutha Wind Facility

This study found that twelve (12) turbines labelled 3-5, 17-18 and 24 – 25 and 28, 32 and 33 (shaded in yellow), located adjacent to various secondary roads within the development site are likely to have a shadow flicker impact on motorists using these roads. It is, however, expected that the number of motorists travelling on these roads will be very limited and the level of exposure will be brief, thereby, not constituting a shadow flicker visual impact of concern for these receptors.

Thirteen (13) turbines labelled 1, 2, 7, 8, 10, 11, 12, 19, 27, 35, 38, 44 and 45 (shaded in red), scattered throughout the development site may have a shadow flicker impact on the villages / settlements including the following:

- Bergendal
- De Rust
- Waaikraal
- Vogelstruispoort
- Geluk
- Leeukloof

However, majority, but not all, of these homesteads are located within the farm portions earmarked for the proposed WEF development. It is therefore assumed that these homes are in fact aware of and to a certain extent accepting of the shadow flicker associated with these turbines.

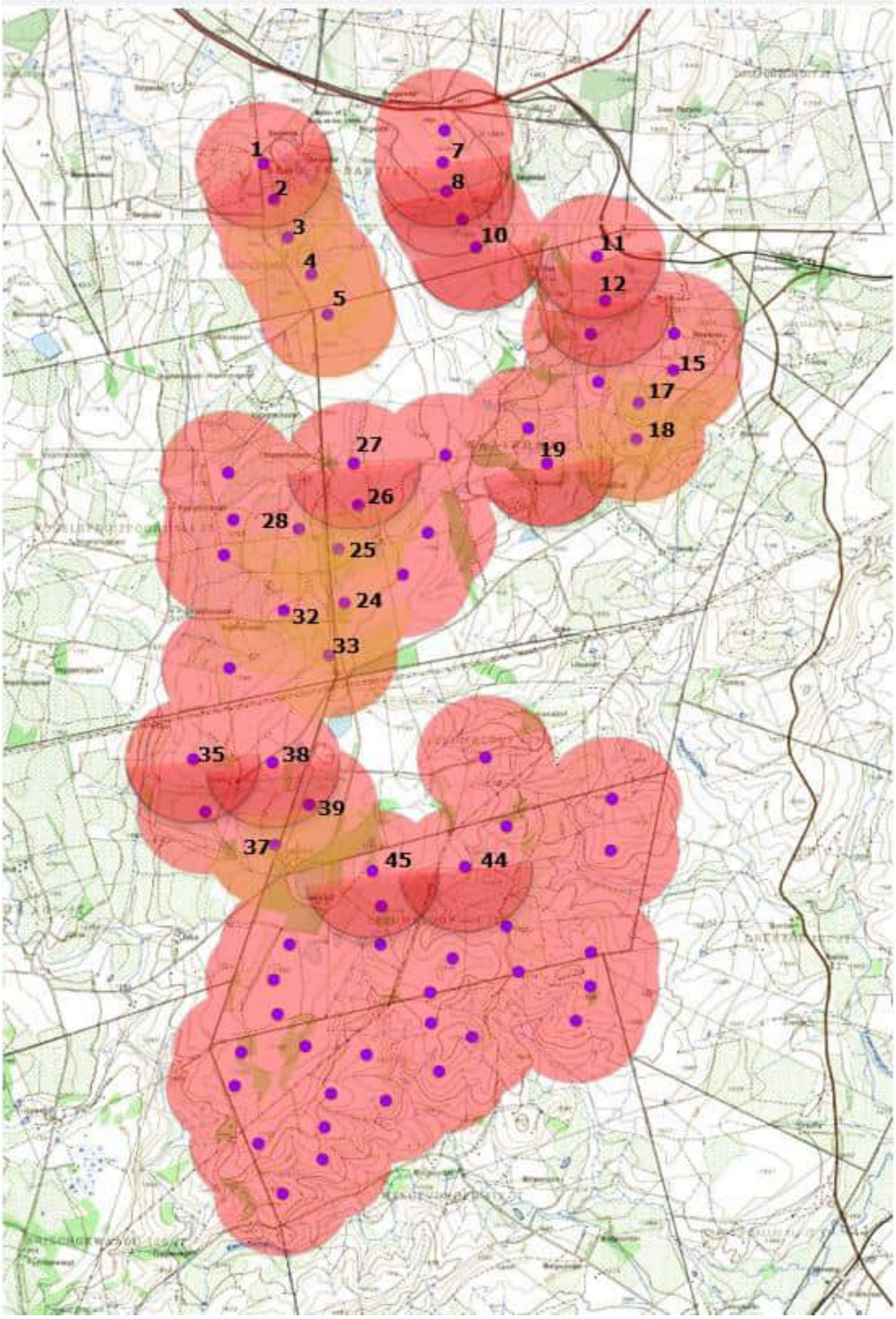


Figure 7-98 - Potential sensitive receptors exposed to shadow flicker for Alternative 1: Dalmanutha Wind facility

Alternative 2: Dalmanutha Wind and Solar Facility

This study found that ten (10) turbines labelled 1-4, 14-16 and 20, 24 and 25 (shaded in yellow), located adjacent to various secondary roads within the development site are likely to have a shadow flicker impact on motorists using these roads. It is, however, expected that the number of motorists travelling on these roads will be very limited and the level of exposure will be brief, thereby, not constituting a shadow flicker visual impact of concern for these receptors.

Thirteen (13) turbines labelled 5, 6, 8, 9-13, 18, 21 ,22, 29 and 39 (shaded in red), scattered throughout the development site may have a shadow flicker impact on the villages / settlements including the following:

- Bergendal
- De Rust
- Waaikraal
- Dalmanutha
- Vogelstruispoort
- Liebenhof
- Welgevonden

However, majority, but not all, of these homesteads are located within the farm portions earmarked for the proposed WEF development. It is therefore assumed that these homes are in fact aware of and to a certain extent accepting of the shadow flicker associated with these turbines. It is recommended that further consultation is undertaken as part of the EIA consultation process with these specific sensitive receptors in order to establish their understanding and concerns regarding this possible impact. Should it be found during the consultation process that the residents of these homesteads are concerned with the impact associated with shadow flicker, it is then recommended that the positioning of the offending turbines be revised or removed.

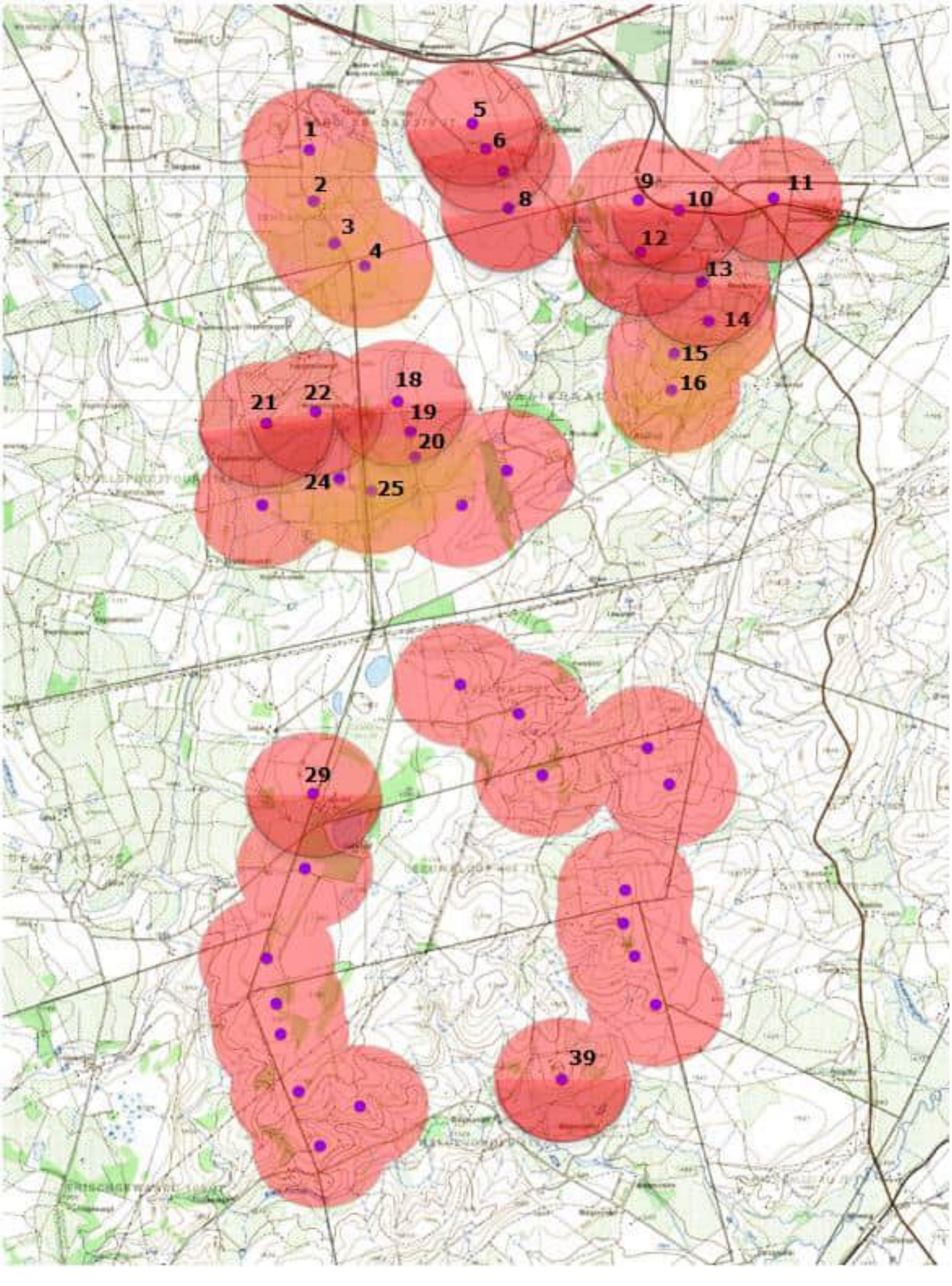


Figure 7-99 - Potential sensitive receptors exposed to shadow flicker for Alternative 2: Dalmanutha Wind and Solar facility

7.3.9 SOLAR GLINT -ALTERNATIVE 2

Glint and glare occurs when the sun reflects off surfaces with specular (mirror-like) properties. Examples of these include glass windows, water bodies and potentially some solar energy generation technologies (e.g. parabolic troughs and CSP heliostats). Glint is generally of shorter duration and is described as "a momentary flash of bright light", whilst glare is the reflection of bright light for a longer duration.

The visual impact of glint and glare relates to the potential it has to negatively affect sensitive visual receptors in relative close proximity to the source (e.g. users of the secondary road), or aviation safety risk for pilots (especially where the source interferes with the approach angle to the runway). The Federal Aviation Administration (FAA) of the United States of America have researched glare as a hazard for aviation pilots on final approach and may prescribe specific glint and glare studies for solar energy facilities in close proximity to aerodromes (airports, airfields, military airbases, etc.). It is generally possible to mitigate the potential glint and glare impacts through the design and careful placement of the infrastructure.

PV panels are designed to generate electricity by absorbing the rays of the sun and are therefore constructed of dark-coloured materials, and are covered by anti-reflective coatings. Indications are that as little as 2% of the incoming sunlight is reflected from the surface of modern PV panels especially where the incidence angle (angle of incoming light) is smaller i.e. the panel is facing the sun directly. This is particularly true for tracker arrays that are designed to track the sun and keep the incidence angle as low as possible.

There are no major roads within a 1km radius of the proposed PV facility. A secondary road is located within 1km of the proposed PV Facility. This approximate distance is recommended as a threshold within which the visual impact of glint and glare (if there is visual line of sight from the road) may influence road users. Furthermore, there are no affected residences within a 1km radius of the proposed PV facility. The potential visual impact related to solar glint and glare on static ground-based receptors (residents of homesteads).

7.3.10 SOCIO-ECONOMIC

SOCIAL OVERVIEW OF THE STUDY AREA

Mpumalanga Province

Mpumalanga Province is located in the north-eastern part of South Africa. The province borders two of South Africa's neighbouring countries viz. Mozambique and Swaziland; and five other South African provinces, namely, Gauteng, Limpopo, KwaZulu-Natal and Free State Provinces. Mpumalanga is characterised by the high plateau grasslands of the Middleveld, which roll eastwards for hundreds of kilometres. It rises towards mountain peaks in the northeast and terminates in an immense escarpment.

Mpumalanga Province covers an area of 76 495km^2 and has a population of approximately 4 335 965. The capital city of Mpumalanga is Mbombela (previously Nelspruit), and other major cities and towns include Emalahleni (formerly Witbank), Standerton, eMkhondo (previously Piet Retief), Malelane, Ermelo, Barberton and Sabie. The province is divided into three district municipalities: Gert Sibande, Ehlanzeni and Nkangala Districts. These three districts are further subdivided into 17 Local Municipalities. The proposed development falls within the Emakhazeni Local Municipality. The

Emakhazeni Local Municipality falls under the Nkangala District Municipality (NDM). The Chief Albert Luthuli local municipality falls under the Gert Sibande District Municipality

Nkangala District Municipality

The NDM is a Category C municipality in the Mpumalanga Province. It is one of three district municipalities in the province, making up 22% of its geographical area. The NDM comprises the Victor Khanye, Emalahleni, Steve Tshwete, Emakhazeni, Thembisile Hani, and Dr JS Moroka local municipalities. The NDM is headquartered in Middelburg. The NDM is the economic hub of Mpumalanga and is rich in minerals and natural resources. The NDM is host to the Maputo corridor, bringing increased economic growth and tourism development potential.

Emakhazeni Local Municipality

The Emakhazeni Local Municipality is strategically located between Pretoria/Johannesburg complex in Gauteng and Nelspruit in Mpumalanga. It is bordered to the north by The Greater Groblersdal and Thaba-Chweu Local Municipalities, forming part of the Limpopo Province and Ehlanzeni District Municipality. Emakhazeni is the gateway to the major tourist attraction points in Mpumalanga and the eastern parts of Limpopo Province. The N4 and Road P81-1 provide links from Gauteng to the major tourism centres in Mpumalanga, specifically the Kruger National Park to the east and Pilgrim's Rest, Graskop, Lydenburg and Hoedspruit to the north-east.

Chief Albert Luthuli local Municipality

The Municipality is located on the eastern escarpment of Mpumalanga Province. The Municipality spans an area of approximately 5,560km2, and according to StatsSA 2016 Community Survey, is home to some 187,630 people, which have increased. The Municipality consists of a diverse society that faces various social, economic, environmental and governance challenges. The rural community faces challenges such as lack of access to services like water, good roads, proper sanitation and access to job opportunities. The urban community, on the other hand experiences challenges such skyrocketing prices for services which cannot be dove-tailed to fit the income levels

National Development Plan

The objective of the NDP relates to the implementation of public employment programmes, with which the municipality aligns to through its Expanded Public Works Programme (EPWP) and the Community Works Programme (CWP) implementation. The municipality also has close working relations with the social partners in ensuring that the locals are prioritized through employment when implementing capital programmes.

Government Outcomes

Cabinet adopted 12 Outcomes within which to frame public-service delivery priorities. Cabinet Ministers accordingly signed Performance Agreements linked to these Outcomes. More detailed delivery Agreements have since been developed to extend targets and responsibilities to National and Provincial Departments, Agencies and Municipalities. Outcome 10 addresses protection and enhancement of environment assets and natural resources. ELM has an Environmental Management Framework which looks to reduce greenhouse gas emissions, mitigate climate change impacts, and improve air quality.

ADMINISTRATIVE CONTEXT

The study area is located within the Emakazeni and Chief Albert Luthuli Local Municipalities, within the Mpumalanga Province. These local municipalities form part of the Nkangala and Gert Sibande District municipalities respectively as outlined in **Figure 7-100** below.

Figure 7-100 - Location of Municipalities within the Mpumalanga Province

DEMOGRAPHIC OVERVIEW

POPULATION

Emakhazeni Local Municipality

Emakhazeni Local Municipality's population increased by 0.4% (47 216 – 48 149) from 2011 to 2016. The total number of households grew from 13 722 in 2011 to 14 633 in 2016, contributing to 3.5% of the number of households in Nkangala (**Table 7-13**). The youth population grew by 1.6% per annum between 2011 and 2016 and forms 39.6% of the total population. **Table 7-13** shows population and household numbers from 2011 to 2019 and the 2030 population projection.

Table 7-13 - Population of Emakhazeni Local Municipality

Key indicators	Census 2011	Community survey 2016	Growth rate 2011-2016	Estimated 2019	Projected 2030
Population number	47 216	48 149	0.4% per annum	48 729	50 917
Household number	13 722	14 633	1.3 % per annum	15 208	17 519

Table 7-14 and **Table 7-15** indicate a slight increase in the Black African population while there is a noticeable decrease in the Coloureds, White and Indian population. Based on in 2011, 87.2% of the population was Black, 10.8% White, 1.2% Coloureds, Indian and Asian 0.7%, and other was 0.2%. The percentages since 2016 have changed to 89.4% Black Africans, 0.6% Coloureds, 0.3% Indian/ Asian and 9.7% Whites.

Table 7-14 - Percentage Distribution of Emakhazeni Municipality by population group -2011

Group	Total	%
Black African	41 168	87.2%
Coloureds	563	1.2%
Indian or Asian	330	0.7%
White	5076	10.8%
Other	79	0.2%
Total	48.149	100%

Table 7-15 - Percentage Distribution of Emakhazeni Municipality by Population Group- 2016

Group	Total	%
Black African	43 025	89.4%
Coloureds	322	0.6%
Indian or Asian	156	0.3%
White	4.646	9.7%
Other	43 025	89.4%
Total	48.149	100%

Chief Albert Luthuli Local Municipality

According to the Chief Albert Luthuli Municipality IDP (2021), the Municipality comprises of 53 480 households. This equates to an average annual growth rate of 0.2% in the number of households since 2011; with an average annual growth rate of 0.2%. 98.0% of households belong to the African population group. The White population group had a total composition of 2% (ranking second). The Asian population group had a total composition of 0.5% of the total households. According to Stats SA (2016 Community Survey - CS), Chief Albert Luthuli's population increased from 186 010 in 2011 to 187 630 people in 2016 – 10th largest population in the province and 16.5% of total population of Gert Sibande in 2016. Population grew by 1 620 in the relevant period and recorded a population growth rate of 0.2% per annum between 2011 and 2016. The population number for 2030 is estimated at more or less 192 952 people given the historic population growth per annum. (0.2% growth per annum).

The number of households in Chief Albert Luthuli increased from 47 705 in 2011 to 53 480 households (almost 6 000 households increase) in 2016 - represents 16% of the Gert Sibande household figure - household size declining from 3.9 to 3.5 in the same period. Youth population (15-34 years) forms 38% of the total population. The share of the female population in 2016 according to the CS was 52.9%. Population movement in the region appears to follow the pattern of economic activity and access to urban

HOUSEHOLDS AND HOUSE TYPES

According to the IDP Emakhazeni Local Municipality (2021), there is a need to prioritise the finalisation of township establishment so people can formally and adequately settle. Approximately 70% of people live in formal dwellings or brick/concrete houses. Traditional dwellings cover 10% of the population. These may be households in rural areas. However, there are still 4% living in an informal settlement and 6% in informal dwellings/shacks in the backyard.

EMPLOYMENT

The unemployment rate of Emakhazeni decreased from 25.92% in 2011 to 23.8% in 2015. In 2015, the unemployment rate was the 7th lowest among all the municipal areas of Mpumalanga. In 2015, the unemployment rate for females was 29.2%, and 19.9% for males. The municipality recorded an unemployment rate of 26.9% in 2017, with the majority of its employed in the mining and transport sectors.

In the Chief Albert Luthuli LM, the high unemployment rate amongst people in the 14 to 64 age group, being the economic productive years, is a noteworthy concern. In 2016 about 36,000 people in this age group were not working (Statistic SA 2016). The unemployment rate in the Municipality is 35,4% and the unemployment rate for young people is alarmingly high at 45%, which is mainly influenced by the lack of economic opportunities in the municipal area. The highest number of unemployed (54%) is in Ward 12 (Ekulindeni area) and the lowest number (20%) is in Ward 21 (Carolina area). Employment in the Municipality increased with 8,600 jobs between 2001 and 2011, and the number of employed individuals is 29 141 (0.12%). The percentage of employment in formal sector was 65.6%, and in the informal sector 21,9% (StatsSA 2016). Unemployment rate (%) 35,4%.

The IDP notes that in terms of future economic development, coal mining can be expected to remain an important sector for the short to medium term. However, the role of this sector is expected to decline in the medium to long term due to limited coal resources, and a move away from a coal-based economy locally and globally due the impact on climate. The current transport and logistics sector is also likely to be impacted on by a decline in coal mining.

EDUCATION

In 2004 around 21% of the population had passed grades 3-6. This percentage decreased to approximately 11% in 2014. **Figure 7-101** indicates that few people have post matric qualifications within the municipality. The implication is that the local community members will not be able to take advantage of job opportunities created by the economic sectors. This has a negative consequence on the payment of municipal rates and socio-economic conditions in the area. The municipality should then speed up the process of the establishment of a Technical and Vocational Education and Training (TVET) Campus. This campus will assist a great deal as it will focus on technical skills needed as the main economic activities relate to mining and trade.

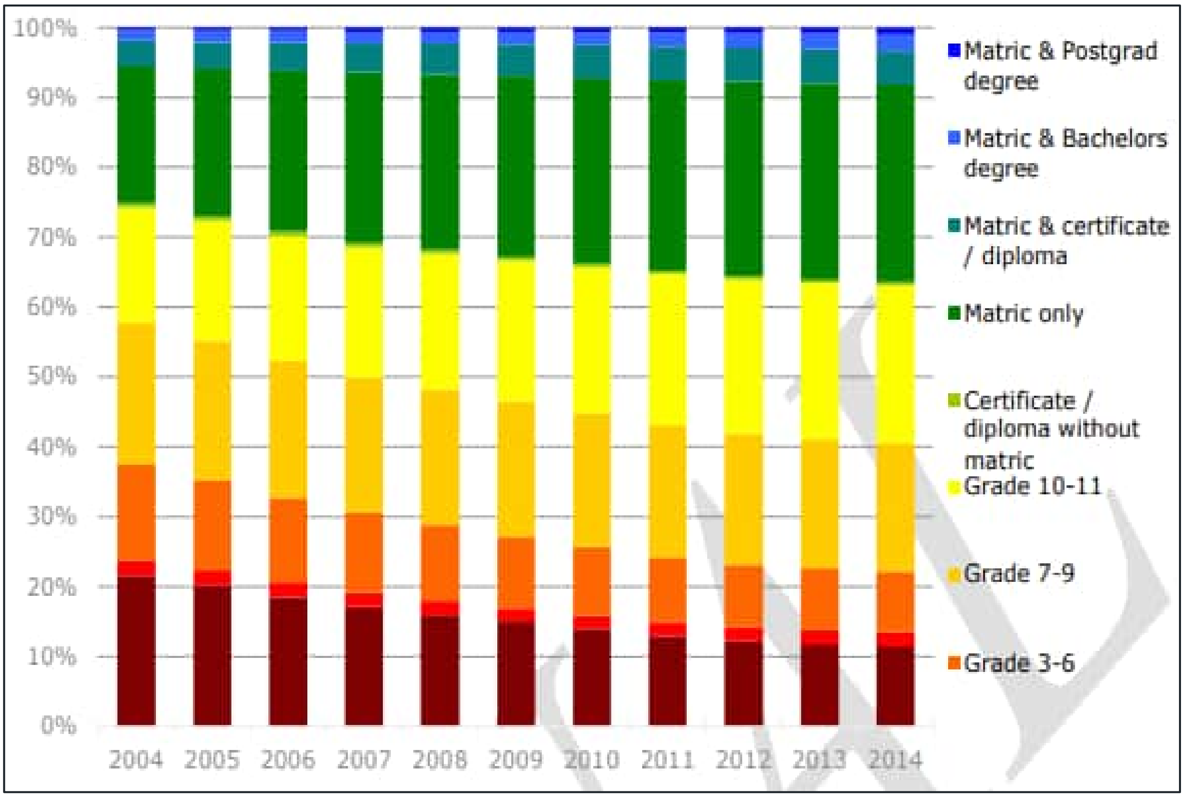


Figure 7-101 - Educational attainment for Emakhazeni Local Municipality from 2004 to 2014

Chief Albert Luthuli Municipality is predominantly a municipality whose population does not have tertiary education. Of the total population of the area; only 5% has university degree qualification; 33% have matric, 30% with some secondary education. 15% of the population has primary education, and 15% do not have any education. According to the 2016 CS of Stats SA the population in Chief Albert Luthuli aged 20+ completed grade 12, increased from 31 122 in 2011 to 38 131 (increase of 7 009) in 2016 – an increase of 22.5% in the relevant period. Chief Albert Luthuli's grade 12 pass rate decreased from 80.9% in 2016 to 79.0% in 2017 which was the 7th highest of the municipal areas of the province. The area achieved an admission rate to university/degree studies of 28.6% in 2017. The challenge is to accommodate the educated young people in the area – a matric is no "ticket" to a job in the labour market – employability of the youth. Provision of adequate educational, recreational infrastructure and skills development to meet the needs of the community. The **Figure 7-102** below outlines the education profile of the municipality.

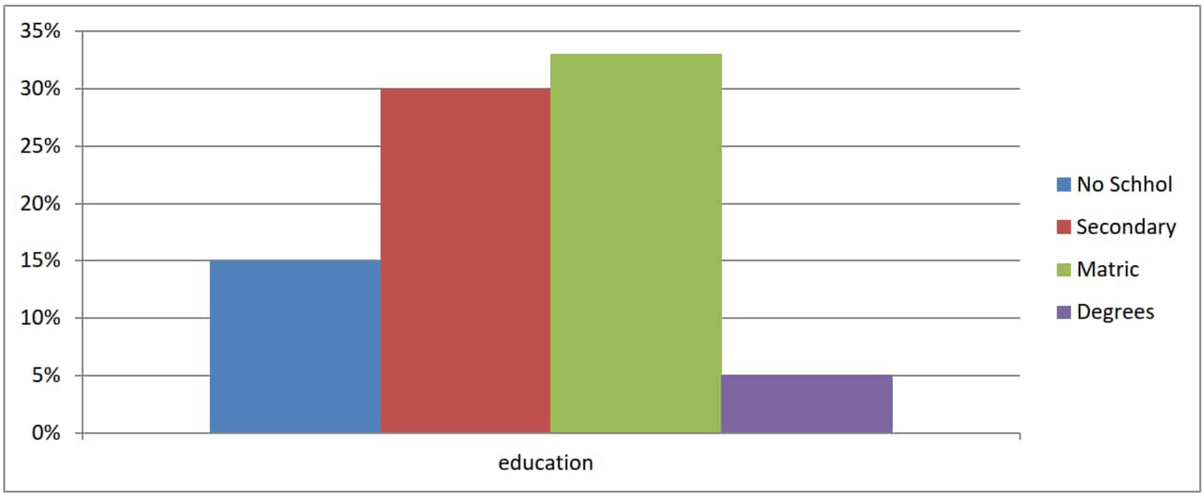


Figure 7-102 - Education profile of Chief Albert Luthuli LM (Stats SA 2016)

MUNICIPAL SERVICES

ELECTRICITY

Figure 7-103 below represents the percentage of households with access to electricity in the Emakhazeni municipality and other energy sources.

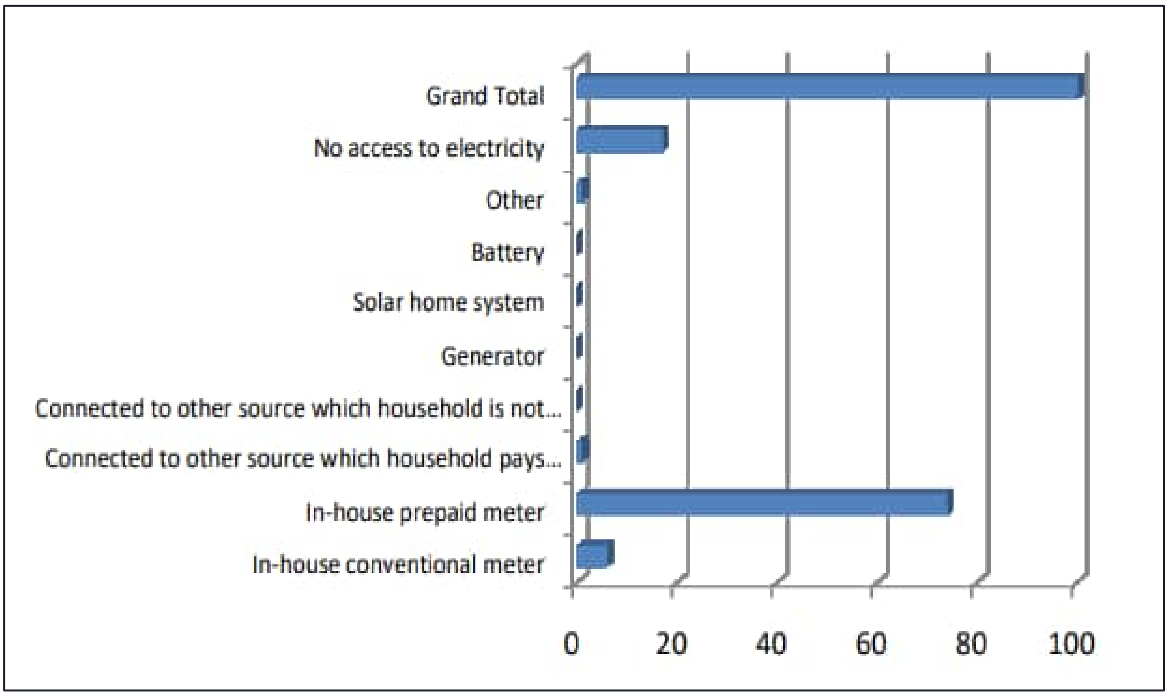


Figure 7-103 - Percentage of household access to electricity in the Emakhazeni LM

Access to electricity is measured on whether a household has access to electricity for cooking, heating, and light. Most households have access to electricity for lighting purposes. However, less than half of the population in Chief Albert Luthuli LM has access to electricity for heating and cooking purposes.

Figure 7-104 indicates the areas in Chief Albert Luthuli LM where households have no access to electricity for lighting purposes. Areas, where more than 50% of households have no access to electricity for lighting, include Empuluzi, Dundonald, Elukwatini, Nhlazatje and Tjakastad.

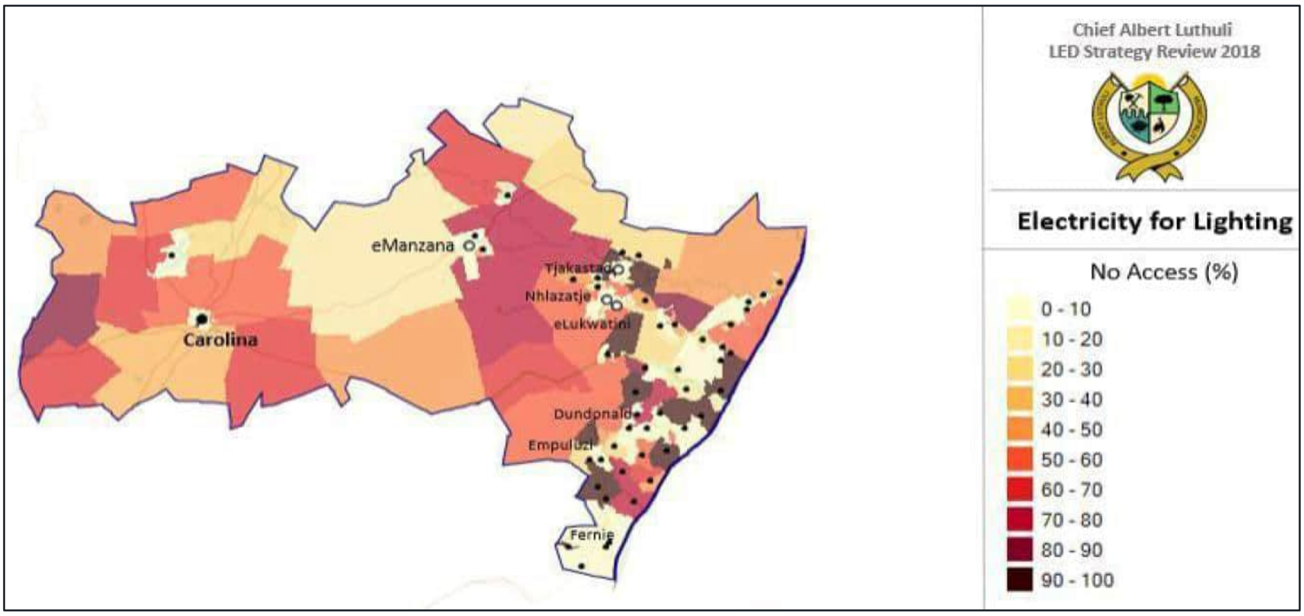


Figure 7-104 - Access to electricity in the Chief Albert Luthuli LM (Statistics South Africa, 2011 via MapAble, 2017

ACCESS TO WATER

According to the Chief Albert Luthuli IDP (2022), 23% of the households in all three study areas have access to water inside their dwellings. Compared to the District and Province, Chief Albert Luthuli LM has a significant number of households with no access to piped water. The areas that have the highest proportion of households with below basic access to water or no access to water are in the eastern areas. These areas also coincide with the areas which have lower levels of access to electricity.

The eMakhazeni Local Municipality had a total number of 6 640 (or 45.46%) households with piped water inside the dwelling, a total of 5 010 (34.27%) households had piped water inside the yard and a total number of 2 010 (13.78%) households had no formal piped water.

SANITATION

Less than 20% of households have access to toilets while 21% of households have access to flush toilets, while the majority of households use a pit latrine with ventilation (38%). In 2011, Chief Albert Luthuli LM had 473 households still using the bucket system.

The eMakhazeni Local Municipality had a total number of 10 900 flush toilets (74.47% of total households), 469 Ventilation Improved Pit (VIP) (3.21% of total households) and 1 510 (10.34%) of total households pit toilets.

REFUSE COLLECTION

In Chief Albert Luthuli LM, only 23 % of households have their refuse removed by the local authority at least once a week. The relatively higher percentage that dispose of their waste at their own dump reflects the rural nature of the area and the difficulty of providing municipal services to areas located at a distance from the main towns in the area.

According to the eMakhazeni LM IDP (2021), the refuse removal by the municipality has dropped since 2011 census. eMakhazeni Local Municipality had a total number of 9 730 (66.61%) households which had their refuse removed weekly by the authority, a total of 396 (2.71%) households had their refuse removed less often than weekly by the authority and a total number of 3 620 (24.79%) households which had to remove their refuse personally (own dump).

ECONOMIC OVERVIEW

In 2014, the eMakhazeni Local Municipality achieved an annual growth rate of 1.26% which is a significant lower GDP growth than the Mpumalanga Province's 2.65%, but is lower than that of South Africa, where the 2014 GDP growth rate was 1.55%. Similar to the short-term growth rate of 2014, the longer-term average growth rate for eMakhazeni (2.46%) is also slightly lower than that of South Africa (2.94%). The economic growth in eMakhazeni peaked in 2010 at 7.96%.

Farming is the dominant economic activity in the eMakhazeni area occupying the largest part of the physical area. Small towns serve as service centres to the agricultural sector. The most dominant activities in the area include field, horticultural, animal husbandry, forestry and some fishing. Agriculture generates and inter-regional income and has a high multiplier effect in the local economy. Belfast, Dullstroom, Machadodorp and Waterval-Boven act as service providers to the surrounding rural areas and provide social services as well as farming and household necessities to the farmers and farm workers in the region.

The main economic driver in the Chief Albert Luthuli Municipality is Community Services Sector, in the form of the various government departments that are the main employers, the Municipality included. The Retail Sector is another key economic driver in the Chief Albert Luthuli Municipality. There are shopping precincts in Carolina, at The Crossing (Elukwatini), Emanzana, and Mayflower/Fernie. These retail chains contribute towards job creation and food security. The Retail Sector is another key economic driver in the Chief Albert Luthuli Municipality. There are shopping precincts in Carolina, at The Crossing (Elukwatini), Emanzana, and Mayflower/Fernie. These retail chains contribute towards job creation and food security

7.3.11 RISK AND SAFETY

A high-level Safety Health and Environmental Risk Assessment was conducted by ISHECON for the proposed Solid-State Lithium (SSL) or Vanadium Redox Flow (VRF) BESS systems at the proposed Dalmanutha facility

Two battery technologies will be considered for the proposed BESS they are Lithium-ion and Vanadium Redox Flow batteries. The safety and health risks associated with vanadium redox flow batteries will likely be lower than for the lithium-ion battery type for both employees and members of the public outside the facility.

Lithium batteries pose a higher fire and explosion risk as well as the possibility of generating noxious smoke under these circumstances. However, they are easier to install, i.e., containers as opposed to formal brick and mortar structures, and probably will not require as many permanent staff as vanadium redox utility scale operations. The environmental risks of aquatic contamination with the vanadium type batteries will likely be higher than for solid state batteries, due to the presence of liquids.

As lithium batteries pose a possibility of generating noxious smoke, there may be a need to slightly adjust the proposed location the Dalmuntha West WEF BESS installation to mitigate the risks of noxious smoke from possible fires on near-by facilities, i.e., ideally the BESS facilities should be 500m from the closest farmsteads / private businesses etc. Similarly, in choosing between the northern, central and southern locations of the Dalmuntha WEF, the central option present lower SHE RA risks as it is further from farmhouses while still be accessible for emergency response. **Figure 7-105** below outlines the alternative BESS sites in relation to the nearby occupied farmhouses.

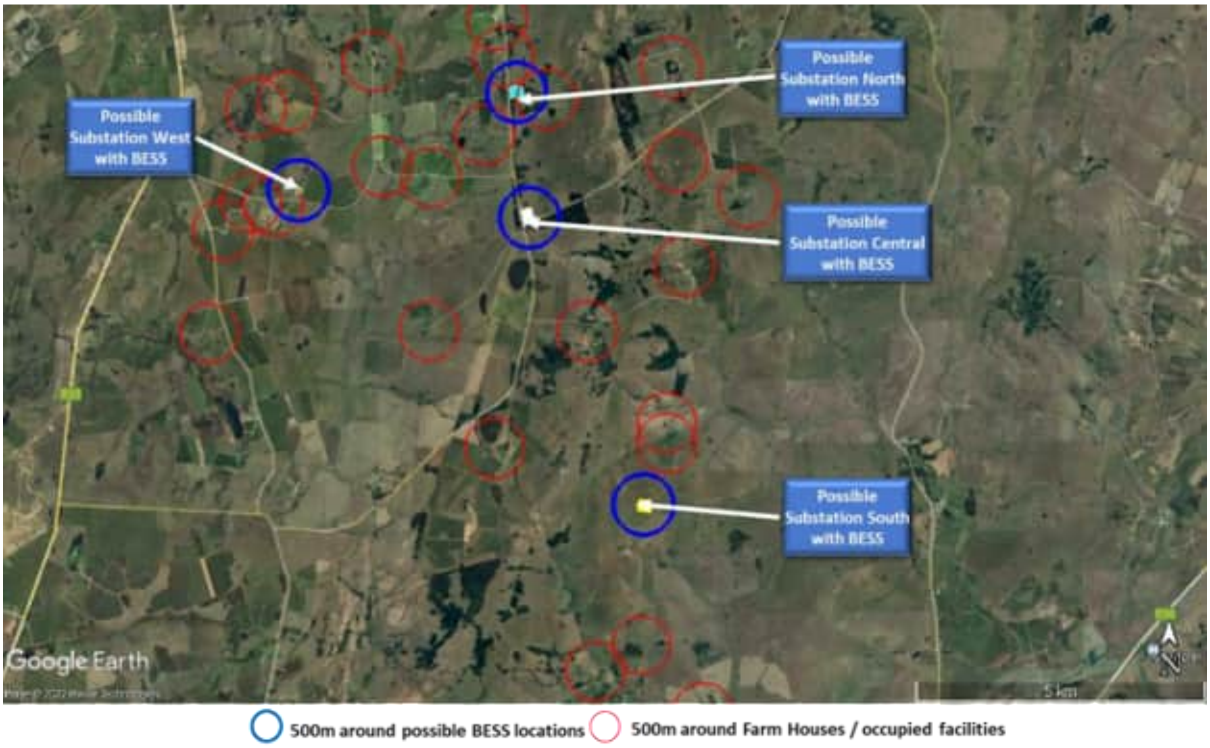


Figure 7-105 - Possible BESS locations for Dalmanutha WEF in relation to occupied farmhouses

VANADIUM REDOX FLOW BATTERY HAZARDS

Hazard – Toxicity and Corrosivity

The electrolyte in the VRF system is corrosive. It is composed of a sulphuric acid-based solution similar to common automotive lead acid batteries. Unlike traditional lead-acid batteries, VRBs do not include lead. Therefore, VRBs do not have the toxicity issues of lead that conventional car batteries have. The only potential source of human toxicity in a VRB is Vanadium.

Vanadium in various physio-chemical states can have a relatively high aquatic and human toxicity. Acute oral exposure to high doses can lead to haemorrhaging, while chronic exposure leads to adverse effects on the digestive system, kidneys and blood (diarrhoea, cramps etc.).

Inhalation hazards lead to irritation of the respiratory tract, bronchospasm, pulmonary congestion. There is little evidence that vanadium compounds are reproductive toxics or teratogens. There is also no evidence that it is carcinogenic (Source USA EPA Risk Assessment Information Systems, Toxicity Profiles, Vanadium 1998).

In the electrolyte the concentration levels of Vanadium are so low that when it is mixed into liquid form in the final product and put into operation, the VRB is deemed non-toxic. In addition, VRBs have a lower concentration of sulfuric acid than traditional lead-acid batteries. Vanadium poses a hazard when it is in powder form, i.e. when making up the electrolyte solution. The Camden facilities will purchase electrolyte already made up and there will be no solid vanadium powder on site.

Toxicity or corrosion risks may be present from off-gassing produced by over-heating aqueous or vaporized electrolytes. In addition, flow batteries in fire scenarios may generate toxic gas from the combustion of hydrocarbons, plastics, or acidic electrolytes. Refer to sections on fire below for mitigation measures.

Hazard – Electrical Shock/Arc

Electrical shock presents a risk to workers and emergency responders, if the energy storage system cannot be “turned off”. This is referred to as “stranded energy” and presents unique hazards. Arc flash or blast is possible for systems operating above 100 V. Li-ion systems operate from 48 - 1000 V, depending on the battery design.

In the area of shock hazard, a flow battery produces voltage only when electrolytes are in a cell stack. For most designs, if the motors are turned off and fluids drained from the cell stack, then the cell stacks have no measurable voltage at the terminals. This happens not only when the battery is forcible turned off but also in the standby mode as vanadium batteries do not include any metal plates to hold the chemical reactions / charges / voltages and can be fully drained when not in use.

If not fully drained, vanadium flow batteries are also unique in terms of short circuiting in that the internal dynamics of the battery are such that the energy discharge is limited to the fluid in the battery at any given time and the is typically less than 1% of the total stored energy. Therefore, together with the relatively low energy density of the vanadium electrolyte, the immediate release of energy, which occurs as a result of electrical shorting, is somewhat limited. The high heat capacity of the aqueous electrolyte is also beneficial in limiting the temperature rise.

Vanadium flow batteries have been tested under dead-short conditions resulting in normal operation with no danger to either equipment or personnel.

Hazard – Fire / Deflagration

Over 50% of the electrolyte solution is made up of water, which gives the electrolyte a non-flammable property. In the event of short circuiting, intense heat or high pressure, it is unlikely for the battery to catch fire. There is no “thermal runaway” risk when compared to other battery technologies.

Whilst some heat may be discharged from the battery, it will not be at a level that is deemed unsafe. Like all other RFBs, VRFs also have a battery management system. A battery management system ensures optimum and safe conditions for battery operation. Often a heat management system is integrated to avoid too high or too low temperatures.

Hazard - Hydrogen Generation

As with all other aqueous batteries, aqueous energy storage media from redox flow batteries are also subject to water limitations. In case of too high voltages or more precisely too high or too low half-cell potentials, the water is decomposed into its components, hydrogen and oxygen. The generation of hydrogen in particular is often present as a very small but undesirable side reaction and causes a charge carrier imbalance between positive and negative half-cells, which leads to a slow loss of capacity. It also presents a fire / explosion hazard.

With VRF, due to the flowability of the energy storage medium, the reaction products that would normally remain in the half-cell can be transported out of the cell and stored in separate tanks thus allowing the capability for a higher capacity than that attainable with conventional batteries. In addition, any deviations from safe operating parameter will trigger the shutdown of the system pumps ceasing to charge the electrolyte and thereby reducing the changes of accidental H2 generation. In addition, the thermal mass of the electrolyte tanks can provide an additional barrier to overcharging conditions by allowing ambient temperature during the discharge times to cool the VRF for the next charge cycle.

Hazard – Waste Electrolyte

Unfortunately, pentavalent vanadium ions have a tendency to react with each other, which leads to the formation of larger molecules which precipitate as solids and can thus damage the system. The reaction depends on the temperature and the concentration of VO2+ (state of charge) but is also a function of the proton concentration. Temperature and concentrations therefore need to be controlled within specified ranges.

Should the concentration of undesirable components increase in the electrolyte, a part may need to be purged and replaced with fresh electrolyte.

Hazard - Electrolyte Leaks

Leaks must be expected in any hazardous-fluid handling equipment. Secondary containment is typically designed into the system and standard corrosive PPE is required for handling liquid. Reliable leak detection, annunciation, and containment is paramount.

As with any chemicals plant a suitable design with detection, alarm and trip instrumentation that has been subject to thorough Hazop study should be in place, e.g. detection of dry running of pumps, detection of dead heading of pumps, prevention of reverse flow, detection of drop in tank levels etc.

SOLID STATE LITHIUM BATTERY CHEMICAL HAZARDS

Hazard - Thermal Decomposition

Upon heating of the contents of a battery due to shorting, contaminants, external heat or exposure to water and reaction heat, the lithium salts in batteries begin to break down exothermically to release either oxygen (oxidants) that enhances combustion, possibly leading to explosion, or fumes such as hydrogen fluoride or chlorine that are toxic.

These exothermic break down reactions are self-sustaining above a certain temperature (typically 70 deg C) and can lead to thermal run away. In this process the battery gets hotter and hotter, the decomposition reactions happen faster and faster and excessive hot fumes are generated in the battery. Eventually the pressure in the battery builds up to the point where those gases need to vented, usually via the weakest point in the system. These vented fumes can be flammable due to vaporization of the electrolyte and can ignite as a flash fire or fire ball (if large amounts) leading to the fire spreading to any surrounding combustible materials, e.g. plastic insulation on cables, the electrolyte, the electrodes and possibly even the plastic parts of the battery casing etc. If the vented flammable vapours do not ignite immediately, they can accumulate within the surrounding structures. If this flammable mixture is ignited later, e.g. due to a spark, this can lead to a violent explosion of the module, cabinet, room, container etc. In addition to being flammable the vented gases will contain toxic components. These could include:

- The products of combustion such as carbon dioxide/monoxide, hydrogen cyanide
- VOCs like benzene and ethylene,
- Decomposition products such as hydrogen fluoride, hydrogen chloride, phosphorous pentafluoride, phosphoryl fluoride and oxides of aluminium, cobalt, copper etc.

The temperature in the batteries and of these vented gases can be extremely high, e.g. > 600 deg C.

In the situation where oxygen is released internally as part of the decomposition (e.g. lithium perchlorate) the oxygen is available to react with the combustible electrolyte and if all this happens extremely fast in a self-sustaining manner within the confines of the device, an explosion of the device can result.

Hazard - Propagation

A BESS is composed of individual batteries which are combined into different size packs such as modules, racks. The very high temperature generated by one battery cell in thermal run away could lead to overheating of adjacent cells. This cell in turn then starts thermal decomposition and so the process propagates through the entire system. In order to prevent propagation, there are separation requirements between cells, modules etc. Separation could be with physical space or insulating materials etc.

Hazard - Electrolyte Leaks

Although extremely unlikely due to the structure of the batteries, should electrolyte liquid leak out of the batteries, it can be potentially flammable as well as corrosive etc. If ignited as fire, or explosion, the smoke would contain toxic components. If unignited it can still be extremely harmful especially if its decomposition products include hydrofluoric acid.

OTHER CHEMICALS OR HAZARDS

The BESS is composed not only of the batteries. There are electrical connections, switches, power converters, cooling systems etc.

Cooling Systems

Due to the need to keep the batteries within a specified temperature range most of the containerized modular system have built-in air-conditioning systems while the VRF building systems may have cooling water systems. Some have only fans for air cooling with filters to remove dust prior to cooling. Others, particularly those in hot environments requiring more cooling, may have refrigerant-based systems. These would have a refrigerant circuit usually containing non-flammable non-toxic refrigerant such as R134a (simple asphyxiant) etc as well as a low hazard circulating medium such as an ethylene glycol-based coolant. At high temperatures above 250 deg C R134 may decompose and may generate hydrogen fluoride and other toxic gases. Ethylene glycol is really only harmful if swallowed. In the environment it breaks down quickly and at low concentrations that would typically occur from occasional small spills, it has no toxicity.

Fire Suppression Systems

Although these are only effective for some fire scenarios, some of the solid-state containerized systems come fitted with “Clean agent” fire suppressant systems. These are pressurized containers of powder/gases that are released into the container to snuff a fire and do not leave a residue on the equipment.

Some containers have water sprinkler systems installed to quench thermal run-away reactions.

VRF batteries do not present a high fire risk. However, on any chemical plant there is always the risk of fires with electrical equipment and other materials used on site. Fire systems would typically consist of local strategically placed extinguishers as well as a fire water hose/hydrant system.

In general fire fighters may respond with water cannons/hydrants, foam systems etc. Such responses may generate large amount of contaminated and hazardous water runoff. A system to contain as much of this as possible should be in place.

General Electrical and Electronic Equipment

Whatever the configuration of the battery containers/ buildings there will be electrical and electronic equipment in the battery compartment, the battery building as well as outside. In some installations the main electrical equipment such as the power conversion system is in a separate compartment separated by a fire wall. In others it can be in a separate container. Wherever there is electrical equipment there is a possibility of shorting and overheating and fire.

8 SITE SENSITIVITY VERIFICATION

The following section outlines the sensitivities identified by the DFFE National Screening tool in relation to that of the Specialists scoping studies for the relevant disciplines.

8.1 AGRICULTURE

Figure 8-1 and **Figure 8-2** illustrates the agricultural theme sensitivity from the screening report generated for both project alternatives.

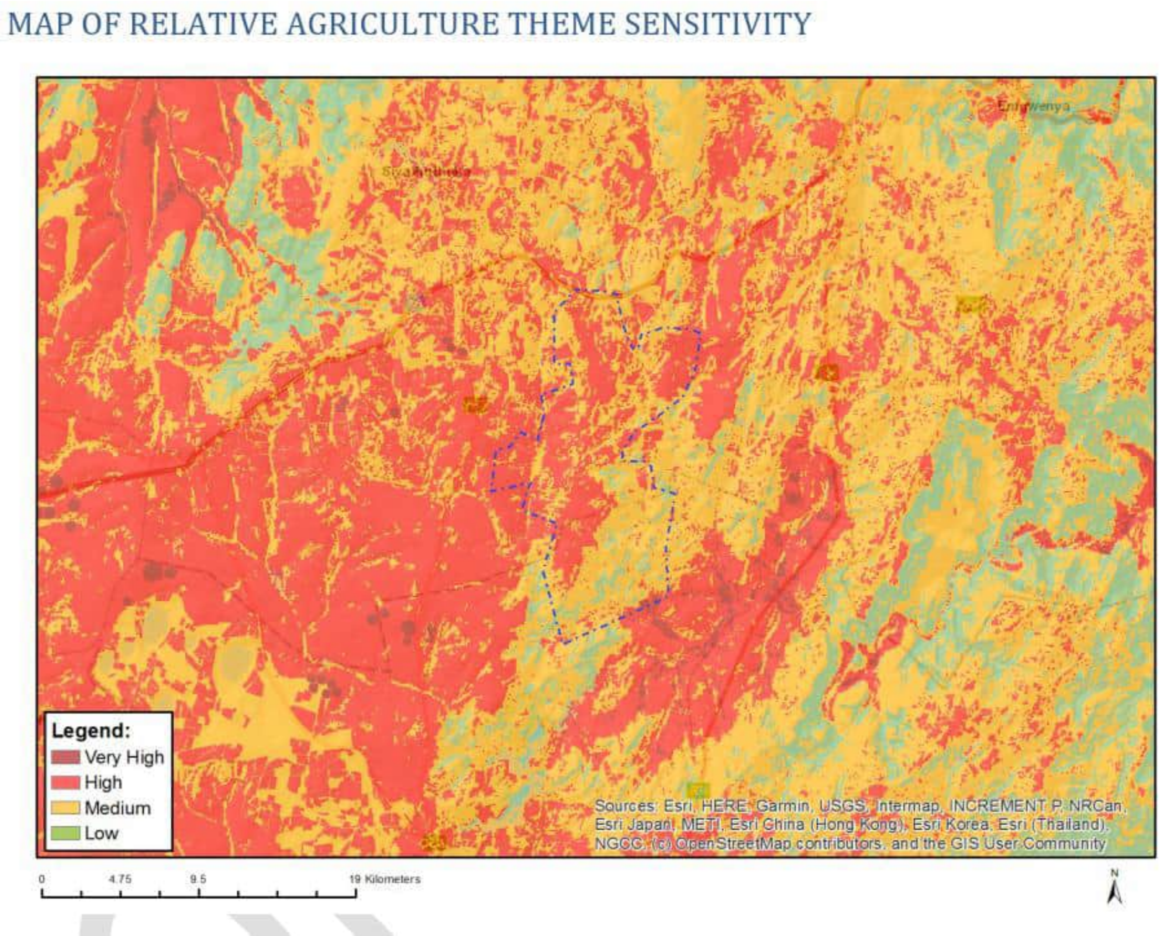


Figure 8-1 - DFFE agricultural theme sensitivity-Alternative 1

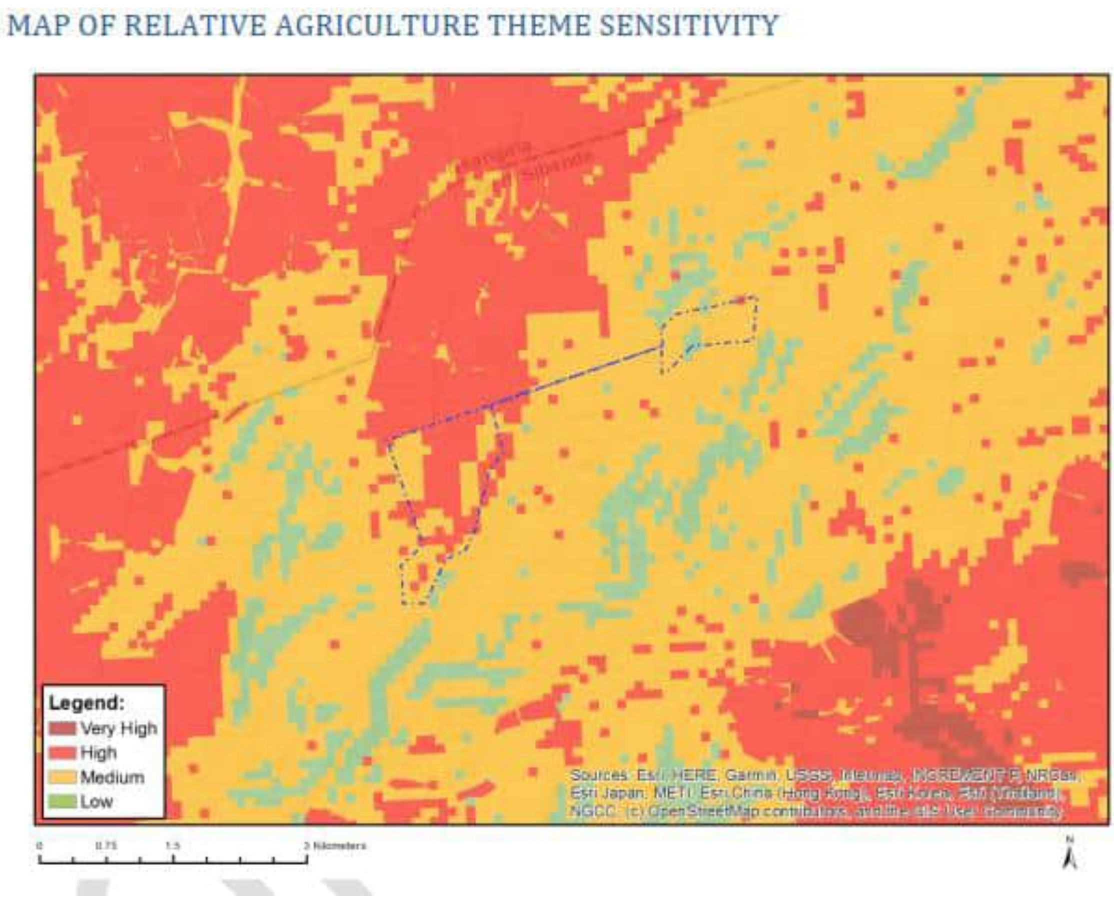


Figure 8-2 - DFFE agricultural theme sensitivity-Alternative 2

The project site areas were allocated agricultural sensitivities in accordance with **Table 8-1** for both project alternatives (see **Figure 8-1** and **Figure 8-2**). The identified 'No-Go' areas include the rivers running through the site (typically underlain by permanently saturated Katspruit soils), wetlands (WSP, 2022a) and associated 50m buffers. The areas around the watercourses were assigned a 50m buffer – as opposed to a more typical 100m buffer – as the terrestrial (dry) soils appear to start close to the edges of the watercourses in the area.

Table 8-1 - Sensitivity Classes

Sensitivity	Areas	Permitted
No-go	Wetlands and buffers	Linear infrastructure such as cabling and powerlines may traverse the areas if essential. Turbine and hardstanding areas are not allowed.
High	Cultivated areas	Linear infrastructure such as cabling and powerlines are allowed. Turbines and hardstanding area not allowed and roads should be limited as far as possible.
Low	Areas of rock and non-arable soils	Turbine, solar PV, hardstanding and road development is allowed.

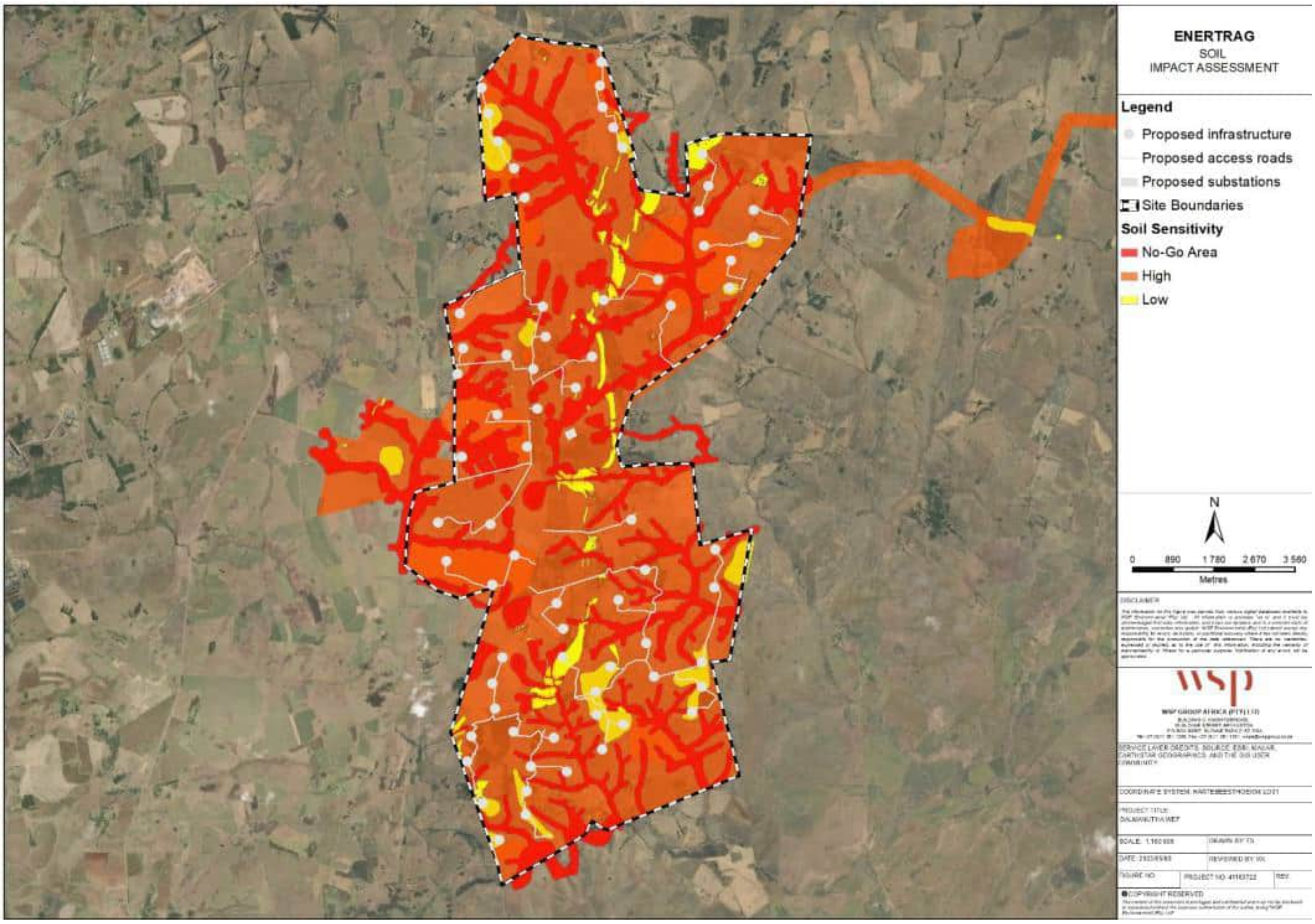


Figure 8-3 – Dalmanutha soil sensitivity -Alternative 1

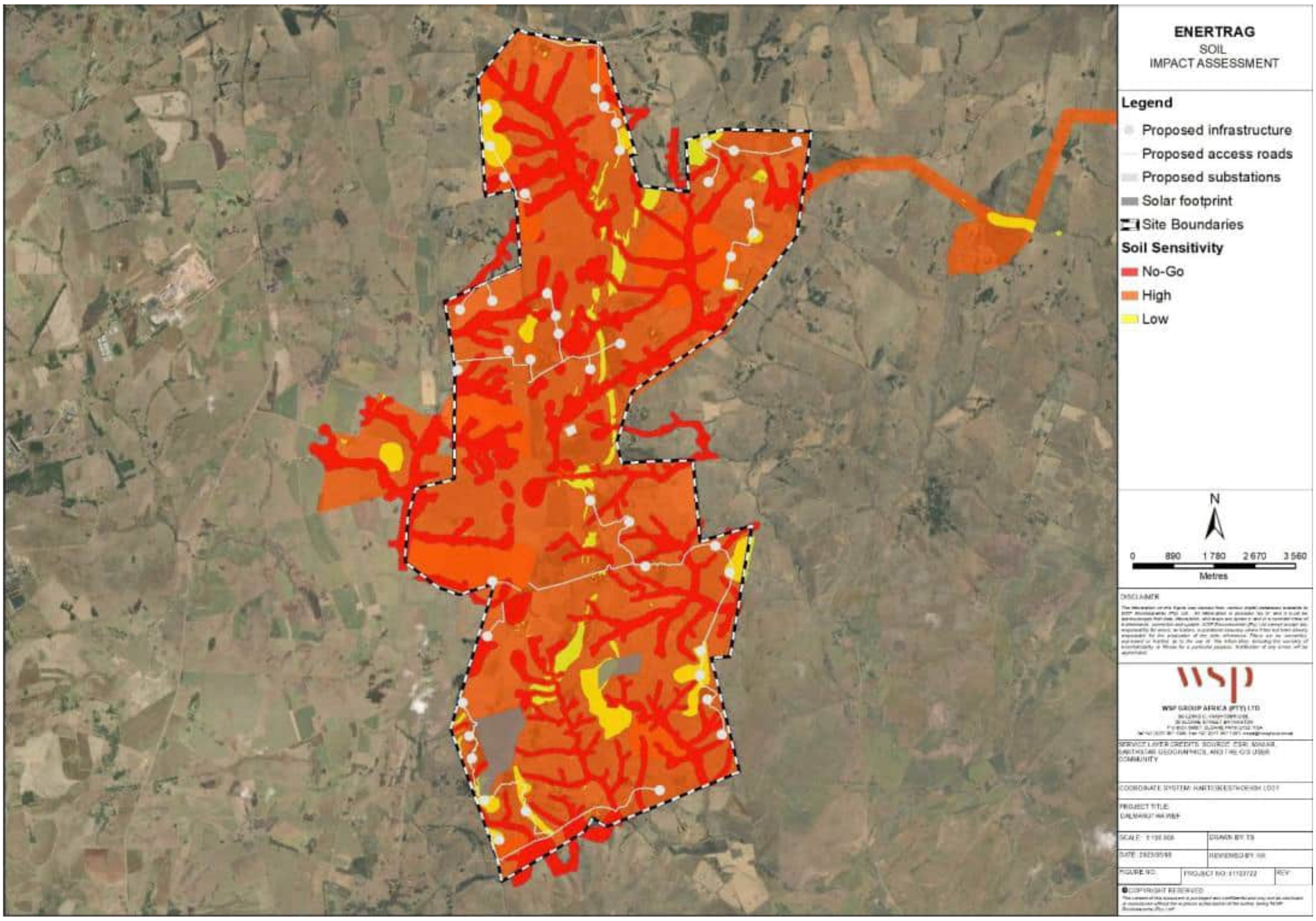


Figure 8-4 – Dalmanutha soil sensitivity -Alternative 2

The DFFE 2021 land sensitivity database shows that the Dalmanutha site comprises mainly a combination of high and medium agricultural sensitivity areas, with small areas of low sensitivity. For the purposes of the study, the areas of the site underlain by arable soils (Shortlands and Clovelly) and those that have been cultivated have been considered high sensitivity areas (see **Figure 8-1** and **Figure 8-2**). Very limited development is typically allowed on agricultural land as the major agricultural concern for any development is the loss of high potential agricultural land and there is already a shortage of arable land available in South Africa. What is available is under threat from competing land uses, leading to a cumulative loss of arable land across the country. Further to this, subdivision of land may create portions that are too small to be agriculturally economically viable. The Department of Agriculture, Forestry and Fisheries (DAFF) thus limits the portion of agricultural land that can be utilised for renewable energy development to 10%. In the case of wind energy however, there is often overlap between where high wind energy resources and high potential agricultural land occur. Wind and agricultural farming can often exist on the same piece of land as the disturbance footprint of a wind farm is typically small (CSIR, 2015). At Dalmanutha this is also the case for solar infrastructure.

The remainder of the site has been considered to comprise low sensitivity areas, underlain by the very shallow Glenrosa and Mispah soils and the duplex Valsrivier soils. Again, the soils information has been augmented with vegetation information (WSP, 2022b) such that the rocky grassland, alien trees, transformed land and infrastructure areas are also considered low sensitivity areas.


8.2 ANIMAL SPECIES

Figure 8-5 and **Figure 8-6** illustrates the animal species theme sensitivity from the screening report generated for both project alternatives.

MAP OF RELATIVE ANIMAL SPECIES THEME SENSITIVITY

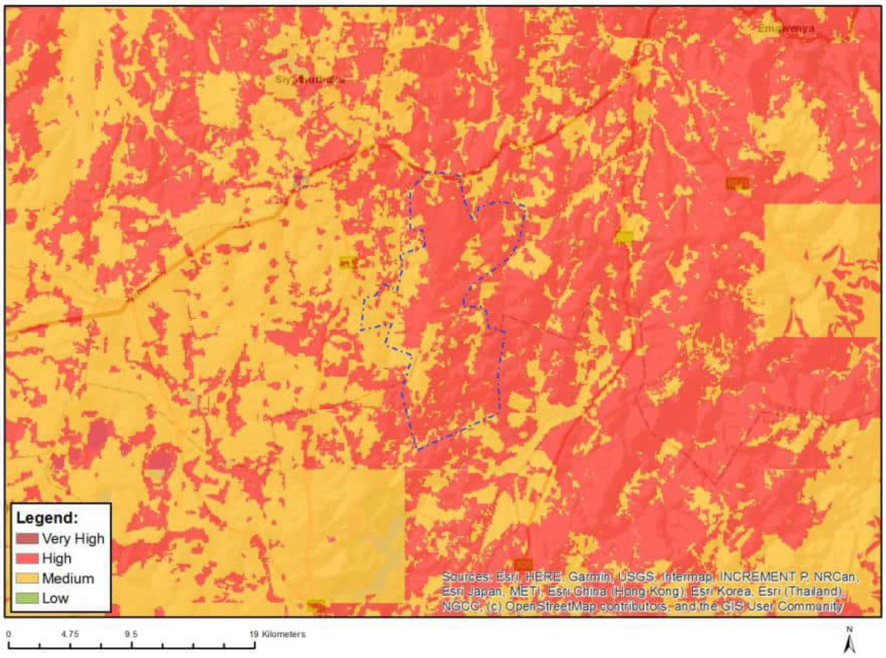


Figure 8-5 - DFFE animal species theme sensitivity-Alternative 1

MAP OF RELATIVE ANIMAL SPECIES THEME SENSITIVITY

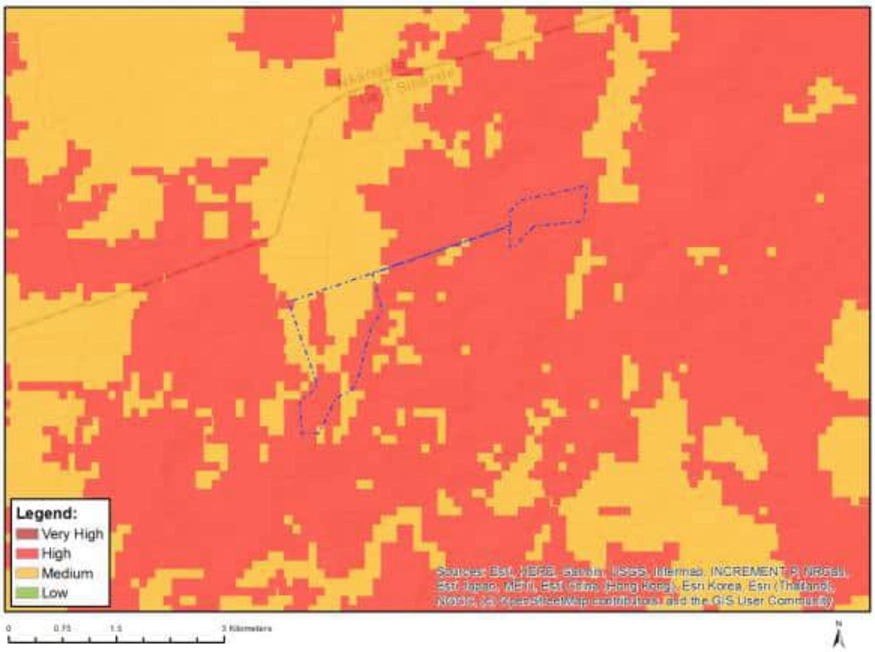


Figure 8-6 - DFFE animal species theme sensitivity-Alternative 2

The DFFE screening report identified the animal theme as high-medium, with mostly listing avifaunal species. According to the specialist study (**Appendix H-14**), the northern region is mostly of High-medium sensitivity. Mostly bird species are listed, including: Black-rumped Buttonquail; Southern Bald Ibis; Secretary bird; Wattled Crane; Denham's Bustard; Yellow-breasted Pipit; African Marsh-Harrier; and White-winged Flufftail. The southern region has bird species listed, including: Bush Blackcap; Southern Bald Ibis; Black-rumped Buttonquail; Denham's Bustard; Wattled Crane; Yellow-breasted Pipit; African Marsh-Harrier; and Secretary bird.

The specialist has confirmed that the northern region is more sensitive due to the bird species identified on site and though various communications with Geoff Lockwood, the Resident Manager at Delta Environmental Centre. The specialist work on site confirms that the site is of Medium to High sensitivity for avifauna. They have confirmed the presence of most of the above listed bird species on site, exceptions being African Marsh-Harrier and White-winged Flufftail.

The remainder of the sensitivity pertains to the fauna on site, where the screening tool identified parts of the site as having a high-medium sensitivity in primary and secondary grasslands, wetlands, the Terrestrial fauna report (**Appendix H-14**) concurs with this sensitivity. Evidence of presence of fauna SCC including Cape Mole Rat (*G. capensis*), grey rhebuck (*P capreolus*) and southern mountain reedbuck (*R. fulvorufula fulvorufula*).

8.3 AQUATIC BIODIVERSITY

Figure 8-7 and **Figure 8-8** illustrates the aquatic biodiversity theme sensitivity from the screening reports for both site alternatives.

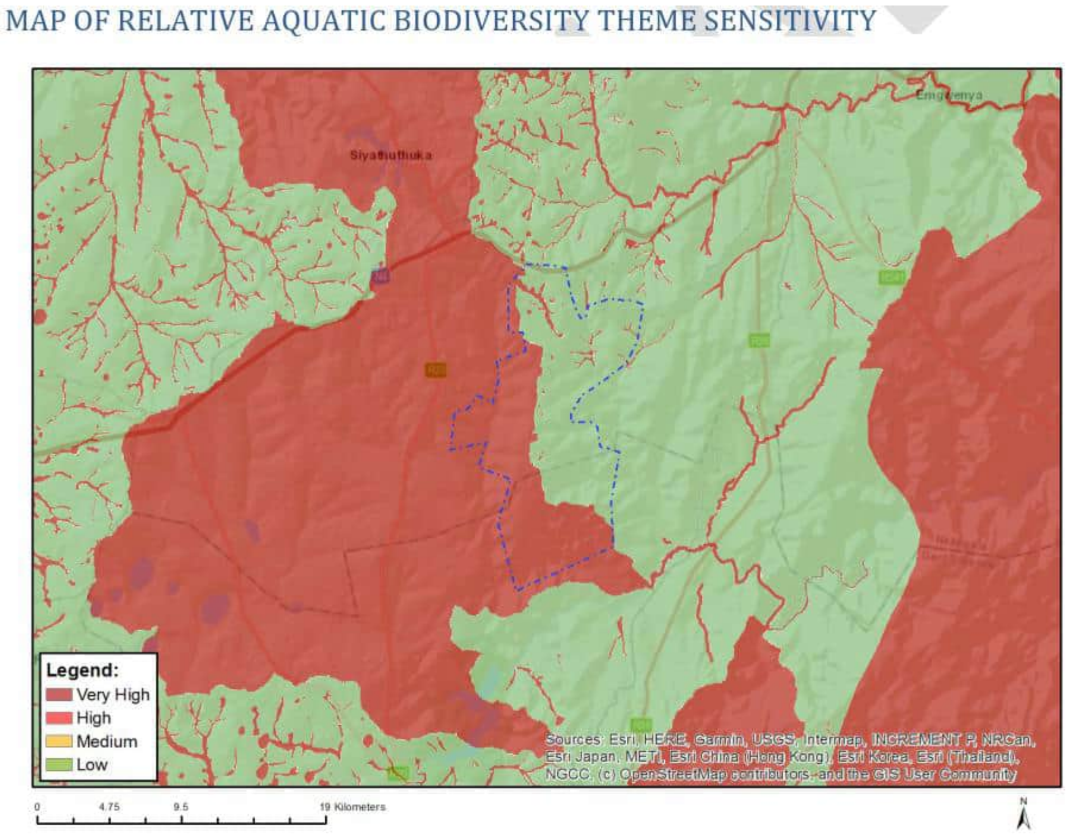


Figure 8-7 - DFFE aquatic theme sensitivity-Alternative 1

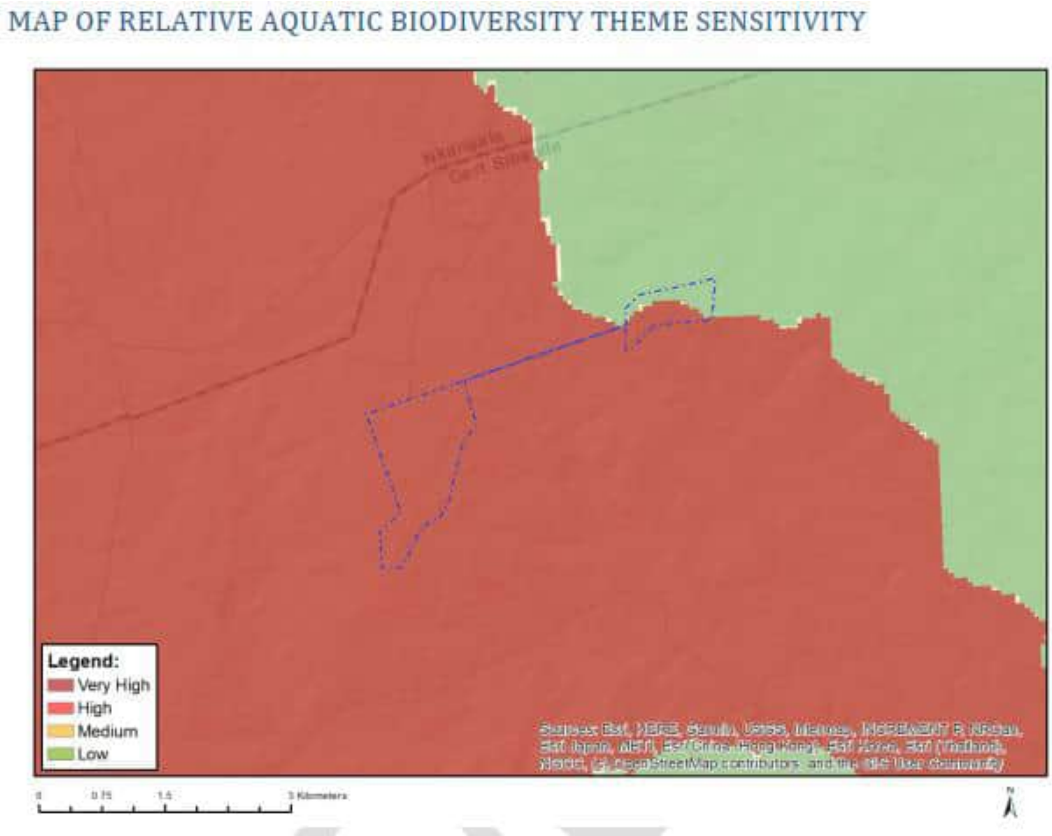


Figure 8-8 - DFFE aquatic theme sensitivity-Alternative 2

The aquatic sensitivity of the site is identified as high-low by the screening tool, the aquatic biodiversity report confirms the Presence of wetland CBA, wetland cluster ESA and Klein-Komati river CBA throughout the study area.

In general, the water quality of the watercourses assessed was regarded as ‘Good’ and fell within the parameters stipulated for the greater Inkomati Catchment (as stipulated by the Department of Water and Sanitation, previously the Department of Water Affairs (2011)) and the Target Water Quality Range as stipulated by the Department of Water and Sanitation, previously the Department of Water Affairs and Forestry (1996).

While the direct loss of wetlands has been avoided/minimised in the Project design through the application of a 100m buffer around wetland habitat and placement of turbines outside that area, the construction of the new access roads associated with the Dalmanutha WEF, both Project alternatives intercept wetland habitat, resulting in the loss of approximately 1.9ha and 1.4ha of wetland habitat respectively. The majority of these wetlands have a Moderately Low to Moderate PES, which infers that while there has been a moderate change in ecosystem processes, the habitat remains predominately intact. Similarly, most wetlands have a moderate EIS in the context of the surrounding cultivated landscape. However, some wetlands in the study area are considered to have a high EIS – primarily as a result of their support of threatened plant species, migration/feeding/breeding sites for fauna (birds), and the regional context of their ecological integrity given the extent of loss/modification of wetland systems in the region.

The high to very high EIS of some of the wetlands in the Project area is largely due to the presence of red listed water birds species such as Wattled Crane and the Grey-crowned Crane (Taylor et al, 2015 as cited in WildSkies Ecological Services, 2022).

8.4 ARCHAEOLOGICAL & CULTURAL HERITAGE

Figure 8-9 and **Figure 8-10** illustrates the archaeological and cultural heritage theme sensitivity from the screening report generated for both project alternatives.

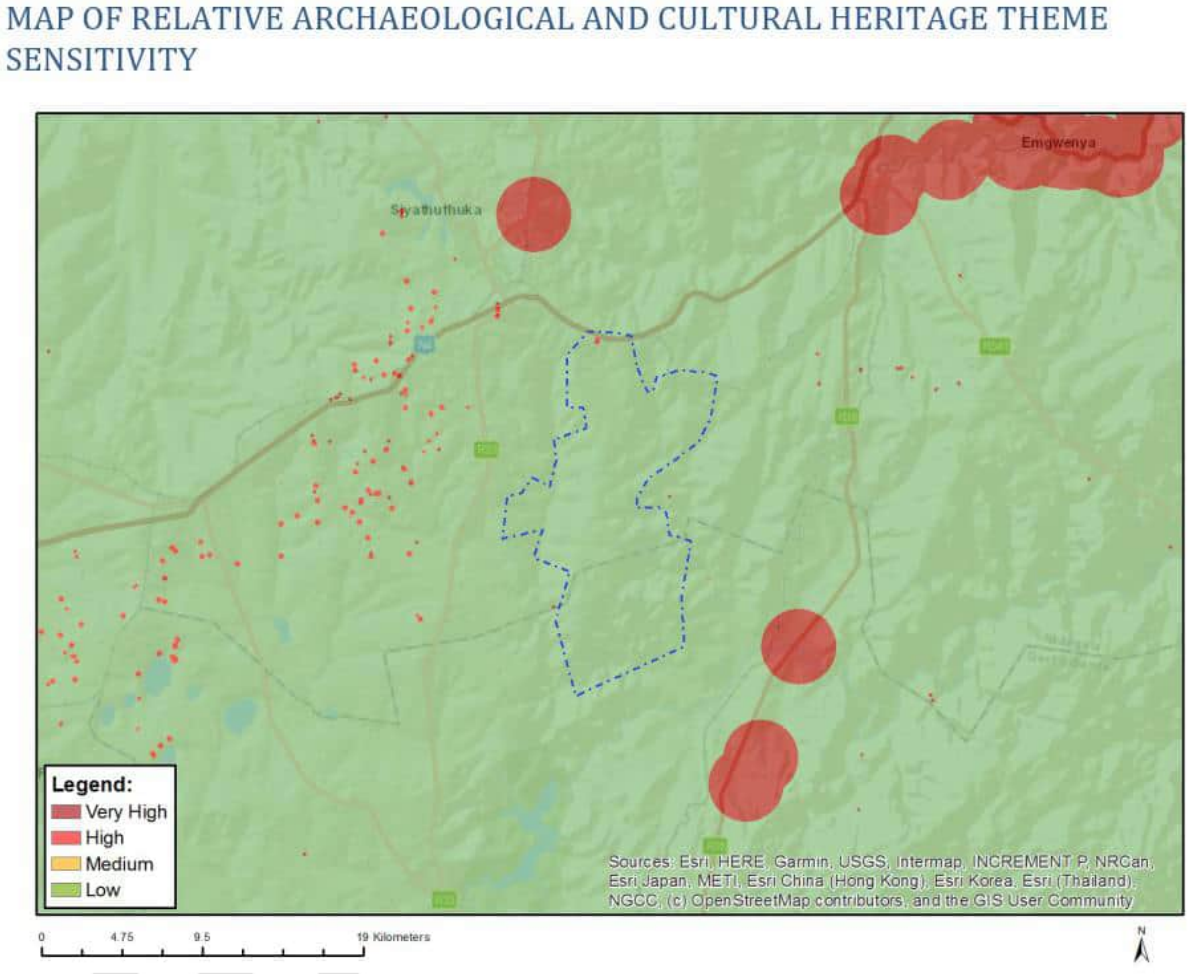


Figure 8-9 - DFFE archaeological & cultural heritage theme sensitivity-Alternative 1

MAP OF RELATIVE ARCHAEOLOGICAL AND CULTURAL HERITAGE THEME SENSITIVITY

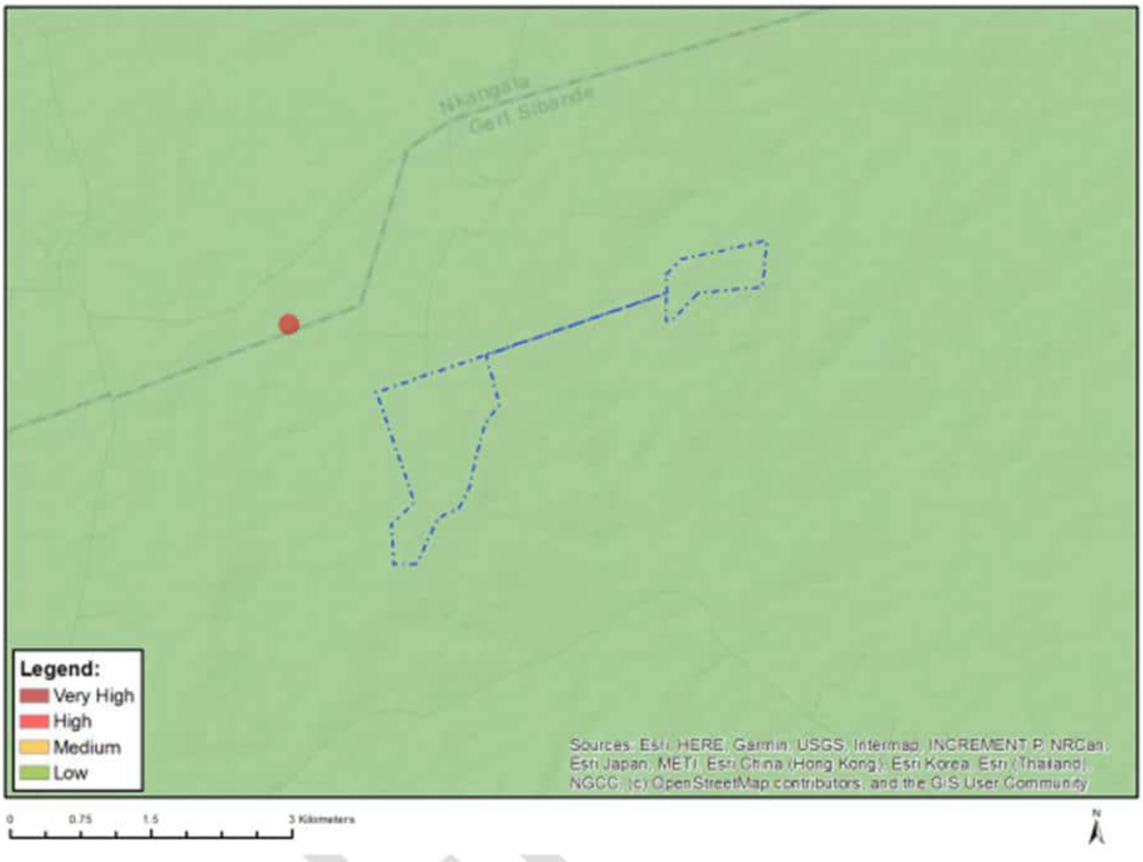


Figure 8-10 - DFFE archaeological & cultural heritage theme sensitivity-Alternative 2

The screening tool has identified the site as being low sensitivity with isolated points being high.

Regionally, the area is mostly cultivated, and forms part of a landscape characterised by wide scale cultivation and mining activities. Development in the study area is limited to farming infrastructure such as access roads, fences, and agricultural developments. The study area is part of a large cultural landscape that include battlefield sites and cemeteries. According to the heritage impact study (**Appendix H-7**) the placement of the turbines has avoided all identified graves and cultural heritage sources in the project area. There were some turbines and roads that the HIA recommended to be move during final micro siting, this has been addressed in the optimised layout (**Figure 11-2**)

The Project is a located within a rich cultural landscape with a cultural layering dating from the Stone Age, through the Iron Age to the historical period.

During the survey of the Dalmanutha WEF cluster, a large number of the aforementioned type sites were recorded and were grouped into four categories. Category A sites that are burial sites, Category B sites that consist of standing structures like farmsteads (some that could be older than 60 years) and farming infrastructure like kraals etc as well as ruins that could date to the recent past or be historical. Category C sites that are archaeological sites and findspots dating to the Late Iron Age and Middle Stone Age and Category D sites that relate or could potentially relate to the Anglo Boer War battlefields in the area.

The landscape is also considered to be a heritage resource with a strong cultural component dating to Late Iron Age occupation (AD 1600-1800's) of the area represented by the various stone walled settlements dating to this period. A second cultural layer consists of 20th century farmsteads and associated infrastructure and most importantly features relating to Anglo Boer war (1899-1902) battle of 'Berg en Dal/Dalmanutha' which were fought across the study area during the time, and the old wagon route that passed to the north of the study area along the N4. The Berg en dal Monument commemorating the battle is located to the north of the study area.

The impacts to tangible heritage resources can be mitigated by micro siting of the Project components to avoid all known significant heritage resources. The main impacts of concern relate to the two cultural landscapes identified and sense of place of the study area where the visual impacts to the cultural landscapes of the area are the key impacts of concern. The precolonial landscape of Iron Age occupation and the historical cultural landscape of the 20th century farmsteads and the 'Berg en Dal' battlefield will be impacted contextually through the addition of wind turbines and related infrastructure.

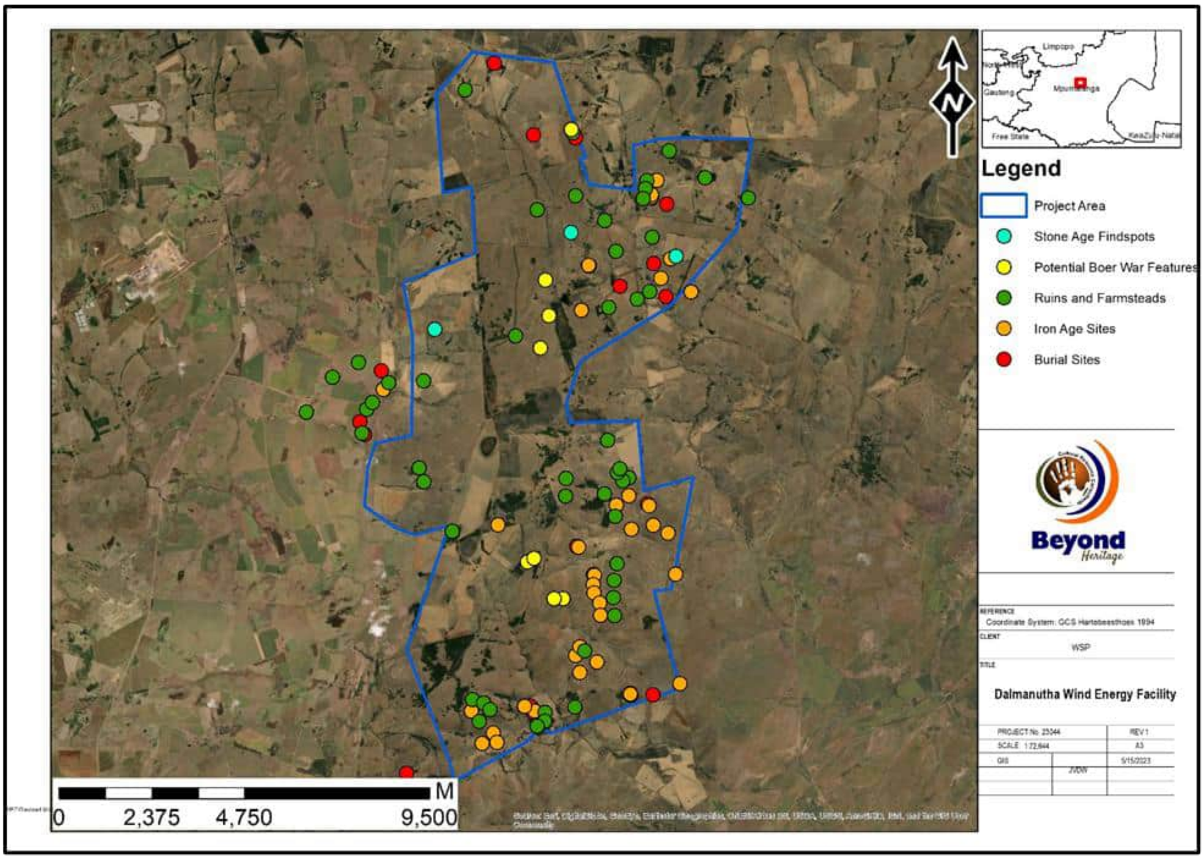


Figure 8-11 – Distribution of cultural and heritage finds on the site

8.5 BATS

Figure 8-12 illustrates the bats (wind) theme sensitivity from the screening report generated on 24 November 2022.

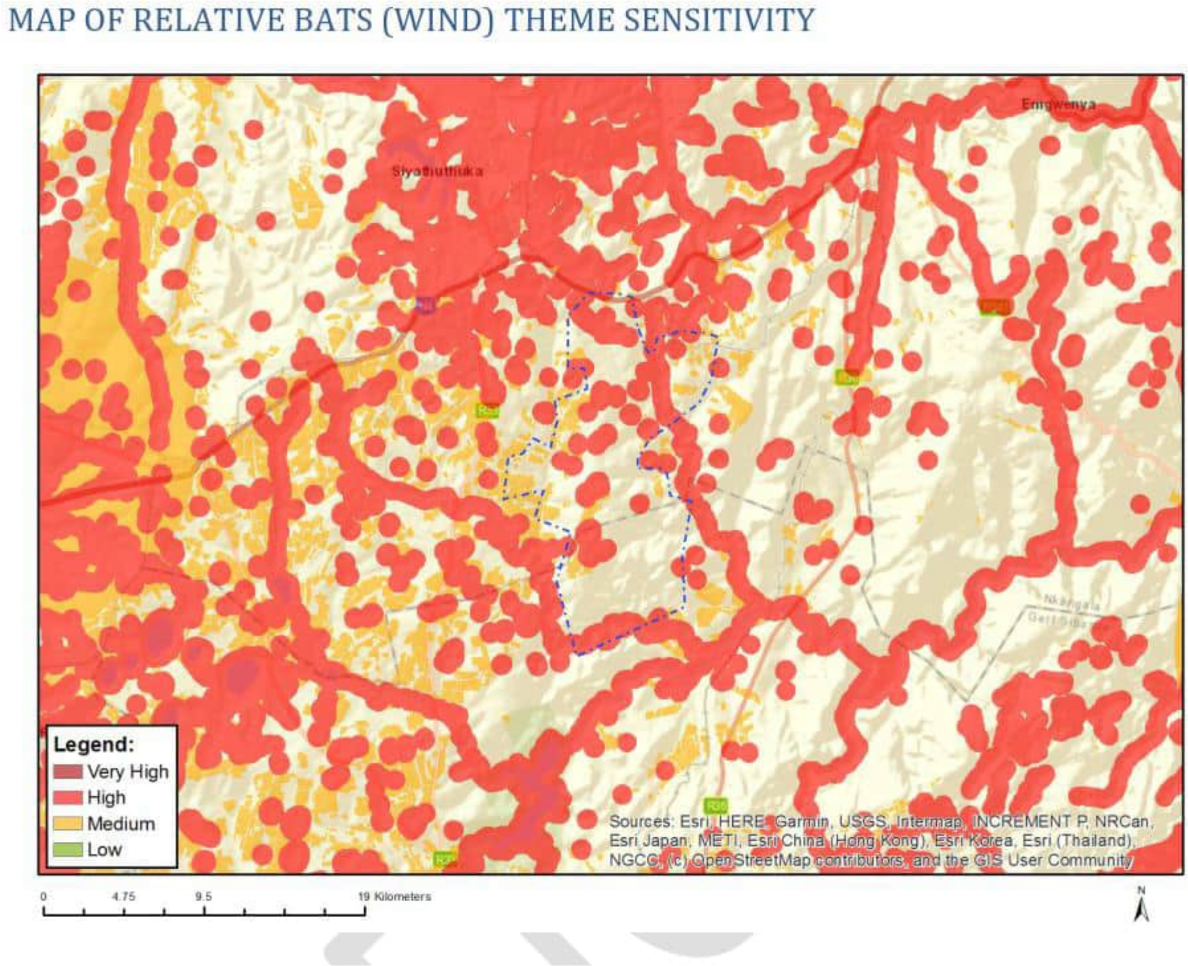


Figure 8-12 - DFFE bats theme

The DFFE screening tool identified parts of the site as high sensitivity.

According to the specialist study (**Appendix H.5**), current data suggests that the proposed project area is located in an area with MEDIUM RISK of bat mortalities, and that the most common species in the area is at low risk of collision.

Currently it must be stressed that all water sources will be considered as SENSITIVE, and no-go areas. Buffers must be implemented around all sources of water. In other words, no turbine blades may intrude into high sensitivity buffers.

Currently no bat sensitive features have been identified as very high sensitive features. As per the SABPG (McEwan et al., 2020) no turbines or any other structure, including infrastructure and major roads, may thus be constructed 200m around bat sensitive areas where practically possible the existing road crossings should be utilised.

During the survey of bats in the area, identified regions on the proposed site for the WEF that are currently classified as High Sensitivity and Medium Sensitivity Zones based on foraging areas, potential and active roosts, and availability of water (**Figure 8-12**). All confirmed roosts and their associated buffers must be considered as High Sensitive, and thus No-Go areas for turbines and no part of the turbines should cross the buffers implemented around these locations. Currently there are three turbines that are located within these buffered zones, and a further three that are potentially too close to the boundary of the medium size roost located in the southern section of the property.

All water sources, including open water and streams, are considered as Medium Sensitive and a 200m buffer has been placed around these areas. There are, however, no turbines in these areas. Potential roosts have also been marked, and a 500 m buffer suggested around these. These roosts may be used by bats from time to time, and it thus important that these are avoided. There are, however, no turbines in these areas.

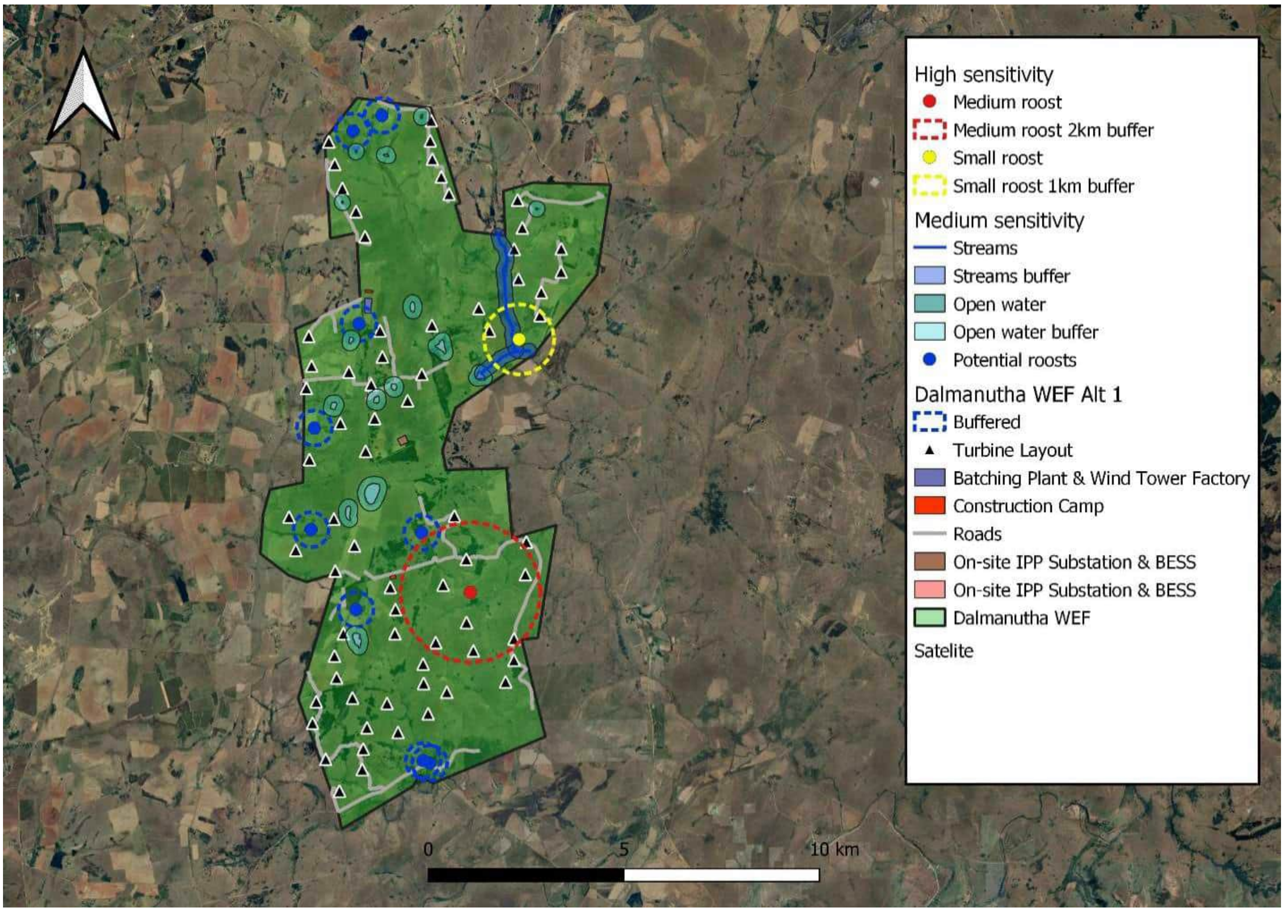


Figure 8-13 – Proposed Alternative 1 Layout with suggested Bat buffer zones.

Based on the SABPG (MacEwan et al., 2020) no roads may be constructed within 200m of any bat roost or foraging area, and powerlines may not be constructed within 500m of any bat roost. All buildings and infrastructure may not be located within 500 m from any bat roost. There is currently no overlap between confirmed roosts and any infrastructure, roads or powerlines (**Figure 8-13**). The proposed road in the south of the project area crossed between two potential roosts, and it is suggested that this road is moved as to not overlap with the 200m buffer around these roosts if possible. All other roads are outside of the 200m buffer around potential roosts and should thus not have an impact. The proposed road also runs along two water sources in the middle of the project area, but these are relatively small and it is not anticipated that it will have an impact.

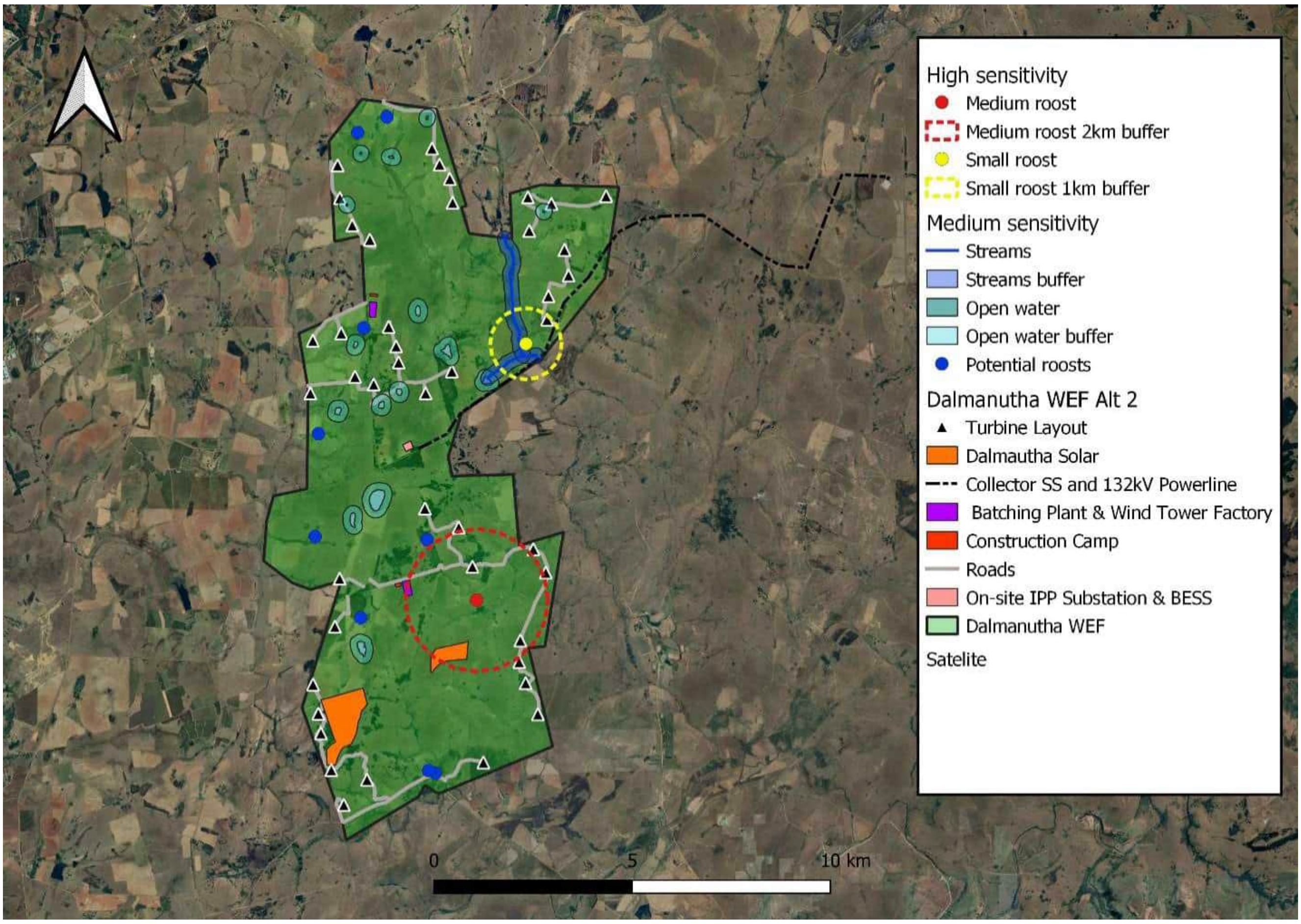


Figure 8-14 - Proposed Alternative 2 Layout with suggested Bat buffer zones.

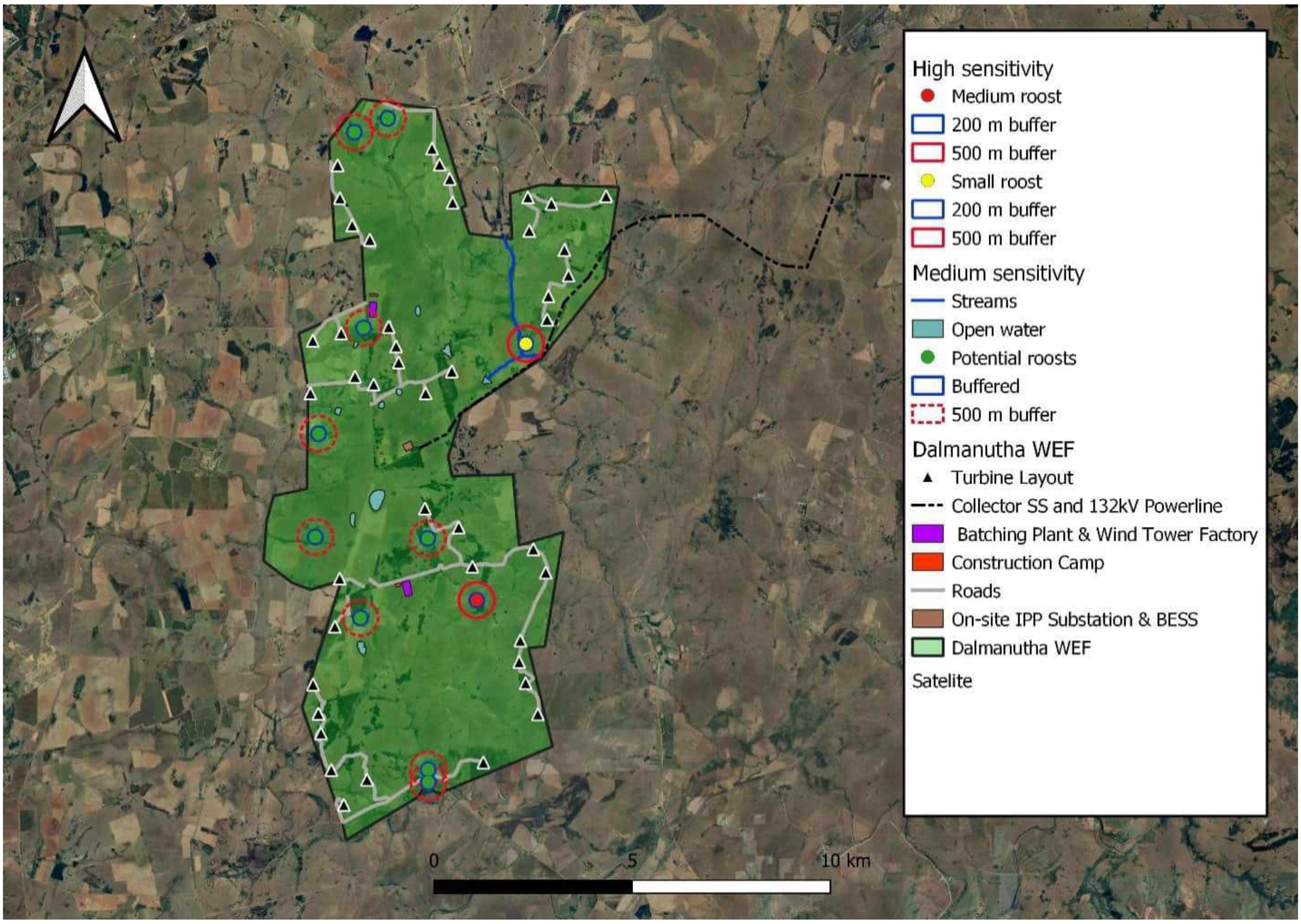


Figure 8-15 - Roads, powerlines and infrastructure and their overlap with bat sensitive zones

8.6 AVIFAUNA

Figure 8-16and **Figure 8-17** illustrates the avian theme sensitivity from the screening report generated for both alternatives

MAP OF RELATIVE AVIAN (WIND) THEME SENSITIVITY

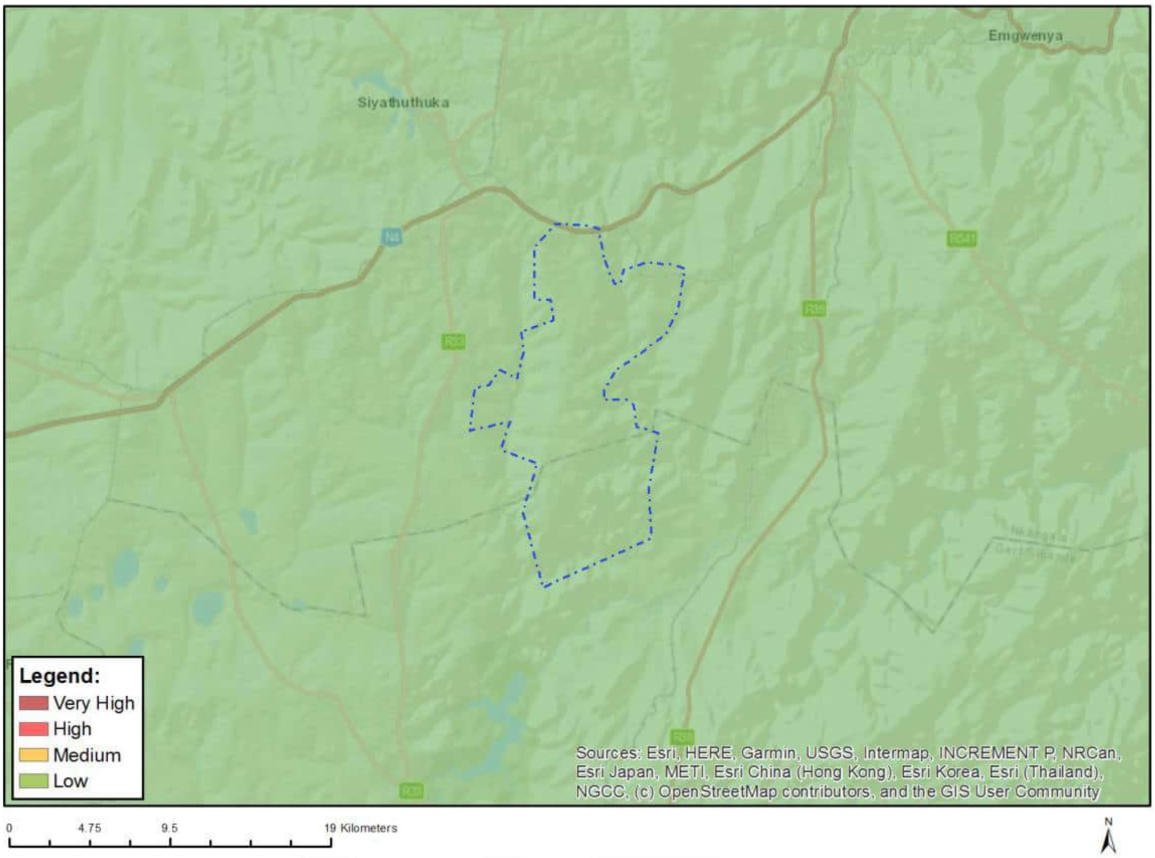


Figure 8-16 - DFFE Avian Theme-Alternative 1

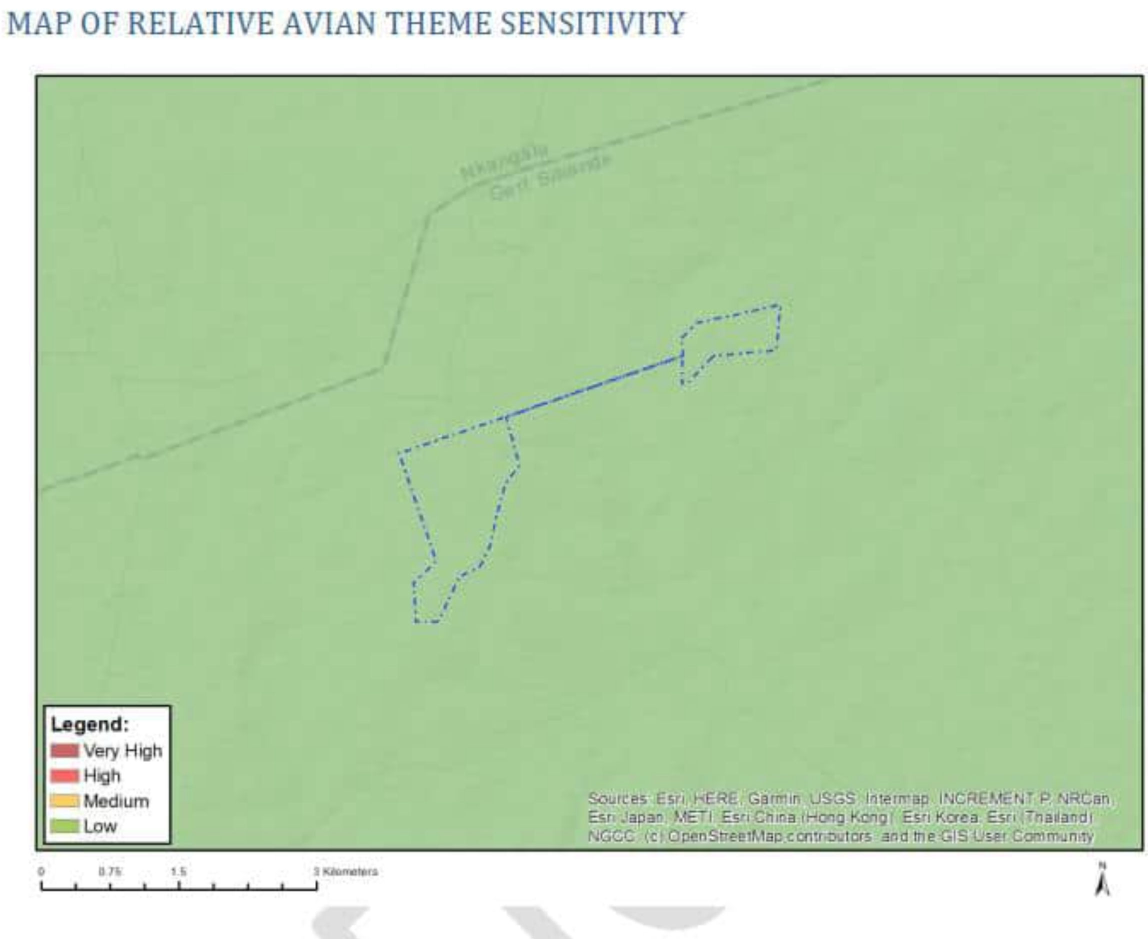


Figure 8-17 - DFFE Avian Theme-Alternative 2

The DFFE screening tool identified the site as low sensitivity for avifauna.

At a landscape level the site is classified as High sensitivity for avifauna, based on the above sources. The northern parts of the site certainly appear to be more sensitive and constrained than the southern parts.

All wetlands identified on site are to be No-Go areas.

Berg en Dal Main wetland body: The main body of this wetland has proven to be of high value with a rich diversity of birdlife including 2 pairs of Marsh Owl and a resident single Wattled Crane. Although no second Wattled Crane has been recorded and no nest found, breeding at this site remains a possibility in the future. The specialist has buffered the main wetland body by 1km to provide protection.

Leeuwkloof Pan 1: A round, medium sized permanent pan covered in short emergent vegetation. This is ideal habitat for many waterfowl and wetland species. The specialist has buffered this pan by 500m.

Leeuwkloof Pan 2: A round, medium sized permanent pan covered in short emergent vegetation. This is ideal habitat for many waterfowl and wetland species. Based on two separate reports from farmers living in the immediate area, this pan of water is a regular seasonal breeding site for both Blue and Wattled Cranes. The specialist stie work has however not confirmed breeding here. The specialist has buffered this pan by 750m.

Figure 8-18 - Leeukloof Pan 2 (Wildskies, 2022)

Cape Vulture Roosts: Cape Vultures have been recorded roosting on two stretches of existing Eskom powerlines in the evenings. Up to a maximum of approximately 40 vultures have been recorded roosting. The large pylons running through this broader area appear to be a regular overnight roost for Cape Vultures. These roosts were originally buffered by 500m. However, when the facility layout was refined to investigate the Alternative options, a 2km buffer was imposed. The specialist acknowledges that alone, this size buffer is not sufficient for this species (mitigating risk would require many kilometres) but has recommended that the roost be preserved through several mitigation measures (Section 9.9).

Southern Bald Ibis roost: A small gorge with cliffs has been identified as being used as a roost by this species. Up to 10 birds have been recorded roosting here by the specialists' surveys. The survey of the cliffs revealed no evidence of breeding, although it cannot be ruled out in the future, and Lockwood (pers comm) reports 5 active nests at this location. It appears that the roost may not be used every evening and it is conceivable that it is used for breeding in some years and not others. This location has been buffered by 1km to provide protection for these birds flying in and out of the roost.

Figure 8-19 - The gorge where Southern Bald Ibis roost (Wildskies, 2022)

Blue Crane nest. Lockwood (pers comm) reported a nest location on site. He specialist included this location in the initial sensitivity mapping and buffered the nest by 1km. However, it was noted that landowners have recently ploughed up most of the grassland surrounding this nest location. In more recent sensitivity mapping it was assumed that this nest is no more.

Grey Crowned Crane breeding area: A pair of adult cranes have been recorded in the area several times, and with two juveniles in one survey. This indicates that breeding took place somewhere in this vicinity. It was identified and delineated the wetland area within which it was assumed these birds have bred. Without having a nest location itself it is difficult to impose a buffer on this area, but it is cautioned against planning any turbines closer to this area than the current positions.

The following specific environmental sensitivities have been identified from an avifaunal perspective:

- 100m all infrastructure exclusion zone around drainage lines and associated wetlands. Wetlands are important breeding, roosting and foraging habitat for a variety of Red List priority species, most notably for African Grass Owl (SA status Vulnerable), Grey Crowned Crane (SA status Endangered) and African Marsh Harrier (SA status Endangered).
- 1km turbine exclusion zone around large pans. The most significant landscape features from a collision risk perspective are the large pans. Pans attract many birds, including Red List species such as Greater Flamingo (SA status Near-threatened), Martial Eagle (SA Status Endangered), Cape Vulture (SA Status Endangered) and Secretary bird (SA status Vulnerable).

- High sensitivity grassland - Limited infrastructure zone. Development in the remaining high sensitivity grassland must be limited as far as possible. Where possible, infrastructure must be located near margins, with shortest routes taken from the existing roads. The grassland is vital breeding, roosting and foraging habitat for a variety of Red List priority species. These include Blue Crane (SA status near-threatened), Blue Korhaan (Global status near -threatened), White-bellied Bustard (SA Status Vulnerable), Denham's Bustard (SA Status Vulnerable).

The avifaunal sensitivities identified from a wind energy perspective for the initial Dalmanutha WEF are shown in **Figure 8-20**.

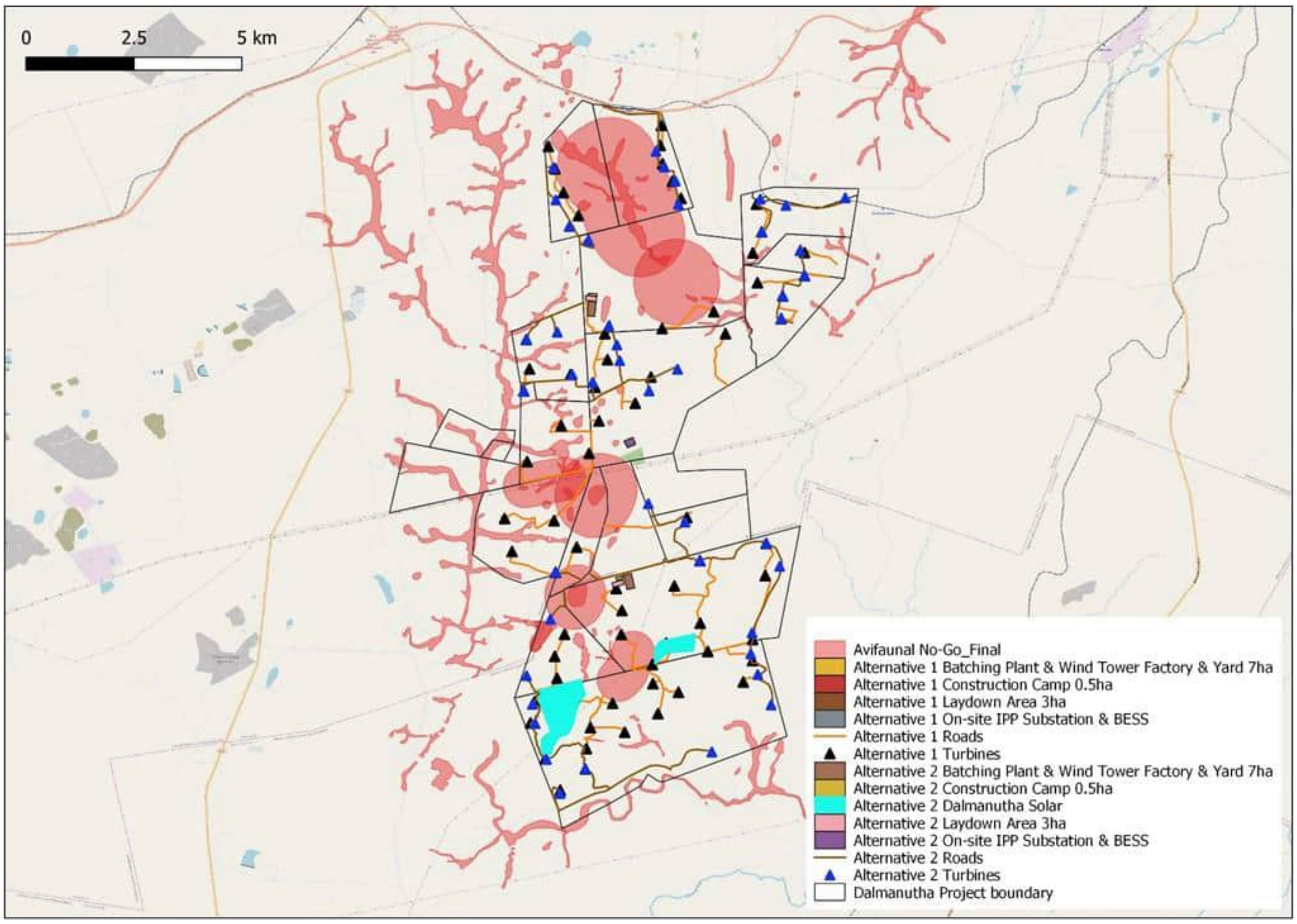


Figure 8-20 - Avifaunal Sensitivities for both the Dalmanutha Alternative layouts (Wildskies, 2023)

A priority bird species list was developed from the pre-construction monitoring data. This list included 14 regionally Red Listed species, for each species a 'Collision Risk Score' was developed as follows:

- **(a)** Relative importance of the overall site for the species was scored (1- 4)
- **(b)** Vulnerability of the species was scored (Regional Red list status – Critically Endangered = 4, Endangered = 3, Vulnerable = 2, Near-threatened = 1)
- **(c)** The Sensitivity of the species was calculated by multiplying **'a' x 'b'**
- **(d)** The Likelihood of Effect (theoretical probability of colliding with turbines) for each species was scored (1 – 4 scale)
- The species 'Collision risk score' was calculated by multiplying **'c' x 'd'**
- The Collision Risk Score was converted into an Index of 1 to 4.
- Each turbine was rated it on a scale of 1 to 3 for risk to each of the 14 species. The turbine risk for a species was based on a combination of proximity of WTG to the species feature (roost, wetland etc), and species flight path data
- the species scores for all 14 species were then summed for each turbine to give an overall turbine Collision Risk Score.
- The turbines were then ranked according to their risk. Highest risk = 1 and lowest = 5.

The final scores and ranking can be seen in **Figure 8-21**. It is noted that the top ranked 7 turbines were close to both Wattled Crane area and Southern Bald Ibis roost in the far north of the site, and that these were dropped after the scoping phase. It is also noted that the specialist recommendation was that from an impact point of view one would not want isolated singles or pairs of turbines spread out around the site, it would be far better to have a compact consolidated layout. This has not been achieved with the Alternative 2 layout which is very dispersed and essentially encompasses the same landscape as the Alternative 1 layout, including the sensitive northern areas of the site.

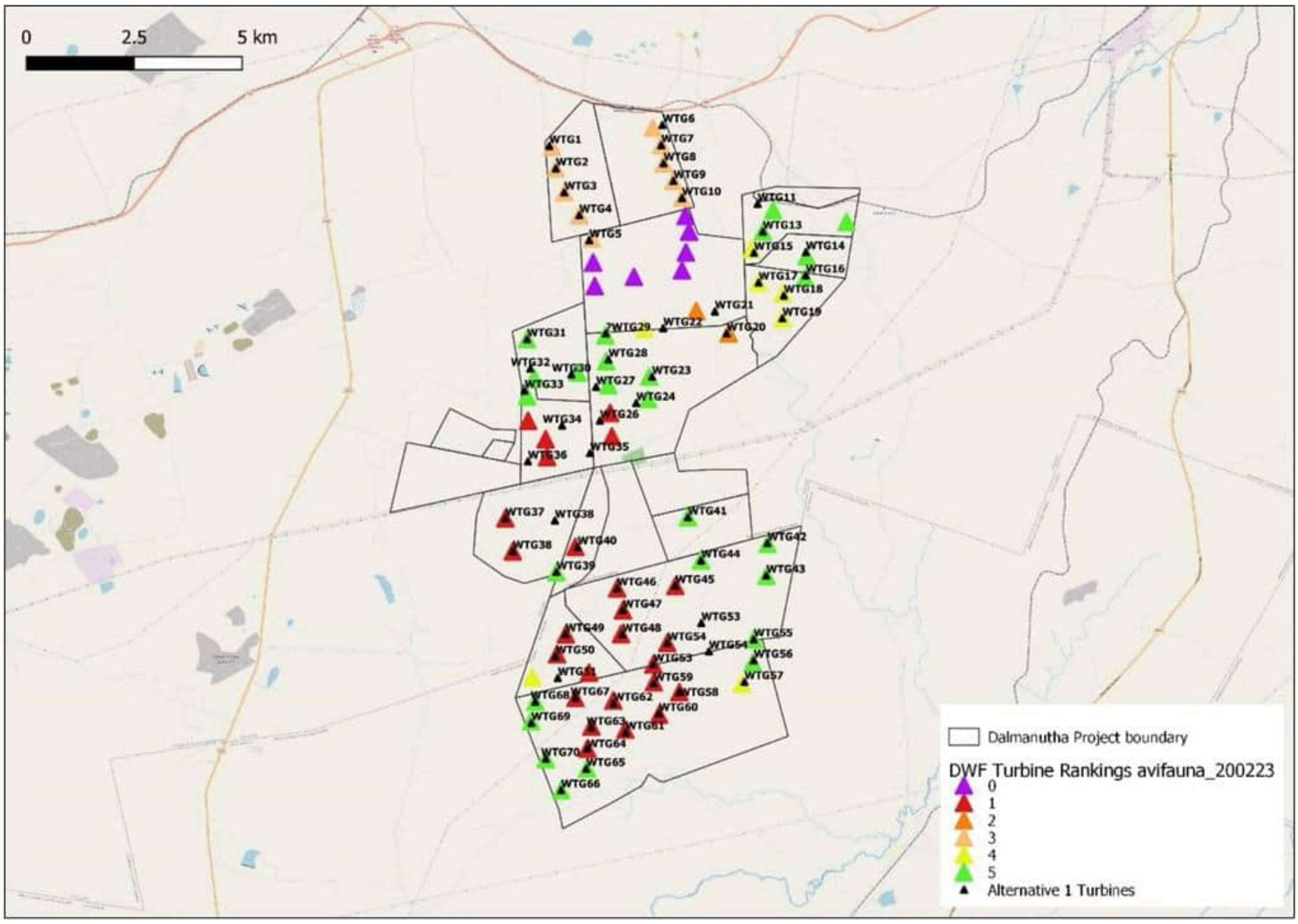


Figure 8-21 – Individual turbine risk ranking

The impact significance of the two alternatives has been formally assessed above. To summarise, both alternatives receive the same significance rating for the various identified impacts. In the case of the impacts of: habitat destruction; disturbance; and displacement, as per the project description supplied by the applicant the development footprint of the two alternatives will be identical (400ha). The impact significance is therefore the same for both alternatives.

In the case of bird fatality through collision with wind turbines, the reduction in the number of wind turbines from 70 to 44 for Alternative 2 is positive for the impact of bird-turbine collision, and certainly reduces the likelihood of impact on birds. The crude estimate of pre-mitigation bird fatality through turbine collision is as follows:

- Alternative 1 – Rotor Swept Area of 30m - 230m (70 turbines). Approximately 18.46 fatalities could be recorded at the wind farm per year across the target bird species recorded flying on site prior to the application of mitigation measures. This includes most notably the following regionally Red Listed species fatalities: Cape Vulture – 10.20 birds/year; Southern Bald Ibis – 1.14 birds/year; Blue Crane – 0.72 birds/year; White-bellied Bustard – 0.26 birds/year.
- Alternative 2 -Rotor Swept Area of 30m to 230m (44 turbines). Approximately 11.60 fatalities could be recorded at the wind farm per year across the target bird species recorded flying on site prior to the application of mitigation measures. This includes the following regionally Red Listed

species fatalities: Cape Vulture – 6.41 birds/year; Southern Bald Ibis – 0.71 birds/year; Blue Crane – 0.45 birds/year; White-bellied Bustard – 0.16 birds/year.

As an example, the species of most concern at the project, Cape Vulture, is estimated to have 10.20 fatalities per year with 70 turbines, or 6.41 per year with 44 turbines. Unfortunately, 6.41 fatalities per year (before the application of mitigation) is still highly significant for an Endangered Species. It is therefore judged that the significance of this impact to be Very High (as with Alternative 1). This number of fatalities would reduce through the application of mitigation. However, the extent of this reduction cannot be estimated. It is therefore judged that the significance of this impact to remain at High Negative post mitigation. The reduction in turbines proposed by the applicant is not enough to reduce the risk lower. Alternative 2 of 44 wind turbines is still a large wind farm project.

While Alternative 2 is strongly preferred from an avifaunal perspective (since fewer turbines should cause fewer collision fatalities) it remains a large wind farm in a highly sensitive area.

8.7 FLICKER

Figure 8-23 illustrates the flicker theme sensitivity from the screening report generated for the project alternative 1.

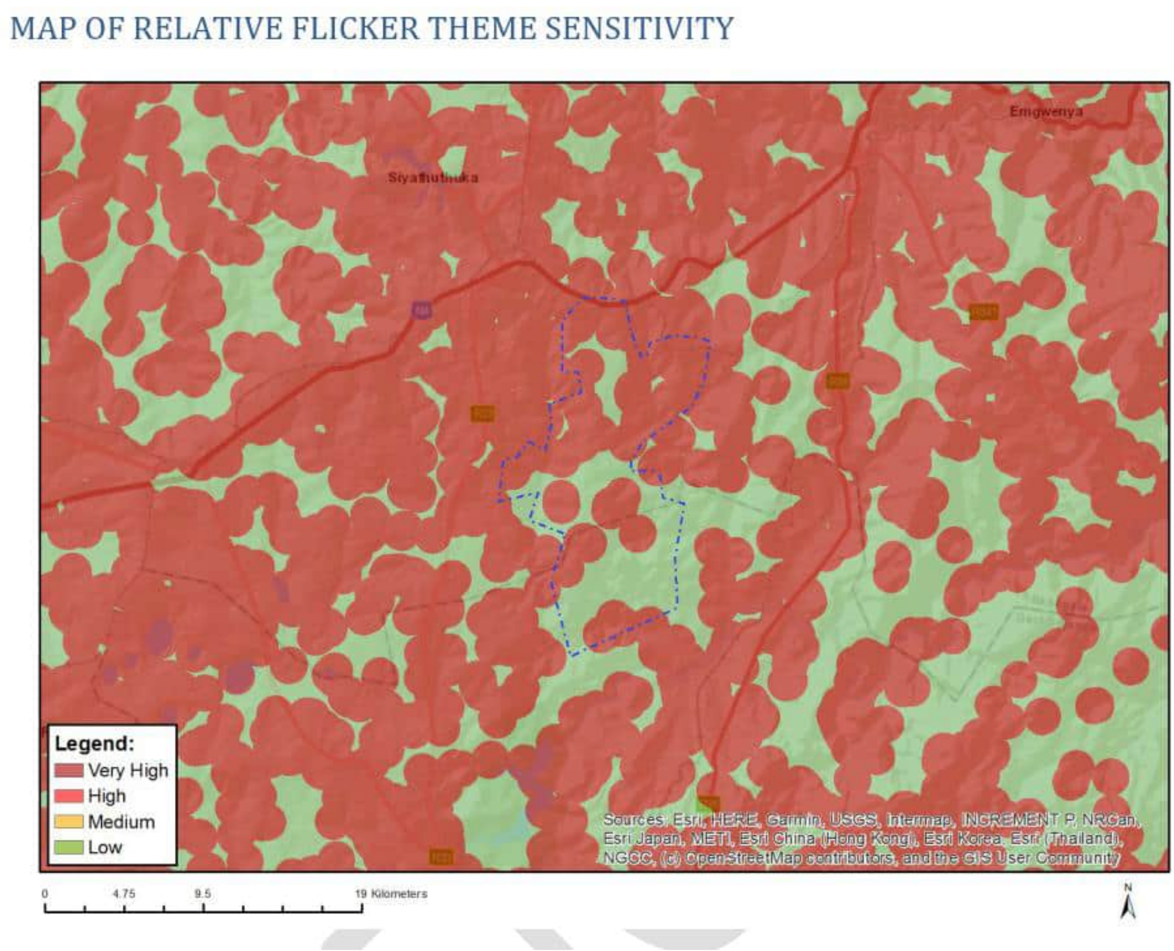


Figure 8-22 - DFFE flicker theme

The screening tool identified the flicker theme as high-low.

A number of homesteads are located within the 1.2km buffer of turbines for both Alternative 1 and 2. Of note is that most of the homesteads are located on properties involved in this development, thereby reducing the probability of this impact occurring. It is expected that motorists travelling along roads within the 1km zone of a turbine could potentially experience shadow flicker, however the shadow flicker experienced by these motorists will be fleeting and not constitute a shadow flicker visual impact of concern.

Alternative 1: Dalmanutha Wind Facility

The specialist study found that twelve (12) turbines labelled 3-5, 17-18 and 24 – 25 and 28, 32 and 33, located adjacent to various secondary roads within the development site are likely to have a shadow flicker impact on motorists using these roads. It is, however, expected that the number of motorists travelling on these roads will be very limited and the level of exposure will be brief, thereby, not constituting a shadow flicker visual impact of concern for these receptors.

Thirteen (13) turbines labelled 1, 2, 7, 8, 10, 11, 12, 19, 27, 35, 38, 44 and 45 (shaded in red), scattered throughout the development site may have a shadow flicker impact on the villages / settlements including the following:

- Bergendal
- De Rust
- Waaikraal
- Vogelstruispoort
- Geluk
- Leeukloof

Alternative 2: Dalmanutha Wind and Solar Facility

The specialist study found that ten (10) turbines labelled 1-4, 14-16 and 20, 24 and 25, located adjacent to various secondary roads within the development site are likely to have a shadow flicker impact on motorists using these roads. It is, however, expected that the number of motorists travelling on these roads will be very limited and the level of exposure will be brief, thereby, not constituting a shadow flicker visual impact of concern for these receptors.

Thirteen (13) turbines labelled 5, 6, 8, 9-13, 18, 21 ,22, 29 and 39 (shaded in red), scattered throughout the development site may have a shadow flicker impact on the villages / settlements including the following:

- Bergendal
- De Rust
- Waaikraal
- Dalmanutha
- Vogelstruispoort
- Liebenhof
- Welgevonden

The significance of shadow flicker is therefore anticipated to be high before mitigation.

8.8 LANDSCAPE/VISUAL

Figure 8-23 and **Figure 8-24** illustrates the landscape theme sensitivity from the screening report generated for both project alternatives.

MAP OF RELATIVE LANDSCAPE (WIND) THEME SENSITIVITY

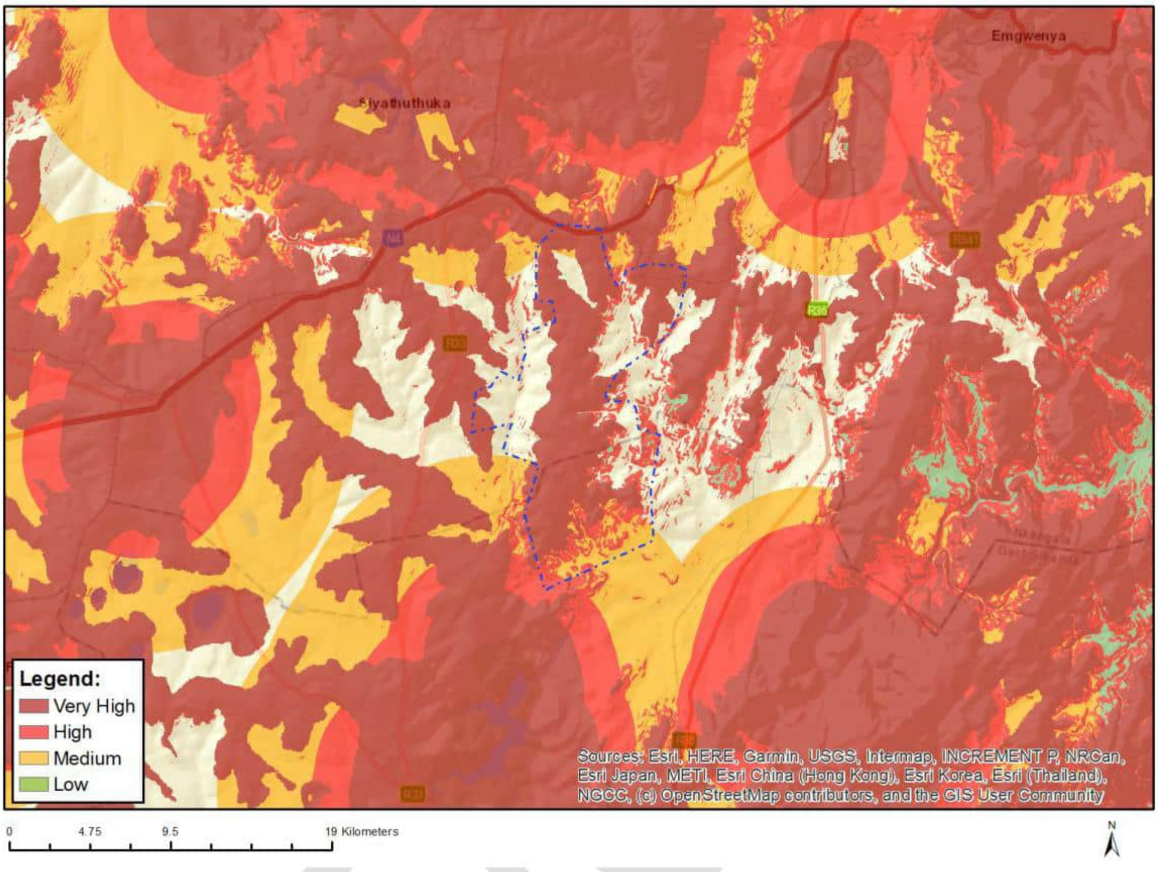


Figure 8-23 - DFFE Landscape Theme-Alternative 1

MAP OF RELATIVE LANDSCAPE (SOLAR) THEME SENSITIVITY

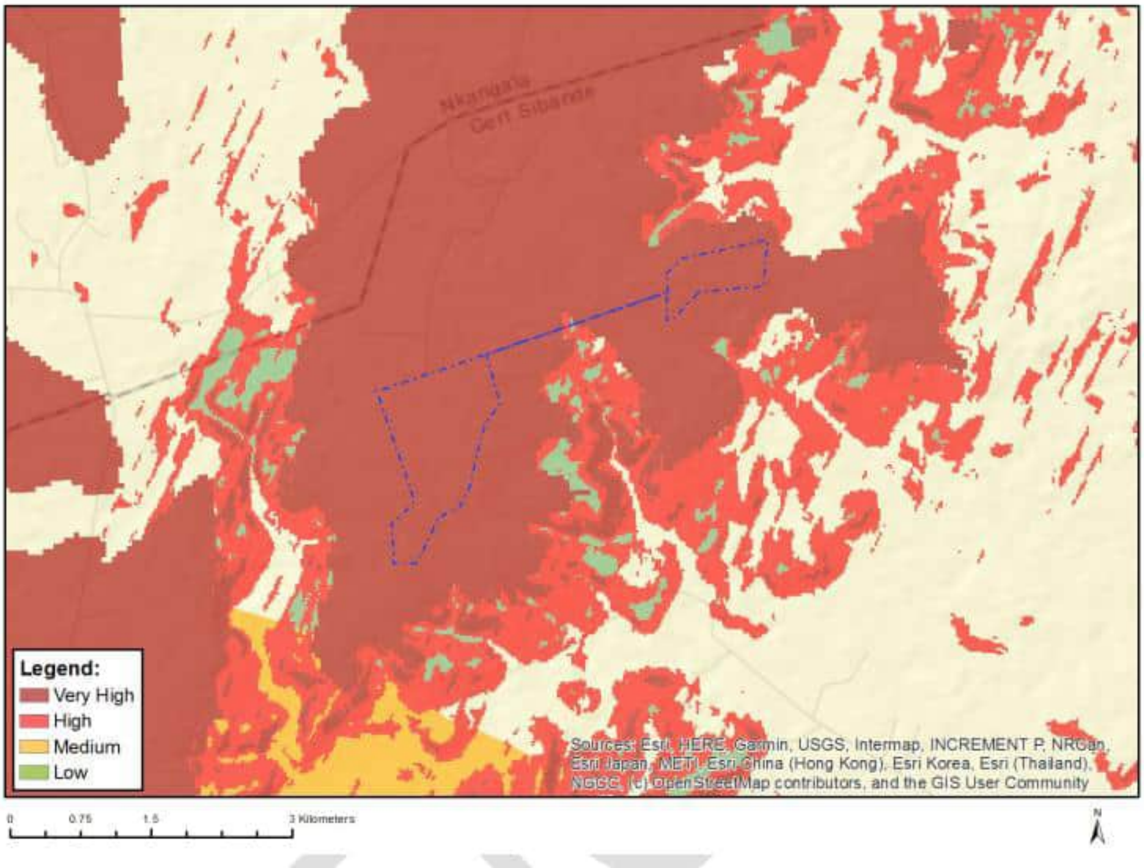


Figure 8-24 - DFFE Landscape Theme-Alternative 2

The screening tool identified the landscape theme as very high.

Visual sensitivity can be defined as the inherent sensitivity of an area to potential visual impacts associated with a proposed development. It is based on the physical characteristics of the area (i.e., topography, landform, and land cover), the spatial distribution of potential receptors, and the likely value judgements of these receptors towards a new development (Oberholzer: 2005). A viewer's perception is usually based on the perceived aesthetic appeal of an area and on the presence of economic activities (such as recreational or nature-based tourism) which may be based on this aesthetic appeal. It is important to note that receptors identified within the WEF project are landowners and supportive of the development proceeding. **Figure 8-25** and **Figure 8-26** below outlines the potential visibility of the proposed WEF to the surrounding areas.

The criteria (previously discussed in this report) which inform the visual impact index are:

- Visibility or visual exposure of the structures
- Observer proximity or visual distance from the structures
- The presence of sensitive visual receptors
- The perceived negative perception or objections to the structures (if applicable)
- The visual absorption capacity of the vegetation cover or built structures (if applicable)

An area with short distance visual exposure to the proposed infrastructure, a high viewer incidence and a potentially negative perception (i.e. a sensitive visual receptor) would therefore have a higher value (greater impact) on the index. This helps in focussing the attention to the critical areas of potential impact and determining the potential magnitude of the visual impact.

The index indicates that potentially sensitive visual receptors within a **5km radius** of the WEF may experience a very high visual impact. The magnitude of visual impact on sensitive visual receptors subsequently subsides with distance; high within a **5 – 10km radius** (where sensitive receptors are present) and moderate within a **10 – 20km radius** (where sensitive receptors are present). Receptors **beyond 20km** are expected to have a low potential visual impact.

Likely areas of potential visual impact and potential sensitive visual receptors located within a 20km radius of the both the proposed project alternatives are displayed on **Figure 8-25** and **Figure 8-26**

Magnitude of the potential visual impact

Alternative 1: Dalmanutha Wind Facility

The WEF may have a visual impact of very high magnitude on the following observers (**within a 5km radius**):

Residents of/visitors to :

- 1) Frisgewaagd
- 2) Clercqsvallei
- 3) Welgevonden
- 4) Frisgewaagd
- 5) Drenthe
- 6) Geluk
- 7) Leeukloof
- 8) Blyvooruitsig
- 9) Vogelstruispoort
- 10) Driekop
- 11) Waaikraal
- 12) De Rust
- 13) Wemmershuis
- 14) Bergendal
- 15) Green Pastures
- 16) Moreson
- 17) Weltevreden
- 18) Weltevreden

Observers travelling along the:

- Observers travelling along the N4 national road
- Observers travelling along the R33 arterial road
- Observers travelling along the Geluk/Dalmanutha secondary roads

The WEF may have a visual impact of high magnitude on the following observers (**5 – 10km radius**):

Residents of/visitors to:

- 19) Hartebeespruit

- 20) De Kroon
- 21) Connievale
- 22) Rietvlei
- 23) Vlakfontein
- 24) Brakspruit
- 25) Mislukt
- 26) Van Wyksvlei
- 27) Eerstelingsfontein
- 28) Blyvooruitzicht
- 29) Zoekop
- 30) Leeuwbank
- 31) Zoekop

As well as the outer lying areas of Belfast and parts of the Nooitgedacht Dam and Lakenvlei Protected areas.

Observers travelling along the:

- Observers travelling along the N4 National road
- Observers travelling along the R33 and R36 arterial roads
- Secondary roads

The WEF may have a visual impact of moderate magnitude impact on the following observers located between a **10 – 20km radius** of the wind turbine structures:

Residents of/visitors to:

- 32) Du Elsarik
- 33) Winchester
- 34) Vaalkop
- 35) Klipfontein
- 36) Weltevrede
- 37) Elgin
- 38) Lakenvlei
- 39) Elandfontein
- 40) Groenvlei
- 41) Rietvlei
- 42) Zevenfontein
- 43) Sewefontein
- 44) Bloemfontein
- 45) Suikerbosfontein
- 46) Leeuwpoort
- 47) Kwaggafontein
- 48) Hawerfontein
- 49) Berg-en-Dal
- 50) Leliefontein
- 51) Twyfelaar
- 52) Goedehoop
- 53) Blesbokspruit

- 54) Grootpan
- 55) Blesbokspruit
- Parts of the Cecilia, Nooitgedacht Dam, Lakenvlei Protected areas, Paulina van Niekerk PNR and Langkloof PNR
- Southern outlying parts of Siyathuthuka

Observers travelling along the:

- Observers travelling along the R33, R36, R541, R540 arterial roads
- Various secondary roads
- Observers travelling along portions of the N4 national road

The WEF may have a visual impact of low magnitude impact on the following observers located **beyond the 20km radius** of the wind turbine structures:

Residents of/visitors to:

56) Klippan

57) Uitvlug

58) Vlakplaas

59) Nooitgedacht

60) Brahmanica Park

61) Vaalbult

62) Helpmekaar

63) Leeupan

Cecilia PNR

Observers travelling along the:

- Observers travelling along the R36, R38, R541 and R540 arterial roads

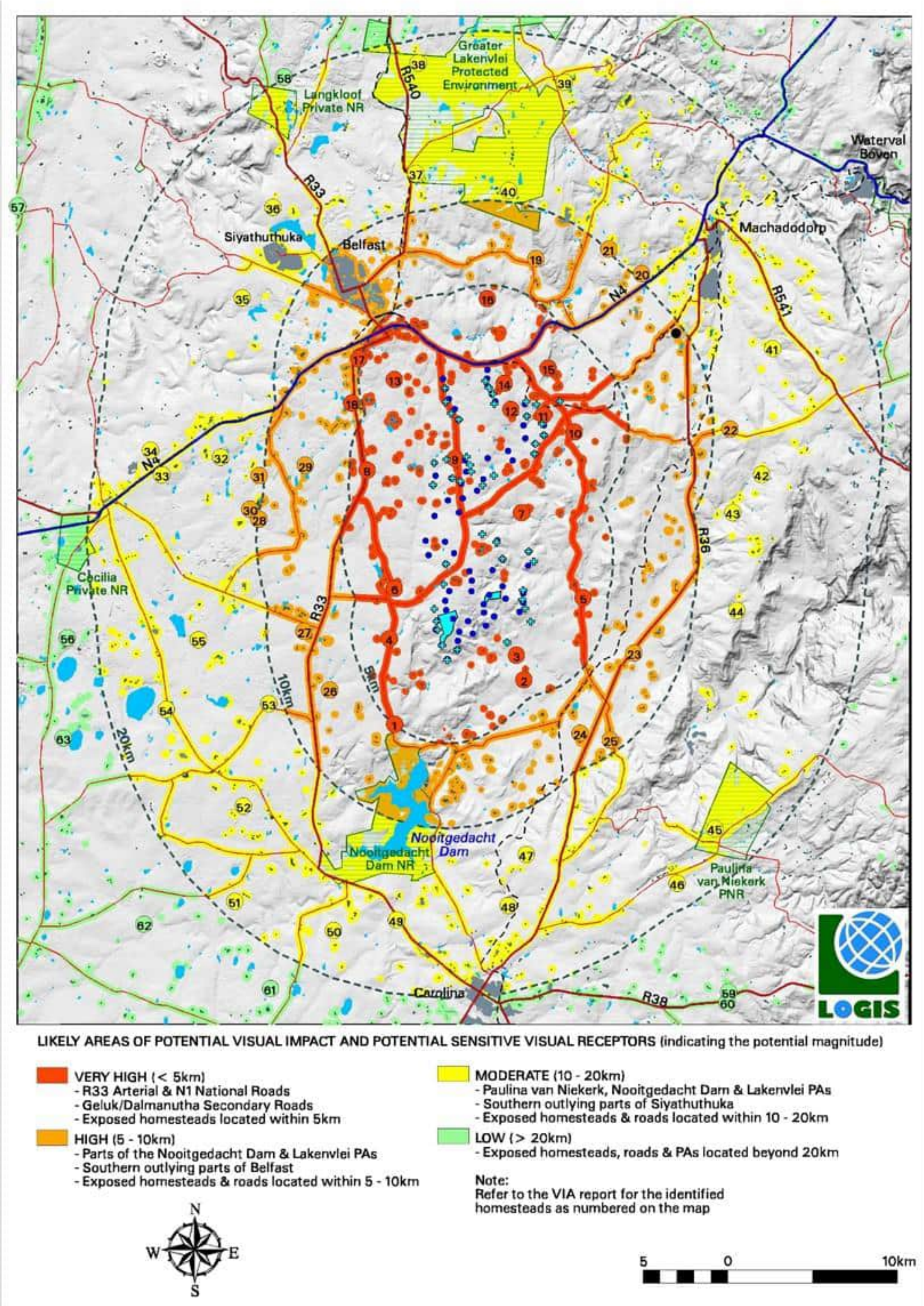


Figure 8-25 - Likely areas of potential visual impact and sensitive visual receptors for Alternative 1: Dalmanutha Wind facility

Alternative 2: Dalmanutha Wind and Solar Facility

The WEF may have a visual impact of very high magnitude on the following observers (**within a 5km** radius):

Residents of/visitors to :

- 1) Frisgewaagd
- 2) Clercqsvallei
- 3) Welgevonden
- 4) Frisgewaagd
- 5) Drenthe
- 6) Geluk
- 7) Leeukloof
- 8) Blyvooruitsig
- 9) Vogelstruispoort
- 10) Driekop
- 11) Waaikraal
- 12) De Rust
- 13) Wemmershuis
- 14) Bergendal
- 15) Green Pastures
- 16) Moreson
- 17) Weltevreden
- 18) Weltevreden

Observers travelling along the:

- Observers travelling along the N4 national road
- Observers travelling along the R33 arterial road
- Observers travelling along the Geluk/Dalmanutha secondary roads

The WEF may have a visual impact of high magnitude on the following observers (**5 – 10km radius**):

Residents of/visitors to:

- 19) Hartebeespruit
- 20) De Kroon
- 21) Connievale
- 22) Rietvlei
- 23) Vlakfontein
- 24) Brakspruit
- 25) Mislukt
- 26) Van Wyksvlei
- 27) Eerstelingsfontein
- 28) Blyvooruitzicht
- 29) Zoekop
- 30) Leeuwbank
- 31) Zoekop

As well as the outer lying areas of Belfast and parts of the Nooitgedacht Dam and Lakenvlei Protected areas.

Observers travelling along the:

- Observers travelling along the N4 National road
- Observers travelling along the R33 and R36 arterial roads
- Secondary roads

The WEF may have a visual impact of moderate magnitude impact on the following observers located between a **10 – 20km radius** of the wind turbine structures:

Residents of/visitors to:

- 32) Du Elsarik
- 33) Winchester
- 34) Vaalkop
- 35) Klipfontein
- 36) Weltevrede
- 37) Elgin
- 38) Lakenvlei
- 39) Elandfontein
- 40) Groenvlei
- 41) Rietvlei
- 42) Zevenfontein
- 43) Sewefontein
- 44) Bloemfontein
- 45) Suikerbosfontein
- 46) Leeuwpoort
- 47) Kwaggafontein
- 48) Hawerfontein
- 49) Berg-en-Dal
- 50) Leliefontein
- 51) Twyfelaar
- 52) Goedehoop
- 53) Blesbokspruit
- 54) Grootpan
- 55) Blesbokspruit
- Parts of the Cecilia, Nooitgedacht Dam, Lakenvlei Protected areas, Paulina van Niekerk PNR and Langkloof PNR
- Southern outlying parts of Siyathuthuka

Observers travelling along the:

- Observers travelling along the R33, R36, R541, R540 arterial roads
- Various secondary roads
- Observers travelling along portions of the N4 national road

The WEF may have a visual impact of low magnitude impact on the following observers located **beyond the 20km radius** of the wind turbine structures:

Residents of/visitors to:

- 56) Klippan
- 57) Uitvlug
- 58) Vlakplaas
- 59) Nooitgedacht
- 60) Brahmanica Park
- 61) Vaalbult
- 62) Helpmekaar
- 63) Leeupan
- Cecilia PNR

Observers travelling along the:

- Observers travelling along the R36, R38, R541 and R540 arterial roads

It must be noted that the visual impact of Alt 2 is very similar to that of Alt 1, with the exception that the frequency of visual exposure to the turbines will be less owing to the reduced number of proposed turbines.

Where any of the above-mentioned homesteads are derelict or deserted, the visual impact will be non-existent, until such time as it is inhabited again.

Additionally, some, not all, of the sensitive visual receptors of farm- and homesteads listed above who could be affected visually by the proposed Dalmanutha Wind are in fact located on properties involved in either this project or the proposed Dalmanutha West WEF and EGI developments adjacent to the proposed WEF.

It is therefore expected that the construction and operation of the proposed Dalmanutha WEF and its associated infrastructure, will have a high visual impact on the study area, especially within (but not restricted to) a 5-10km radius of the proposed facility. The visual impact will differ amongst places, depending on the distance from the facility. Tourists travelling through the region and residents of homesteads will likely experience visual impacts where the wind turbine structures are visible.

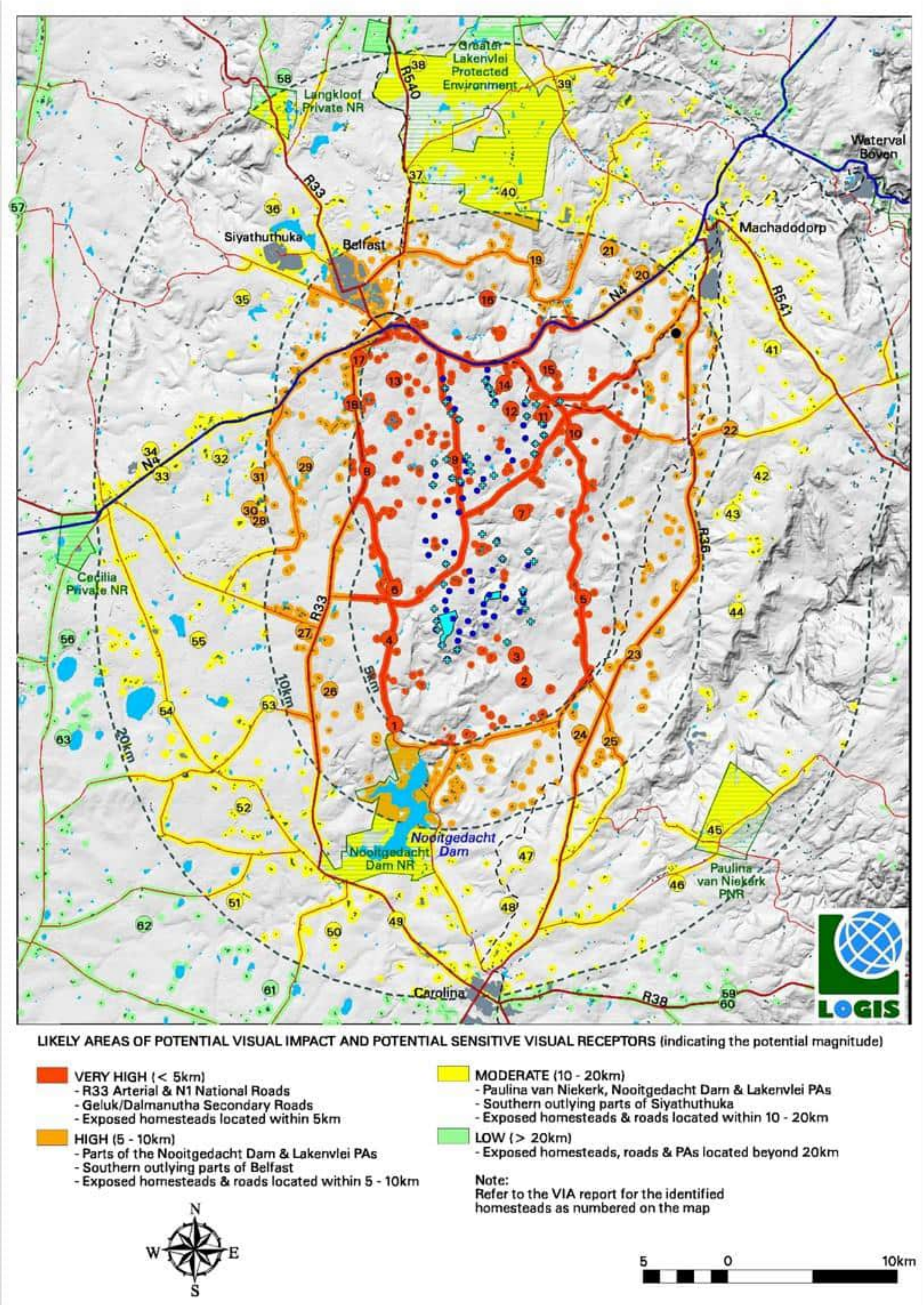


Figure 8-26 - Likely areas of potential visual impact and sensitive visual receptors for Alternative 1: Dalmanutha Wind facility

8.9 PALAEONTOLOGY

Figure 8-27 and **Figure 8-28** illustrates the palaeontology theme sensitivity from the screening reports for both alternatives.

MAP OF RELATIVE PALEONTOLOGY THEME SENSITIVITY

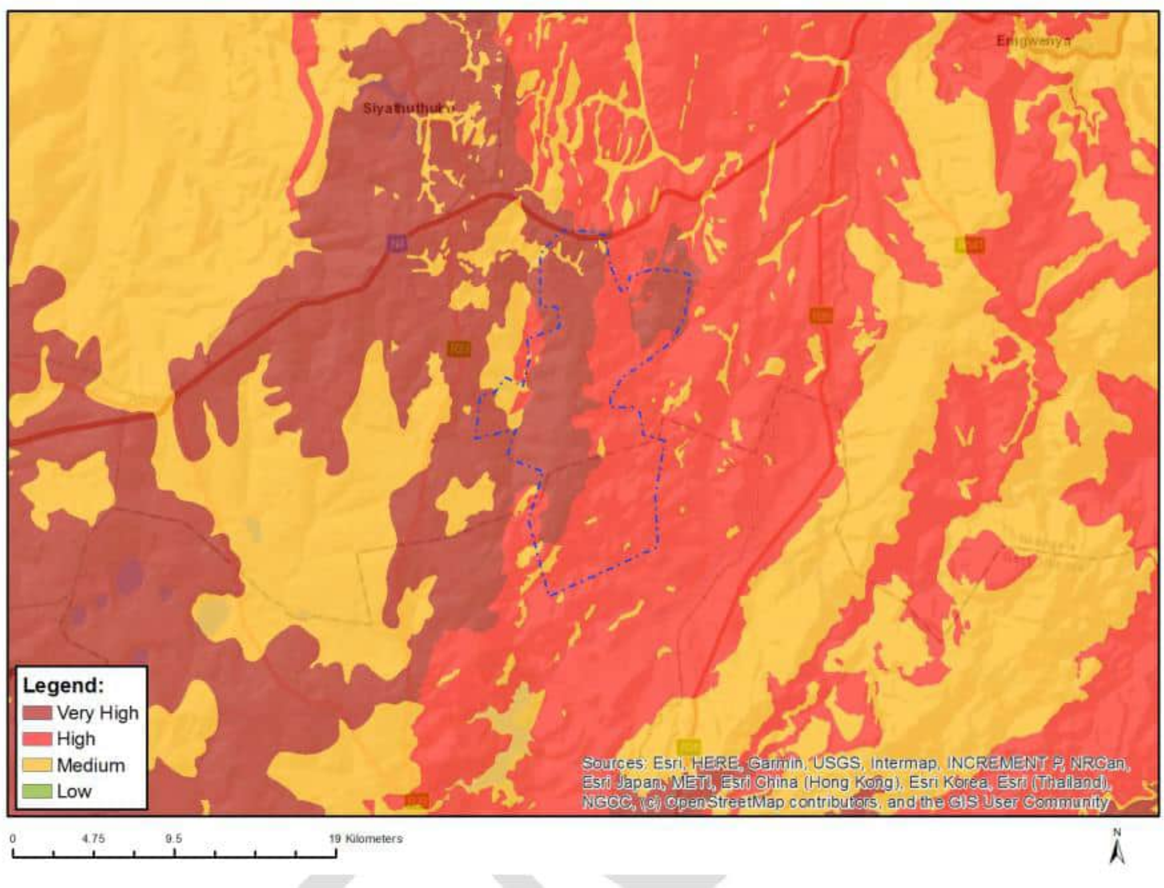


Figure 8-27 - DFFE palaeontology theme-Alternative 1

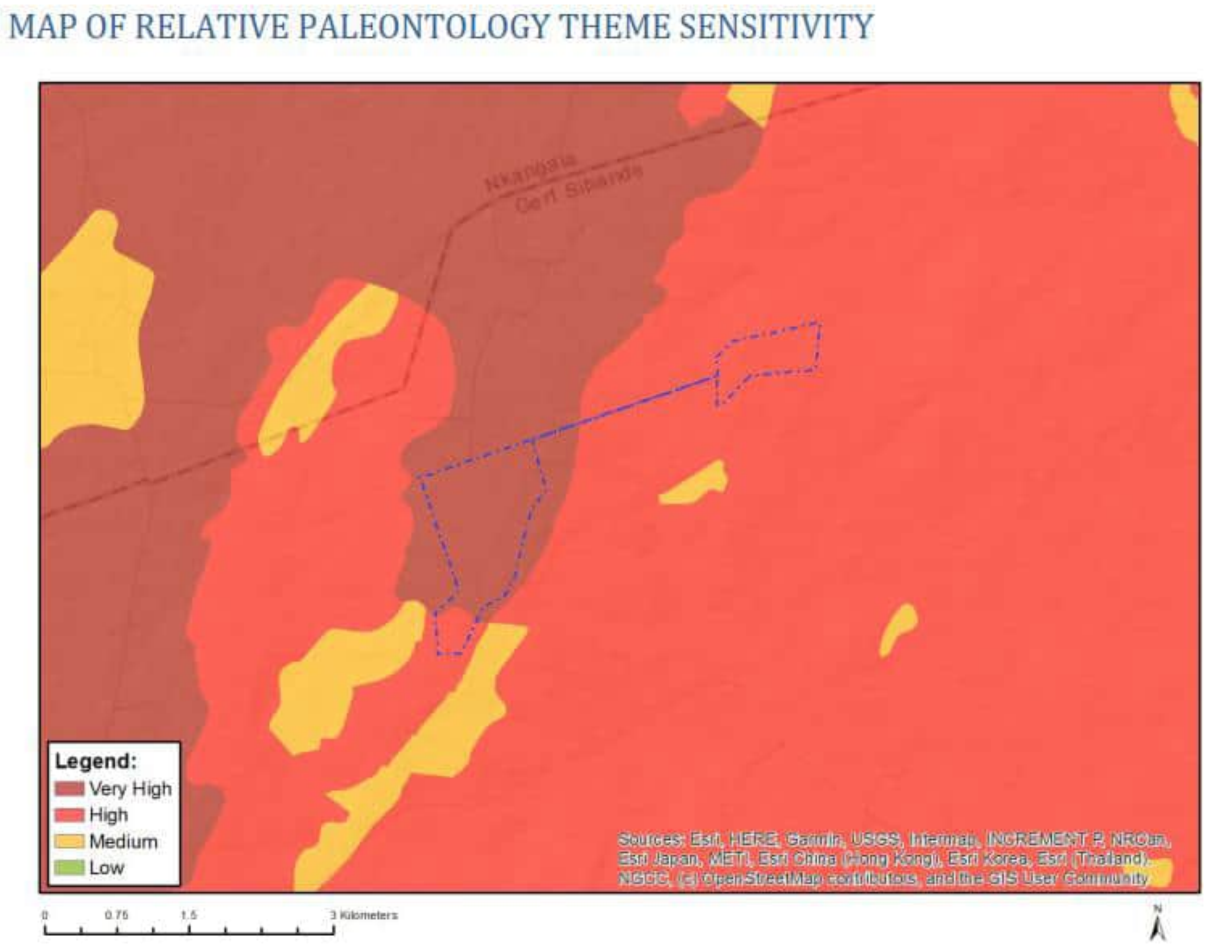


Figure 8-28 - DFFE palaeontology theme-Alternative 2

The palaeontological sensitivity of the site as per the screening tool was identified as Very High-High. However, the specialist appointed has rated the site as low sensitivity pre-mitigation.

Based on site visit verification and walkdown, as well as the lack of any previously recorded fossils from the area, it is extremely unlikely that any fossils would be preserved in the overlying soils and sands of the Quaternary. The site visit and walkthrough in February 2023 confirmed that there were NO FOSSILS (stromatolites or fossil plants) on the surface.

There were very few rocky outcrops that could potentially preserve fossils. There is a very small chance that fossils may occur below ground in the dolomites or quartzites, if present, or in the below-ground shales of the early Permian Vryheid Formation so a Fossil Chance Find Protocol is added to the EMPr (**Appendix I**).

8.10 NOISE

Figure 8-29 illustrates the noise theme sensitivity from the screening report generated

MAP OF RELATIVE NOISE THEME SENSITIVITY

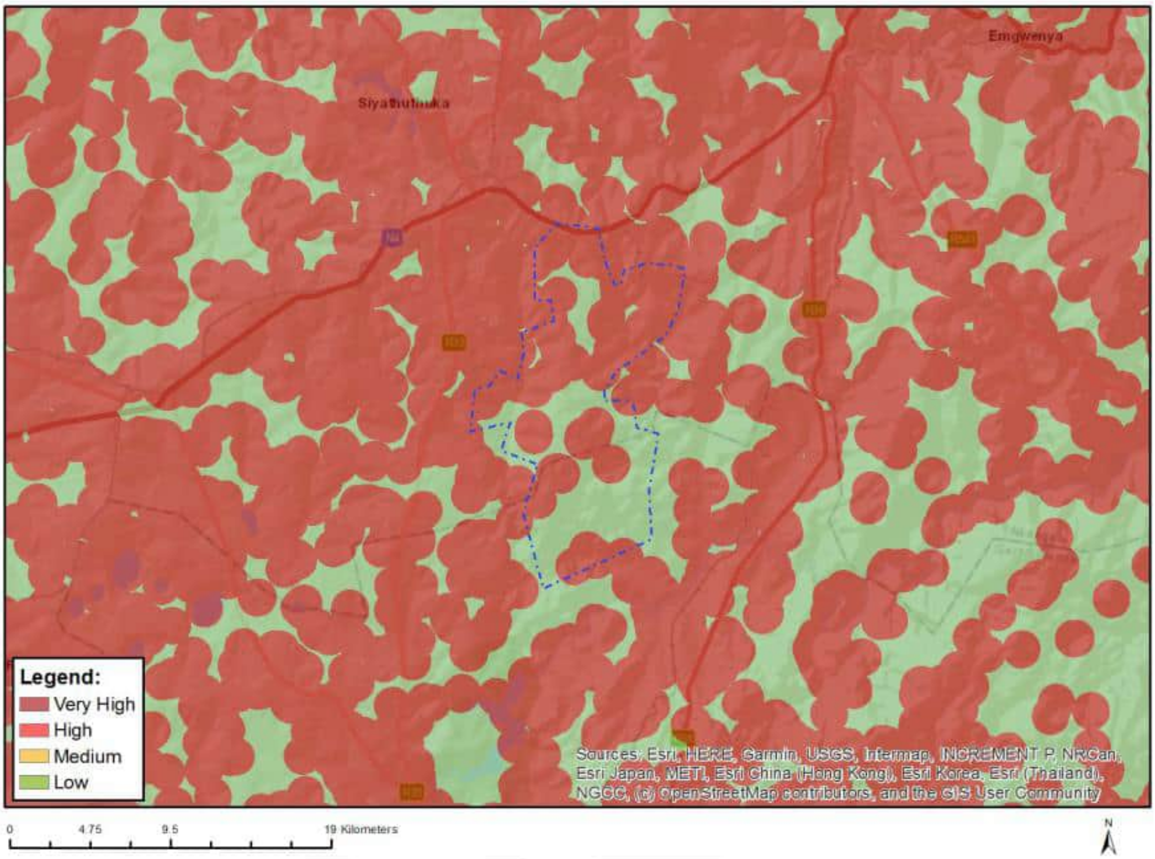


Figure 8-29 - DFFE noise theme

The screening tool has identified patches of the site as being high-low sensitivity in terms of noise receptors. The acoustic scoping study (**Appendix H.11**), has determined that the sensitivity is very low-moderate, post mitigation.

The resultant environmental acoustic risks associated with the construction phase of the Project are anticipated to be “low” to “very low” with general mitigation options employed. For the operational phase (Alternative 1), impacts are anticipated to be “low” as it is understood that the direct surrounding receptors are all vested in the Project. For the operational phase (Alternative 2), impacts are anticipated to be “moderate” especially at Rec 17 and Rec 18. Should the nearby turbines be relocated slightly, impacts are anticipated to become “low”.

8.11 TERRESTRIAL PLANT SPECIES

Figure 8-30 and **Figure 8-31** illustrates the plant species theme sensitivity from the screening report generated for both project alternatives.

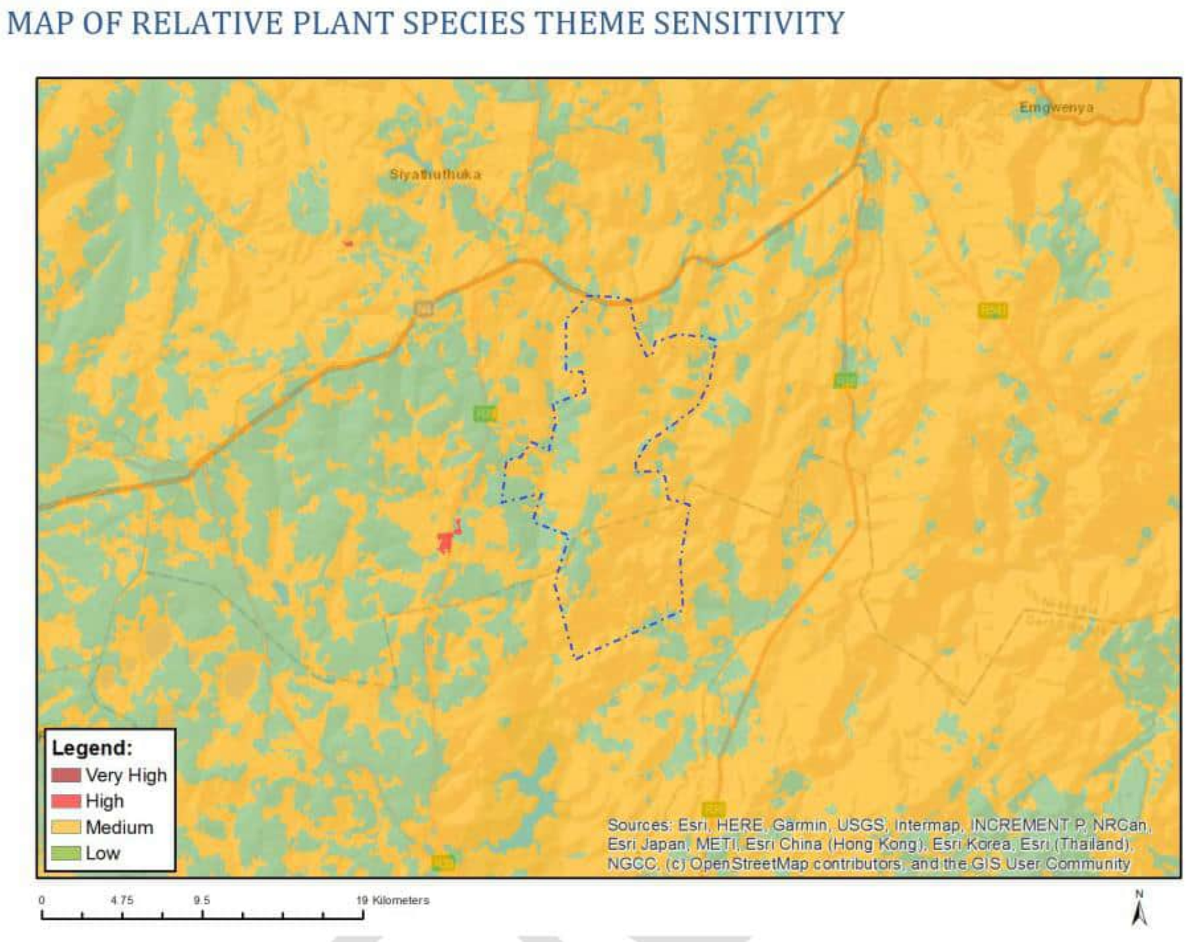


Figure 8-30 - DFFE plant species theme-Alternative 1

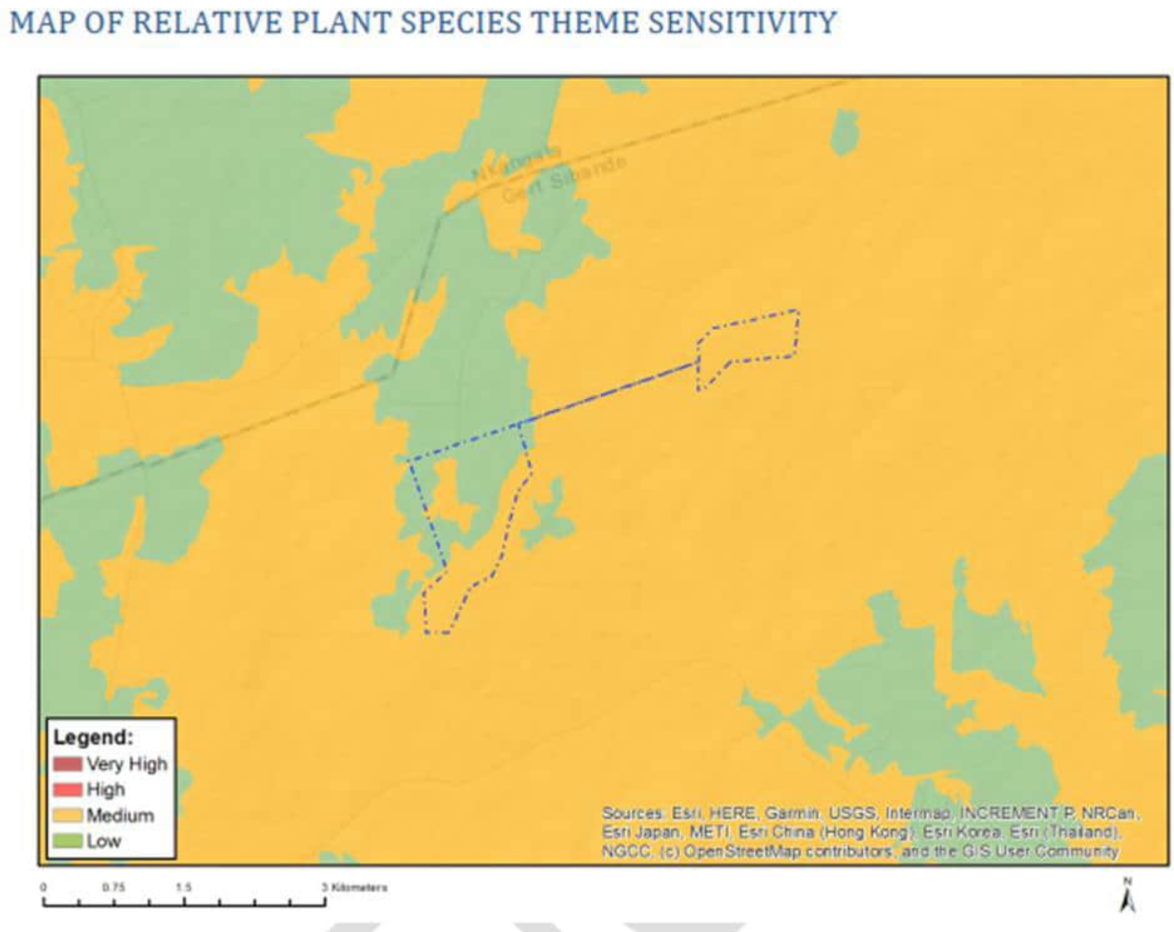


Figure 8-31 - DFFE plant species theme-Alternative 2

The screening tool identified the site as being medium-low sensitivity in terms of the plant species theme.

According to the terrestrial ecology impact assessment (**Appendix H**) the overall Plant Species Theme for the study area was confirmed to be 'Medium Sensitivity' on account of the potential presence of several threatened flora species.

Mapping of the Mpumalanga Biodiversity Sector Plan (2019) indicates that the study area encompasses a large, almost contiguous tract of land running longitudinally down the centre of the study area that is designated as either CBA Irreplaceable and CBA Optimal – shown in **Figure 7-30.** These areas are likely to be impacted by proposed Project infrastructure for both Alternative 1 and Alternative 2.

However, a review of GTI (2020) landcover classification for the study area indicates that certain small land parcels that are mapped as CBA Irreplaceable or CBA Optimal actually comprise modified habitats/sites. Similarly, it was noted during the October 2022 field survey, that large areas of grassland in the north of the study area had recently been ploughed and converted to cultivated fields by local farmers. As this land conversion is very recent, it is not reflected in the Mpumalanga Biodiversity Sector Plan and the GTI (2020) spatial datasets. As such, there is a degree of discrepancy between the CBA spatial layers and land that has in fact been recently transformed by farmers and subject to active cropping.

Figure 8-32 and **Figure 8-33** present maps showing identified sites where the CBA status of land is disputed. It must be appreciated that the delineation of the recently modified land portions discussed above, was conducted based on field observations and with the satellite imagery available at the time. Notwithstanding the above, it is evident from **Figure 8-32** and **Figure 8-33** that infrastructure associated with both proposed Project's will directly impact land designated as CBA Irreplaceable, as well as CBA optimal.

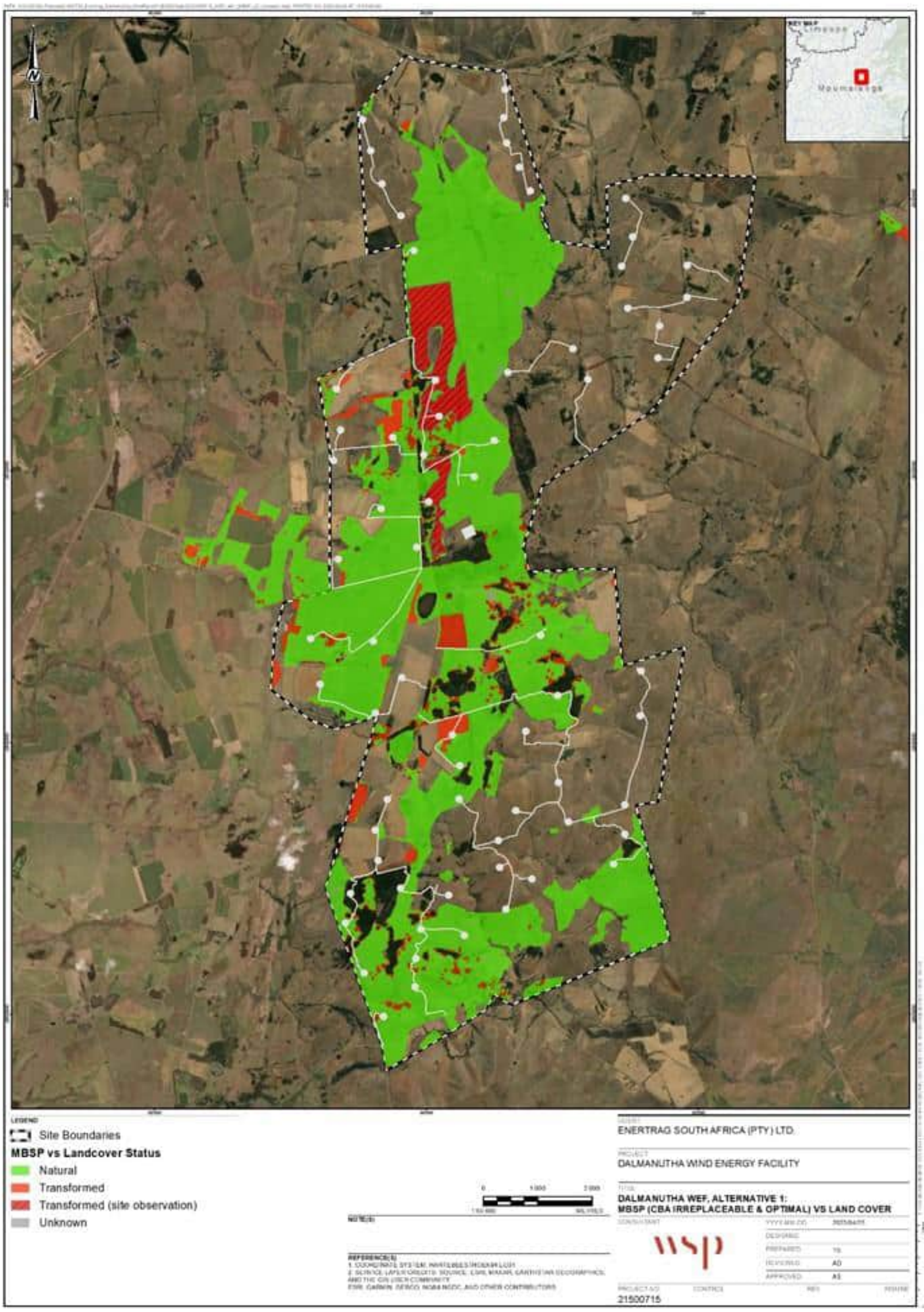


Figure 8-32 - Proposed Alternative 1 infrastructure and areas (red) of land designated CBA Irreplaceable and CBA Optimal designated land that are actually characterised by modified habitat, as determined by a comparison with land cover imagery and/or field observations.

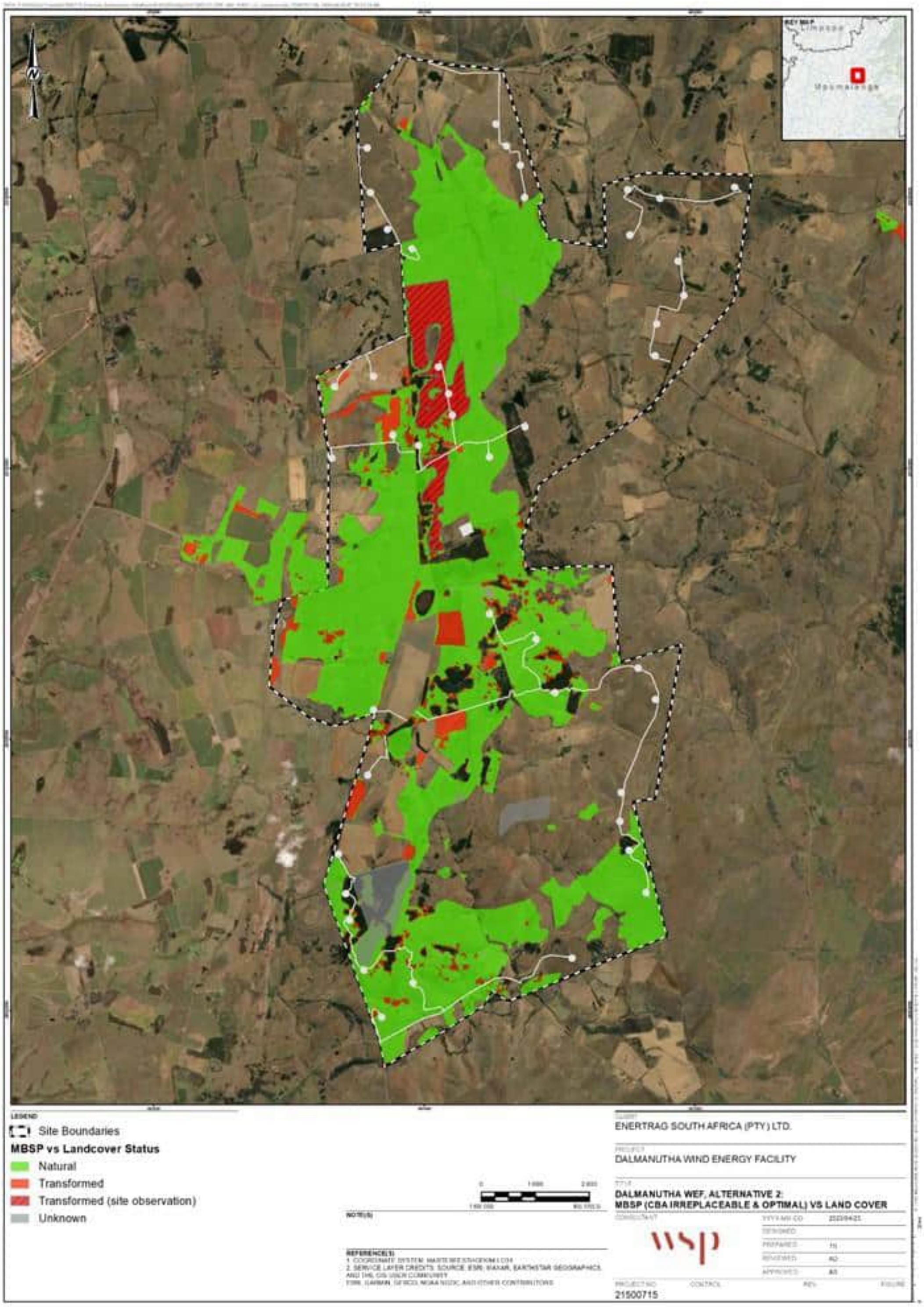


Figure 8-33 - Proposed Alternative 2 infrastructure and areas (red) of land designated CBA Irreplaceable and CBA Optimal designated land that are actually characterised by modified habitat, as determined by a comparison with land cover imagery and/or field observations.

8.12 TERRESTRIAL BIODIVERSITY

Figure 8-34 and **Figure 8-35** illustrates the terrestrial biodiversity theme sensitivity from the screening report generated for both project alternatives.

MAP OF RELATIVE TERRESTRIAL BIODIVERSITY THEME SENSITIVITY

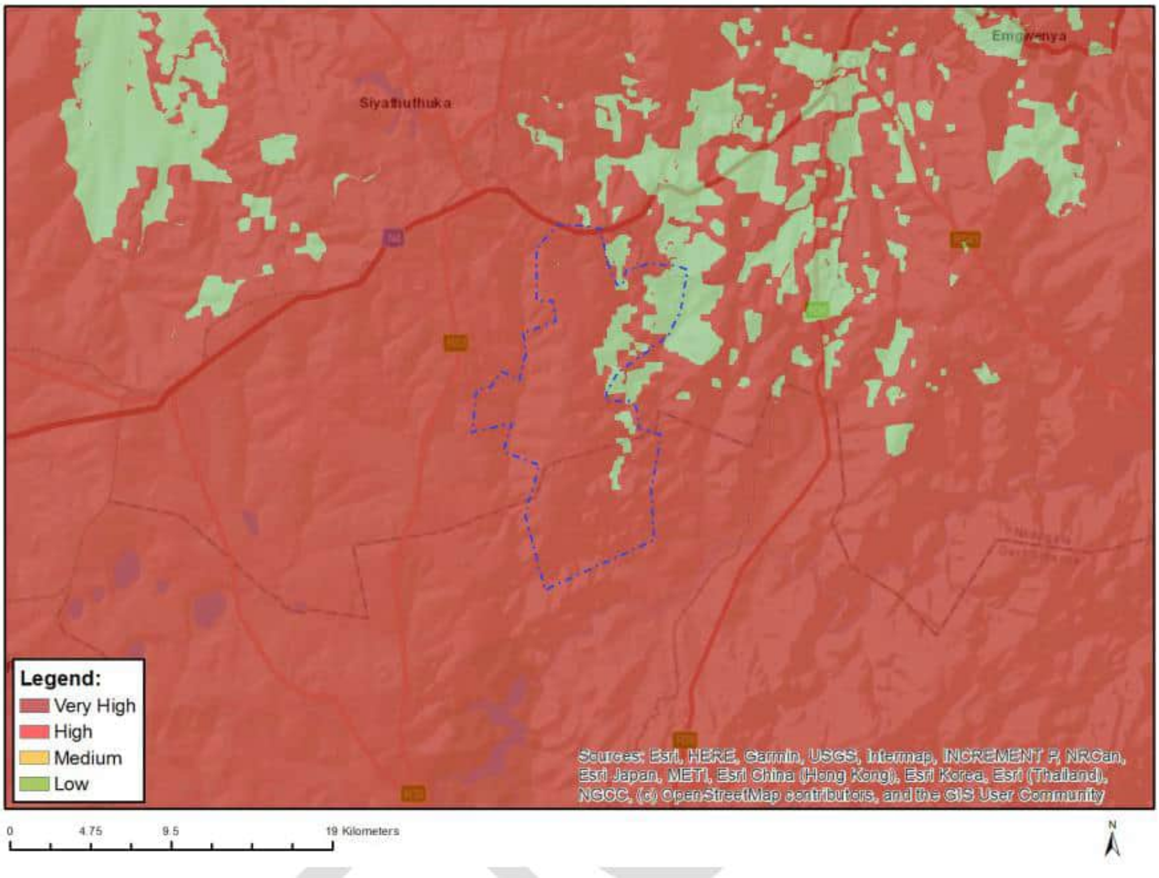


Figure 8-34 - DFFE terrestrial biodiversity theme-Alternative 1

MAP OF RELATIVE TERRESTRIAL BIODIVERSITY THEME SENSITIVITY

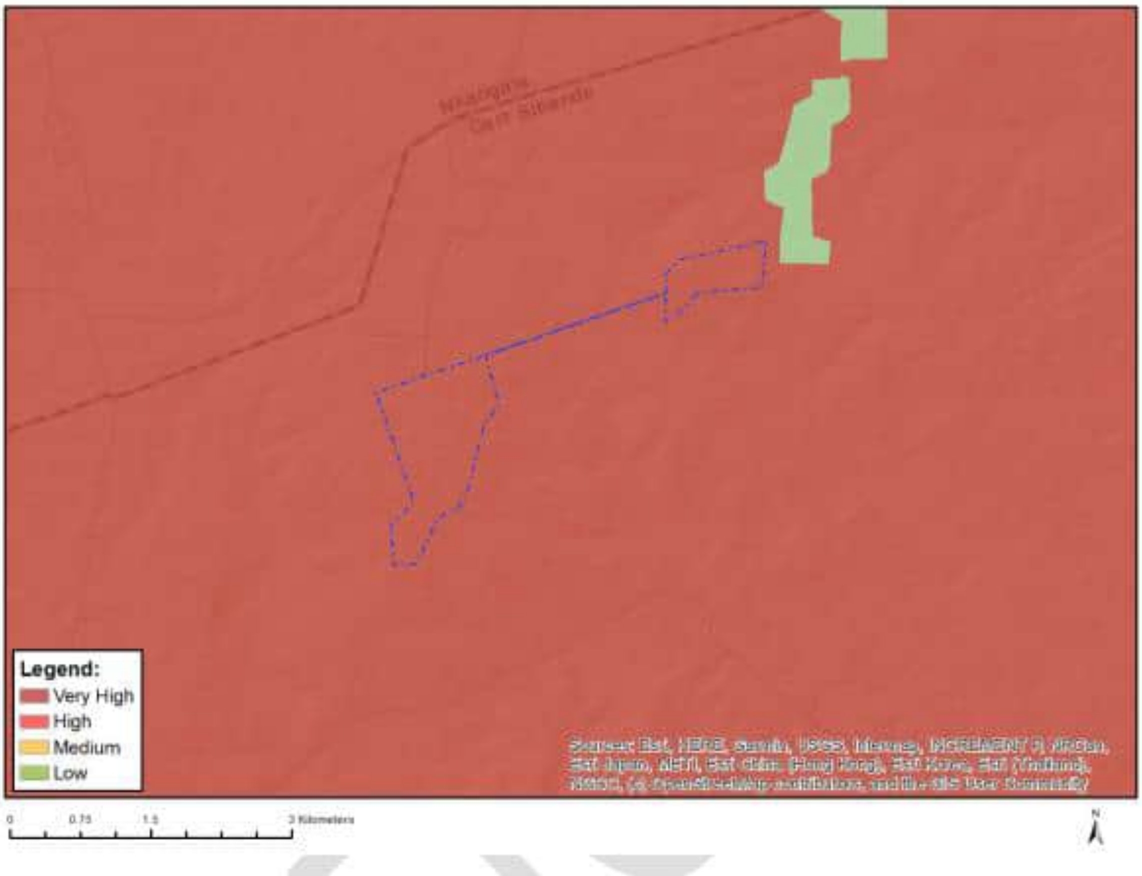


Figure 8-35 - DFFE terrestrial biodiversity theme-Alternative 2

According to the screening tool, much of the site is classified as highly sensitive, while also having patches of low sensitive areas. According to the terrestrial biodiversity studies, the site is highly sensitive due to the primary grasslands and has a present ecological state of A/B (Natural/near natural) in wetlands. The study also confirms the low sensitivity in secondary grassland and modified habitats. Secondary grasslands and modified habitats cannot contribute to provincial conservation targets, which is the intention of CBAs. Only (unavoidable) impacts sustained in primary grasslands and high value wetlands can be considered to affect CBAs, and as such trigger potential offset/compensation requirements.

The proposed infrastructure footprint was assessed at desktop level using the National Web-based Environmental Screening Tool.

According to the Tool, the Terrestrial Biodiversity Theme for the LSA is rated as 'Very High Sensitivity', due to its overlap with land mapped as:

- 'Critical Biodiversity Area' (CBA) 1, CBA2;
- Ecological Support Area: Landscape Corridor and Local Corridors (MBSP, 2019);
- Freshwater Ecosystem Priority Area (FEPA) sub-catchments;
- Endangered (Eastern Highveld Grassland, KaNgwane Montane Grassland) ecosystems;
- Protected Areas Expansion Strategy.

The National Web Based Screening Tool also indicated that the majority of the LSA is considered to be of 'Medium sensitivity' in terms of the Plant Species Theme on account of the potential presence of at least 19 flora species of conservation concern (e.g. *Khadia carolinensis, Asclepias dissona, Miraglossum davyi*).

The LSA is considered to be of 'Medium' – 'High' sensitivity in terms of the Animal Species Theme, due to the potential presence of the range-restricted Badplaas Black Millipede (*Doratogonus furculifer*) which is listed as Endangered on the IUCN Red List (Rudolf et al., 2021), and the mammals Robust Golden Mole (*Amblysomus robustus* – VU (Rampartab & Bronner, 2016)), Rough-haired Golden Mole (*Chrysospalax villosus* - VU), Maquassie Musk Shrew (*Crocidura maquassiensis* – VU), Spotted-necked Otter (*Hydrictis maculicollis* – VU), and Oribi (*Ourebia ourebi ourebi* - EN).

The LSA is considered to be of High sensitivity for bats, due to the presence of wetland and riparian habitat which bats utilise for foraging, and to a lesser degree (Medium sensitivity) due to the presence of croplands – also a foraging environment for bats.

The terrestrial plant and animal biodiversity specialist studies (**Appendix H.3,** and **Appendix H.15**) further confirmed the presence of land designated Critical Biodiversity Area (CBA) Irreplaceable, CBA Optimal, Ecological Support Area (ESA) Landscape Corridor, ESA Local Corridor, FEPA Sub-catchment, Endangered and Vulnerable Ecosystems, and a National Protected Area Expansion Strategy focus area.

Mapped vegetation communities within the study area, including locally important habitat types (e.g. forest gorge habitat) and their functional integrity and ecological importance, are summarised below:

Table 8-2 - Ecological importance of mapped vegetation communities in the LSA

Vegetation Community	Analysis
Cultivated Fields	A modified vegetation community, that has been heavily impacted by anthropogenic activity. Typically characterised by high-levels of ongoing disturbance and either denuded of vegetation (recently ploughed) and/or dominated by non-indigenous flora species. The ecological importance of this vegetation community is rated **Very Low**.
Alien Tree Plantations	A modified vegetation community, that is characterised by an almost complete dominance of alien invasive tree species. Little indigenous flora is present. It is noted that plantations do provide refuge habitat for sensitive fauna species. Notwithstanding this functional attribute, the ecological importance of the Alien Tree Plantations vegetation community is rated **Very Low**.
Dry Mixed Grassland	This is a large and variable vegetation community, that ranges from undisturbed to localised sites of disturbance and alien wattle colonisation. Dry mixed grassland constitutes important natural habitat for a variety of flora and fauna species, including many SCC. This community also play an important role in maintaining landscape connectivity, and in buffering rocky grassland and moist grassland/wetland habitats. The conservation importance and functional integrity of this vegetation community are both rated high, resulting in a high biodiversity importance

Vegetation Community	Analysis
	score. Receptor resilience is rated high-medium, resulting in an ecological importance rating of **Medium**.
Disturbed Grassland	Disturbed grassland is a subclimax vegetation community that has regenerated following past disturbance. Habitat is stable and essentially retains the functional attributes of undisturbed grassland habitat. This community is rated as having a medium functional integrity, but low conservation importance. The biodiversity importance of disturbed grassland community is thus low. Receptor resilience is rated high, resulting in an ecological importance rating of **Low**.
Rocky Grassland	Rocky grassland is a natural vegetation community, that is confined to ridge areas and localised sites embedded within the broader study area habitat matrix. The prominence of large rock outcrops and the presence of indigenous woody flora species, increases local-scale habitat heterogeneity and flora and fauna diversity. Several flora and fauna SCC have been recorded in this community, or have a high probability of occurrence. The functional integrity and conservation importance of the Rocky grassland are both rated high, resulting in a high biodiversity importance score. Receptor resilience is rated medium, and accordingly ecological importance is rated **High**.
Moist Grassland and Wetland	The Moist grassland and wetland community maintains several important ecological functions / traits, including its role in local hydrological patterns, providing linear and largely intact movement and dispersal corridors for fauna and flora, and promoting local-scale habitat heterogeneity. Moreover, several flora and fauna SCC have been recorded in this community, or have a high probability of occurrence. The functional integrity and conservation importance of the Moist grassland and wetland are both rated high, resulting in a high biodiversity importance score. Receptor resilience is rated medium, and accordingly ecological importance is rated **High**.
Forested Gorge Habitat	In the context of the study area, this is a small, but unique community, that is characterised by well-developed indigenous forest, flanked by tall vegetated rocky cliffs. The complex topographical template supports numerous microhabitats, which significantly contribute to local-scale habitat heterogeneity and the flora and fauna diversity of the study area. Several flora SCC have a high probability of occurrence in this community. The functional integrity and conservation importance of this community are rated high. The biodiversity importance of disturbed grassland community is thus high. Receptor resilience is rated low, and accordingly ecological importance is rated **Very High** (due to the very small extent of this community in the study area, it is not reflected on vegetation maps).

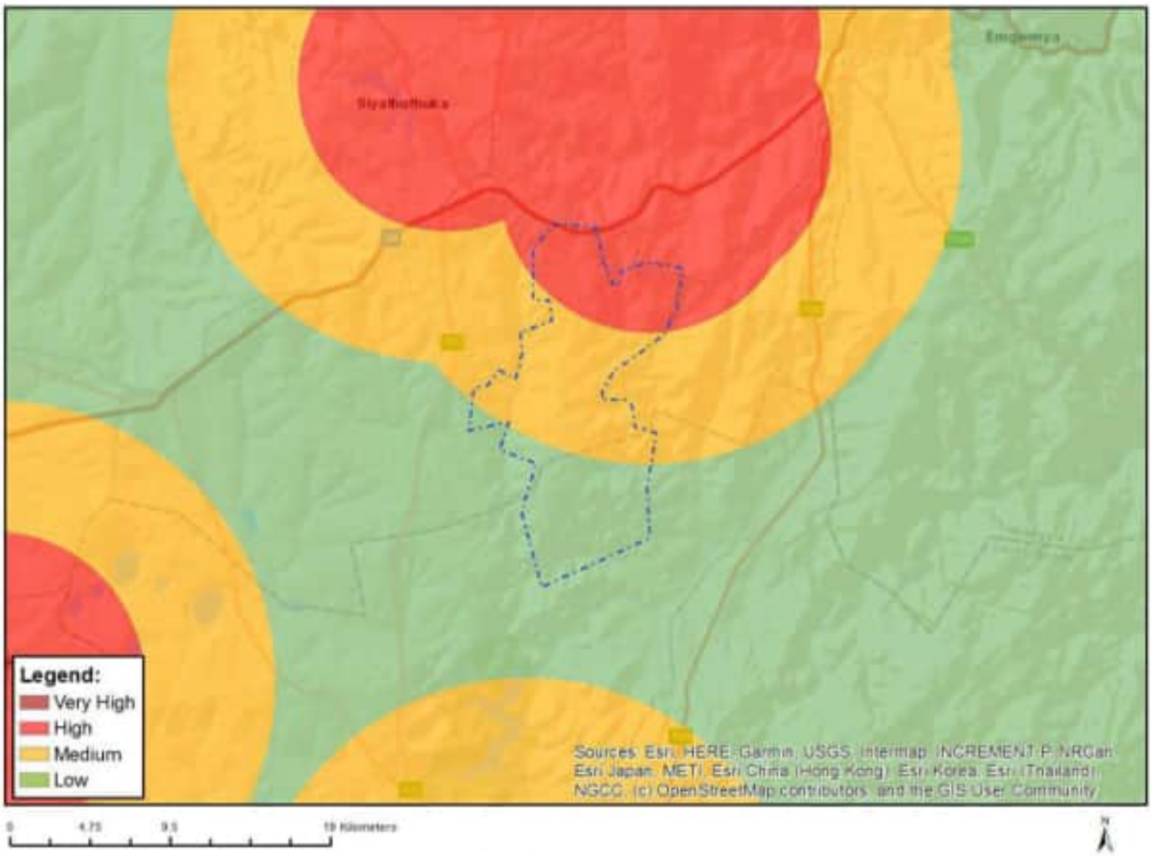
The proposed WEF development is not expected to significantly alter wetland ecological corridors/connectivity in the LSA for ground-dwelling species, since a 100 m buffer around all wetlands/watercourses was applied for turbine siting purposes, and while some road crossings of wetlands will be upgraded, upstream and downstream connectivity will be retained.

The siting of turbines at least 100 m outside of wetland/watercourse habitat for both alternatives is expected to partially reduce the risk of collision to birds using migratory flyways; Alternative 2 is preferred in this regard since it specifically replaces some higher risk turbines with solar developments, which pose low risk to flying birds.

8.13 CIVIL AVIATION

Figure 8-36 and **Figure 8-37** illustrates the civil aviation theme sensitivity from the screening report generated for both project alternatives.

MAP OF RELATIVE CIVIL AVIATION (WIND) THEME SENSITIVITY



Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
	X		

Sensitivity Features:

Sensitivity	Feature(s)
High	Within 8 km of other civil aviation aerodrome
Low	Low sensitivity
Medium	Between 8 and 15 km of other civil aviation aerodrome

Figure 8-36 - DFFE Civil Aviation Theme-Alternative 1

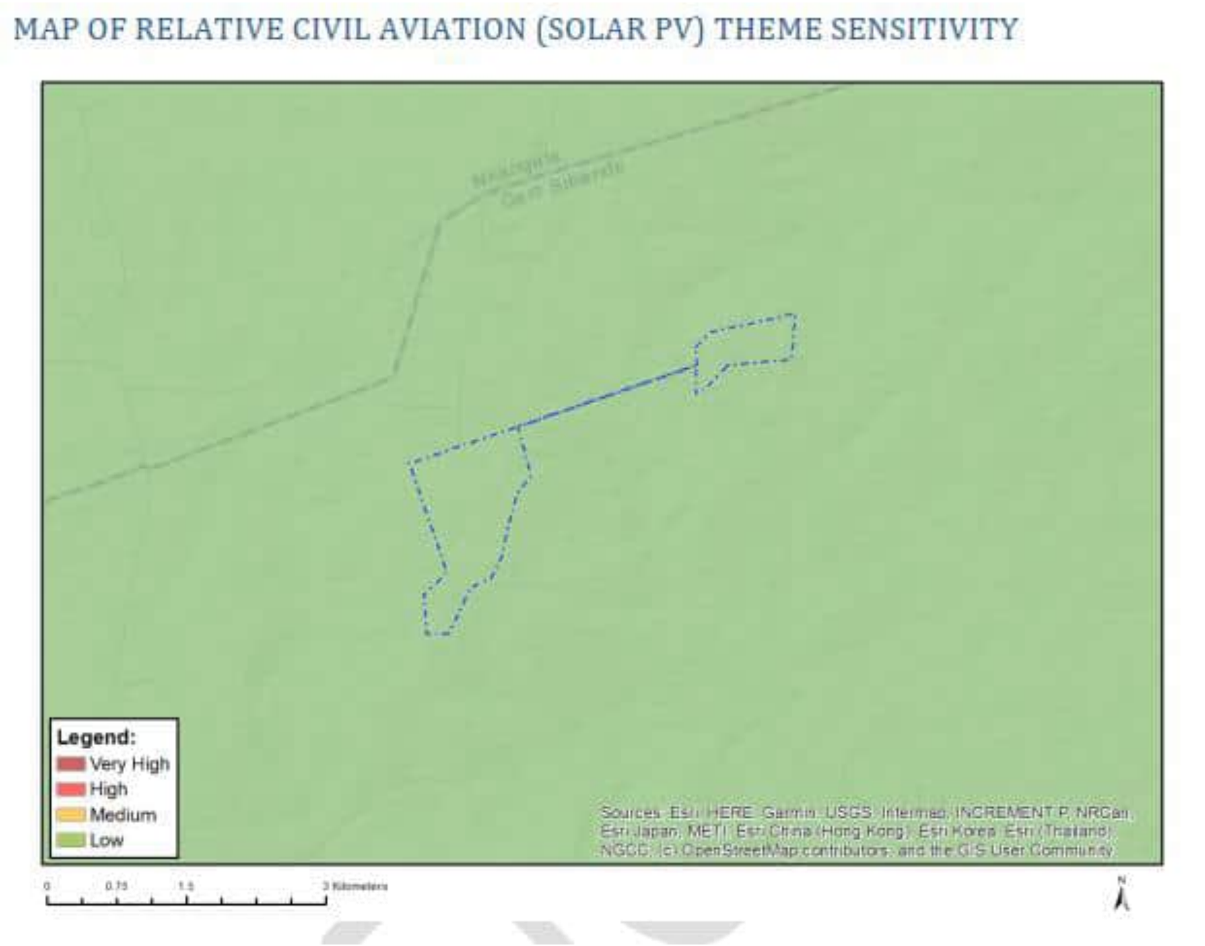


Figure 8-37 - DFFE Civil Aviation Theme-Alternative 2

According to the DFFE Screening Tool Report, civil aviation is regarded as having high sensitivity in the northern section of the study area. The proposed development site is located between 8 and 15 km of civil aviation aerodromes. The only aerodromes identified within 8 – 15km of the study area is the Belfast Aerodrome. Satellite imagery shows no obvious facilities (i.e. hangarage) for residential aircraft. Historical photos show that there has been no active use or maintenance of runways in the past 5 years (**Figure 8-38**). The aerodrome is thus considered unserviceable by general aviation. Therefore, the sensitivity is considered to be low.

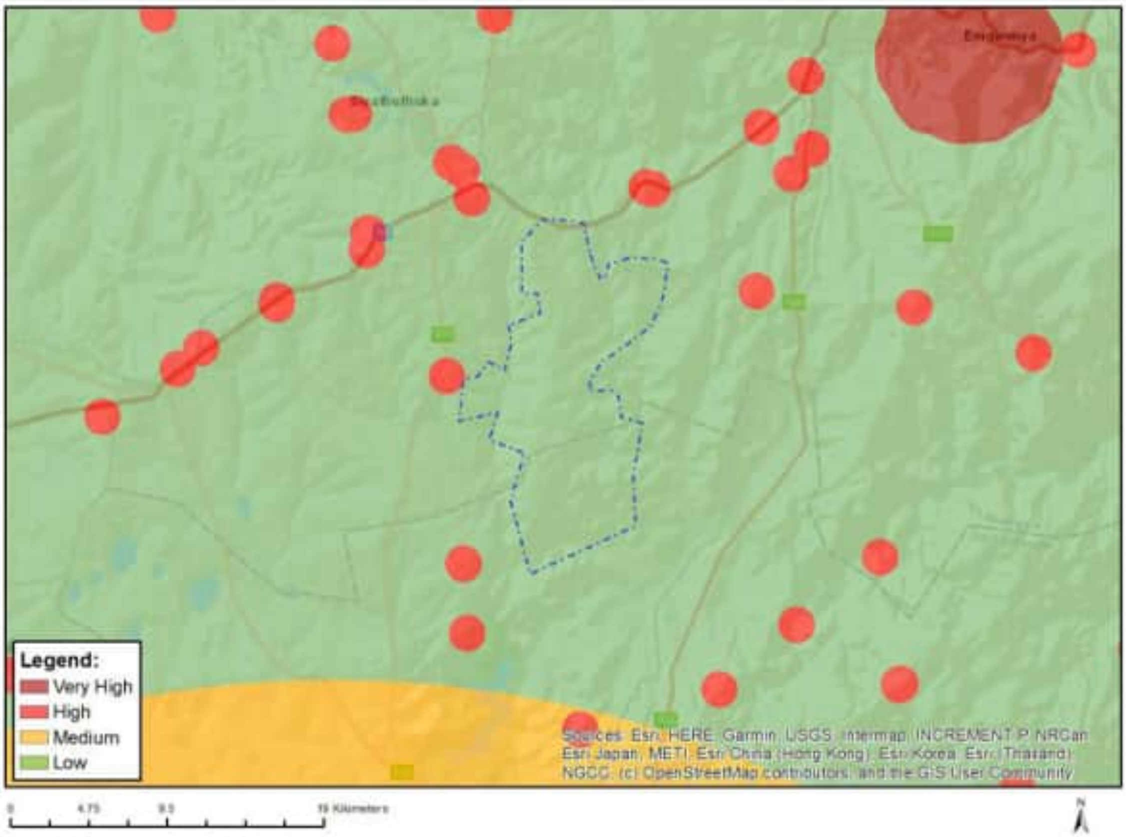
The relevant Authorities (i.e. ATNS and SACAA) have been included on the project stakeholder database. As of the 1st of May 2021, ATNS has been appointed as the new Obstacle application Service Provider for Windfarms and later Solar Plants. Their responsibility would pertain to the assessments, maintenance, and all other related matters in respect to Windfarms and in due time Power Plant assessments. An Application for the Approval of Obstacles has been submitted to ATNS but not response has been received to date. The SACAA will be included on the project stakeholder database.

Figure 8-38 - Satellite Imagery of Belfast Aerodrome (left - 2023, Right - 2019)

8.14 RFI

Figure 8-39 and **Figure 8-40** illustrates the RFI theme sensitivity from the screening report generated for both project alternatives.

MAP OF RELATIVE RFI (WIND) THEME SENSITIVITY



Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
	X		

Sensitivity Features:

Sensitivity	Feature(s)
High	Within 1 km of a telecommunication facility;None;More than 60 km from a Weather Radar installation
Low	Low sensitivity for telecommunications;None;More than 60 km from a Weather Radar installation

Figure 8-39 - DFFE RFI Theme- Alternative 1

MAP OF RELATIVE RFI THEME SENSITIVITY

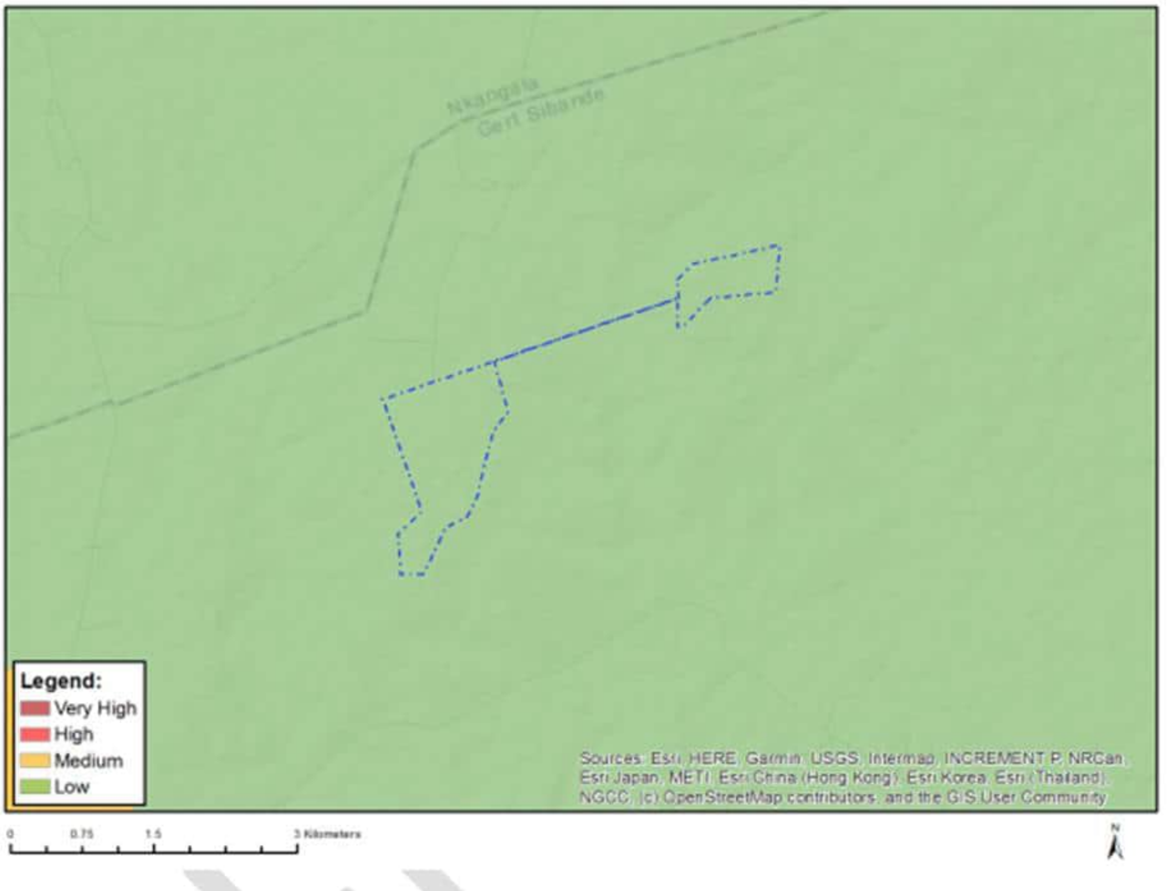


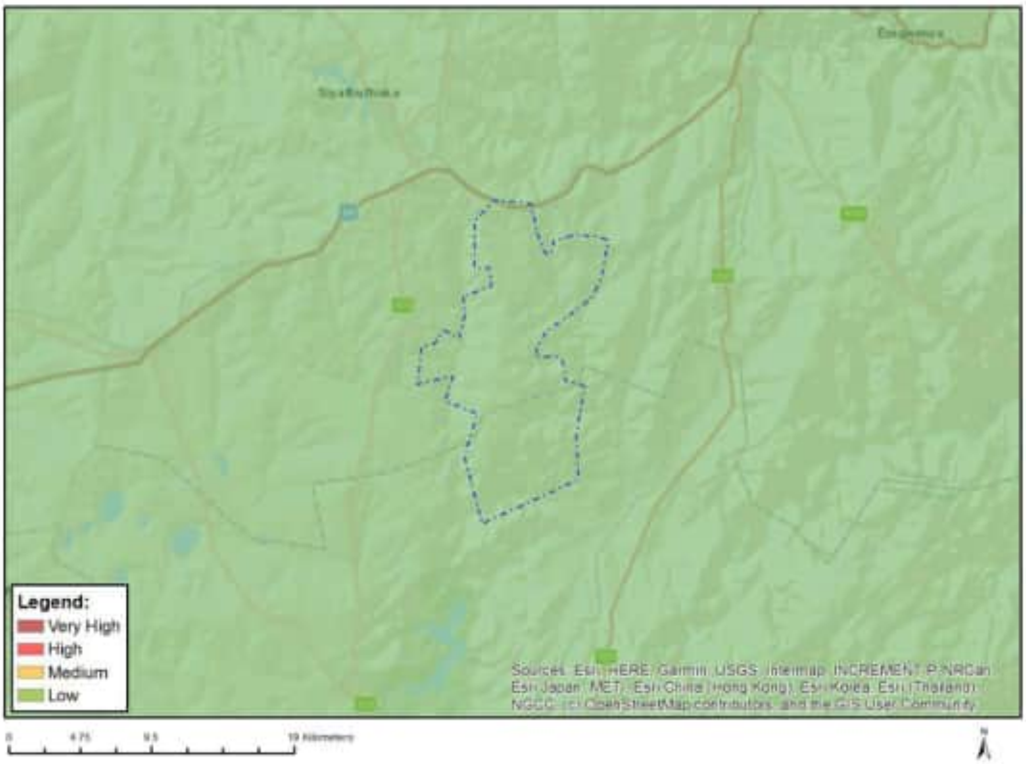
Figure 8-40 - DFFE RFI Theme-Alternative 2

The RFI theme is considered to be of low sensitivity and therefore a compliance statement is not required. However, the relevant stakeholders have been included on the project stakeholder database i.e. SARAO, SKA and SAWS. The developer has submitted a telecom letter to SAWS inquiring about the potential impact of the project on their telecommunications network. Response was received on 19 October 2021 stating that the project will have no significant impact on their radar.

8.15 DEFENCE

Figure 8-41 and **Figure 8-42** illustrates the Defence theme sensitivity from the screening report generated for both project alternatives.

MAP OF RELATIVE DEFENCE (WIND) THEME SENSITIVITY



Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
			X

Sensitivity Features:

Sensitivity	Feature(s)
Low	Low sensitivity

Figure 8-41 - DFFE Defence Theme-Alternative 1

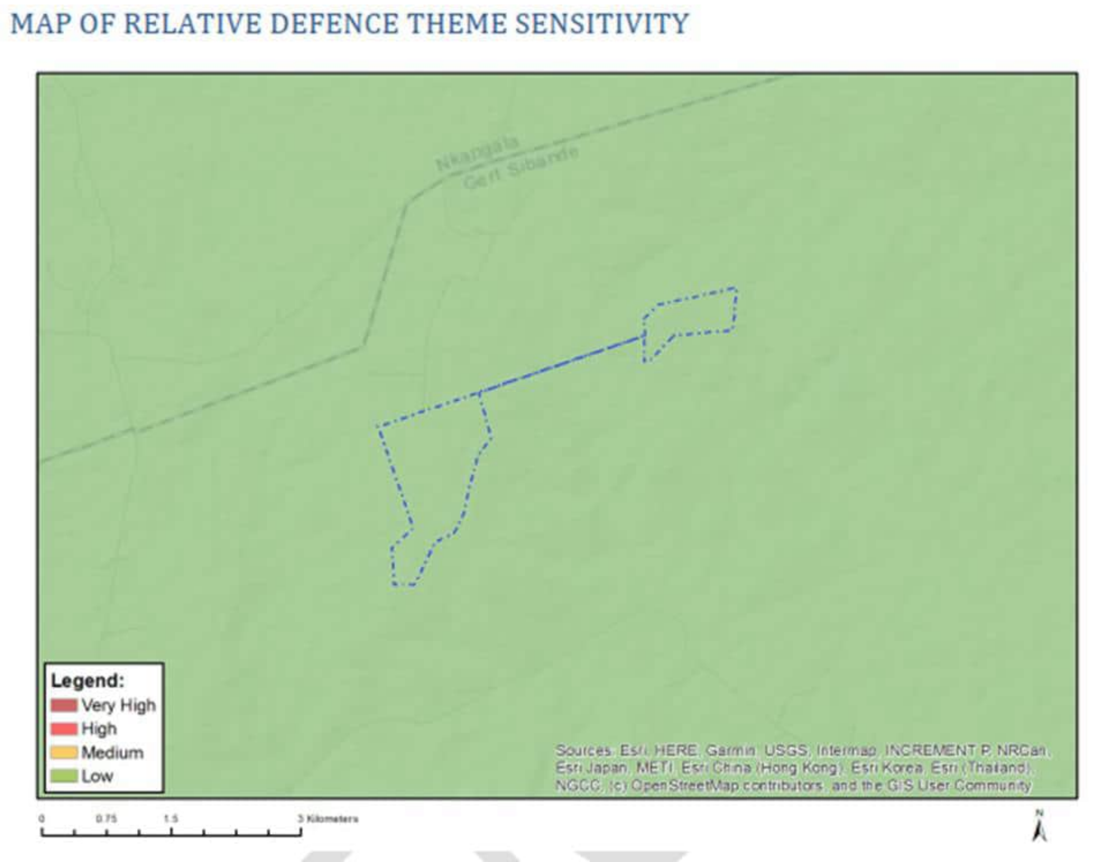


Figure 8-42 - DFFE Defence Theme-Alternative 2

The defence theme is considered to be of low sensitivity and therefore a compliance statement is not required. However, the relevant stakeholders have been included on the project stakeholder database i.e. Department of Defence. The developer has submitted a telecom letter to SANDF inquiring about the potential impact of the project on their telecommunications network. Response was received on 29 June 2022 stating that (i) the location of the facility is not in proximity to military infrastructure and is therefore not expected to have any impacts on the landward activities, (ii) the facility does not intrude into the DOD specified buffers around communication installations and communication links and (iii) the facility is located beyond the bounds of any aviation related buffers and holds no implication for the SAAF.

8.16 SITE SENSITIVITY VERIFICATION SUMMARY

A summary of the DFFE screening tool, the applicable legislation as well as the specialist sensitivity verification are detailed in **Table 8-3** below.

Table 8-3 - Assessment Protocols and Site Sensitivity Verification Summary

Specialist Assessment	Assessment Protocol	DFFE Screening Tool Sensitivity (WEF)	DFFE Screening Tool Sensitivity (SEF)	Specialist Sensitivity Verification
Agricultural Compliance Statement	*Protocol for the specialist assessment and minimum report content requirements of environmental impacts on agricultural resources by onshore wind and/or solar photovoltaic energy generation facilities where the electricity output is 20 megawatts or more*	High and Medium Sensitivity	High and Medium Sensitivity	High and Low Sensitivity
Terrestrial Biodiversity Impact Assessment	*Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial Biodiversity*	High Sensitivity	High Sensitivity	High Sensitivity
Aquatic Biodiversity Impact Assessment	*Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Aquatic Biodiversity*	High and Low Sensitivity	High and Low Sensitivity	High to Very High Sensitivity for Wetlands
Plant Species	*Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial Plant Species*	Medium and Low Sensitivity	Medium and Low Sensitivity	Medium Sensitivity
Animal Species	*Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial Animal Species*	High and Medium Sensitivity	High and Medium Sensitivity	High-Medium Sensitivity
Bats	*Site Sensitivity Verification Requirements where a specialist Assessment is required*	High Sensitivity	N/A	High to Medium Sensitivity

Specialist Assessment	Assessment Protocol	DFFE Screening Tool Sensitivity (WEF)	DFFE Screening Tool Sensitivity (SEF)	Specialist Sensitivity Verification
	but no Specific Assessment Protocol has been prescribed			
Avifauna Impact Assessment	*Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial Animal Species*	Low Sensitivity	Low Sensitivity	Very High Sensitivity
Archaeological and Cultural Heritage Impact Assessment	*Site Sensitivity Verification Requirements where a specialist Assessment is required but no Specific Assessment Protocol has been prescribed*	Low Sensitivity	Low Sensitivity	Low with isolated points as High Sensitivity
Palaeontology Impact Assessment	*Site Sensitivity Verification Requirements where a specialist Assessment is required but no Specific Assessment Protocol has been prescribed*	Very High and High Sensitivity	Very High and High Sensitivity	Low Sensitivity
Visual (Landscape) Impact Assessment	*Site Sensitivity Verification Requirements where a specialist Assessment is required but no Specific Assessment Protocol has been prescribed*	Very High Sensitivity	Very High Sensitivity	High Sensitivity
Flicker Assessment	*Site Sensitivity Verification Requirements where a specialist Assessment is required but no Specific Assessment Protocol has been prescribed*	High and Low Sensitivity	N/A	High Sensitivity
Noise Assessment	*Protocol for Specialist Assessment and Minimum Report Content requirements for Noise Impacts*	High and Low Sensitivity	N/A	Medium to Low Sensitivity
Civil Aviation Assessment	*Site Sensitivity Verification Requirements*	High Sensitivity	Low Sensitivity	Low Sensitivity

Specialist Assessment	Assessment Protocol	DFFE Screening Tool Sensitivity (WEF)	DFFE Screening Tool Sensitivity (SEF)	Specialist Sensitivity Verification
	where a specialist Assessment is required but no Specific Assessment Protocol has been prescribed			
Defence Assessment	*Site Sensitivity Verification Requirements where a specialist Assessment is required but no Specific Assessment Protocol has been prescribed*	Low Sensitivity	Low Sensitivity	Low Sensitivity
RFI Assessment	*Site Sensitivity Verification Requirements where a specialist Assessment is required but no Specific Assessment Protocol has been prescribed*	Low Sensitivity	Low Sensitivity	Low Sensitivity

8.17 CONSOLIDATED SITE SENSITIVITY

The Dalmanutha site boundary, as indicated in Section 6.1, was assessed by the specialists as part of desktop assessments and subsequent fieldwork. The specialists provided their sensitivity layers indicating the various sensitivities present on site. Utilising the sensitivity layers (which includes the required buffers) provided by the specialists, a preliminary consolidated map showing all sensitivities identified by specialists for Alternative 1 and Alternative 2, as illustrated in **Figure 8-43** and **Figure 8-44** respectively. **Figure 8-45** and **Figure 8-46** show the consolidated No-Go areas and buffers identified by the specialists on the site for Alternative 1 and Alternative 2 respectively.

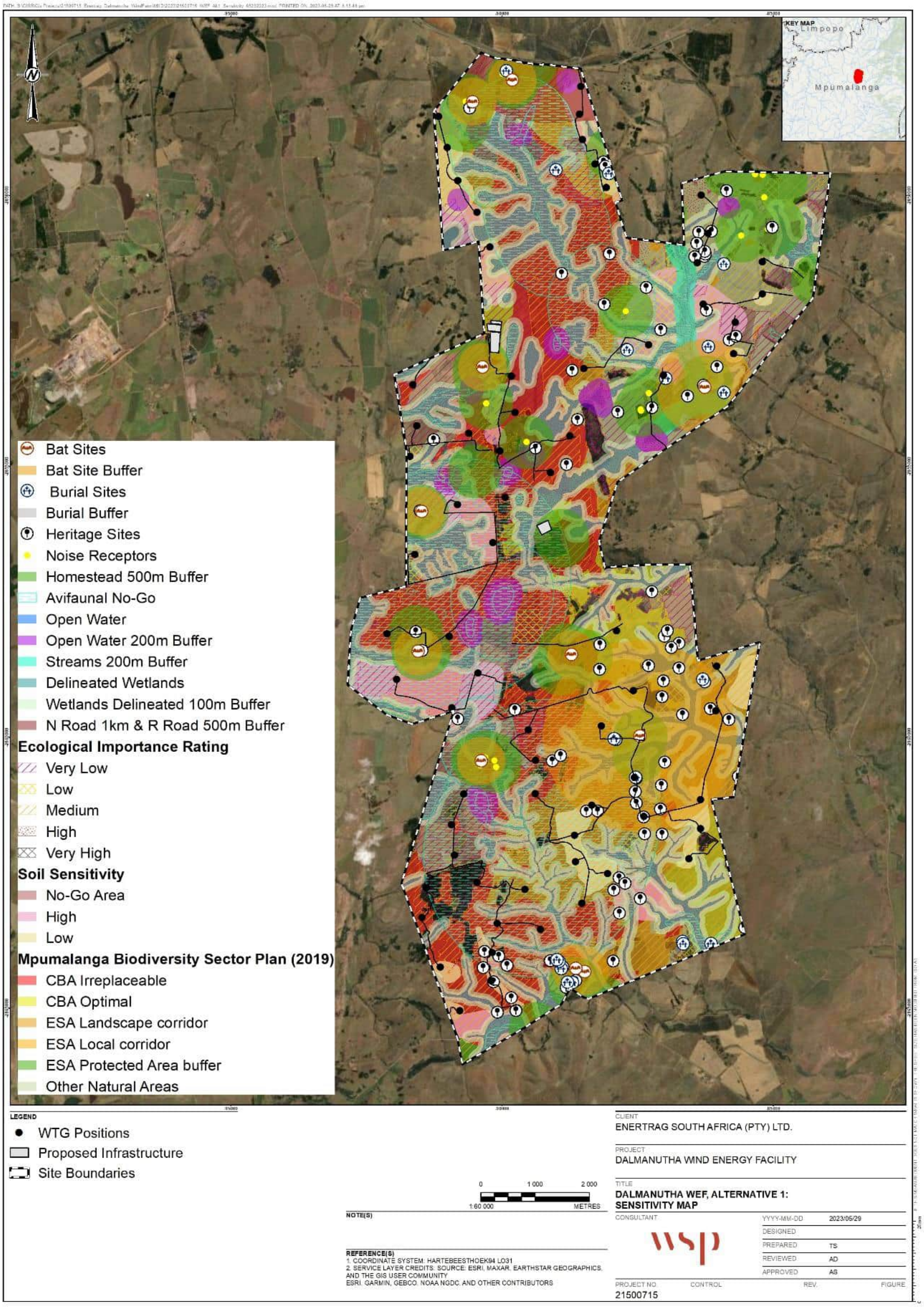


Figure 8-43 - Consolidated Sensitivity map-Alternative 1

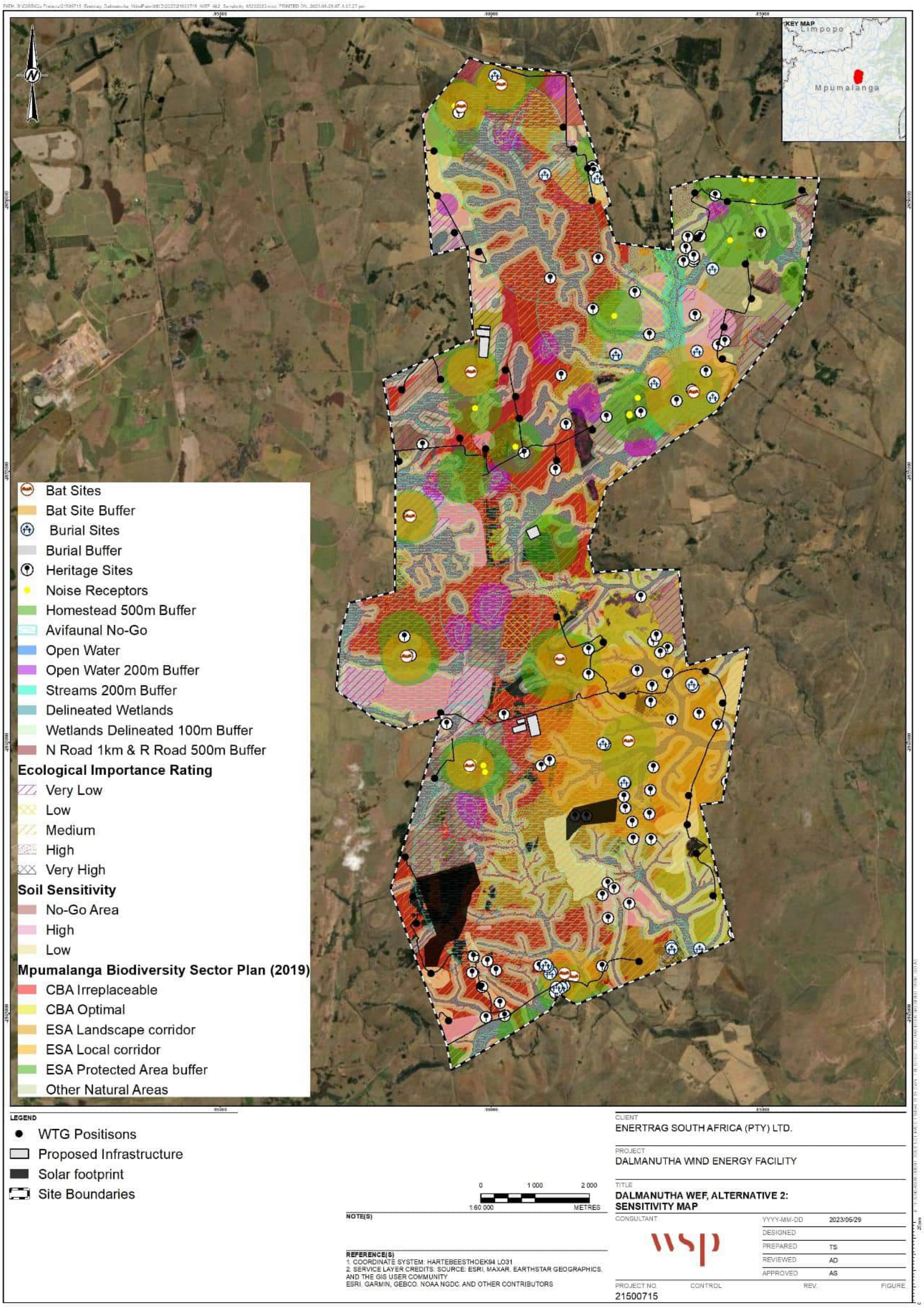


Figure 8-44 - Consolidated Sensitivity map-Alternative 2

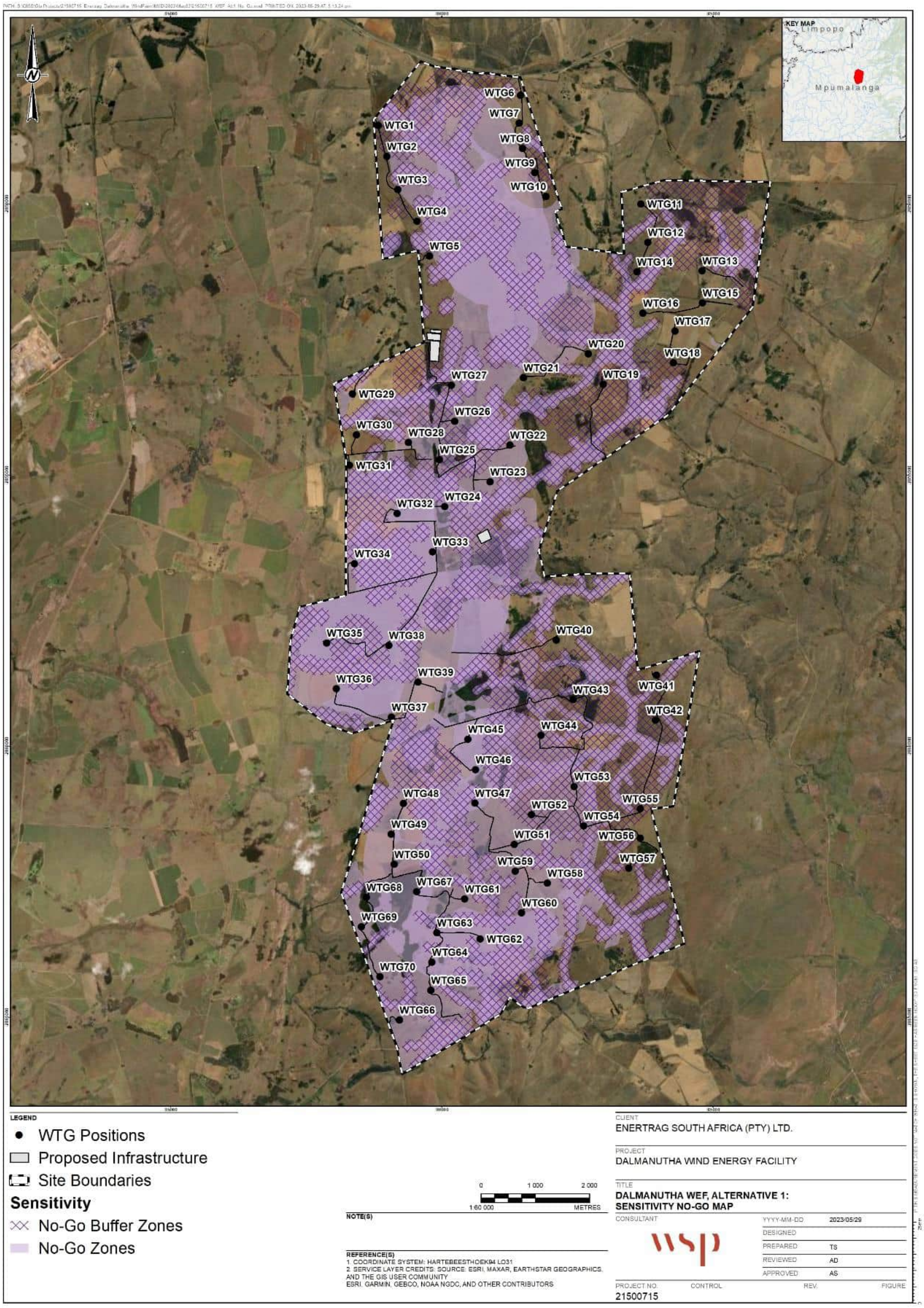


Figure 8-45 - Consolidated No-Go Areas map-Alternative 1

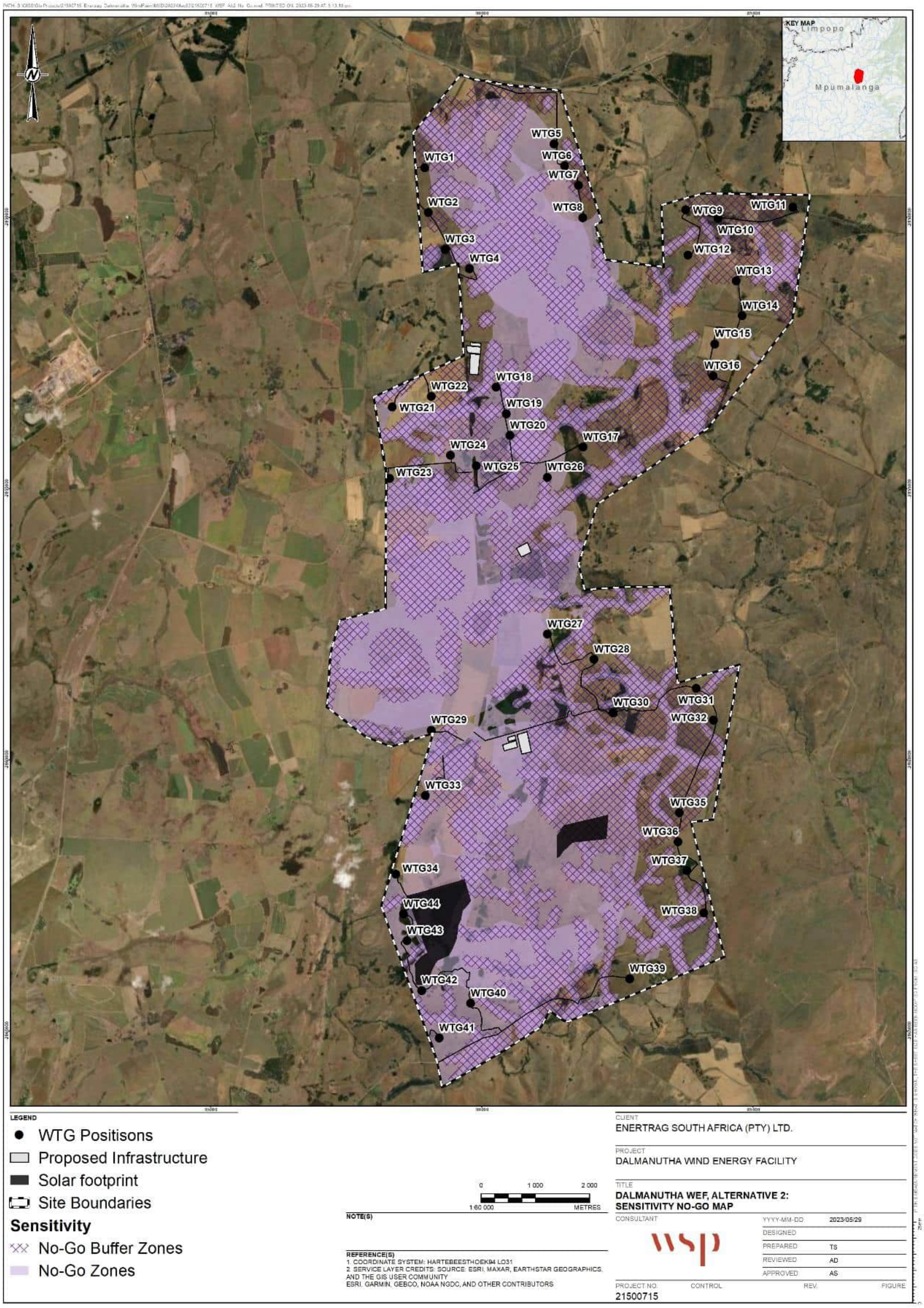


Figure 8-46 - Consolidated No-Go Areas map-Alternative 2

9 IMPACT ASSESSMENT

This impact assessment phase of the EIR process is aimed to assess those potential impacts that are most likely to be significant from an environmental and social perspective. The assessment of anticipated impacts associated with the proposed Project is a key component to the EIR process. This Chapter identifies and assesses those perceived environmental and social effects associated with the proposed Project alternatives. The assessment methodology is indicated in **Section 4.2.**

The issues assessed stem from those aspects presented in **Section 7** of this document as well as project description provided. Each significant issue that has been identified has been investigated further during this EIR process.

Potential impacts have been identified and assessed according to the phases of the project's development. For purposes of this report, these phases have been generically defined below.

- Construction Phase:

  The construction phase includes the preparatory works/activities typically associated the creation of surface infrastructure, access and electrical power. The activities most relevant to this phase include but not limited to : Topsoil stripping; Cut and fill activities associated with site preparation (if required).

- Operation Phase:

  The operational phase includes the daily activities associated with Dalmanutha Energy facility.

- Decommissioning Phase:

  The closure phase includes the activities associated with the removal/dismantling of machinery/equipment/infrastructure no long necessary to the operation.

9.1 NOISE AND VIBRATIONS

9.1.1 CONSTRUCTION PHASE

Unlike general industry, construction activities are not always stationary and in one location. Construction activities at the proposed site will include civil works (including surveying), reinforced concrete works, masonry works, façade works, floor works, general construction activities including mechanical, electrical, and plumbing installation works. Due to the erratic and transient nature of such construction activities as well as the fact that detailed construction phase plans have not yet been developed for the proposed Project, noise impacts from the construction phase of the facility could not be quantified.

During the construction phase of the facility various noise sources will be present onsite including earth-moving equipment (trucks, cranes, scrapers and loaders), compressors and generators, pumps, rotary drills, concrete mixers and materials handling activities among others. All of these sources will generate substantial amounts of noise and may impact on neighbouring sensitive receptors. As such, mitigation interventions are advised during the construction phase. These mitigation recommendations are detailed in the section that follows:

Table 9-1 – Construction Impact of Noise

Potential Impact Construction phase impacts of noise on sensitive receptors- (both Alternatives)	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	3	2	1	1	3	**21**	**Low**	(-)	Easy
With Mitigation	2	2	1	1	2	**12**	**Very Low**	(-)	
Mitigation and Management Measures	▪ Planning construction activities in consultation with local communities so that activities with the greatest potential to generate noise are planned during periods of the day that will result in least disturbance. Information regarding construction activities should be provided to identified and nearby receptors likely to be affected. Such information includes: ▪ Proposed working times. ▪ Anticipated duration of activities. ▪ Explanations on activities to take place and reasons for activities. ▪ Contact details of a responsible person on site should complaints arise. ▪ When working near a potential sensitive receptor, limit the number of simultaneous activities to a minimum as far as possible. ▪ Using noise control devices, such as temporary noise barriers and deflectors for high impact activities, and exhaust muffling devices for combustion engines. ▪ Selecting equipment with the lowest possible sound power levels whilst still being suitable for the specific task. ▪ Ensuring equipment is well-maintained to avoid additional noise generation.									

9.1.2 OPERATIONAL PHASE

The operational impact associated with alternative 1 is outlined below:

Table 9-2 – Operational Impact of Noise

Potential Impact									
Operational phase impacts of noise on sensitive receptors (Alternative 1)	**Magnitude**	**Extent**	**Reversibility**	**Duration**	**Probability**	**Significance**		**Character**	**Ease of mitigation**
Without Mitigation	2	1	1	4	3	**24**	**Low**	(-)	Easy
With Mitigation	2	1	1	4	2	**16**	**Low**	(-)	
Mitigation and Management Measures	▪ Operating turbines in reduced noise mode should any complaints be received. ▪ Selecting turbines with lower noise level specifications. ▪ Building walls/appropriate noise barriers around potentially affected buildings. ▪ Limiting turbine operations above the wind speed at which turbine noise becomes unacceptable in the project-specific circumstances. ▪ Relocating these two receptors or offering them financial incentives.								

The operational impact associated with alternative 2 is outlined below

Table 9-3 – Operational Impact of Noise

Potential Impact									
Operational phase impacts of noise on sensitive receptors (Alternative 2)	**Magnitude**	**Extent**	**Reversibility**	**Duration**	**Probability**	**Significance**		**Character**	**Ease of mitigation**
Without Mitigation	2	2	1	4	4	**36**	**Moderate**	(-)	Easy
With Mitigation	2	2	1	4	2	**18**	**Low**	(-)	
Mitigation and Management Measures	▪ Operating turbines in reduced noise mode should any complaints be received. ▪ Selecting turbines with lower noise level specifications. ▪ Building walls/appropriate noise barriers around potentially affected buildings.								

	▪ Limiting turbine operations above the wind speed at which turbine noise becomes unacceptable in the project-specific circumstances. ▪ Relocating these two receptors or offering them financial incentives.

9.2 GEOLOGY

9.2.1 CONSTRUCTION PHASE

During the construction phase the displacement of natural earth material and overlying vegetation could lead to the following impacts:

- Exposure of upper soil layer by removal of vegetation.
- Increase in stormwater velocity.
- Soil will be washed downslope, as well as into surrounding drainage channels leading to sedimentation.
- The erosion of these slopes will be exacerbated during periods of heavy rainfall.

Table 9-4 – Construction Impact of soil erosion

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Soil erosion									
Without Mitigation	4	3	3	3	5	65	High	(-)	Easy
With Mitigation	2	1	1	2	2	12	Very Low	(-)	
Mitigation and Management Measures	▪ Rehabilitation of affected areas (such as revegetation, mechanical stabilization). ▪ Selection of non-erodible and non-dispersive topsoil for general fill to avoid erosion. ▪ Correct engineering design and construction of gravel roads and water crossings. ▪ Use existing road network and access tracks where possible. ▪ Construction of temporary berms and drainage channels to divert surface water.								

During the construction phase the possible contamination of ground and surface water resources from heavy plant can lead to quality deterioration of these water resources.

Table 9-5 – Construction Impact of oil spillages

Potential Impact Oil spillages	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	5	3	5	5	5	90	Very High	(-)	Easy
With Mitigation	2	2	3	1	2	16	Low	(-)	
Mitigation and Management Measures	▪ Vehicle and construction machinery repairs to be undertaken in designated areas with proper soil protection. ▪ Frequent checks and conditional monitoring of all vehicles and equipment on site								

9.2.2 OPERATION PHASE

Impacts associated with the operation/maintenance of the facility could include the displacement of natural earth material are outlined below:

Table 9-6 – Operational Impact of soil erosion

Potential Impact Soil erosion	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	2	1	3	2	2	16	Moderate	(-)	Easy
With Mitigation	1	1	1	1	1	4	Very low	(-)	
Mitigation and Management Measures	▪ Use of existing service roads and tracks to avoid damaging vegetation ▪ Rehabilitation of affected areas during construction(such as erosion control mats) ▪ Maintenance of stormwater system.								

During the operation and maintenance of the facility, potential oil spillages from service vehicles and heavy plant equipment can arise. These impacts are outlined below:

Table 9-7 – Operational Impact of oil spillages

Potential Impact Oil spillages	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	3	2	5	5	3	**45**	**Moderate**	(-)	Easy
With Mitigation	2	1	3	2	2	**16**	**Low**	(-)	
Mitigation and Management Measures	▪ Vehicle repairs to be undertaken in designated areas.								

9.2.3 DECOMISSIONING PHASE

These impacts are expected to be the same as those of the construction phase, therefore the same mitigation measures should be implemented.

9.3 SOILS, LAND CAPABILITY AND AGRICULTURAL POTENTIAL

9.3.1 CONSTRUCTION PHASE

The stripping of soil, especially topsoil, ahead of the development of roads and the platforms sited on arable soil, will lead to a loss of usable soil if not undertaken correctly. The soil horizons need to be separately stripped, stockpiled and reused to rehabilitate the disturbed footprint.

In the cases of Alternatives 1 and 2, the disturbed footprint (the turbine foundation, solar PV and immediate surroundings) is likely to be relatively small and will not result in a significant loss of soil and agricultural potential. Post construction rehabilitation in the form of shaping and grassing of all disturbed areas in veld or in pastures should be undertaken, in order to stabilise loose soil and reduce erosion losses.

Table 9-8 – Construction Impact on soils

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Loss of soil									
Without Mitigation	4	1	3	4	5	60	Moderate	(-)	Moderate
With Mitigation	3	1	3	4	2	22	Low	(-)	
Mitigation and Management Measures	▪ Strip and stockpile all useable soil material. ▪ Soil stockpiles should be kept low (below 3m tall). ▪ Irrespective of where soil is stockpiled, it should be vegetated as soon as possible to protect against erosion, discourage weeds and maintain active soil microbes. ▪ The Shortlands and Clovelly topsoils should be stripped to a depth of 30 cm and subsoils to a depth of 80cm. All stripping and stockpiling should be undertaken according to the guidelines below. ▪ Demarcate the area to be stripped clearly, so that the contractor does not strip beyond the demarcated boundary. ▪ The stripped soil should be relocated by truck along set removal paths. ▪ The area to be stripped requires storm water management and the in-flow of water should be prevented with suitable structures. ▪ Prepare the haul routes prior to stripping. ▪ Stripping should not be undertaken in wet conditions.								

There exists the potential for loss of agricultural land owing to direct occupation of the footprint of the energy facility infrastructure and the fragmentation of agricultural land. Cultivated land currently makes up 16% of the Project area. The movement of vehicles and equipment is very likely to result in compaction, disturbance and possible sterilization of soils and associated change in land capability.

The more clay-rich soils identified on site (such as the Valsrivier soils and the Shortlands that dominate the site) will be more vulnerable to compaction than the sandier soils will. Soil compaction reduces the pore space available for air and water within soil, reducing soil arability and increasing the risk of soil erosion. Soil compaction cannot be fully mitigated against as compacted soil cannot regain its original structure.

Table 9-9 – Construction Impact on agricultural land

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Loss of agricultural land									
Without Mitigation	5	1	3	4	5	65	High	(-)	Moderate
With Mitigation	4	1	3	4	5	60	Moderate	(-)	
Mitigation and Management Measures	▪ Limit vehicle routes on site by demarcating traffic areas. ▪ Limit site vehicle access were possible. ▪ Reuse existing roads to prevent additional areas from becoming compacted. ▪ Strip soils when they are dry. ▪ Rip compacted soils to make them more suitable for cultivation.								

Construction activities, division of fields and prevention of aerial crop spraying owing to wind turbines can disturb agricultural practices (CSIR, 2015).

Table 9-10 – Construction Impact on agricultural practices

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Disturbance to agricultural practices									
Without Mitigation	2	1	3	4	5	50	Moderate	(-)	Moderate
With Mitigation	1	1	3	4	3	27	Low	(-)	
Mitigation and Management Measures	▪ Construction activities should be planned in such a way that they work around farming schedules. ▪ Final siting of the turbines should avoid dividing fields into sections that are too small to be agriculturally viable and should take into account any aerial crop spraying activities that might be undertaken. ▪ Turbines should be sited out of cultivated areas, where possible.								

Soil stripping, clearing of vegetation, movement of vehicles and earthworks are very likely to result in increased loose material being exposed and consequent erosion. Some erosion will occur wherever soils are disturbed, especially if mitigation measures are not correctly put in place. The thin, hilltop soils (Mispah and Glenrosa) and the less structured soils (Clovelly) will be more vulnerable to erosion than the more clay-rich soils (Valsrivier, Shortlands and Katspruit). Soil erosion can lead to sedimentation of the watercourses that cross the site, and to the loss of valuable topsoil that is essential for agricultural and rehabilitation purposes.

Although the magnitude and extent of erosion and sedimentation are likely to be limited if the recommended mitigation measures are properly implemented, some erosion is inevitable when clearing an area, and erosion and sedimentation are not easily reversible.

Table 9-11 – Construction Impact on erosion and sedimentation

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Erosion and sedimentation									
Without Mitigation	4	1	3	4	5	**60**	**Moderate**	(-)	Moderate
With Mitigation	2	1	3	4	3	**30**	**Low**	(-)	
Mitigation and Management Measures	▪ Limit earthworks and vehicle movement to demarcated paths and areas. ▪ Limit the duration of construction activities, especially those involving earthworks / excavations. ▪ Access roads associated with the development should have gradients or surface treatment to limit erosion, and road drainage systems should be accounted for. ▪ Existing roads should be used and regraded instead of creating new roads wherever possible. ▪ Removal of vegetation must be avoided until such time as soil stripping is required and similarly exposed surfaces and soil stockpiles should be re-vegetated or stabilised as soon as is practically possible. ▪ A construction phase-specific storm water management plan should be designed for the site and adhered-to. ▪ During periods of strong winds, stockpiles that have not yet been vegetated should be covered with appropriate material.								

Movement of vehicles and plant / equipment on site could result in leaks and spills of hazardous materials including hydrocarbons. Contaminated soil is expensive to rehabilitate and contamination entering the soils of the project area will infiltrate into the ground as well as migrate from site during rainfall events. The more clay-rich soils identified on site will be more vulnerable to contamination than the sandier soils will, as the more clay-rich soils are more chemically active and will interact with the contaminants. All soils will be at risk of contamination especially during the construction phase.

Table 9-12 – Construction Impact on soil contamination

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Soil contamination									
Without Mitigation	4	2	3	5	5	70	High	(-)	Moderate
With Mitigation	3	1	3	4	2	22	Low	(-)	
Mitigation and Management Measures	▪ On-site vehicles should be well-maintained, ▪ Drip trays should be placed under parked vehicles; ▪ On-site pollutants/hazardous materials should be contained in a bunded area and on an impermeable surface; ▪ Ensure proper control of dangerous substances entering the site; ▪ Adequate disposal facilities should be provided, ▪ A non-polluting environment should be enforced.								

9.3.2 OPERATIONAL PHASE

Table 9-13 – Operational Impact on soils

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Loss of soil									
Without Mitigation	1	1	3	4	5	45	Moderate	(-)	Moderate
With Mitigation	1	1	3	4	1	9	Very low	(-)	

Mitigation and Management Measures	▪ Strip and stockpile all useable soil material. ▪ Soil stockpiles should be kept low (below 3m tall). ▪ Irrespective of where soil is stockpiled, it should be vegetated as soon as possible to protect against erosion, discourage weeds and maintain active soil microbes. ▪ The Shortlands and Clovelly topsoils should be stripped to a depth of 30 cm and subsoils to a depth of 80cm. All stripping and stockpiling should be undertaken according to the guidelines below. ▪ Demarcate the area to be stripped clearly, so that the contractor does not strip beyond the demarcated boundary. ▪ The stripped soil should be relocated by truck along set removal paths. ▪ The area to be stripped requires storm water management and the in-flow of water should be prevented with suitable structures. ▪ Prepare the haul routes prior to stripping. ▪ Stripping should not be undertaken in wet conditions.

There exists the potential for loss of agricultural land owing to direct occupation of the footprint of the energy facility infrastructure and the fragmentation of agricultural land. Cultivated land currently makes up 16% of the Project area. The movement of vehicles and equipment is very likely to result in compaction, disturbance and possible sterilization of soils and associated change in land capability.

The more clay-rich soils identified on site (such as the Valsrivier soils and the Shortlands that dominate the site) will be more vulnerable to compaction than the sandier soils will. Soil compaction reduces the pore space available for air and water within soil, reducing soil arability and increasing the risk of soil erosion. Soil compaction cannot be fully mitigated against as compacted soil cannot regain its original structure.

Table 9-14 – Operational Impact on agricultural land

Potential Impact Loss of agricultural land	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	2	1	3	4	5	50	Moderate	(-)	Moderate

With Mitigation	1	1	3	4	1	**45**	**Mode rate**	(-)	
Mitigation and Management Measures	▪ Limiting vehicle routes on site by demarcating traffic areas. ▪ Limiting site vehicle access. ▪ Reuse of existing roads will prevent additional areas from becoming compacted. ▪ Stripping soils when they are dry. ▪ Compacted soils can be ripped to make them more suitable for cultivation.								

Construction activities, division of fields and prevention of aerial crop spraying owing to wind turbines can disturb agricultural practices (CSIR, 2015).

Table 9-15 – Operational Impact on agricultural practices

Potential Impact Disturbance to agricultural practices	**Magnitude**	**Extent**	**Reversibility**	**Duration**	**Probability**		**Significance**	**Character**	**Ease of mitigation**
Without Mitigation	2	1	3	4	5	**50**	**Mode rate**	(-)	Easy
With Mitigation	1	1	3	4	1	**9**	**Very low**	(-)	
Mitigation and Management Measures	▪ Maintenance activities should be planned in such a way that they work around farming schedules.								

Movement of vehicles and earthworks are very likely to result in increased loose material being exposed and consequent erosion. Some erosion will occur wherever soils are disturbed, especially if mitigation measures are not correctly put in place. The thin, hilltop soils (Mispah and Glenrosa) and the less structured soils (Clovelly) will be more vulnerable to erosion than the more clay-rich soils (Valsrivier, Shortlands and Katspruit). Soil erosion can lead to sedimentation of the watercourses that cross the site, and to the loss of valuable topsoil that is essential for agricultural and rehabilitation purposes.

Although the magnitude and extent of erosion and sedimentation are likely to be limited if the recommended mitigation measures are properly implemented, some erosion is inevitable when clearing an area, and erosion and sedimentation are not easily reversible.

Table 9-16 – Operational Impact on erosion and sedimentation

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Erosion and sedimentation									
Without Mitigation	2	1	3	4	5	50	Moderate	(-)	Easy
With Mitigation	1	1	3	4	2	18	Low	(-)	
Mitigation and Management Measures	▪ Limit vehicle movement to demarcated paths and areas. ▪ Access roads associated with the development should have gradients or surface treatment to limit erosion, and road drainage systems should be accounted for. ▪ Existing roads should be used and regraded instead of creating new roads wherever possible. ▪ Removal of vegetation must be avoided ▪ A operational phase-specific storm water management plan should be designed for the site and adhered-to. ▪ During periods of strong winds, stockpiles that have not yet been vegetated should be covered with appropriate material.								

Movement of vehicles and plant / equipment on site could result in leaks and spills of hazardous materials including hydrocarbons. Contaminated soil is expensive to rehabilitate and contamination entering the soils of the project area will infiltrate into the ground as well as migrate from site during rainfall events. The more clay-rich soils identified on site will be more vulnerable to contamination than the sandier soils will, as the more clay-rich soils are more chemically active and will interact with the contaminants. All soils will be at risk of contamination especially during the construction phase.

Table 9-17 – Operational Impact on soil contamination

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
soil contamination									
Without Mitigation	2	2	3	5	5	60	Moderate	(-)	Easy

With Mitigation	2	1	3	4	3	**30**	**Low**	(-)	
Mitigation and Management Measures	■ On-site vehicles should be well-maintained, ■ Drip trays should be placed under parked vehicles; ■ On-site pollutants/hazardous materials should be contained in a bunded area and on an impermeable surface; ■ Ensure proper control of dangerous substances entering the site; ■ Adequate disposal facilities should be provided, ■ A non-polluting environment should be enforced.								

9.4 SURFACE WATER

9.4.1 CONSTRUCTION PHASE

The clearing of vegetation and the stripping of topsoil for surface infrastructure such as the substations, etc. can result in the movement of sediment into downstream and adjacent aquatic systems, particularly during rainfall events. In addition, the use of heavy machinery within the construction footprint will lead to soil compaction, increasing the runoff potential over the topsoil and the reduction in stormwater infiltration into the soil profile, thereby increasing the likelihood of erosion gully formation and the deposition of sediment within the surrounding watercourses and wetland systems. Further, the construction of various roads across wetlands and drainage lines throughout the study area may increase the potential for fragmentation and/or result in the confinement of flow ultimately leading to erosional processes which will further add to the sediment input into the surrounding aquatic ecosystems.

Various impacts have been attributed to sedimentation of aquatic ecosystems, including reduction of light penetration (resulting in reduction in photosynthesis and subsequently, productivity), alteration of foraging dynamics of both carnivores and herbivores, impacting on predator and prey relationships, clogging of gills, rendering the watercourse unfit for various aquatic organisms, truncating and shifting the trophic pyramid, absorption of nutrients onto suspended particles, rendering them unavailable and thereby reducing the productivity of the watercourse, and filling of interstitial spaces, thereby destroying habitat for macro invertebrates and vertebrates owing to sedimentation, etc.

However, numerous variables (including sediment characteristics, sediment concentration, exposure time, temperature, natural ecosystem processes, etc.) dictate the vulnerability of aquatic assemblages and fish species specifically to elevated suspended sediment loads within a natural system. For example, warm water species differ in their response to elevated silt loads at different stages of their life histories (e.g. Smit et al., 1998) and at different water temperatures. In other studies, the response of species has also been shown to vary with duration of exposure, with short-term exposure reported to increase the frequency of gill flaring during periods of elevated turbidity in an attempt to facilitate clearing of suspended sediment on the gill surfaces (e.g. Berg & Northcote, 1985; Servizi & Martens, 1992), while long term exposure potentially causing thickening of the gill epithelium and loss of respiratory function (e.g. Bell, 1973). Still other research indicates the cardiovascular response of lacustrine fish is more extreme than that of riverine fish of the same species, suggesting that compensatory mechanisms that can minimise cardio-respiratory disruption caused by increased suspended silt concentrations are more prevalent in riverine species in relation to lacustrine species (Bunt *et al*., 2004). Sediment deposition within both the Waarkraalloop and the Komati River Catchments is further expected to smother available stones biotopes, leading to a reduction in abundance and diversity of flow-sensitive hydraulic habitat, ultimately resulting in a loss of sensitive aquatic biota noted to be present.

Table 9-18 – Construction Impact on clearing of vegetation and stripping of top soil

Potential Impact Onset of erosion and sedimentation Altered surface water runoff patterns Loss of biodiversity Proliferation of alien and invasive species	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	4	3	3	4	4	**56**	**Moderate**	(-)	Moderate
With Mitigation	2	1	3	4	2	**20**	**Low**	(-)	
Mitigation and Management Measures	▪ Ensure that site offices, ablutions, contractor laydown areas, construction materials and stockpiles, where relevant, are placed outside and above the 1:100 year flood line; ▪ Limit the footprint area of the construction activities to what is absolutely essential in order to minimise impacts as a result of vegetation clearing and compaction of soils; ▪ As far as possible, Site clearing activities should take place at the end of the wet season to minimise the risk of erosion, incision and sedimentation of the associated watercourses, and as far as possible, all remaining construction activities should take place during the dry winter months to minimise impacts as a result of high flows and runoff from exposed soils and materials; ▪ Ensure a soil management programme is implemented and maintained to minimise the potential for erosion and sedimentation;									

	▪ All/any topsoil or building material stockpiles must be protected from erosion, stored on flat areas where runoff will be minimised, and be surrounded by bunds. Stockpiles must also only be stored for the minimum amount of time necessary; ▪ Erosion berms or suitable water attenuation measures should be installed on roadways and downstream of construction and infrastructure areas to prevent gully formation and siltation of the associated watercourses. ▪ Active rehabilitation, re-sloping, and re-vegetation of disturbed areas immediately after construction must take place; ▪ All erosion noted within the construction footprint should be remedied immediately and included as part of an ongoing rehabilitation plan; ▪ Implement and maintain an alien vegetation management programme; ▪ No unnecessary crossing of the watercourses should take place; ▪ Only authorised personnel should be allowed within the construction area; ▪ Watercourses should be designated as “No-Go” areas and be off limits to all unauthorised ▪ vehicles and personnel; ▪ No material may be dumped or stockpiled within or adjacent to the watercourses; ▪

During the construction phase, as activities are taking place within and adjacent to watercourses and wetlands, there is a possibility that water quality may be impaired. Typically, impairment will occur as a consequence of sediment disturbance resulting in an increase in turbidity. Water quality may also be impaired as a consequence of accidental spillages and the intentional washing and rinsing of equipment. The proposed cement batching plants, as well as the potential use and storage of hydrocarbons and other potential pollutants, have the potential to result in impaired water quality.

Changes in water quality have the potential to cause a shift in aquatic species composition, favouring only tolerant species, resulting in the localised exclusion of sensitive species. Sudden drastic changes in water quality can also have chronic effects on aquatic biota leading to localised extinction. Pollution could also result in negative impacts to people and livestock that are reliant on water resources for drinking purposes. Furthermore, the Klein-Komati River and its tributaries are classified as CBAs as the Klein-Komati River is classified as a FEPA river, which makes water quality considerations and the protection of biodiversity particularly relevant.

Table 9-19 – Construction Impact of earthworks

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Onset of erosion and sedimentation Altered surface water runoff patterns Loss of biodiversity Proliferation of alien and invasive species									
Without Mitigation	4	3	3	4	4	**56**	**Moderate**	(-)	Moderate
With Mitigation	3	1	3	4	2	**22**	**Low**	(-)	
Mitigation and Management Measures	▪ Ensure that site offices, ablutions, contractor laydown areas, construction materials and stockpiles, where relevant, are placed outside and above the 1:100 year flood line; ▪ Limit the footprint area of the construction activities to what is absolutely essential in order to minimise impacts as a result of vegetation clearing and compaction of soils; ▪ As far as possible, Site clearing activities should take place at the end of the wet season to minimise the risk of erosion, incision and sedimentation of the associated watercourses, and as far as possible, all remaining construction activities should take place during the dry winter months to minimise impacts as a result of high flows and runoff from exposed soils and materials; ▪ Ensure a soil management programme is implemented and maintained to minimise the potential for erosion and sedimentation; ▪ All/any topsoil or building material stockpiles must be protected from erosion, stored on flat areas where runoff will be minimised, and be surrounded by bunds. Stockpiles must also only be stored for the minimum amount of time necessary; ▪ Erosion berms or suitable water attenuation measures should be installed on roadways and downstream of construction and infrastructure areas to prevent gully formation and siltation of the associated watercourses. ▪ Active rehabilitation, re-sloping, and re-vegetation of disturbed areas immediately after construction must take place; ▪ All erosion noted within the construction footprint should be remedied immediately and									

	included as part of an ongoing rehabilitation plan; ▪ Implement and maintain an alien vegetation management programme; ▪ No unnecessary crossing of the watercourses should take place; ▪ Only authorised personnel should be allowed within the construction area; ▪ Watercourses should be designated as “No-Go” areas and be off limits to all unauthorised ▪ vehicles and personnel; ▪ No material may be dumped or stockpiled within or adjacent to the watercourses;

Table 9-20 – Construction Impact of materials management

Potential Impact Water and soil pollution Loss of biodiversity	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	3	3	3	5	3	42	Moderate	(-)	High
With Mitigation	1	1	3	1	2	12	Very low	(-)	
Mitigation and Management Measures	▪ All vehicles must be regularly inspected for leaks; ▪ Re-fuelling must take place on a sealed surface area away from the watercourses to prevent ▪ ingress of hydrocarbons into topsoil; ▪ Storage of potentially hazardous materials (including but not limited to fuel, oil, cement, etc.) must be above any 100-year flood line or outside the designated watercourse buffer, whichever is greater; ▪ A walled concrete platform, dedicated store with adequate flooring or bermed area must be used to accommodate chemicals such as fuel, oil, paint, herbicide and insecticides, as appropriate, in well-ventilated areas; ▪ All spills should be immediately cleaned up and treated accordingly; and ▪ Appropriate sanitary facilities must be provided for the duration of the construction activities and all waste must be removed to an appropriate waste facility.								

	▪ No mixing of construction materials such as cement should be permitted within or adjacent to watercourses and no such mixing may occur on bare soils in the surrounding areas;

Table 9-21 – Construction Impact of turbines, road network and substations

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Altered surface water runoff patterns Loss of biodiversity Potential fragmentation of watercourses									
Without Mitigation	4	2	5	4	4	**60**	**Moderate**	(-)	Moderate
With Mitigation	3	1	5	4	2	**26**	**Low**	(-)	
Mitigation and Management Measures	▪ Ensure that site offices, ablutions, contractor laydown areas, construction materials and stockpiles, where relevant, are placed outside and above the 1:100 year flood line; ▪ Limit the footprint area of the construction activities to what is absolutely essential in order to minimise impacts as a result of vegetation clearing and compaction of soils; ▪ As far as possible, Site clearing activities should take place at the end of the wet season to minimise the risk of erosion, incision and sedimentation of the associated watercourses, and as far as possible, all remaining construction activities should take place during the dry winter months to minimise impacts as a result of high flows and runoff from exposed soils and materials; ▪ Ensure a soil management programme is implemented and maintained to minimise the potential for erosion and sedimentation; ▪ All/any topsoil or building material stockpiles must be protected from erosion, stored on flat areas where runoff will be minimised, and be surrounded by bunds. Stockpiles must also only be stored for the minimum amount of time necessary; ▪ Erosion berms or suitable water attenuation measures should be installed on roadways and downstream of construction and infrastructure									

	areas to prevent gully formation and siltation of the associated watercourses. ▪ Active rehabilitation, re-sloping, and re-vegetation of disturbed areas immediately after construction must take place; ▪ All erosion noted within the construction footprint should be remedied immediately and included as part of an ongoing rehabilitation plan; ▪ Implement and maintain an alien vegetation management programme; ▪ No unnecessary crossing of the watercourses should take place; ▪ Only authorised personnel should be allowed within the construction area; ▪ Watercourses should be designated as "No-Go" areas and be off limits to all unauthorised ▪ vehicles and personnel; ▪ No material may be dumped or stockpiled within or adjacent to the watercourses;

Table 9-22 – Construction Impact of Movement of vehicles and machinery

Potential Impact Water and soil pollution Proliferation of alien and invasive species	**Magnitude**	**Extent**	**Reversibility**	**Duration**	**Probability**	**Significance**		**Character**	**Ease of mitigation**
Without Mitigation	3	2	5	4	4	**56**	**Moderate**	(-)	Moderate
With Mitigation	2	1	2	4	2	**18**	**Low**	(-)	
Mitigation and Management Measures	▪ Movement of heavy machinery should be minimised to what is essential for the completion of the necessary project activities and should not be allowed to drive indiscriminately through the surrounding areas or within the associated watercourses; ▪ Any movement of machinery should make use of existing roads or servitudes and no new access roads should be cut unless absolutely necessary; ▪ Implement and maintain an alien vegetation management programme;								

9.4.2 OPERATIONAL PHASE

Table 9-23 – Operational Impact of Physical presence of turbines, road network and substations

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Altered surface water runoff patterns Loss of biodiversity Potential fragmentation of watercourses									
Without Mitigation	4	2	5	5	4	64	High	(-)	Moderate
With Mitigation	3	1	5	5	2	28	Low	(-)	
Mitigation and Management Measures	▪ Ensure a soil management programme is implemented and maintained to minimise the potential for erosion and sedimentation; ▪ Erosion berms or suitable water attenuation measures should be installed on roadways and downstream of infrastructure areas to prevent gully formation and siltation of the associated watercourses. ▪ All erosion noted within the operational footprint should be remedied immediately and included as part of an ongoing rehabilitation plan; ▪ Implement and maintain an alien vegetation management programme;								

Table 9-24 – Operational Impact of Materials management

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Water and soil pollution Loss of biodiversity									
Without Mitigation	3	3	3	5	3	42	Moderate	(-)	Moderate
With Mitigation	1	1	3	1	2	12	Very Low	(-)	
Mitigation and Management Measures	▪ All vehicles must be regularly inspected for leaks; ▪ Re-fuelling must take place on a sealed surface area away from the watercourses to prevent ingress of hydrocarbons into topsoil;								

	- Storage of potentially hazardous materials (including but not limited to fuel, oil, etc.) must be above any 100-year flood line or outside the designated watercourse buffer, whichever is greater; - A walled concrete platform, dedicated store with adequate flooring or bermed area must be used to accommodate chemicals such as fuel, oil, paint, herbicide and insecticides, as appropriate, in well-ventilated areas; - All spills should be immediately cleaned up and treated accordingly; and - Appropriate sanitary facilities must be provided for the duration of the operational activities and all waste must be removed to an appropriate waste facility.

Table 9-25 – Operational Impact of Movement of vehicles and machinery

Potential Impact Water and soil pollution	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation							**Moderate**	(-)	Moderate
With Mitigation							**Very Low**	(-)	
Mitigation and Management Measures	- Movement of maintenance vehicles should be minimised to what is essential for the completion of the necessary maintenance activities and should not be allowed to drive indiscriminately through the surrounding areas or within the associated watercourses;								

9.4.3 DECOMMISSIONING PHASE

Table 9-26 – Decommissioning Impact of Physical presence of former turbines, former solar fields, road network and substations

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Altered surface water runoff patterns Loss of biodiversity Potential fragmentation of watercourses									
Without Mitigation	4	2	5	5	4	**64**	**High**	(-)	Low
With Mitigation	3	1	5	5	2	**28**	**low**	(-)	
Mitigation and Management Measures	▪ Ensure that as far as possible all decommissioning activities take place outside of the delineated watercourses; ▪ Limit the footprint area of the decommissioning activities to what is absolutely essential in order to minimise impacts; ▪ All erosion noted within the decommissioning footprint should be remedied immediately and included as part of the ongoing rehabilitation plan; ▪ A suitable alien and/or invasive plant species control programme must be put in place so as to prevent further encroachment as a result of disturbance to the surrounding terrestrial zones; ▪ Watercourses should be designated as "No-Go" areas and be off limits to all unauthorised vehicles and personnel; ▪ No material may be dumped or stockpiled within any watercourses in the vicinity of the proposed decommissioning footprint; ▪ Appropriate sanitary facilities must be provided for the duration of the decommissioning activities and all waste must be removed to an appropriate waste facility.									

Table 9-27 – Decommissioning Impact of Movement of vehicles and machinery

Potential Impact Water and soil pollution Loss of biodiversity Proliferation of alien and invasive species	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	3	2	3	4	4	48	Moderate	(-)	Moderate
With Mitigation	2	1	2	4	2	18	Low	(-)	
Mitigation and Management Measures	▪ No vehicles or heavy machinery may be allowed to drive indiscriminately within any delineated watercourses. All vehicles must remain on demarcated roads and within the decommissioning area footprint; ▪ All vehicles must be regularly inspected for leaks; ▪ Re-fuelling must take place on a sealed surface area away from any associated watercourses to prevent ingress of hydrocarbons into topsoil; ▪ All spills should be immediately cleaned up and treated accordingly; ▪								

9.5 HAZARDOUS SUBSTANCES AND POLLUTANTS

9.5.1 CONSTRUCTION PHASE

Potential exists for soil, groundwater and surface water contamination associated with potential releases of small quantities of environmental contaminants and hazardous substances. Sources of pollutants and release mechanisms include:

Leakages of hydrocarbons (diesel and oil) from construction vehicles and heavy machinery (e.g. excavators and bulldozers).

Loss of containment and accidental spillage associated with storage and handling of hydrocarbons, chemicals, and concrete.

Runoff creates a preferential pathway and exposure of the above contaminants into the subsurface and water resources leading to a deterioration in water quality and secondary health impacts on aquatic ecosystems and water users.

The construction impact assessment for the abovementioned impact is included in **Table 9-28.**

Table 9-28: Construction Impact of contaminants on soil, groundwater and surface water

Potential Impact Soil, groundwater and surface water contamination	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	5	3	5	5	5	90	Very High	(-)	Easy
With Mitigation	2	2	3	1	2	16	Low	(-)	
Mitigation and Management Measures	▪ Avoid identified sensitive areas (watercourses and associated buffers) as far as possible. ▪ Chemicals, hydrocarbon materials and hazardous substances maintained onsite must be managed in accordance with the Hazardous Substances Act (No. 15 of 1973) and its relevant regulations. ▪ All machinery and equipment should be inspected regularly for faults and possible leaks; these should be serviced off-site or in appropriately bunded areas. ▪ Drip trays or any form of oil absorbent material must be placed underneath vehicles/machinery and equipment when not in use. ▪ All contaminated soil shall be treated in situ or removed and be placed in containers. ▪ Provide secure storage for fuel, oil, chemicals and other waste materials to prevent contamination of stormwater runoff. ▪ Spill kits must be available at all locations where hazardous substances are stored, handled or used, and spills must be cleaned up immediately in accordance with an established protocol applicable to the material.									

9.5.2 OPERATIONAL PHASE

The anticipated contamination impacts during the operational phase of the project include spillage of oils, fuel, grease (from site operational and maintenance vehicles) and permanent onsite sewage systems. The operational impact of potential land contamination from hazardous substances is outlined in **Table 9-29.**

Table 9-29: Operational Impact due to hazardous substances

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Soil, groundwater and surface water contamination									
Without Mitigation	2	1	3	2	2	16	Moderate	(-)	Easy
With Mitigation	1	1	1	1	1	4	Very low	(-)	
Mitigation and Management Measures	▪ Chemicals, hydrocarbon materials and hazardous substances maintained onsite must be managed in accordance with the Hazardous Substances Act (No. 15 of 1973) and its relevant regulations. ▪ The proper handling and storage of hazardous materials, the use of hardstanding in storage areas of hazardous substances where possible. The use of bunding around storage of hazardous materials and proper upkeep of machinery and vehicles. A complete spill kit must be onsite at all times. ▪ Implement site inspections on the effectiveness and integrity of the stormwater management systems.								

9.5.3 DECOMMISSIONING PHASE

The impacts associated with the decommissioning phase are expected to be the same as those of the construction phase, therefore the same mitigation measures can be applied.

9.6 WASTE MANGAEMENT

9.6.1 CONSTRUCTION PHASE

Generation of General and Hazardous Waste

The table below provides a summary of the typical general and hazardous waste types that are likely to be generated on site during construction. The presence of construction workers has the potential to increase litter on site in the absence of adequate waste receptacles. This results in an unsightly working environment and possible entry into surrounding environment. Furthermore, waste materials may attract pest species / vectors into working areas leading to potential health implications for construction staff and community members.

Spoil material unsuitable for reuse as backfill and bedding material has the potential to disrupt land use and habitats if inappropriately manage or disposed illegally.

Waste generation (domestic waste, mixed industrial and metal waste) and a lack of appropriate separation, temporary storage and recycling (i.e. not aligned with the Waste Hierarchy) has the potential to result in unnecessary waste material to landfill.

Hazardous waste generation and inappropriate management and disposal has the potential to lead to contamination of soil, groundwater and surface water.

Table 9-30 – Typical Construction Waste Types

Waste Category	Waste Type	Typical Constituents
General Waste	Domestic Waste	Paper and cardboard packaging, empty plastic and metal containers (non-hazardous original contents) etc.
	Organic Waste	Canteen, food and cooking waste
	Mixed Industrial	Wood, plastic, packaging etc.
	Metal Waste	Ferrous and non-ferrous scrap and stainless steel, metal cuttings, electrode stubs from welding.
	Spoil Material	Excavations, trenching and terracing will result in the generation of spoil material
	Building rubble	Wasted flooring material, paint containers, wall tiles, timber, piping etc.
	Biomass	Cleared vegetation
Hazardous Waste	Oily Waste	Used lubricant and hydraulic oils and hydrocarbon-based solvents
	Oil Contaminated Waste	Solid material (rags etc.) that has come into contact with and contains traces of oil or grease
	Hazardous Chemical Containers	From temporary storage and use of chemicals on site
	Sanitary Waste	Sewerage / faecal matter generated at the contractor's camp

The construction impact of waste generation is outlined in **Table 9-31.**

Table 9-31: Construction Impact of waste generation

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Generation of general and hazardous waste									
Without Mitigation	3	3	3	2	3	33	Moderate	(-)	Easy
With Mitigation	2	2	2	2	2	16	Low	(-)	
Mitigation and Management Measures	▪ Despite the modest volumes of waste anticipated to be generated by the Project, recycling opportunities should be sought in order to reduce the volume of waste to landfill and harness commercial benefits for both the project team and local community. ▪ General waste (i.e. construction waste, building rubble, plastic, metal, excavated material, packaging material, paper and domestic waste etc.) generated during the construction phase should be stored in a designated area within suitable waste collection bins and skips (or similar). ▪ Provision of suitable waste receptacles for temporary storage of hazardous waste (in compliance with Material Safety Data Sheets). ▪ Collection and disposal of hazardous waste at appropriately licenced landfills and proof of disposal to be retained on site.. ▪ Bins/skips must be emptied regularly and collected by a licensed contractor for disposal at an appropriate, licensed facility. Bins/skips must not be allowed to overflow. ▪ Solid waste must be managed to avoid risk to local fauna and to avoid attracting animals to the site and to ensure containment and regular collection for disposal at a licenced landfill site. ▪ Maintain good housekeeping on site and minimise the generation of waste.									

Sanitation Waste

Sanitation services are required to accommodate workers on site, contractor's yard and at site camps. Temporary ablution facilities (chemical toilets) are proposed to appropriately contain and treat waste for offsite disposal. The incorrect siting of chemical toilets (i.e. within 100m of a watercourse or stream) and loss of containment could lead to pollution of the receiving environment (soil, groundwater and surface water), leading to secondary health impact to ecosystems and communities (ground and surface water users).

Sanitary waste, if not correctly contained, has the potential to enter surface water via runoff and increase organic matter loading in water systems.

The construction impact associate with sanitation waste generation is outlined in **Table 9-32.**

Table 9-32: Construction Impact associated with sanitation waste

Potential Impact Generation of sanitation waste	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	3	3	3	2	3	**33**	**Moderate**	(-)	Easy
With Mitigation	2	2	2	2	2	**16**	**Low**	(-)	
Mitigation and Management Measures	▪ Chemical toilet facilities are to be supplied and serviced by an approved contractor. ▪ Ablution facilities must be located in a specific area agreed to by the ECO prior to placement and must be located away from sensitive environments. ▪ Spillages must be prevented during cleaning or servicing. ▪ Ablution facilities must be effectively secured to prevent toppling or being wind-blown ▪ Ablution facilities must be maintained in a hygienic state and serviced regularly								

9.6.2 OPERATIONAL PHASE

It is noted that only small volumes of waste are anticipated to be generated by the facility during operations. The waste generated should therefore be managed in accordance with the waste management hierarchy (See EMPr **Appendix I**).

9.6.3 DECOMMISSIONING PHASE

The impacts associated with the decommissioning phase are expected to be the same as those of the construction phase.

9.7 TERRESTRIAL PLANT BIODIVERSITY

9.7.1 CONSTRUCTION PHASE

Habitat loss and disturbance refers to the direct removal or disturbance of natural habitat that results from vegetation clearing and earth works. The development of proposed Project infrastructure will require vegetation clearing and earth works within the planned development footprints. This will directly impact individual flora species, as well as flora habitat integrity.

Alternative 1 will result in approximately 66.37ha of natural habitat loss, whereas Alternative 2 will result in approximately 142.06ha of natural habitat. For Alternative 1, this incorporates about 31ha of CBA Irreplaceable and 16ha of CBA Optimal land. For Alternative 2, this incorporates about 84 ha of CBA Irreplaceable and 18ha of CBA Optimal land.

Alternative 1: The impact prior to mitigation is considered to be of high magnitude, permanently affecting vegetation within and potentially adjacent to the development footprints (local). It is also considered to have a definite probability, resulting in an impact of “high” significance. Considering the development nature of the proposed Project, this impact is difficult to avoid, however measures can be taken to minimise the significance. With mitigation, the magnitude of the impact can be lowered to medium, and it can be confined to the site scale. Duration can be reduced to the long-term, and probability to high. This results in an after-mitigation impact of “medium” significance.

Table 9-33 – Construction Impact on flora habitat-Alternative 1

Potential Impact Loss and Disturbance of Flora Habitat	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	4	2	3	5	5	**70**	**High**	(-)	Easy
With Mitigation	3	1	3	4	4	**44**	**Moderate**	(-)	
Mitigation and Management Measures	Minimisation ▪ Vegetation clearing should be restricted to the proposed Project footprints only, with no clearing permitted outside of these areas; ▪ The footprints to be cleared should be clearly demarcated prior to construction to prevent unnecessary clearing outside of these areas; and ▪ No heavy vehicles should travel beyond the marked works zone. Rehabilitation ▪ A rehabilitation/landscaping protocol should be developed and implemented on-site. The protocol should include, inter alia, the following provisions: ▪ Stockpiling of topsoil from development footprints during site preparation; ▪ Post-construction, the land form should be correctly contoured to limit potential erosion and compacted soils should be ripped and loosened to facilitate vegetation establishment; ▪ Topsoil removed during construction should be applied to all non-operational sites that were disturbed during construction and require revegetation; and								

	▪ Locally occurring indigenous grasses species should be used to revegetate all areas disturbed during construction. ▪ Monitoring of rehabilitated and revegetated sites should be conducted annually until such as time as rehabilitation of disturbed sites has proved successful; ▪ Key aspects that should be monitored include: ▪ Successful establishment and coverage of vegetation; ▪ Sites of erosion; ▪ The findings of monitoring should be used to inform the need for additional rehabilitation and/ or corrective actions. ▪ To be undertaken during the wet/growing season Offsetting ▪ To offset the loss of land designated as CBA Irreplaceable and CBA Optimal, a biodiversity offsetting strategy has been developed, and will be refined under consultation with the local conservation authority (i.e., Mpumalanga Parks and Tourism Agency).

Alternative 2: As substantial more natural habitat will be lost compared to Alternative 1, the impact prior to mitigation is considered to be of very high magnitude, permanently affecting vegetation within and potentially adjacent to the development footprints (local). It is also considered to have a definite probability, resulting in an impact of “high” significance. With mitigation, the magnitude of the impact can be lowered to high, and it can be confined to the site scale. Duration can be reduced to the long-term, and probability to high. This results in an after-mitigation impact of “medium” significance.

Table 9-34 – Construction Impact on flora habitat-Alternative 2

Potential Impact Loss and Disturbance of Flora Habitat	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	5	2	3	5	5	**75**	**High**	(-)	Easy
With Mitigation	4	1	3	4	4	**48**	**Moderate**	(-)	
Mitigation and Management Measures	Minimisation								

	- Vegetation clearing should be restricted to the proposed Project footprints only, with no clearing permitted outside of these areas; - The footprints to be cleared should be clearly demarcated prior to construction to prevent unnecessary clearing outside of these areas; and - No heavy vehicles should travel beyond the marked works zone. Rehabilitation - A rehabilitation/landscaping protocol should be developed and implemented on-site. The protocol should include, inter alia, the following provisions: - Stockpiling of topsoil from development footprints during site preparation; - Post-construction, the land form should be correctly contoured to limit potential erosion and compacted soils should be ripped and loosened to facilitate vegetation establishment; - Topsoil removed during construction should be applied to all non-operational sites that were disturbed during construction and require revegetation; and - Locally occurring indigenous grasses species should be used to revegetate all areas disturbed during construction. - Monitoring of rehabilitated and revegetated sites should be conducted annually until such as time as rehabilitation of disturbed sites has proved successful; - Key aspects that should be monitored include: - Successful establishment and coverage of vegetation; - Sites of erosion; - The findings of monitoring should be used to inform the need for additional rehabilitation and/ or corrective actions. - To be undertaken during the wet/growing season Offsetting - To offset the loss of land designated as CBA Irreplaceable and CBA Optimal, a biodiversity offsetting strategy has been developed, and will be refined under consultation with the local conservation authority (i.e., Mpumalanga Parks and Tourism Agency).

The presence of proposed Project infrastructure, particularly linear infrastructure (e.g., the access roads), may cause alterations in important ecosystem processes, such as wildfire patterns (through habitat fragmentation) and water flow/seepage patterns (through soil compaction). This may result in changes in flora composition driving a potential loss of species richness.

Alternative 1: The impact prior to mitigation is considered to be of high magnitude, with a long-term duration. The extent of the impact will be local and it is also considered to have a high probability, resulting in an impact of “medium” significance. With mitigation, the magnitude and probability of the impact can be reduced to low. Extent will remain local, but the duration is reduced to the short-term. This results in an after-mitigation impact of “low” significance

Table 9-35 – Construction Impact on ecosystems-Alternative 1

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Disruption of Ecosystem Processes due to Project Infrastructure									
Without Mitigation	4	2	1	4	4	**44**	**Moderate**	(-)	Moderate
With Mitigation	3	2	1	2	2	**16**	**Low**	(-)	
Mitigation and Management Measures	Minimisation ▪ To promote grassland health, local farmers should be approached in order to investigate the potential of developing a co-ordinated grassland burning (wildfire) programme for the study area; and ▪ To prevent wetland desiccation, the wetland management and protection measures outlined in the wetland impact assessment for the proposed Project should be strictly implemented on-site.								

Alternative 2: The impact prior to mitigation is considered to be of medium magnitude, with a long-term duration. The extent of the impact will be local and it is also considered to have a medium probability, resulting in an impact of “medium” significance. With mitigation, the magnitude and probability of the impact can be reduced to low. Extent will remain local, but the duration is reduced to the short-term. This results in an after-mitigation impact of “low” significance.

Table 9-36 – Construction Impact on ecosystems-Alternative 2

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Disruption of Ecosystem Processes due to Project Infrastructure									
Without Mitigation	3	2	1	4	3	**30**	**Moderate**	(-)	Moderate
With Mitigation	2	2	1	2	2	**14**	**Low**	(-)	
Mitigation and Management Measures	Minimisation ▪ To promote grassland health, local farmers should be approached in order to investigate the potential of developing a co-ordinated grassland burning (wildfire) programme for the study area; and ▪ To prevent wetland desiccation, the wetland management and protection measures outlined in the wetland impact assessment for the proposed Project should be strictly implemented on-site.								

Disturbances caused by vegetation clearing and earth works during construction will facilitate the establishment and spread of alien invasive vegetation. Alien plant infestations can spread exponentially, suppressing or replacing indigenous vegetation. This may result in the impairment of ecosystem functioning and a loss of biodiversity.

Several highly invasive alien species were recorded on-site during the field visit, including inter alia; woody taxa such as *Acacia dealbata and Acacia mearnsii*, and herbaceous species such as *Cirsium vulgare*, *Datura stramonium and Verbena bonariensis.* It is possible that additional disturbances caused by construction activities may result in the further spread of alien vegetation into grassland and wetland habitats.

This impact is likely to be the same for both alternatives. Impact character is considered to be the same for both project alternatives. Before mitigation, impact magnitude is high, while duration is long term and it has a high probability. The spatial extent of alien invasive species spread is local. Prior to mitigation, the establishment and spread of alien invasive species is rated an impact of “medium” significance. With the implementation of active control during the construction phase, this impact can be reduced to a low magnitude, with a short-term duration. Spatial extent will be reduced to the site only and the probability of the impact occurring as predicted would be reduced to low. After mitigation, this impact is rated to be of “low” significance.

Table 9-37 – Construction Impact on alien invasive species

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Establishment and Spread of Alien Invasive Species									
Without Mitigation	4	2	3	4	4	**52**	**Moderate**	(-)	High
With Mitigation	2	1	3	2	2	**16**	**Low**	(-)	
Mitigation and Management Measures	Minimisation ▪ An Alien Invasive Species (AIS) Control and Eradication Plan must be developed for the Project. It is recommended that the plan include: ▪ A combined approach using both chemical and mechanical control methods; ▪ Periodic follow-up treatments, informed by regular monitoring; ▪ A specific focus on: ▪ All sites disturbed by construction; and ▪ Areas of wetland/stream vegetation. ▪ Annual on-site alien invasive species monitoring should be conducted. Monitoring should focus on: ▪ All sites disturbed during the construction phase; ▪ Riparian/wetland areas adjacent to construction sites; and ▪ Monitoring should assess species type and density, and these data should inform the scope of ongoing alien invasive species control. ▪ To be undertaken during the wet/growing season								

Several flora SCC were recorded on-site or are likely to be present, based on known distribution ranges, and it is possible that individual plants will be cleared during construction.

As SCC are likely to be distributed throughout the study area, this impact is likely to be similar for both alternatives. Before mitigation, impact magnitude is very high, while duration is immediate. It has a definite probability of occurrence. The spatial extent of the impact is at the local scale. Prior to mitigation, this impact is rated of “high” significance. With mitigation, this impact can be reduced to a low magnitude, while duration will remain of immediate. Spatial extent will be reduced to the site only, but probability will be reduced to low. After mitigation, this impact is rated to be of “low” significance

Table 9-38 – Construction Impact on flora SCC

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Loss of Flora Species of Conservation Concern									
Without Mitigation	5	2	5	1	5	65	High	(-)	Easy
With Mitigation	2	1	1	2	2	12	Low	(-)	
Mitigation and Management Measures	Avoidance and Minimisation ■ Prior to any vegetation clearing, the proposed construction footprints should be clearly marked in the field; ■ A wet/growing season field survey for flora SCC should then be conducted within the planned development footprints to determine the identify and number of potentially impacted flora SCC; ■ Informed by the findings of the survey: ■ Wherever possible, infrastructure footprints should be re-aligned/re-positioned to avoid SCC locations; ■ Where re-alignment/re-positioning is not possible, permits should be obtained from the relevant authority to rescue and relocate impacted plants; and ■ A Flora SCC Rescue and Relocation Plan should be developed for the proposed Project to provide guidance on all aspects of SCC rescue and relocation.								

Construction activities, such as the removal of vegetation and earth works, are likely to increase the potential for soil erosion, which can spread beyond the development footprint and can cause broader-scale habitat degradation

This impact is likely to be the same for both alternatives. Before mitigation, the magnitude of soil erosion is medium, while duration is long term and it has a high probability. The spatial extent of soil erosion is local. Prior to mitigation, this impact is rated an impact of “medium” significance. With the implementation of active control, this impact can be reduced to a low magnitude, with a short-term duration. Spatial extent will be reduced to the site only and the probability of the impact occurring as predicted would be reduced to low. After mitigation, this impact is rated to be of “low” significance.

Table 9-39 – Construction Impact on soil erosion

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Increased Incidences of Soil Erosion									
Without Mitigation	3	2	3	4	4	48	Moderate	(-)	Easy
With Mitigation	2	1	3	1	2	12	Low	(-)	
Mitigation and Management Measures	Avoidance and Minimisation ▪ All sites disturbed during the construction phase should be stabilised and rehabilitated, as per the rehabilitation / landscaping protocol discussed in Construction Phase impacts; ▪ The location of sites requiring erosion prevention and rehabilitation should be identified through regular field inspections. ▪ Monitoring of rehabilitated and revegetated sites should be conducted annually until such as time as rehabilitation of disturbed sites has proved successful; ▪ Key aspects that should be monitored include: ▪ Successful establishment and coverage of vegetation; ▪ Sites of erosion; ▪ The findings of monitoring should be used to inform the need for additional rehabilitation and/ or corrective actions. ▪ To be undertaken during the wet/growing season								

9.7.2 OPERATIONAL PHASE

The potential establishment of alien invasive species will continue to be an impact of concern during the operational phase.

This impact is likely to be the same for both alternatives. Before mitigation, impact magnitude is high, while duration is long term and the impact has a medium probability of occurring. The spatial extent of alien invasive species spread is local. This results in an impact significance before mitigation of “medium”. With the continued implementation of active control during the operational phase, this impact can be reduced to a low magnitude, with a short-term duration. Spatial extent will be reduced to the site only and the probability of the impact occurring as predicted would be reduced to low. After mitigation, this impact is rated to be of “low” significance.

Table 9-40 – Operational Impact on alien invasive species

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Establishment and Spread of Alien Invasive Species									
Without Mitigation	4	2	3	4	3	**39**	**Moderate**	(-)	Easy
With Mitigation	2	1	3	2	2	**16**	**Low**	(-)	
Mitigation and Management Measures	Minimisation ▪ Active alien invasive species control should continue throughout the operational phase, as per the Project's AIS Control and Eradication Plan. ▪ Annual on-site alien invasive species monitoring should be conducted. Monitoring should focus on: ▪ All sites disturbed during the construction phase; ▪ Riparian/wetland areas adjacent to construction sites; and ▪ Monitoring should assess species type and density, and these data should inform the scope of ongoing alien invasive species control. ▪ To be undertaken during the wet/growing season								

9.7.3 DECOMMISSIONING PHASE

Decommissioning activities, such as the dismantling and clearing away of infrastructure are likely to disturb vegetation and soils, which may facilitate the establishment and spread of alien invasive species.

This impact is likely to be the same for both alternatives. Before mitigation, impact magnitude is high, while duration is long term and it has a high probability. The spatial extent of alien invasive species spread is local. Prior to mitigation, the establishment and spread of alien invasive species is rated an impact of "medium" significance. With the implementation of active control during the decommissioning phase, this impact can be reduced to a low magnitude, with a short-term duration. Spatial extent will be reduced to the site only and the probability of the impact occurring as predicted would be reduced to low. After mitigation, this impact is rated to be of "low" significance.

Table 9-41 – Decommissioning Impact on alien invasive species

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Establishment and Spread of Alien Invasive Species									
Without Mitigation	4	2	3	4	4	52	Moderate	(-)	Easy
With Mitigation	2	1	3	2	2	16	Low	(-)	
Mitigation and Management Measures	Minimisation ▪ Active alien invasive species control, as per the AIS Control and Eradication Plan, should continue during the decommissioning phase and follow up control should be carried out for a five- year period following decommissioning. ▪ Alien invasive species monitoring should be conducted on a biannual basis during decommissioning and annually for a five-year period following decommissioning. Monitoring should focus on: ▪ All sites disturbed during decommissioning; ▪ Riparian/wetland areas adjacent to former development sites; and ▪ Monitoring should assess species type and density, and these data should inform the scope of ongoing alien invasive species control. Rehabilitation ▪ All project infrastructure should be dismantled and removed from site; ▪ All sites disturbed during the decommissioning phase should be stabilised and rehabilitated, as per the rehabilitation/landscaping protocol. ▪									

Decommissioning activities, such as the dismantling and clearing away of infrastructure are likely to disturb vegetation and soils, which may increase the potential for soil erosion, which can cause broader-scale habitat degradation

This impact is likely to be the same for both alternatives. Before mitigation, the magnitude of soil erosion is medium, while duration is long term and it has a high probability. The spatial extent of soil erosion is local. Prior to mitigation, this impact is rated an impact of “medium” significance. With the implementation of active control, this impact can be reduced to a low magnitude, with a short-term duration. Spatial extent will be reduced to the site only and the probability of the impact occurring as predicted would be reduced to low. After mitigation, this impact is rated to be of “low” significance.

Table 9-42 – Decommissioning Impact on erosion

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Increased Incidences of Soil Erosion									
Without Mitigation	3	2	3	4	4	48	Moderate	(-)	Easy
With Mitigation	2	1	1	2	2	12	Low	(-)	
Mitigation and Management Measures	▪ Minimisation ▪ All sites disturbed during the decommissioning phase should be stabilised and rehabilitated, as per the rehabilitation/landscaping protocol. ▪ The location of sites requiring erosion prevention and rehabilitation should be identified through regular field inspections. ▪ Monitoring of rehabilitated and revegetated sites should be conducted annually during decommissioning and for a two-year period after decommissioning; ▪ Key aspects that should be monitored include: ▪ Successful establishment and coverage of vegetation; ▪ Sites of erosion; ▪ The findings of monitoring should be used to inform the need for additional rehabilitation and/or corrective actions.								

9.8 TERRESTRAIL ANIMAL BIODIVERSITY

9.8.1 CONSTRUCTION PHASE

Habitat loss refers to the physical removal of natural habitat. Habitat disturbance refers to the modification of habitat to the extent that it loses important functionality. These impacts can negatively impact the viability of all fauna populations occurring in the study area, including SCC.

Construction activities will include vegetation clearing and bulk earth works, which will take place in the footprints of proposed Project infrastructure. This will result in the direct loss of habitat available to fauna, some of which is designated as Critical Biodiversity Areas (CBA) by the MPTA.

Based on the available infrastructure layout plans for the proposed Project, a breakdown of the approximate extent of direct habitat loss and disturbance associated with the two proposed Project alternatives is as follows: Alternative 1 will result in approximately 66.37ha of natural habitat loss, whereas Alternative 2 will result in approximately 141.05ha of natural habitat.

Alternative 1: The impact prior to mitigation is considered to be of high magnitude, permanently affecting vegetation within and potentially adjacent to the development footprints (local). It is also considered to have a definite probability, resulting in an impact of “high” significance. Considering the development nature of the proposed Project, this impact is difficult to avoid, however measures can be taken to minimise the significance. With mitigation, the magnitude of the impact can be lowered to high, and it can be confined to the site scale. Duration can be reduced to the long-term, and probability to high. This results in an after-mitigation impact of “medium” significance.

Table 9-43 – Construction Impact on fauna habitat- Alternative 1

Potential Impact Loss and Disturbance of Fauna Habitat	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	4	2	3	5	5	**70**	**High**	(-)	Easy
With Mitigation	3	1	3	4	4	**44**	**Moderate**	(-)	
Mitigation and Management Measures	Minimisation ▪ Vegetation clearing should be restricted to the proposed Project footprints only, with no clearing permitted outside of these areas; ▪ The footprints to be cleared should be clearly demarcated prior to construction to prevent unnecessary clearing outside of these areas; ▪ No heavy vehicles should travel beyond the marked works zone. Rehabilitation ▪ A rehabilitation/landscaping protocol should be developed and implemented on-site. The protocol should include, inter alia, the following provisions: ▪ Stockpiling of topsoil from development footprints during site preparation; ▪ Post-construction, the land form should be correctly contoured to limit potential erosion and compacted soils should be ripped and loosened to facilitate vegetation establishment; ▪ Topsoil removed during construction should be applied to all non-operational sites that were disturbed during construction and require revegetation; and ▪ Locally occurring indigenous grasses species should be used to revegetate all areas disturbed during construction. ▪ Monitoring of rehabilitated and revegetated sites should be conducted annually until such									

	as time as rehabilitation of disturbed sites has proved successful; ■ Key aspects that should be monitored include: ■ Successful establishment and coverage of vegetation; ■ Sites of erosion; ■ The findings of monitoring should be used to inform the need for additional rehabilitation and/ or corrective actions. Offsetting ■ To offset the loss of land designated as CBA Irreplaceable and CBA Optimal, a biodiversity offsetting strategy has been developed, and will be refined under consultation with the local conservation authority (i.e., Mpumalanga Parks and Tourism Agency).

Alternative 2: As substantial more natural habitat will be lost compared to Alternative 1, the impact prior to mitigation is considered to be of very high magnitude, permanently affecting vegetation within and potentially adjacent to the development footprints (local). It is also considered to have a definite probability, resulting in an impact of "high" significance. With mitigation, the magnitude of the impact can be lowered to medium, and it can be confined to the site scale. Duration can be reduced to the long-term, and probability to high. This results in an after-mitigation impact of "medium" significance.

Table 9-44 – Construction Impact on fauna habitat-Alternative 2

Potential Impact Loss and Disturbance of Fauna Habitat	**Magnitude**	**Extent**	**Reversibility**	**Duration**	**Probability**	**Significance**		**Character**	**Ease of mitigation**
Without Mitigation	5	2	3	5	5	**75**	**High**	(-)	Easy
With Mitigation	4	1	3	4	4	**48**	**Moderate**	(-)	
Mitigation and Management Measures	Minimisation ■ Vegetation clearing should be restricted to the proposed Project footprints only, with no clearing permitted outside of these areas; ■ The footprints to be cleared should be clearly demarcated prior to construction to prevent unnecessary clearing outside of these areas; ■ No heavy vehicles should travel beyond the marked works zone.								

	Rehabilitation ▪ A rehabilitation/landscaping protocol should be developed and implemented on-site. The protocol should include, inter alia, the following provisions: ▪ Stockpiling of topsoil from development footprints during site preparation; ▪ Post-construction, the land form should be correctly contoured to limit potential erosion and compacted soils should be ripped and loosened to facilitate vegetation establishment; ▪ Topsoil removed during construction should be applied to all non-operational sites that were disturbed during construction and require revegetation; and ▪ Locally occurring indigenous grasses species should be used to revegetate all areas disturbed during construction. ▪ Monitoring of rehabilitated and revegetated sites should be conducted annually until such as time as rehabilitation of disturbed sites has proved successful; ▪ Key aspects that should be monitored include: ▪ Successful establishment and coverage of vegetation; ▪ Sites of erosion; ▪ The findings of monitoring should be used to inform the need for additional rehabilitation and/ or corrective actions. Offsetting ▪ To offset the loss of land designated as CBA Irreplaceable and CBA Optimal, a biodiversity offsetting strategy has been developed, and will be refined under consultation with the local conservation authority (i.e., Mpumalanga Parks and Tourism Agency).

Habitat fragmentation occurs when habitat loss results in the partitioning of natural habitat into smaller, discontinuous and often isolated habitat patches. This can negatively affect various landscape-scale ecological processes, such as fauna movement and dispersal.

Vegetation clearing associated with proposed linear infrastructure (access roads) will cause fragmentation of habitat in the study area, which could potentially negatively impact fauna movement and dispersal. Owing to the higher number of proposed turbines, the access road network associated with Alternative 1 will be more extensive than that for Alternative 2. The significance of habitat fragmentation is therefore assessed separately for the two alternatives:

Alternative 1: Before mitigation, impact magnitude is very high, while duration is permanent and it has a high probability. The spatial extent of is local. Prior to mitigation, the fragmentation of fauna habitat is rated an impact of “moderate” significance. With mitigation, this impact can be reduced to a moderate magnitude, with a long-term duration. Spatial extent will be retained at the local scale and the probability of the impact occurring as predicted would be reduced to low. After mitigation, this impact is rated to be of “low” significance.

Table 9-45 – Construction Impact on fauna habitat-Alternative 1

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Fragmentation of Habitat and a Disruption of Fauna Movement/Dispersal									
Without Mitigation	5	2	3	5	4	**60**	**Moderate**	(-)	Easy
With Mitigation	3	2	3	4	2	**24**	**Low**	(-)	
Mitigation and Management Measures	Minimisation ▪ See mitigation measures for Impact 1: Loss and Disturbance of Fauna Habitat; and ▪ Limit the erection of fences or other linear artificial movement barriers to the minimum required to meet facility safety/security requirements. Rehabilitation ▪ As per Mitigation Actions for Impact 1: Loss and Disturbance of Fauna Habitat.								

Alternative 2: Before mitigation, impact magnitude is high, while duration is permanent and it has a high probability. The spatial extent of is local. Prior to mitigation, the fragmentation of fauna habitat is rated an impact of “moderate” significance. With mitigation, this impact can be reduced to a low magnitude, with a long-term duration. Spatial extent will be retained at the local scale and the probability of the impact occurring as predicted would be reduced to low. After mitigation, this impact is rated to be of “low” significance.

Table 9-46 – Construction Impact on fauna habitat-Alternative 2

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation

Fragmentation of Habitat and a Disruption of Fauna Movement/Dispersal									
Without Mitigation	4	2	3	5	4	**56**	**Moderate**	(-)	Easy
With Mitigation	2	2	3	4	2	**24**	**Low**	(-)	
Mitigation and Management Measures	Minimisation - See mitigation measures for Impact 1: Loss and Disturbance of Fauna Habitat; and - Limit the erection of fences or other linear artificial movement barriers to the minimum required to meet facility safety/security requirements. Rehabilitation - As per Mitigation Actions for Impact 1: Loss and Disturbance of Fauna Habitat.								

Large and mobile fauna will move off to avoid disturbances caused by construction activities. However, smaller and less mobile species may be trapped, injured and killed during vegetation clearing and earth works. Susceptible fauna includes inter alia, burrowing mammals (e.g., rodents), reptiles and amphibians. Other common potential causes of fauna death, injury and disturbance during the construction phase may include:

- Vehicle collisions along construction and access roads;
- Hunting and snaring by construction workers;
- Trapping of fauna in excavations and trenches; and
- Excessive dust and noise from construction machinery may cause sensory disturbances.

This impact is likely to be the same for both alternatives. The impact prior to mitigation is considered to be of medium magnitude and will permanently impact affected fauna. The spatial scale is local. It is also considered to have a high probability, resulting in an impact of “medium” significance.

With mitigation, which includes inter alia, the active and correct management of all human-animal interactions, magnitude is reduced to low, and probability of the impact can be reduced to low, and scale to the site only. This results in an after-mitigation impact of “low” significance.

Table 9-47 – Construction Impact on fauna mortality

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Injury, Mortality and Disturbance of Fauna									
Without Mitigation	3	2	5	5	4	60	Moderate	(-)	High
With Mitigation	2	1	1	2	2	12	Low	(-)	
Mitigation and Management Measures	▪ Avoidance and Minimisation ▪ An Environmental Control Officer (ECO) should be on-site during vegetation clearing to monitor and manage any wildlife-human interactions; ▪ As appropriate, barriers should be erected around construction trenches and excavations to prevent fauna being trapped in these features; ▪ Any fauna species trapped in construction areas, should be safely and correctly relocated to an adjacent area of natural habitat; ▪ A low-speed limit (recommended 20-40 km/h) should be enforced on site to reduce wildlife collisions; ▪ The handling, poisoning and killing of on-site fauna by contractors must be strictly prohibited; ▪ General noise abatement equipment should be fitted to construction machinery and vehicles; ▪ Dust suppression using water bowsers should be undertaken on all roads and other sites where dust entrainment occurs; ▪ The rules and regulations concerning fauna should be communicated to contractors through on-site signage and awareness training; and ▪ An incidence register should be maintained throughout all phases of the Project detailing any fauna mortalities/injuries caused by on-site activities. The register should be used to identify additional biodiversity management requirements.									

Three mammal SCC were recorded in the study area during the field programme (Mountain Reedbuck, Grey Rhebok and Serval), and it is possible that several additional fauna SCC may also be present, based on habitat suitability. Proposed Project activities may lead to the loss/disturbance of fauna SCC through the loss of functional habitat or direct mortality (e.g., hunting). This is of particular concern for the Mountain Reedbuck (Endangered), which has experienced a significant population decline in South Africa in recent years.

This impact is likely to be the same for both alternatives. The impact prior to mitigation is considered to be of very high magnitude and will permanently impact affected fauna SCC. The spatial scale is local. It is also considered to have a high probability, resulting in an impact of “high” significance. With mitigation, which includes a suite of measures to inter alia, limit habitat loss, reduce direct mortality/disturbance, and conduct further surveying (e.g., for Mountain Reedbuck) to inform adaptive management, impact magnitude is reduced to high, and probability of the impact can be reduced to low, and scale to the site only. This results in an after-mitigation impact of “low” significance.

Table 9-48 – Construction Impact on fauna SCC

Potential Impact Loss of fauna species of conservation concern	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	5	2	5	5	4	68	High	(-)	High
With Mitigation	4	1	1	2	2	16	Low	(-)	
Mitigation and Management Measures	▪ Avoidance and Minimisation ▪ See mitigation measures for Impact 3: Injury, Mortality and Disturbance of Fauna; ▪ A Mountain Reedbuck (EN) surveying programme should be conducted to determine the population size and spatial use (i.e., territorial configuration) of the study area. These data should then be used to identify additional and adaptive conservation and management interventions for Mountain Reedbuck for inclusion in the Project’s Biodiversity Action Plan (BAP); ▪ The on-site ECO should be trained in inter alia, the preliminary identification of fauna SCC; ▪ In the event that millipedes are encountered during construction, the ECO should collect a suitable specimen and submit it to a millipede expert for identification. If it is found to be Doratogonus furculifer, construction activities at the relevant site should cease immediately, and the ECO should consult the millipede expert and the MPTA with respects to implementing a rescue and relocation managing programme for this species.									

Disturbances caused by vegetation clearing and earth works during the construction phase will facilitate the establishment and spread of alien invasive vegetation. Areas that are likely to be particularly vulnerable to AIS colonisation include grassland and wetland habitats in close proximity to existing wattle stands and construction footprints. Alien plant infestations can spread exponentially, suppressing or replacing indigenous vegetation. This may result in a loss of functional fauna habitat and an attendant reduction in fauna diversity.

This impact is likely to be the same for both alternatives. Before mitigation, impact magnitude is high, while duration is long term and it has a high probability. The spatial extent of alien invasive species spread is local. Prior to mitigation, the establishment and spread of alien invasive species is rated an impact of "moderate" significance.

With the implementation of active control during the construction phase, this impact can be reduced to a low magnitude, with a short-term duration. Spatial extent will be reduced to the site only and the probability of the impact occurring as predicted would be reduced to low. After mitigation, this impact is rated to be of "low" significance.

Table 9-49 – Construction Impact of alien invasive species

Potential Impact Establishment and Spread of Alien Invasive Species Resulting in Degradation of Fauna Habitat.	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	4	2	3	4	4	**52**	**Moderate**	(-)	High
With Mitigation	2	1	1	2	2	**12**	**Low**	(-)	
Mitigation and Management Measures	Minimisation ▪ An Alien Invasive Species (AIS) Control and Eradication Plan must be developed for the Project. It is recommended that the plan include: ▪ A combined approach using both chemical and mechanical control methods; ▪ Periodic follow-up treatments, informed by regular monitoring; ▪ A specific focus on: ▪ All sites disturbed by construction; and ▪ Areas of wetland/stream vegetation. ▪ Annual on-site alien invasive species monitoring should be conducted. Monitoring should focus on: ▪ All sites disturbed during the construction phase; ▪ Riparian/wetland areas adjacent to construction sites; ▪ ▪ Monitoring should assess species type and density, and these data should inform the scope of ongoing alien invasive species control.								

	▪ To be undertaken during the Wet/growing season

9.8.2 OPERATIONAL PHASE

Key potential causes of terrestrial fauna death and injury during the operational phase include:

- Vehicle collisions along access roads during day-to-day maintenance activities; and
- Increased hunting and snaring as a result of improved accessibility associated with the proposed access road network.

This impact is likely to be the same for both alternatives. The impact prior to mitigation is considered to be of very high magnitude and will permanently impact affected fauna. The spatial scale is local. It is also considered to have a moderate probability, resulting in an impact of "medium" significance. With mitigation, magnitude is reduced to moderate, and probability of the impact can be reduced to low, and scale to the site only. This results in an after-mitigation impact of "low" significance.

Table 9-50 – Operational Impact fauna morality

Potential Impact Injury, Mortality and Disturbance of Fauna, including SCC	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	5	2	5	5	3	**51**	**Moderate**	(-)	High
With Mitigation	3	1	3	2	2	**18**	**Low**	(-)	
Mitigation and Management Measures	Avoidance and Minimisation ▪ No off-road driving is permitted for vehicles and mobile machinery used during operations and for maintenance purposes. ▪ A low-speed limit (recommended 20-40 km/h) should be enforced on site to reduce wildlife collisions; ▪ The handling, poisoning and killing of on-site fauna by maintenance personnel must be strictly prohibited; ▪ The rules and regulations concerning fauna should be communicated to maintenance personnel through on-site signage and awareness training.								

The spread of alien invasive species from disturbed sites into areas of natural habitat will continue to be an impact of concern during the operational phase.

Before mitigation, impact magnitude is high, while duration is long term and it has a medium probability. The spatial extent of alien invasive species spread is local. Prior to mitigation, the establishment and spread of alien invasive species is rated an impact of "moderate" significance. With the implementation of active control during the operational phase, this impact can be reduced to a low magnitude, with a short-term duration. Spatial extent will be reduced to the site only and the probability of the impact occurring as predicted would be reduced to low. After mitigation, this impact is rated to be of "low" significance.

Table 9-51 – Operational Impact on fauna habitat

Potential Impact Establishment and Spread of Alien Invasive Species Resulting in Degradation of Fauna Habitat.	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	4	2	3	4	3	**39**	**Moderate**	(-)	High
With Mitigation	2	1	3	2	2	**16**	**Low**	(-)	
Mitigation and Management Measures	Minimisation ▪ Active alien invasive species control should continue throughout the operational phase, as per the Project's AIS Control and Eradication Plan. ▪ Annual on-site alien invasive species monitoring should be conducted. Monitoring should focus on: ▪ All sites disturbed during the construction phase; ▪ Riparian/wetland areas adjacent to construction sites; ▪ Monitoring should assess species type and density, and these data should inform the scope of ongoing alien invasive species control. ▪ To be undertaken during the wet/growing season								

Ground vibrations caused by operating wind turbines has been noted to potentially cause disturbance to ground-dwelling species, such as moles and the mole-rats, and this may reduce the extent of suitable habitat for these species. It is noted however, that overall impact vibrations on fauna remain poorly understood and additional research focusing on the South African context is required to develop a better understanding of the type and significance of potential impacts, identify particularly sensitive species, and identify effective mitigation measures. Pursuant to the above, an adaptive approach is recommended, with the Project proponent committing to keep abreast with research and developments in this field, and revise and implement additional mitigation measures as they become available.

Before mitigation, impact magnitude is high, while duration is permanent, and it has a medium probability. The spatial extent is local. Prior to mitigation, this is rated an impact of “moderate” significance.

With the adoption of adaptive management approach, this impact can be reduced to a low magnitude, with a medium-term duration. Spatial extent will remain local and the probability of the impact occurring as predicted would be reduced to low. After mitigation, this impact is rated to be of “low” significance.

Table 9-52 – Operational Impact on fauna SCC

Potential Impact Vibration from Operating Wind Turbines	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	4	2	1	5	3	**36**	**Mode rate**	(-)	Mode rate
With Mitigation	2	2	1	3	2	**16**	**Low**	(-)	
Mitigation and Management Measures	Minimisation ▪ Project proponent must keep actively informed about new research in the field of vibration impacts on fauna and potential mitigation options; ▪ Based on the findings of new research, the biodiversity management plan for the proposed Project should be updated to include additional mitigation measures and these should be implemented on-site.								

9.8.3 DECOMMISSIONING PHASE

The dismantling and removal of Project infrastructure during decommissioning may result in increased incidences of fauna death and injury. Common causes may include, inter alia:

- Vehicle and machinery collisions along access roads and at infrastructure sites where decommissioning activities are occurring; and
- Increased hunting and snaring by workers involved in decommissioning activities are occurring.

The impact prior to mitigation is considered to be of very high magnitude, and will permanently impact affected fauna. The spatial scale is local. It is also considered to have a moderate probability, resulting in an impact of “medium” significance. With mitigation, magnitude is reduced to moderate, and probability of the impact can be reduced to low, and scale to the site only. This results in an after-mitigation impact of "low" significance.

Table 9-53 – Decommissioning Impact on fauna mortality

Potential Impact Injury, Mortality and Disturbance of Fauna, including SCC	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	4	2	3	4	4	**52**	**Moderate**	(-)	High
With Mitigation	2	1	3	2	2	**16**	**Low**	(-)	
Mitigation and Management Measures	Avoidance and Minimisation ▪ No off-road driving is permitted for vehicles and mobile machinery used during decommissioning phases activities; ▪ A low-speed limit (recommended 20-40 km/h) should be enforced on site to reduce wildlife collisions; ▪ The handling, poisoning and killing of on-site fauna by on-site workers must be strictly prohibited; ▪ The rules and regulations concerning fauna should be communicated to maintenance personnel through on-site signage and awareness training.								

Decommissioning activities, such as the dismantling and clearing away of infrastructure are likely to disturb vegetation and soils, which may facilitate the establishment and spread of alien invasive flora species.

Before mitigation, impact magnitude is high, while duration is long term and it has a high probability. The spatial extent of alien invasive species spread is local. Prior to mitigation, the establishment and spread of alien invasive species is rated an impact of "moderate" significance.

With the implementation of active control, this impact can be reduced to a low magnitude, with a short-term duration. Spatial extent will be reduced to the site only and the probability of the impact occurring as predicted would be reduced to low. After mitigation, this impact is rated to be of "low" significance .

Table 9-54 – Decommissioning Impact on habitat

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Establishment and Spread of Alien Invasive Species Resulting in Degradation of Fauna Habitat.									
Without Mitigation	4	2	3	4	4	52	Moderate	(-)	High
With Mitigation	2	1	3	2	2	16	Low	(-)	
Mitigation and Management Measures	Minimisation ▪ Active alien invasive species control, as per the AIS Control and Eradication Plan, should continue during the decommissioning phase and follow up control should be carried out for a five- year period following decommissioning. Rehabilitation ▪ All project infrastructure should be dismantled and removed from site; ▪ All sites disturbed during the decommissioning phase should be stabilised and rehabilitated, as per the rehabilitation/landscaping protocol. ▪ Alien invasive species monitoring should be conducted on a biannual basis during decommissioning and annually for a five-year period following decommissioning. Monitoring should focus on: ▪ All sites disturbed during decommissioning; ▪ Riparian/wetland areas adjacent to former development sites; ▪ Monitoring should assess species type and density, and these data should inform the scope of future alien invasive species control.									

9.9 AQUATIC BIODIVERSITY

9.9.1 CONSTRUCTION PHASE

Alternative 1

The Dalmanutha WEF alternative 1 project intercepts channelled valley bottom, unchanneled valley bottom, depression and hillslope seepage wetlands. The location of these wetlands in relation to the proposed 70 turbines and access roads is shown in **Figure 7-53**. While the direct loss of wetlands has been avoided/minimised in the Project design through the application of a 100 m buffer around wetland habitat and placement of turbines outside that area, the construction of the new access roads associated with the Dalmanutha WEF alternative 1 will result in the direct loss of approximately 1.9 ha of wetland habitat. Adjacent wetland habitat may also be affected by construction activities and machinery. The significance of the direct loss of wetland habitat and disturbance of adjacent wetland habitats is moderate prior to mitigation, as although site based in extent, the duration of the impact is permanent, and outright loss cannot be mitigated.

Assuming that the predicted wetland loss cannot be avoided through changes in access road layout, the loss will remain as an impact of moderate significance post-mitigation. Additional measures will be required to address significant residual impacts i.e. compensate or offset the permanent loss of wetland habitat.

Alternative 2

As with alternative 1 of the Dalmanutha WEF, the construction of the proposed project will result in the loss of wetland habitat which will result mainly from the construction of access roads. The construction of alternative 2 will result in a slightly reduced direct loss of wetland habitat, at approximately 1.4 ha. As is the case for direct loss to alternative 1, additional measures will be required to address significant residual impacts i.e. compensate or offset the permanent loss of wetland habitat.

The following impacts have been identified:

Table 9-55 – Construction Impact on wetland habitat

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Loss of wetland habitat									
Without Mitigation	3	1	5	4	4	**52**	**Moderate**	(-)	Easy
With Mitigation	-	-	-	-	-	**-**	**-**	(-)	
Mitigation and Management Measures	▪ All construction roads and supporting infrastructure in or adjacent to the wetland habitat shall be minimised, and shall be aligned and managed to ensure uninterrupted flow both upstream and downstream of infrastructure which crosses the wetness zones and/or in-stream habitats. ▪ A construction method statement for wetland road crossings must be developed by a wetland ecologist and environmental engineer, and implemented on site during construction. ▪ Construction should be done in the dry season and completed by the wet season, so that appropriate water management systems are in place for stormwater management. ▪ As far as possible, use of existing access roads should be made. ▪ Pollution prevention measures for the protection of wetlands, rivers and streams from contamination with hydrocarbons, sediments and other chemicals to be implemented.									

	- No protected wetland plants to be disturbed without the necessary permits in place – plant search and rescue surveys of affected wetlands should be conducted in the wet season immediately prior to construction, in line with an agreed plant translocation plan. - Vegetation and soil clearing should be restricted to the immediate construction footprint only. - A 100 m buffer around wetlands (other than those being crossed by access roads) must be clearly demarcated and maintained throughout the duration of the construction phase to enable construction workers to avoid the wetland areas outside the construction footprint, and minimise the risk of disturbance impacts on wetland ecosystems arising from construction activities as well as the physical presence of Project infrastructure (other than road or other infrastructure crossings) in the catchments. - Vegetation establishment of bare soils after construction should be done using indigenous grass species found naturally in the area, which should be detailed as part of the wetland rehabilitation and management plan. - The re-vegetation programme shall take cognisance of the climatic and seasonal conditions but should generally be undertaken annually starting in spring and early summer. - Regular inspection and maintenance of the wetland crossings at access roads to ensure that subsurface drains are in working order, and no confinement or impoundment of water is establishing.

The excavation of foundations for the turbines, solar PV in the case of alternative 2, as well as the access roads and subsequent presence of that infrastructure for the duration of operation will also interrupt surface and/or subsurface flows in wetlands being crossed, potentially leading to flow concentration (downstream of the crossings), changes in flow pathways, flow impoundment (upstream of the crossings), increased surface water runoff and increased risk of erosion within the wetland via gullies.

The potential significance of such impacts on the affected wetlands is determined to be moderate, as effects would be permanent, with a site-based impact extent and with a long term impact resulting in a moderate impact significance. Provided that the mitigation measures are implemented prior to commencement of construction and are maintained for the operational lifetime of the Project, the extent of impact and impact magnitude can be reduced, resulting in a residual impact of low significance post-mitigation.

Table 9-56 – Construction Impact on wetland hydrology

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Interruption of wetland hydrology									
Without Mitigation	3	1	5	4	4	**52**	**Moderate**	(-)	Easy
With Mitigation	2	1	3	2	3	**24**	**Low**	(-)	
Mitigation and Management Measures	▪ All construction roads and supporting infrastructure in or adjacent to the wetland habitat shall be minimised, and shall be aligned and managed to ensure uninterrupted flow both upstream and downstream of infrastructure which crosses the wetness zones and/or in-stream habitats. ▪ A construction method statement for wetland road crossings must be developed by a wetland ecologist and environmental engineer, and implemented on site during construction. ▪ Construction should be done in the dry season and completed by the wet season, so that appropriate water management systems are in place for stormwater management. ▪ As far as possible, use of existing access roads should be made. ▪ Pollution prevention measures for the protection of wetlands, rivers and streams from contamination with hydrocarbons, sediments and other chemicals to be implemented. ▪ A 100 m buffer around wetlands (other than those being crossed by access roads) must be clearly demarcated and maintained throughout the duration of the construction phase to enable construction workers to avoid the wetland areas outside the construction footprint, and minimise the risk of disturbance impacts on wetland ecosystems arising from construction activities as well as the physical presence of Project infrastructure (other than road or other infrastructure crossings) in the catchments. ▪ Regular inspection and maintenance of the wetland crossings at access roads to ensure that subsurface drains are in working order, and no confinement or impoundment of water is establishing.									

During construction, the water quality in affected wetlands may deteriorate as a consequence of vegetation removal, and increased risk of eroded soils and sediments being transported after rainfall events. Contaminants from machinery and materials being used for excavations and construction of access roads could enter the wetland and contribute to water quality changes.

Potential impacts on water quality in the wetlands have a moderate impact score without mitigation, as the effects will last for the duration of the construction phase. The implementation of the recommended mitigation measures is required to avoid and minimise adverse impacts on water quality of wetlands and associated downstream riparian systems. Provided that the mitigation measures are implemented, the extent of potential impacts can be reduced to a site-only scale; the impact can be reversible, and the probability of the impact occurring can be reduced to low. In this scenario, a post-mitigation impact of very-low significance is predicted.

Table 9-57 – Construction Impact on wetland water quality

Potential Impact Wetland water quality deterioration	**Magnitude**	**Extent**	**Reversibility**	**Duration**	**Probability**	**Significance**		**Character**	**Ease of mitigation**
Without Mitigation	4	2	3	3	4	**48**	**Moderate**	(-)	Easy
With Mitigation	3	1	1	2	2	**14**	**Very Low**	(-)	
Mitigation and Management Measures	▪ All construction roads and supporting infrastructure in or adjacent to the wetland habitat shall be minimised, and shall be aligned and managed to ensure uninterrupted flow both upstream and downstream of infrastructure which crosses the wetness zones and/or in-stream habitats. ▪ A construction method statement for wetland road crossings must be developed by a wetland ecologist and environmental engineer, and implemented on site during construction. ▪ Construction should be done in the dry season and completed by the wet season, so that appropriate water management systems are in place for stormwater management. ▪ As far as possible, use of existing access roads should be made. ▪ Pollution prevention measures for the protection of wetlands, rivers and streams from contamination with hydrocarbons, sediments and other chemicals to be implemented								

	▪ A 100 m buffer around wetlands (other than those being crossed by access roads) must be clearly demarcated and maintained throughout the duration of the construction phase to enable construction workers to avoid the wetland areas outside the construction footprint, and minimise the risk of disturbance impacts on wetland ecosystems arising from construction activities as well as the physical presence of Project infrastructure (other than road or other infrastructure crossings) in the catchments.

Erosion of wetland soils could occur as a result of vegetation and topsoil removal during construction, which could result in additional loss of the remaining wetland habitat, particularly the remaining areas of wetlands that will be partially or mostly removed, as well as wetlands being intercepted by access roads. Vegetation clearance and removal will lead to reduced surface roughness within the remaining wetlands which could further exacerbate soil erosion.

Erosion of wetland soils will lead to habitat deterioration and changes in the natural wetland hydrology. These effects may be expressed as flow concentrations, lowering of the water table and possible desiccation in hillslope seepage and valley bottom wetlands.

The impact on soil erosion has a moderate impact significance before mitigation. With the application of the recommended mitigation measures, the magnitude of change in wetland health as a result of erosion can be reduced to low, effects can be restricted to the site only, and the duration of effects will be of short term, lasting for the duration of construction. The overall impact post-mitigation is predicted to be one of low significance.

Table 9-58 – Construction Impact on wetland soil

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Wetland soil erosion									
Without Mitigation	3	2	5	4	4	**56**	**Moderate**	(-)	Easy
With Mitigation	2	1	3	2	3	**24**	**Low**	(-)	
Mitigation and Management Measures	▪ Design and planning of all proposed activities in the wetlands or adjacent to or in the vicinity of rivers, streams and wetlands shall consider the following measures: ▪ Erosion control and protection measures installed as part of the construction of the								

	project will be adapted for the specific area and situation where signs of erosion appear. ▪ Soil compacted in non-operational areas during construction activities should be ripped to break up the compacted soil surface and re-vegetated to aid infiltration and decrease run-off. ▪ Topsoil stockpiles to be re-vegetated with non-invasive vegetation, in order to stabilise the soil, reduce run-off and minimise erosion into adjacent and downstream wetlands. ▪ A 100 m buffer around wetlands (other than those being crossed by access roads) must be clearly demarcated and maintained throughout the duration of the construction phase to enable construction workers to avoid the wetland areas outside the construction footprint, and minimise the risk of disturbance impacts on wetland ecosystems arising from construction activities as well as the physical presence of Project infrastructure (other than road or other infrastructure crossings) in the catchments. ▪ Vegetation establishment of bare soils after construction should be done using indigenous grass species found naturally in the area, which should be detailed as part of the wetland rehabilitation and management plan. ▪ The re-vegetation programme shall take cognisance of the climatic and seasonal conditions but should generally be undertaken annually starting in spring and early summer. ▪ The efficiency of erosion control and protection measures installed as part of the construction of the project will be monitored specifically after high rainfall events.

9.9.2 OPERATIONAL PHASE

The construction phase of the project could see an increase in the establishment and spread of alien invasive species into adjacent wetlands habitat, which would persist throughout the operational lifetime of the Project – particularly along new access roads. The magnitude of impact is high prior to the implementation of mitigation measures, with the impact extending beyond site to the local extent, resulting in a moderate impact significance.

The establishment of alien invasive species in, and immediately adjacent to, the proposed development footprint will continue to be an impact of concern during the operational phase. However, with the implementation of recommended mitigation measures such as the continued implementation of an active alien species control programme during the operational phase, the impact significance can be reduced to a very-low impact significance, due to the extent of impact reduced to site only and the impact lasting only for a short term and having a medium impact magnitude.

Table 9-59 – Operational Impact on alien invasive plants

Potential Impact Spread of alien invasive plants	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	4	2	3	4	4	**52**	**Moderate**	(-)	Easy
With Mitigation	3	1	1	2	2	**14**	**Very low**	(-)	
Mitigation and Management Measures	▪ Develop an alien and invasive plant management program to pro-actively strive towards the eradication and control of alien invasive species within the mining right area. Alien and invasive species management in remaining wetland areas should be prioritised for the following areas: ▪ Areas where wetland vegetation cover is disturbed. ▪ Wetland areas where soils imported from external sources are applied. ▪ All rehabilitated wetland areas								

9.9.3 DECOMMISSIONING PHASE

The impacts associated with the decommissioning activities are expected to be the same as the construction phase, therefore the same mitigation measures should be applied.

9.10 AVIFAUNA

9.10.1 CONSTRUCTION PHASE

The following impacts have been assessed for both the project alternatives

Destruction and alteration of bird habitat during construction is a negative impact, which will definitely occur as a certain amount of habitat transformation is inevitable, in spite of any mitigation. Turbine hard stands, Solar PV arrays roads and other infrastructure need to be built and will transform habitat. The significance of this impact is rated as High Negative pre-mitigation, and Moderate Negative post-mitigation.

Table 9-60 – Construction Impact on bird habitat destruction

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Habitat is destroyed and transformed									
Without Mitigation	3	1	5	4	5	**65**	**High**	(-)	Easy
With Mitigation	3	1	5	4	4	**52**	**Moderate**	(-)	
Mitigation and Management Measures	▪ The sensitive (No-Go) areas identified by this study should be adhered to. ▪ A pre-construction avifaunal walk down should be conducted to confirm final layout and identify any sensitivities that may arise between the conclusion of the EIA process and the construction phase. ▪ All human activities associated with construction, operation and decommissioning should be strictly managed according to generally accepted environmental best practice standards, so as to avoid any unnecessary impact on the receiving environment. ▪ Use should be made of existing roads as far as possible. ▪ All staff, vehicle and machinery activities should be strictly controlled at all times so as to ensure that the absolute minimum of surface area is impacted. ▪ Care should be taken not to introduce or propagate alien plant species/weeds during construction. ▪ The “during construction” and “post-construction” monitoring programme outlined in Appendix 10 of the Avifaunal Assessment should be implemented according to the latest available version of the Best Practice Guidelines at the time.									

Disturbance of birds

Disturbance of birds during construction is a negative impact, which will definitely occur to some extent. However, few sensitive species breeding sites (which would be most susceptible to impact) have been identified and these have been provided with spatial protection in the form of No-Go buffers. This impact is rated as Low Negative significance both pre and post-mitigation.

Table 9-61 – Construction Impact on disturbance of birds

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Birds are disturbed during construction activities									
Without Mitigation	2	2	1	1	4	24	Low	(-)	Easy
With Mitigation	2	2	4	4	3	18	Low	(-)	
Mitigation and Management Measures	▪ The sensitive (No-Go) areas identified by this study should be adhered to. ▪ A pre-construction avifaunal walk down should be conducted to confirm final layout and identify any sensitivities that may arise between the conclusion of the EIA process and the construction phase. ▪ All human activities associated with construction, operation and decommissioning should be strictly managed according to generally accepted environmental best practice standards, so as to avoid any unnecessary impact on the receiving environment. ▪ Use should be made of existing roads as far as possible. ▪ All staff, vehicle and machinery activities should be strictly controlled at all times so as to ensure that the absolute minimum of surface area is impacted. ▪ Care should be taken not to introduce or propagate alien plant species/weeds during construction. ▪ The "during construction" and "post-construction" monitoring programme outlined in Appendix 10 of the Avifaunal Assessment should be implemented according to the latest available version of the Best Practice Guidelines at the time.									

9.10.2 OPERATIONAL PHASE

Disturbance of birds

Since the risk to sensitive bird breeding sites has been adequately avoided through spatial protection, the magnitude of disturbance of birds in the operational phase will be low. This impact has been rated as Low Negative significance both pre and post-mitigation.

Table 9-62 – Operational Impact on disturbance of birds

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Birds are disturbed during operations of the facility									
Without Mitigation	2	2	1	1	3	**18**	**Low**	(-)	Easy
With Mitigation	2	2	1	1	3	**18**	**Low**	(-)	
Mitigation and Management Measures	▪ A post-construction site inspection must be conducted by an avifaunal specialist to confirm that all aspects have been appropriately handled and in particular that road and hard stand verges do not provide additional substrate for raptor prey species. It is essential that the new wind farm does not create favourable conditions for such mammals in high risk areas. It is therefore recommend that within the first year of operations a full assessment of this aspect be made by the ornithologist contracted for post-construction monitoring. If such conditions have been created, case-specific solutions will need to be developed and implemented by the wind farm. ▪ It is strongly recommended that rodenticides not be used at the newly established Operation and Maintenance (O&M) buildings or around auxiliary infrastructure on the project site. While pest control of this nature may be effective, even so-called “environmentally friendly” rodenticides are toxic and pose significant secondary poisoning risk to predatory avifauna, especially owls. ▪ A ‘Cape Vulture Food Management Programme’ must be implemented on site to ensure all dead livestock/wildlife on site are removed as soon as possible and made unavailable to vultures for feeding. This programme will reduce the amount of available vulture food on site and reduce vulture-turbine collision risk. This programme will require the deployment of a dedicated (i.e. no other tasks) and adequately resourced (transport, binoculars, GPS, cameras, training) team of staff to patrol the full site and immediate surrounds during all daylight hours. The co-operation of landowners will also be essential to ensure that reported carcasses are disposed of effectively. This programme must be operational by the time the first turbine blades									

	are turning on site and should not wait for Commercial Operations Date (COD). A full detailed method statement for this programme must be designed by an ornithologist prior to COD, and included in the EMPr. ▪ The landowner agreements should ensure specifically that any vulture feeding sites be stopped from the start of wind farm construction and not used for the full lifespan of the wind farm. Landowners should also be sensitised to the need to cooperate with the above Cape Vulture Food Management Programme. ▪ Cape Vultures will have to be effectively deterred from roosting on overhead power lines on site. This will need to be achieved well before turbines are operational and maintained through the project lifespan. ▪ Eskom Bird Guards (perch deterrents) must be installed on all pylons at the two roost sites, with full coverage of steel cross members (not just above live phases as per Eskom standard). In addition, the team of staff employed to implement the Cape Vulture Food Management Programme described above should also be tasked with patrolling the relevant sections of power line early morning and late evenings to scare any perching vultures away. This should first be trialled by in collaboration with an avifaunal specialist to ensure that such actions don't increase turbine collision risk in the short term by flushing vultures into turbines. ▪ An Observer-Led Turbine Shutdown on Demand (OLSDOD) programme must be implemented on site from COD. This is required in order to mitigate the risk of turbine collision for priority bird species. This programme must consist of a suitably qualified, trained, dedicated and resourced team of observers present on site for all daylight hours 365 days of the year. This team must be stationed at vantage points with full visible coverage of all turbine locations. The observers must detect incoming priority bird species, track their flights, judge when they enter a turbine proximity threshold, and alert the control room to shut down the relevant turbine/s until the risk has reduced. A full detailed method statement must be designed by an ornithologist prior to COD, and included in the EMPr. The effectiveness of this programme is highly dependent on hiring the correct staff and managing them appropriately. The project must

	pay careful attention to this aspect if it is to succeed. ■ All turbines must have one of their blades painted according to a protocol currently under development by the South African Wind Energy Association (SAWEA) from the outset. Provision must be made by the developer for the resolution of any technical, warranty or supplier challenges that this may present. ■ A bird fatality threshold and adaptive management plan must be designed by an ornithologist for the site prior to the Commercial Operation Date (COD) and included in the EMPr. This plan should identify most importantly the number of bird fatalities of priority species which will trigger a management response, appropriate responses, and time lines for such responses. Fatalities of priority bird species are usually rare events (but with very high consequence) and it is difficult to analyse trends or statistics related to these fatalities as they occur. It is therefore important to have a threshold policy in place proactively to assist adaptive management. ■ Any residual impacts after all possible mitigation measures have been implemented will need to be mitigated off site. The facility will need to address other sources of mortality of priority species in a measurable way so as to compensate for residual effects on the facility itself. This will need to be detailed in a Biodiversity Action Plan. ■ The “during construction” and “post-construction” monitoring programme outlined in Appendix 10 of the Avifaunal impact assessment should be implemented according to the latest available version of the Best Practice Guidelines at the time. The findings from Operational Phase monitoring should inform the adaptive management programme to mitigate any impacts on avifauna to acceptable levels. ■

Displacement of birds

Similarly, to the above, this impact has been rated this impact as Low Negative significance both pre and post-mitigation.

Table 9-63 – Operational Impact on displacement of birds

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Birds are displaced entirely from the site									
Without Mitigation	2	2	1	1	3	**18**	**Low**	(-)	Easy
With Mitigation	2	2	1	1	3	**18**	**Low**	(-)	
Mitigation and Management Measures	■ A post-construction site inspection must be conducted by an avifaunal specialist to confirm that all aspects have been appropriately handled and in particular that road and hard stand verges do not provide additional substrate for raptor prey species. It is essential that the new wind farm does not create favourable conditions for such mammals in high risk areas. It is therefore recommended that within the first year of operations a full assessment of this aspect be made by the ornithologist contracted for post-construction monitoring. If such conditions have been created, case-specific solutions will need to be developed and implemented by the wind farm. ■ It is strongly recommended that rodenticides not be used at the newly established Operation and Maintenance (O&M) buildings or around auxiliary infrastructure on the project site. While pest control of this nature may be effective, even so-called "environmentally friendly" rodenticides are toxic and pose significant secondary poisoning risk to predatory avifauna, especially owls. ■ A 'Cape Vulture Food Management Programme' must be implemented on site to ensure all dead livestock/wildlife on site are removed as soon as possible and made unavailable to vultures for feeding. This programme will reduce the amount of available vulture food on site and reduce vulture-turbine collision risk. This programme will require the deployment of a dedicated (i.e. no other tasks) and adequately resourced (transport, binoculars, GPS, cameras, training) team of staff to patrol the full site and immediate surrounds during all daylight hours. The co-operation of landowners will also be essential to ensure that reported carcasses are disposed of effectively. This programme must be operational by the time the first turbine blades									

	are turning on site and should not wait for Commercial Operations Date (COD). A full detailed method statement for this programme must be designed by an ornithologist prior to COD, and included in the EMPr. ▪ The landowner agreements should ensure specifically that any vulture feeding sites be stopped from the start of wind farm construction and not used for the full lifespan of the wind farm. Landowners should also be sensitised to the need to cooperate with the above Cape Vulture Food Management Programme. ▪ Cape Vultures will have to be effectively deterred from roosting on overhead power lines on site. This will need to be achieved well before turbines are operational and maintained through the project lifespan. ▪ Eskom Bird Guards (perch deterrents) must be installed on all pylons at the two roost sites, with full coverage of steel cross members (not just above live phases as per Eskom standard). In addition, the team of staff employed to implement the Cape Vulture Food Management Programme described above should also be tasked with patrolling the relevant sections of power line early morning and late evenings to scare any perching vultures away. This should first be trialled by in collaboration with an avifaunal specialist to ensure that such actions don't increase turbine collision risk in the short term by flushing vultures into turbines. ▪ An Observer-Led Turbine Shutdown on Demand (OLSDOD) programme must be implemented on site from COD. This is required in order to mitigate the risk of turbine collision for priority bird species. This programme must consist of a suitably qualified, trained, dedicated and resourced team of observers present on site for all daylight hours 365 days of the year. This team must be stationed at vantage points with full visible coverage of all turbine locations. The observers must detect incoming priority bird species, track their flights, judge when they enter a turbine proximity threshold, and alert the control room to shut down the relevant turbine/s until the risk has reduced. A full detailed method statement must be designed by an ornithologist prior to COD, and included in the EMPr. The effectiveness of this programme is highly dependent on hiring the correct staff and managing them appropriately. The project must

	pay careful attention to this aspect if it is to succeed. ▪ All turbines must have one of their blades painted according to a protocol currently under development by the South African Wind Energy Association (SAWEA) from the outset. Provision must be made by the developer for the resolution of any technical, warranty or supplier challenges that this may present. ▪ A bird fatality threshold and adaptive management plan must be designed by an ornithologist for the site prior to the Commercial Operation Date (COD) and included in the EMPr. This plan should identify most importantly the number of bird fatalities of priority species which will trigger a management response, appropriate responses, and time lines for such responses. Fatalities of priority bird species are usually rare events (but with very high consequence) and it is difficult to analyse trends or statistics related to these fatalities as they occur. It is therefore important to have a threshold policy in place proactively to assist adaptive management. ▪ Any residual impacts after all possible mitigation measures have been implemented will need to be mitigated off site. The facility will need to address other sources of mortality of priority species in a measurable way so as to compensate for residual effects on the facility itself. This will need to be detailed in a Biodiversity Action Plan. ▪ The “during construction” and “post-construction” monitoring programme outlined in Appendix 10 of the Avifaunal impact assessment should be implemented according to the latest available version of the Best Practice Guidelines at the time. The findings from Operational Phase monitoring should inform the adaptive management programme to mitigate any impacts on avifauna to acceptable levels. ▪

Collision of birds with turbines

Collision of birds with the turbines once operating is the primary risk at the proposed site, and is a risk to multiple regionally Red Listed species, including Critically Endangered and Endangered species. This impact is rated as Very High Negative significance pre-mitigation. Although we have recommended a comprehensive suite of mitigation measures (Section 9), the most important of these (blade painting and observer led shutdown on demand) are either not fully proven in South Africa, or highly dependent on human effort, skill and management (and so somewhat risky). On a precautionary basis we judge the significance to remain at High Negative significance post-mitigation.

Table 9-64 – Operational Impact on bird collisions

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Birds are killed through collision with turbines									
Without Mitigation	4	4	5	4	5	85	Very high	(-)	Easy
With Mitigation	4	3	5	4	4	64	High	(-)	
Mitigation and Management Measures	▪ A post-construction site inspection must be conducted by an avifaunal specialist to confirm that all aspects have been appropriately handled and in particular that road and hard stand verges do not provide additional substrate for raptor prey species. It is essential that the new wind farm does not create favourable conditions for such mammals in high risk areas. It is therefore recommended that within the first year of operations a full assessment of this aspect be made by the ornithologist contracted for post-construction monitoring. If such conditions have been created, case-specific solutions will need to be developed and implemented by the wind farm. ▪ It is strongly recommended that rodenticides not be used at the newly established Operation and Maintenance (O&M) buildings or around auxiliary infrastructure on the project site. While pest control of this nature may be effective, even so-called "environmentally friendly" rodenticides are toxic and pose significant secondary poisoning risk to predatory avifauna, especially owls. ▪ A 'Cape Vulture Food Management Programme' must be implemented on site to ensure all dead livestock/wildlife on site are removed as soon as possible and made unavailable to vultures for feeding. This programme will reduce the amount of available vulture food on site and reduce vulture-turbine collision risk. This programme will require the deployment of a dedicated (i.e. no other tasks)									

	and adequately resourced (transport, binoculars, GPS, cameras, training) team of staff to patrol the full site and immediate surrounds during all daylight hours. The co-operation of landowners will also be essential to ensure that reported carcasses are disposed of effectively. This programme must be operational by the time the first turbine blades are turning on site and should not wait for Commercial Operations Date (COD). A full detailed method statement for this programme must be designed by an ornithologist prior to COD, and included in the EMPr. ▪ The landowner agreements should ensure specifically that any vulture feeding sites be stopped from the start of wind farm construction and not used for the full lifespan of the wind farm. Landowners should also be sensitised to the need to cooperate with the above Cape Vulture Food Management Programme. ▪ Cape Vultures will have to be effectively deterred from roosting on overhead power lines on site. This will need to be achieved well before turbines are operational and maintained through the project lifespan. ▪ Eskom Bird Guards (perch deterrents) must be installed on all pylons at the two roost sites, with full coverage of steel cross members (not just above live phases as per Eskom standard). In addition, the team of staff employed to implement the Cape Vulture Food Management Programme described above should also be tasked with patrolling the relevant sections of power line early morning and late evenings to scare any perching vultures away. This should first be trialled by in collaboration with an avifaunal specialist to ensure that such actions don't increase turbine collision risk in the short term by flushing vultures into turbines. ▪ An Observer-Led Turbine Shutdown on Demand (OLSDOD) programme must be implemented on site from COD. This is required in order to mitigate the risk of turbine collision for priority bird species. This programme must consist of a suitably qualified, trained, dedicated and resourced team of observers present on site for all daylight hours 365 days of the year. This team must be stationed at vantage points with full visible coverage of all turbine locations. The observers must detect incoming priority bird species, track their flights, judge when they enter a turbine proximity threshold, and alert the

	control room to shut down the relevant turbine/s until the risk has reduced. A full detailed method statement must be designed by an ornithologist prior to COD, and included in the EMPr. The effectiveness of this programme is highly dependent on hiring the correct staff and managing them appropriately. The project must pay careful attention to this aspect if it is to succeed. ▪ All turbines must have one of their blades painted according to a protocol currently under development by the South African Wind Energy Association (SAWEA) from the outset. Provision must be made by the developer for the resolution of any technical, warranty or supplier challenges that this may present. ▪ A bird fatality threshold and adaptive management plan must be designed by an ornithologist for the site prior to the Commercial Operation Date (COD) and included in the EMPr. This plan should identify most importantly the number of bird fatalities of priority species which will trigger a management response, appropriate responses, and time lines for such responses. Fatalities of priority bird species are usually rare events (but with very high consequence) and it is difficult to analyse trends or statistics related to these fatalities as they occur. It is therefore important to have a threshold policy in place proactively to assist adaptive management. ▪ Any residual impacts after all possible mitigation measures have been implemented will need to be mitigated off site. The facility will need to address other sources of mortality of priority species in a measurable way so as to compensate for residual effects on the facility itself. This will need to be detailed in a Biodiversity Action Plan. ▪ The “during construction” and “post-construction” monitoring programme outlined in Appendix 10 of the avifaunal impact assessment should be implemented according to the latest available version of the Best Practice Guidelines at the time. The findings from Operational Phase monitoring should inform the adaptive management programme to mitigate any impacts on avifauna to acceptable levels. ▪

Collision & electrocution of birds on overhead power lines

Collision of birds with overhead power lines, and electrocution of birds perched on pylons (a negative impact since birds are killed) is rated as High Negative significance pre-mitigation. However, by placing all internal collector power line underground (and only along road verges) this impact can easily be mitigated to Low Negative significance. (the grid connection power line is not part of this application)

Table 9-65 – Operational Impact on collision & electrocution of birds on overhead power lines

Potential Impact Birds are killed through flying into & colliding with power lines, or through perching on pylons & being electrocuted	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	4	3	5	4	5	80	High	(-)	Easy
With Mitigation	4	3	5	5	1	17	Low	(-)	
Mitigation and Management Measures	▪ No internal medium voltage power lines should be overhead. All such cables should be buried, and follow road verges at all times. Only the 132kV grid connection power line should be above ground (and this is assessed in a separate application). ▪ Any overhead conductors or earth wires should be fitted with an Eskom approved anti-bird collision line-marking device to make cables more visible to birds in flight and reduce the likelihood of collisions. ▪ The pole design of any overhead power line should be approved by an ornithologist in terms of the electrocution risk it may pose to large birds such as eagles and vultures.									

9.10.3 DECOMMISSIONING PHASE

The disturbance of birds associated with the decommissioning activities are expected to be the same as the construction phase, therefore the same mitigation measures should be applied.

9.11 BATS

9.11.1 CONSTRUCTION PHASE

Due to the construction of roads, turbines and infrastructure it expected that a certain amount of habitat destruction will occur. The most sensitive habitat features for bats in the area appears to be sources of open water, and these must be avoided at all costs. In addition, the confirmed roosts must be avoided, and the buffers suggested above seen as NO-GO areas. While there are patches of trees in the area, these are all exotics and pose a risk to the surrounding grasslands. In addition, based on data obtained from our bat detectors, it does not appear that these trees are utilised by bats to a great extent.

Currently there are very little planned construction near these sensitive features, and thus the impact without mitigation is expected to be Low. However, there are planned construction close to potential roosts and water sources. If these are moved outside of the buffered areas the impact is expected to be Very Low.

The impacts and associated mitigation measures for the construction phase are outlined below.

Table 9-66 – Construction Impact on bat habitats and roosts

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Habitat and roost destruction									
Without Mitigation	2	1	3	3	2	**18**	**Low**	(-)	Easy
With Mitigation	1	1	3	3	1	**9**	**Very Low**	(-)	
Mitigation and Management Measures	▪ Construction of roads should be 200 m away from any water sources. ▪ Construction of roads should be 200 m away from any potential roosts.								

9.11.2 OPERATIONAL PHASE

The overall median number of bat passes per hour was 0,27 BP/H at ground level and 0,00 BP/H in the rotor sweep zone. The SABPG states that between 0,23 and 1,76 bat passes per hour in the grassland biome should be considered as Medium Risk for bats. This area is thus classified as medium risk but falls on the lower end of this scale. While no specific migratory pathways were found there is a large influx of bats during specific times of the year, and the overall number of bat passes per hour increases drastically.

During these periods the Impact Magnitude could be High to very High and have a long-lasting effect on the bat population. However, if the No-Go areas and necessary buffers are implemented and respected, and mitigation measures and adaptive mitigation measures applied, the impact on bats due to collision or barotrauma can be greatly reduced.

The impacts and associated mitigation measures for the operational phase are outlined below.

Table 9-67 –Operational Impact on bat mortalities

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	4	4	5	3	4	64	High	(-)	Easy
With Mitigation	2	4	5	3	2	28	Low	(-)	
Mitigation and Management Measures	▪ No construction of turbines within buffered areas identified for bats ▪ Adaptive mitigation during operational phase								

Artificial lights can have a negative effect on bat behaviour by affecting foraging activity and flight paths used. Artificial lights can attract insects which will entice bats to feed in the area leading to a higher likelihood of bat fatalities due to collision with infrastructure or barotrauma (if lighting is present at the turbines). This impact could be high, but is easily reduced if low intensity, directional lights, and only minimal compulsory civil aviation lighting is used.

Furthermore, non- UV emitting lights must be used. This should be applicable to all areas, but especially bat sensitive features used for foraging, such as any waterbodies. In certain areas the use of artificial lights will be unavoidable, and these include areas where offices, substations or operational and maintenance buildings will be constructed. The impacts and associated mitigation measures for the operational phase are outlined below.

Table 9-68 –Operational Impact of artificial lighting

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Impact due to artificial lighting									
Without Mitigation	3	1	5	4	4	52	Moderate	(-)	Easy
With Mitigation	1	1	5	4	2	22	Low	(-)	
Mitigation and Management Measures	▪ Use only minimal compulsory civil aviation lighting								

9.11.3 DECOMMISSIOING PHASE

The decommissioning phase are expected to have the same impacts as the construction phase, therefore the same mitigation measures must be applied.

9.12 VISUAL AND LANDSCAPE

9.12.1 CONSTRUCTION PHASE

During the construction period, there will be an increase in heavy vehicles utilising the roads to the construction sites that may cause, at the very least, a visual nuisance to other road users and landowners in the area in close proximity (within 5km). Within the region, dust as a result of construction activities may also be visible, as such it will result in a visual impact occurring during construction. Sensitive receptors in this zone consist of observers travelling along the R398, various secondary and internal farm roads, as well as residents of various homesteads.

Construction activities may potentially result in a high (significance rating = 80) temporary visual impact, that may be mitigated to moderate (significance rating = 56) for both Alternative 1 and 2.

Homesteads located on farm portions earmarked for the Dalmanutha Wind project reduces the probability of this impact occurring on these specific receptors (i.e. it is assumed that these landowners are supportive of WEF developments and their associated visual impacts).

Table 9-69 – Construction Impact on visual receptors

Potential Impact Visual impact of construction activities on sensitive visual receptors in close proximity to the proposed Developments	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	10	4	1	2	5	80	High	(-)	Moderate
With Mitigation	8	4	1	2	5	56	Moderate	(-)	
Mitigation and Management Measures	Planning: ▪ Retain and maintain natural vegetation in all areas outside of the development footprint, but within the project site. Construction: ▪ Ensure that vegetation is not unnecessarily removed during the construction period. ▪ Plan the placement of laydown areas and temporary construction equipment camps in order to minimise vegetation clearing (i.e. in already disturbed areas) where possible.								

	- Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads. - Ensure that rubble, litter, and disused construction materials are appropriately stored (if not removed daily) and then disposed of regularly at licensed waste facilities. - Reduce and control construction dust using approved dust suppression techniques as and when required (i.e. whenever dust becomes apparent). - Restrict construction activities to daylight hours whenever possible in order to reduce lighting impacts. - Rehabilitate all disturbed areas immediately after the completion of construction works.

9.12.2 OPERATIONAL PHASE

The operation of the proposed WEF is expected to have a very high visual impact (significance rating = 90) on observers/visitors residing at homesteads and travelling along the N4, R33 and other secondary roads within a 5km radius of the wind turbine structures.

Homesteads located on farm portions earmarked for the Dalmanutha Wind project reduces the probability of this impact occurring on these specific receptors (i.e. it is assumed that these landowners are supportive of WEF developments and their associated visual impacts).

A mitigating factor within this scenario is that observers traveling along these roads will only be exposed to the visual intrusion for a short period of time. This reduces the probability of this impact occurring.

No mitigation of this impact is possible (i.e. the structures will be visible regardless), but general mitigation and management measures are recommended as best practice. The table below illustrates this impact assessment.

Table 9-70 – Operational Impact on visual receptors within 5km radius

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Potential visual impact on sensitive visual receptors located within a 5km radius of the wind turbine structures									
Without Mitigation	10	4	1	4	5	90	Very high	(-)	Moderate

With Mitigation	10	4	1	4	5	90	Very high	(-)	
Mitigation and Management Measures	▪ Retain / re-establish and maintain natural vegetation in all areas outside of the development footprint. ▪ Maintain the general neat and tidy appearance of the facility as a whole. ▪ Monitor rehabilitated areas, and implement remedial action as and when required. ▪ Investigate the potential to screen affected receptor sites (if applicable and located within 1km of the facility) with planted vegetation cover (Alternative 2) ▪ Decommissioning: ▪ Remove infrastructure not required for the post-decommissioning use of the site. ▪ Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications. ▪ Monitor rehabilitated areas post-decommissioning and implement remedial actions.								

The proposed WEF could have a high visual impact (significance rating = 75) on residents of (or visitors to) homesteads and observers travelling along the roads within a 5 - 10km radius of the wind turbine structures.

Homesteads located on farm portions earmarked for the Dalmanutha Wind project reduces the probability of this impact occurring on these specific receptors (i.e. it is assumed that these landowners are supportive of WEF developments and their associated visual impacts).

No mitigation of this impact is possible (i.e. the structures will be visible regardless), but general mitigation and management measures are recommended as best practice. The table below illustrates this impact assessment.

Table 9-71 – Operational Impact on visual receptors within 5km-10km radius

Potential Impact Potential visual impact on sensitive visual receptors within the local area (5 – 10km radius)	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	8	3	1	4	5	75	High	(-)	Moderate
With Mitigation	8	3	1	4	5	75	High	(-)	

Mitigation and Management Measures	■ Retain / re-establish and maintain natural vegetation in all areas outside of the development footprint. ■ Maintain the general neat and tidy appearance of the facility as a whole. ■ Monitor rehabilitated areas, and implement remedial action as and when required. ■ Investigate the potential to screen affected receptor sites (if applicable and located within 1km of the facility) with planted vegetation cover (Alternative 2) ■ Decommissioning: ■ Remove infrastructure not required for the post-decommissioning use of the site. ■ Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications. ■ Monitor rehabilitated areas post-decommissioning and implement remedial actions.

The proposed WEF could have a moderate visual impact (significance rating = 48) on residents of (or visitors to) homesteads and observers travelling along the roads within a 10 - 20km radius of the wind turbine structures.

Homesteads located on farm portions earmarked for the Dalmanutha Wind project reduces the probability of this impact occurring on these specific receptors (i.e. it is assumed that these landowners are supportive of WEF developments and their associated visual impacts).

No mitigation of this impact is possible (i.e. the structures will be visible regardless), but general mitigation and management measures are recommended as best practice. The table below illustrates this impact assessment.

Table 9-72 – Operational Impact on visual receptors within 10km-20km radius

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Potential visual impact on sensitive visual receptors within the district (10 – 20km radius)									
Without Mitigation	4	2	1	4	4	**48**	**Moderate**	(-)	Moderate
With Mitigation	4	2	1	4	4	**48**	**Moderate**	(-)	

Mitigation and Management Measures	▪ Retain / re-establish and maintain natural vegetation in all areas outside of the development footprint. ▪ Maintain the general neat and tidy appearance of the facility as a whole. ▪ Monitor rehabilitated areas, and implement remedial action as and when required. ▪ Investigate the potential to screen affected receptor sites (if applicable and located within 1km of the facility) with planted vegetation cover (Alternative 2) ▪ Decommissioning: ▪ Remove infrastructure not required for the post-decommissioning use of the site. ▪ Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications. ▪ Monitor rehabilitated areas post-decommissioning and implement remedial actions.

The proposed WEF could have a low visual impact (significance rating = 27) on residents of (or visitors to) homesteads, observers travelling along the roads and visitors to the Cecilia Private NR beyond the 20km radius of the wind turbine structures.

Homesteads located on farm portions earmarked for the Dalmanutha Wind project reduces the probability of this impact occurring on these specific receptors (i.e. it is assumed that these landowners are supportive of WEF developments and their associated visual impacts).

No mitigation of this impact is possible (i.e. the structures will be visible regardless), but general mitigation and management measures are recommended as best practice. The table below illustrates this impact assessment.

Table 9-73 – Operational Impact on visual receptors beyond 20km radius

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Potential visual impact on sensitive visual receptors within the region (beyond 20 Km radius)									
Without Mitigation	4	1	1	4	3	27	Low	(-)	Moderate
With Mitigation	4	1	1	4	3	27	Low	(-)	
Mitigation and Management Measures	▪ Retain / re-establish and maintain natural vegetation in all areas outside of the development footprint.								

	▪ Maintain the general neat and tidy appearance of the facility as a whole. ▪ Monitor rehabilitated areas, and implement remedial action as and when required. ▪ Investigate the potential to screen affected receptor sites (if applicable and located within 1km of the facility) with planted vegetation cover (Alternative 2) ▪ Decommissioning: ▪ Remove infrastructure not required for the post-decommissioning use of the site. ▪ Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications. ▪ Monitor rehabilitated areas post-decommissioning and implement remedial actions.

The proposed WEF could have a moderate visual impact (significance rating = 56) on visitors to portions of the Greater Lakenvlei Protected Environment, the Cecilia Private NR, Paulina van Niekerk PNR, Langkloof PNR and the Nooitgedacht Dam NR between 5- 20km radius of the wind turbine structures.

No mitigation of this impact is possible (i.e. the structures will be visible regardless), but general mitigation and management measures are recommended as best practice. The table below illustrates this impact assessment.

Table 9-74 – Operational Impact on protected areas within a 5 – 20km radius

Potential Impact Potential visual impact on Protected Areas within the district within a 5 – 20km radius	**Magnitude**	**Extent**	**Reversibility**	**Duration**	**Probability**	**Significance**		**Character**	**Ease of mitigation**
Without Mitigation	8	2	1	4	4	**56**	**Moderate**	(-)	Moderate
With Mitigation	8	2	1	4	4	**56**	**Moderate**	(-)	
Mitigation and Management Measures	▪ Retain / re-establish and maintain natural vegetation in all areas outside of the development footprint. ▪ Maintain the general neat and tidy appearance of the facility as a whole. ▪ Monitor rehabilitated areas, and implement remedial action as and when required. ▪ Investigate the potential to screen affected receptor sites (if applicable and located within								

	1km of the facility) with planted vegetation cover (Alternative 2) ■ Decommissioning: ■ Remove infrastructure not required for the post-decommissioning use of the site. ■ Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications. ■ Monitor rehabilitated areas post-decommissioning and implement remedial actions.

Shadow flicker only occurs when the sky is clear, and when the turbine rotor blades are between the sun and the receptor (i.e. when the sun is low). De Gryse in Scenic Landscape Architecture (2006) found that "most shadow impact is associated with 3-4 times the height of the object". Based on this research, and 1.2km buffer along the edge of the outer most turbines were identified as the zone within which there is a risk of shadow flicker occurring.

A number of homesteads are located within the 1.2km buffer of turbines for both Alt 1 and 2. Of note is that most of the homesteads are located on properties involved in this development, thereby reducing the probability of this impact occurring. It is expected that motorists travelling along roads within the 1km zone of a turbine could potentially experience shadow flicker, however the shadow flicker experienced by these motorists will be fleeting and not constitute a shadow flicker visual impact of concern.

Table 9-75 – Operational Impact of shadow flicker

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Shadow flicker on sensitive visual receptors in close proximity to the proposed WEF.									
Without Mitigation	8	4	1	4	4	**64**	**High**	(-)	Moderate
With Mitigation	6	4	1	4	3	**42**	**Moderate**	(-)	
Mitigation and Management Measures	■ Planning & operation: ■ Adjust wind turbine locations to reduce the number of receptors likely to experience shadow flicker. ■ Consult with participating landowners or identified receptors who may experience shadow flicker impacts to identify feasible and reasonable management and mitigation measures, should they be required.								

	▪ Installation of screening structures and/ or planting of trees to block shadows cast by the turbines on the identified affected receptors. ▪ Investigate the use of turbine control strategies which shut down the offending turbines when shadow flicker is likely to occur on identified receptors is investigated

Table 9-76 – Operational Impact of shadow flicker

Potential Impact Shadow flicker on sensitive visual receptors in close proximity to the proposed WEF.	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	8	4	1	4	4	**64**	**High**	(-)	Moderate
With Mitigation	6	4	1	4	3	**42**	**Moderate**	(-)	
Mitigation and Management Measures	▪ Planning & operation: ▪ Adjust wind turbine locations to reduce the number of receptors likely to experience shadow flicker. ▪ Consult with participating landowners or identified receptors who may experience shadow flicker impacts to identify feasible and reasonable management and mitigation measures, should they be required. ▪ Installation of screening structures and/ or planting of trees to block shadows cast by the turbines on the identified affected receptors. ▪ Investigate the use of turbine control strategies which shut down the offending turbines when shadow flicker is likely to occur on identified receptors is investigated								

This impact is only applicable to Alternative 2: Dalmanutha Wind and Solar facility.

Glint and glare occurs when the sun reflects off surfaces with specular (mirror-like) properties. Examples of these include glass windows, water bodies and potentially some solar energy generation technologies (e.g. parabolic troughs and CSP heliostats). Glint is generally of shorter duration and is described as “a momentary flash of bright light”, whilst glare is the reflection of bright light for a longer duration.

The visual impact of glint and glare relates to the potential it has to negatively affect sensitive visual receptors in relative close proximity to the source (e.g. users of the secondary road), or aviation safety risk for pilots (especially where the source interferes with the approach angle to the runway). The Federal Aviation Administration (FAA) of the United States of America have researched glare as a hazard for aviation pilots on final approach and may prescribe specific glint and glare studies for solar energy facilities in close proximity to aerodromes (airports, airfields, military airbases, etc.). It is generally possible to mitigate the potential glint and glare impacts through the design and careful placement of the infrastructure.

PV panels are designed to generate electricity by absorbing the rays of the sun and are therefore constructed of dark-coloured materials, and are covered by anti-reflective coatings. Indications are that as little as 2% of the incoming sunlight is reflected from the surface of modern PV panels especially where the incidence angle (angle of incoming light) is smaller i.e. the panel is facing the sun directly. This is particularly true for tracker arrays that are designed to track the sun and keep the incidence angle as low as possible.

There are no major roads within a 1km radius of the proposed PV facility. A secondary road is located within 1km of the proposed PV Facility. This approximate distance is recommended as a threshold within which the visual impact of glint and glare (if there is visual line of sight from the road) may influence road users. The potential visual impact related to solar glint and glare as a road travel hazard is therefore expected to be of low significance. *No mitigation of this impact is required since the solar reflection is predicted towards a local/secondary road.*

Table 9-77 – Operational Impact of solar glint

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Potential visual impact of solar glint and glare as a visual distraction and possible air/road travel hazard									
Without Mitigation	4	4	1	4	2	**24**	**Low**	(-)	Moderate
With Mitigation	-	-	-	-	-	**-**	**-**	(-)	
Mitigation and Management Measures	▪								

This impact is only applicable to Alternative 2: Dalmanutha Wind and Solar facility.

There are no affected residences within a 1km radius of the proposed PV facility. The potential visual impact related to solar glint and glare on static ground-based receptors (residents of homesteads) is therefore expected to be of low significance, both before and after mitigation.

Mitigation of this impact is possible and both specific measures as well as general "best practice" measures are recommended in order to reduce/mitigate the potential visual impact. The table below illustrates this impact assessment.

Table 9-78 – Operational Impact of solar glint

Potential Impact visual impact of solar glint and glare on residents of homesteads in closer proximity to the PV facility	**Magnitude**	**Extent**	**Reversibility**	**Duration**	**Probability**	**Significance**		**Character**	**Ease of mitigation**
Without Mitigation	4	4	1	4	2	**24**	**Low**	(-)	Moderate
With Mitigation	4	4	1	4	2	**24**	**Low**	(-)	
Mitigation and Management Measures	▪ Use anti-reflective panels and dull polishing on structures, where possible and industry standard. ▪ If specific sensitive visual receptors are identified during operation, investigate screening at the receptor site, where possible.								

The area immediately surrounding the proposed facility has a relatively low incidence of receptors and light sources, so light trespass and glare from the security and after-hours operational lighting for the facility will have some significance for visual receptors in the study area.

Another source of glare light, albeit not as intense as flood lighting, is the aircraft warning lights mounted on top of the hub of the wind turbines. These lights are less aggravating due to the toned-down red colour, but have the potential to be visible from a great distance. This is especially true due to the strobing effect of the lights, a function specifically designed to attract the observer's attention. The Civil Aviation Authority (CAA) prescribes these warning lights and the potential to mitigate their visual impacts have traditionally been very low other than to restrict the number of lights to turbines that delineate the outer perimeter of the facility.

Some ground-breaking new technology in the development of strobing lights that only activate when an aircraft is detected nearby may aid in restricting light pollution at night and should be investigated and implemented by the project proponent, if available and permissible by the CAA. This new technology is referred to as needs-based night lights, which deactivates the wind turbine's night lights when there is no flying object within the airspace of the WEF. The system relies on the active detection of aircraft by radar sensors, which relays a switch-on signal to the central wind farm control to activate the obstacle lights.

Last is the potential lighting impact known as sky glow. Sky glow is the condition where the night sky is illuminated when light reflects off particles in the atmosphere such as moisture, dust or smog. The sky glow intensifies with the increase in the number of light sources. Each new light source, especially upwardly directed lighting, contributes to the increase in sky glow.

Table 9-79 – Operational Impact of operational, safety and security lighting of the facility at night

Potential Impact Visual impact of lighting at night on sensitive visual receptors.	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	10	1	1	4	5	**75**	**High**	(-)	Moderate
With Mitigation	8	1	1	4	4	**52**	**Moderate**	(-)	
Mitigation and Management Measures	Planning & operation: ▪ Aviation standards and CAA Regulations for turbine lighting must be followed. ▪ The possibility of limiting aircraft warning lights to the turbines on the perimeter according to CAA requirements, thereby reducing the overall impact, must be investigated. ▪ Install aircraft warning lights that only activate when the presence of an aircraft is detected, if permitted by CAA. ▪ Shield the sources of light by physical barriers (walls, vegetation, or the structure itself). ▪ Limit mounting heights of lighting fixtures, or alternatively use foot-lights or bollard level lights. ▪ Make use of minimum lumen or wattage in fixtures. ▪ Make use of down-lighters, or shielded fixtures. ▪ Make use of Low-Pressure Sodium lighting or other types of low impact lighting. ▪ Make use of motion detectors on security lighting. This will allow the site to remain in relative darkness, until lighting is required for security or maintenance purposes.									

On-site ancillary infrastructure associated with the WEF includes a substation and collector substation, Battery Energy Storage System (BESS), underground cabling between the wind turbines, internal access roads, gate house, Operation and Maintenance buildings (including a control centre, offices, warehouses, workshop, canteen, visitors centre, staff lockers, etc.). No dedicated viewshed analyses have been generated for the ancillary infrastructure, as the range of visual exposure will fall within (and be overshadowed by) that of the turbines.

Table 9-80 – Operational Impact of ancillary infrastructure

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Visual impact of ancillary infrastructure on observers in close proximity to the structures.									
Without Mitigation	4	4	1	4	2	**24**	**Low**	(-)	Moderate
With Mitigation	4	4	1	4	2	**24**	**Low**	(-)	
Mitigation and Management Measures	Planning: ▪ Retain/re-establish and maintain natural vegetation in all areas outside of the development footprint/servitude, but within the project site. Operations: ▪ Maintain the general appearance of the infrastructure.								

Sense of place refers to a unique experience of an environment by a user, based on his or her cognitive experience of the place. Visual criteria, specifically the visual character of an area (informed by a combination of aspects such as topography, level of development, vegetation, noteworthy features, cultural / historical features, etc.), play a significant role.

An impact on the sense of place is one that alters the visual landscape to such an extent that the user experiences the environment differently, and more specifically, in a less appealing or less positive light.

In general, the landscape character of the greater study area and site itself presents as largely undeveloped and natural in character. The visual quality of the region is generally high and large tracts of intact vegetation characterise most of the visual environment, as well as, the presence of a number of protected areas.

The anticipated significance of the visual impacts on the sense of place within the region (i.e. beyond a 20km radius of the development and within the greater region) is expected to be of Moderate significance.

No mitigation of this impact is possible (i.e. the structures will be visible regardless), but general mitigation and management measures are recommended as best practice. The table below illustrates this impact assessment.

Table 9-81 – Operational Impact on sense of place

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Impact on the sense of place of the region									
Without Mitigation	8	1	1	4	4	**52**	**Moderate**	(-)	Moderate
With Mitigation	8	1	1	4	4	**52**	**Moderate**	(-)	
Mitigation and Management Measures	Planning: ▪ Retain / re-establish and maintain natural vegetation in all areas outside of the development footprint. ▪ Plan ancillary infrastructure in such a way and in such a location that clearing of vegetation is minimised. ▪ Use existing roads wherever possible. Where new roads are required to be constructed, these should be planned carefully, taking due cognisance of the local topography. Roads should be laid out along the contour wherever possible, and should never traverse slopes at 90 degrees. Construction of roads should be undertaken properly, with adequate drainage structures in place to forego potential erosion problems. Operations: ▪ Maintain the general neat and tidy appearance of the facility as a whole. ▪ Monitor rehabilitated areas, and implement remedial action as and when required. Decommissioning: ▪ Remove infrastructure not required for the post-decommissioning use of the site. ▪ Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications. ▪ Monitor rehabilitated areas post-decommissioning and implement remedial actions.								

9.13 HERITAGE AND CULTURAL RESOURCES

On the current layout only a Historical farmstead at DN080 will be impacted on. As the site is of low to medium significance due to its age, avoidance of the site is suggested. Other sites within the Project area will not be impacted by turbines, roads or associated infrastructure.

Impacts to heritage resources without mitigation within the Project footprint will be permanent and negative and occur during the pre-construction and construction activities. It is assumed that the pre-construction and construction phase involves the removal of topsoil and vegetation as well as the establishment of infrastructure. These activities can impact on heritage features and impacts include destruction or partial destruction of non-renewable heritage resources. Impacts during the operation phase is considered to affect the cultural landscape and sense of place.

The main cause of impacts to heritage resources is physical disturbance of the material itself and its context during removal of topsoil and vegetation as well as the excavations associated with the establishment of infrastructure.

Impacts to the cultural landscape would occur during all three phases and would relate to the presence of very tall industrial-type structures in a landscape that is distinctly rural and/or natural in character. They would be negative impacts because of the general incompatibility between wind turbines and the cultural landscape. Because the cultural landscape is highly developed, it has been accorded high cultural significance and hence the extent of the impacts would be local. The magnitude of impacts is likely to be low because the area is so remote and there is an existing layer of electrical infrastructure and agricultural activity in the surrounding landscape. Damage to the landscape is reversible with rehabilitation but the impacts are considered to be long term impacts because the facility is likely to operate for many years. If the facility is constructed, then the probability is probable because the existence of the turbines will be inescapable. The impact can be addressed by implementing best practice measures to reduce the visual impacts in line with the recommendations made in the Visual Impact Assessment.

9.13.1 CONSTRUCTION PHASE

Table 9-82 – Construction Impact on graves in the areas-Alternative 1

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Graves located within the proposed development area close to roads and wind turbines DN029, DN039, DN045, DN062									
Without Mitigation	4	2	5	5	5	80	High	(-)	Moderate
With Mitigation	4	2	5	5	1	16	Low	(-)	

Mitigation and Management Measures	▪ The graves should be avoided, demarcated with access for family and 30m buffer.

Table 9-83 – Construction Impact on Historical infrastructure-Alternative 1

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Historical infrastructure will be damaged / destroyed by the proposed development DN035, DN041, DN051									
Without Mitigation	2	2	4	4	4	**48**	**Moderate**	(-)	Moderate
With Mitigation	3	2	4	4	1	**13**	**Very low**	(-)	
Mitigation and Management Measures	▪ Avoidance is the preferred course of action, if not possible the sites can be mitigated prior to destruction.								

Table 9-84 – Construction Impact on Iron Age sites-Alternative 1

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Iron Age sites will be damaged/ destroyed by the development DN030, DN031, DN033, DN034 DN038, DN064									
Without Mitigation	2	2	4	4	4	**48**	**Moderate**	(-)	Moderate
With Mitigation	3	2	4	4	1	**13**	**Very low**	(-)	
Mitigation and Management Measures	▪ Avoidance is the preferred course of action, if not possible the sites can be mitigated prior to destruction.								

Table 9-85 – Construction Impact on sense of place the cultural landscape-Alternative 1

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
The project will alter the sense of place and impact on the cultural landscape.									
Without Mitigation	2	2	4	4	3	**36**	**Moderate**	(-)	Moderate
With Mitigation	2	2	4	4	2	**24**	**Low**	(-)	
Mitigation and Management Measures	▪ Best practice measures to reduce visual impact.								

Table 9-86 – Construction Impact on graves in the areas-Alternative 2

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Graves located within the proposed development area close to roads and wind turbines DN010									
Without Mitigation	4	2	5	5	5	**80**	**High**	(-)	Moderate
With Mitigation	4	2	5	5	1	**16**	**Low**	(-)	
Mitigation and Management Measures	▪ The graves should be avoided, demarcated with access for family and 30m buffer.								

Table 9-87 – Construction Impact on Historical infrastructure-Alternative 2

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Historical infrastructure will be damaged / destroyed by the proposed development DN071, DN051									
Without Mitigation	2	2	4	4	4	**48**	**Moderate**	(-)	Moderate
With Mitigation	3	2	4	4	1	**13**	**Very low**	(-)	

Mitigation and Management Measures	▪ Avoidance is the preferred course of action, if not possible the sites can be mitigated prior to destruction.

Table 9-88 – Construction Impact on Iron Age sites-Alternative 2

Potential Impact Iron Age sites will be damaged/ destroyed by the development DN019,DN041,DN039, DN064	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	2	2	4	4	4	**48**	**Moderate**	(-)	Moderate
With Mitigation	3	2	4	4	1	**13**	**Very low**	(-)	
Mitigation and Management Measures	▪ Avoidance is the preferred course of action, if not possible the sites can be mitigated prior to destruction.								

Table 9-89 – Construction Impact on battlefields-Alternative 2

Potential Impact Battlefield sites will be damaged/ destroyed. DN036 , DN037	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	4	3	4	4	4	**60**	**Moderate**	(-)	Moderate
With Mitigation	3	2	4	4	1	**13**	**Very Low**	(-)	
Mitigation and Management Measures	▪ Avoidance is the preferred course of action, if not possible the sites can be mitigated prior to destruction								

Table 9-90 – Construction Impact on sense of place the cultural landscape-Alternative 2

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
The project will alter the sense of place and impact on the cultural landscape.									
Without Mitigation	2	2	4	4	3	36	Moderate	(-)	Moderate
With Mitigation	2	2	4	4	2	24	Low	(-)	
Mitigation and Management Measures	▪ Best practice measures to reduce visual impact.								

9.13.2 OPERATIONAL PHASE

Table 9-91 – Operational Impact on graves in the areas-Alternative 1

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Graves located within the proposed development area close to roads and wind turbines DN029, DN039, DN045, DN062									
Without Mitigation	4	2	5	5	4	64	High	(-)	Moderate
With Mitigation	4	2	5	5	1	16	Low	(-)	
Mitigation and Management Measures	▪ Implementation of the Heritage Management Plan for the Project.								

Table 9-92 – Operational Impact on Historical infrastructure-Alternative 1

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Historical infrastructure will be damaged / destroyed by the proposed development DN035, DN044, DN051									
Without Mitigation	2	2	4	4	4	48	Moderate	(-)	Moderate
With Mitigation	3	2	4	4	1	13	Very low	(-)	

Mitigation and Management Measures	▪ Implementation of the Heritage Management Plan for the Project.

Table 9-93 – Operational Impact on Iron Age sites-Alternative 1

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Iron Age sites will be damaged/ destroyed by the development DN030, DN031, DN033, DN034 DN038, DN064									
Without Mitigation	2	2	4	4	4	48	Moderate	(-)	Moderate
With Mitigation	3	2	4	4	1	13	Very low	(-)	
Mitigation and Management Measures	▪ Implementation of the Heritage Management Plan for the Project.								

Table 9-94 – Operational Impact on sense of place the cultural landscape-Alternative 1

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
The project will alter the sense of place and impact on the cultural landscape.									
Without Mitigation	2	2	4	4	3	36	Moderate	(-)	Moderate
With Mitigation	2	2	4	4	2	24	Low	(-)	
Mitigation and Management Measures	▪ Best practice measures to reduce visual impact.								

Table 9-95 – Operational Impact on graves in the areas-Alternative 2

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance	Character	Ease of mitigation
Graves located within the proposed development area close to roads and wind turbines DN010								

Without Mitigation	4	2	5	5	5	**80**	**High**	(-)	Moderate
With Mitigation	4	2	5	5	1	**16**	**Low**	(-)	
Mitigation and Management Measures	▪ The graves should be avoided, demarcated with access for family and 30m buffer. ▪ Implementation of the Heritage Management Plan for the Project.								

Table 9-96 – Operational Impact on Historical infrastructure-Alternative 2

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Historical infrastructure will be damaged / destroyed by the proposed development DN071, DN051									
Without Mitigation	2	2	4	4	4	**48**	**Moderate**	(-)	Moderate
With Mitigation	3	2	4	4	1	**13**	**Very low**	(-)	
Mitigation and Management Measures	▪ Avoidance is the preferred course of action, if not possible the sites can be mitigated prior to destruction.								

Table 9-97 – Operational Impact on Iron Age sites-Alternative 2

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Iron Age sites will be damaged/ destroyed by the development DN019, DN041,DN039, DN064									
Without Mitigation	2	2	4	4	4	**48**	**Moderate**	(-)	Moderate
With Mitigation	3	2	4	4	1	**13**	**Very low**	(-)	
Mitigation and Management Measures	▪ Avoidance is the preferred course of action, if not possible the sites can be mitigated prior to destruction.								

Table 9-98 – Operational Impact on battlefields-Alternative 2

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Battlefield sites will be damaged/ destroyed. DN036 , DN037									
Without Mitigation	4	3	4	4	4	60	Moderate	(-)	Moderate
With Mitigation	3	2	4	4	1	13	Very Low	(-)	
Mitigation and Management Measures	▪ Avoidance is the preferred course of action, if not possible the sites can be mitigated prior to destruction								

Table 9-99 – Operational Impact on sense of place the cultural landscape-Alternative 2

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
The project will alter the sense of place and impact on the cultural landscape.									
Without Mitigation	2	2	4	4	3	36	Moderate	(-)	Moderate
With Mitigation	2	2	4	4	2	24	Low	(-)	
Mitigation and Management Measures	▪ Best practice measures to reduce visual impact.								

9.13.3 DECOMMISSIONING PHASE

Table 9-100 – Decommissioning Impact on graves in the areas-Alternative 1

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Graves located within the proposed development area close to roads and wind turbines DN029, DN039, DN045, DN062									
Without Mitigation	4	2	5	5	4	64	High	(-)	Moderate
With Mitigation	4	2	5	5	1	16	Low	(-)	

Mitigation and Management Measures	▪ Implementation of the Heritage Management Plan for the Project.

Table 9-101 – Decommissioning Impact on Historical infrastructure-Alternative 1

Potential Impact Historical infrastructure will be damaged / destroyed by the proposed development DN035, DN044, DN051	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	2	2	4	4	4	48	Moderate	(-)	Moderate
With Mitigation	3	2	4	4	1	13	Very low	(-)	
Mitigation and Management Measures	▪ Implementation of the Heritage Management Plan for the Project.								

Table 9-102 – Decommissioning Impact on Iron Age sites-Alternative 1

Potential Impact Iron Age sites will be damaged/ destroyed by the development DN030, DN031, DN033, DN034 DN038, DN064	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	2	2	4	4	4	48	Moderate	(-)	Moderate
With Mitigation	3	2	4	4	1	13	Very low	(-)	
Mitigation and Management Measures	▪ Implementation of the Heritage Management Plan for the Project.								

Table 9-103 – Decommissioning Impact on sense of place the cultural landscape-Alternative 1

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
The project will alter the sense of place and impact on the cultural landscape.									
Without Mitigation	2	2	4	4	3	36	Moderate	(-)	Moderate
With Mitigation	2	2	4	4	2	24	Low	(-)	
Mitigation and Management Measures	▪ Best practice measures to reduce visual impact.								

Table 9-104 – Decommissioning Impact on graves in the areas-Alternative 2

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Graves located within the proposed development area close to roads and wind turbines DN010									
Without Mitigation	4	2	5	5	5	80	High	(-)	Moderate
With Mitigation	4	2	5	5	1	16	Low	(-)	
Mitigation and Management Measures	▪ The graves should be avoided, demarcated with access for family and 30m buffer. ▪ Implementation of the Heritage Management Plan for the Project.								

Table 9-105 – Decommissioning Impact on Historical infrastructure-Alternative 2

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Historical infrastructure will be damaged / destroyed by the proposed development DN071, DN051									
Without Mitigation	2	2	4	4	4	48	Moderate	(-)	Moderate
With Mitigation	3	2	4	4	1	13	Very low	(-)	

Mitigation and Management Measures	▪ Avoidance is the preferred course of action, if not possible the sites can be mitigated prior to destruction.

Table 9-106 – Decommissioning Impact on Iron Age sites-Alternative 2

Potential Impact Iron Age sites will be damaged/ destroyed by the development DN019, DN041,DN039, DN064	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	2	2	4	4	4	**48**	**Moderate**	(-)	Moderate
With Mitigation	3	2	4	4	1	**13**	**Very low**	(-)	
Mitigation and Management Measures	▪ Avoidance is the preferred course of action, if not possible the sites can be mitigated prior to destruction.								

Table 9-107 – Decommissioning Impact on battlefields-Alternative 2

Potential Impact Battlefield sites will be damaged/ destroyed. DN036 , DN037	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	4	3	4	4	4	**60**	**Moderate**	(-)	Moderate
With Mitigation	4	2	4	4	1	**15**	**Very Low**	(-)	
Mitigation and Management Measures	▪ Avoidance is the preferred course of action, if not possible the sites can be mitigated prior to destruction								

Table 9-108 – Decommissioning Impact on sense of place the cultural landscape-Alternative 2

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
The project will alter the sense of place and impact on the cultural landscape.									
Without Mitigation	2	2	4	4	3	**36**	**Moderate**	(-)	Moderate
With Mitigation	2	2	4	4	2	**24**	**Low**	(-)	
Mitigation and Management Measures	▪ Best practice measures to reduce visual impact.								

9.14 PALAEONTOLOGY

9.14.1 CONSTRUCTION PHASE

The site visit and verification confirmed that there are no fossils on the surface in the project footprint. The discovery and removal of fossils as a direct result of this project has a positive impact because prior to this the particular fossils or fossil deposit were unknown to science. As far as the palaeontology is concerned, there are no additional impacts because the fossils are inert and inactive.

Table 9-109 – Construction Impact on palaeontological finds

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Potential discovery of fossils on site									
Without Mitigation	3	1	3	1	3	**24**	**Low**	(-)	Easy
With Mitigation	1	1	1	1	1	**4**	**Very low**	(+)	
Mitigation and Management Measures	▪ Any further impact on the palaeontological heritage can be reduced greatly by the environmental officer or contractor checking the excavations for fossils, photographing and putting aside any possible fossils, and seeking the opinion of a palaeontologist as to whether the possible fossils are of any scientific value. ▪ The palaeontologist can then remove any scientifically important fossils with the relevant SAHRA permit.								

	▪ The Fossil Chance Find Protocol in EMPr (Appendix I) must be implemented in the event of a fossil find on site.

9.14.2 OPERATIONAL PHASE

There are no impacts on palaeontology associated with the operational phase.

9.14.3 DECOMMISSIONING PHASE

The decommissioning phase are expected to have the same impacts as the construction phase, therefore the same mitigation measures must be applied.

9.15 TRAFFIC

9.15.1 CONSTRUCTION PHASE

Table 9-110 – Construction Impact of vehicle trips on-site

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Noise, dust & exhaust pollution due to vehicle trips on-site									
Without Mitigation	2	1	1	1	5	**25**	**Low**	(-)	Easy
With Mitigation	1	1	1	1	2	**8**	**Very Low**	(-)	
Mitigation and Management Measures	▪ All unsurfaced site roads must be regularly sprayed with water or dust suppression products to reduce dust generation ▪ All vehicles that travel on-site must be roadworthy to ensure noise and emissions levels comply to national vehicle standards, thereby minimising noise & exhaust pollution ▪ All vehicles that travel on-site must not be overloaded, and abnormal vehicles must comply to relevant legislation for overweight loads, to ensure lowest possible road surface damage.								

Table 9-111 – Construction Impact of additional trips on unsurfaced district roads

Potential Impact Noise, dust & exhaust pollution due to additional trips on unsurfaced district road D1039, D2524, D2636, D560	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	2	3	1	1	5	35	Moderate	(-)	Easy
With Mitigation	1	3	1	1	2	12	Very low	(-)	
Mitigation and Management Measures	▪ The D1039, D2524, D2636, D560 and site access roads must be regularly sprayed with water or dust suppression products to reduce dust generation ▪ All vehicles that travel on the D1039, D2524, D2636, D560 and site access roads must be roadworthy to ensure noise and emissions levels comply to national vehicle standards, thereby minimising noise & exhaust pollution ▪ All vehicles that travel on the D1039, D2524, D2636, D560 and site access roads must not be overloaded, and abnormal vehicles must comply to relevant legislation for overweight loads, to ensure lowest possible road surface damage.									

Table 9-112 – Construction Impact of additional trips on the surfaced roads

Potential Impact Noise & exhaust pollution due to additional trips on the surfaced R33 and N4	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	2	3	1	1	5	35	Moderate	(-)	Easy
With Mitigation	1	3	1	1	2	12	Very low	(-)	
Mitigation and Management Measures	▪ All vehicles that travel on the R33 and N4 must be roadworthy to ensure noise and emissions levels comply to national vehicle standards, thereby minimising noise & exhaust pollution								

	▪ All vehicles that travel on the R33 and N4 must not be overloaded, and abnormal vehicles must comply to relevant legislation for overweight loads, to ensure lowest possible road surface damage.

9.15.2 OPERATIONAL PHASE

Table 9-113 – Operational Impact of vehicle trips on-site

Potential Impact Noise, dust & exhaust pollution due to vehicle trips on-site	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	2	1	1	1	5	25	Low	(-)	Easy
With Mitigation	1	1	1	1	2	8	Very Low	(-)	
Mitigation and Management Measures	▪ Unsurfaced site roads will not require dust suppression due to the negligible vehicle volumes ▪ All vehicles that travel on-site must be roadworthy to ensure noise and emissions levels comply to national vehicle standards, thereby minimising noise & exhaust pollution ▪ All vehicles that travel on-site must not be overloaded, and abnormal vehicles must comply to relevant legislation for overweight loads, to ensure lowest possible road surface damage.								

Table 9-114 – Operational Impact of additional trips on unsurfaced district roads

Potential Impact Noise, dust & exhaust pollution due to additional trips on unsurfaced district road D1039, D2524, D2636, D560	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	2	1	1	1	5	25	Low	(-)	Easy
With Mitigation	1	3	1	1	2	12	Very Low	(-)	

Mitigation and Management Measures	▪ The D1039, D2524, D2636, D560 will not require dust suppression due to the low expected vehicle volumes ▪ All vehicles that travel on the D1039, D2524, D2636, D560 must be roadworthy to ensure noise and emissions levels comply to national vehicle standards, thereby minimising noise & exhaust pollution ▪ All vehicles that travel on the D1039, D2524, D2636, D560 must not be overloaded, and abnormal vehicles must comply to relevant legislation for overweight loads, to ensure lowest possible road surface damage.

Table 9-115 – Operational Impact of additional trips on the surfaced roads

Potential Impact Noise & exhaust pollution due to additional trips on the surfaced R33 and N4	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	2	3	1	1	5	**35**	**Moderate**	(-)	Easy
With Mitigation	1	3	1	1	2	**12**	**Very Low**	(-)	
Mitigation and Management Measures	▪ All vehicles that travel on the R33 and N4 must be roadworthy to ensure noise and emissions levels comply to national vehicle standards, thereby minimising noise & exhaust pollution ▪ All vehicles that travel on the R33 and N4 must not be overloaded, and abnormal vehicles must comply to relevant legislation for overweight loads, to ensure lowest possible road surface damage.								

9.15.3 DECOMMISSIONING PHASE

The decommissioning phase are expected to have the same impacts as the construction phase, therefore the same mitigation measures must be applied.

9.16 SOCIO-ECONOMIC

9.16.1 CONSTRUCTION PHASE

During the construction phase, the developer will require various goods and services. This requirement is likely to generate economic opportunities for local businesses. It is anticipated that the construction workforce will be housed in local accommodations (private homes, guest houses or rental options); this will also contribute to the growth of the local economy. Provided that a significant proportion of money derived from wages earned would likely be spent in the vicinity of the Project area, it is expected to create substantial flows of revenue within surrounding communities, thus acting as a catalyst for growth in the formal and second economy.

Table 9-116 – Construction Impact on economic benefits

Potential Impact Increase in economic benefits	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	1	2	1	3	2	14	**Very low**	(+)	Easy
With Mitigation	4	4	3	4	3	**45**	**Moderate**	(+)	
Mitigation and Management Measures	▪ Communities within the vicinity of the Project should be given special consideration regarding the benefits arising from the Project because they will be the most affected. ▪ The developer shall first give preference to appropriate subcontractors located in the surrounding communities, followed by those located in the municipal area and those located elsewhere or outside the province. ▪ Resources required during construction should be sourced, preferably from local businesses. Accommodation needed for contractors should favour local guesthouses and hostels. The developer should support development initiatives for communities in the Project area. ▪								

During the construction phase, the developer will require high and lower-skilled employees. Procurement should largely favour and benefit the local community. The municipality recorded an unemployment rate of 26.9% in 2017. The introduction of this Project can increase the employment rate and further allow skill development for the local community.

Table 9-117 – Construction Impact on employment

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Increase in employment									
Without Mitigation	2	3	2	3	2	20	Low	(+)	Moderate
With Mitigation	4	3	3	4	4	56	Moderate	(+)	
Mitigation and Management Measures	■ Recruitment policies must ensure preference for local residents. ■ Furthermore, a monitoring system should be implemented to assess local employment levels. ■ A local skills database should be developed and updated regularly to maximise the uptake of local labour.								

During the facility's construction phase, various noise sources will be present on site, including earth-moving equipment (trucks, cranes, scrapers and loaders), compressors and generators, pumps, rotary drills, and concrete mixers and materials handling activities, among others.

Table 9-118 – Construction Impact on noise

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Increase in noise									
Without Mitigation	2	2	2	2	2	16	Low	(-)	Easy
With Mitigation	1	2	2	1	2	12	Very low	(-)	
Mitigation and Management Measures	■ Proposed working times. ■ Anticipated duration of activities.								

	- Explanations of activities to take place and reasons for activities. - Contact details of a responsible person on site should complaints arise

During the construction period, there will be an increase in heavy vehicles utilising the roads to the construction sites that may cause, at the very least, a visual nuisance to other road users and landowners in the area nearby (within 5km). Within the region, dust due to construction activities may also be visible, as there may be health implications for the nearby farms. Sensitive receptors in this zone consist of observers travelling along the R398, various secondary and internal farm roads, and local residents.

Table 9-119 – Construction Impact on dust

Potential Impact Increase in dust	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	2	3	3	1	4	36	Moderate	(-)	Easy
With Mitigation	2	3	2	3	2	20	Low	(-)	
Mitigation and Management Measures	- Reduce and control construction dust using approved dust suppression techniques as and when required. - To suppress dust, spraying unpaved haul roads with environmentally friendly products								

The area surrounding the proposed facility has a relatively low incidence of receptors and light sources, so light trespass and glare from the security and after-hours during construction will significantly impact receptors. Lighting from the construction camp will also contribute to the cumulative light impact.

Table 9-120 – Construction Impact on lighting

Potential Impact Increase in lighting	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation

Without Mitigation	2	3	3	1	4	**36**	**Moderate**	(-)	Easy
With Mitigation	2	3	2	3	2	**20**	**Low**	(-)	
Mitigation and Management Measures	▪ Shield the light sources with physical barriers (walls, vegetation, or the structure itself). ▪ Limit mounting heights of lighting fixtures, or use footlights or bollard level lights. ▪ Make use of minimum lumen or wattage in fixtures. ▪ Make use of down-lighters or shielded fixtures. ▪ Make use of low-pressure sodium lighting or other types of low-impact lighting. ▪ Make use of motion detectors on security lighting. Such sensors will allow the site to remain in relative darkness until illumination is required for security or maintenance purposes.								

According to the traffic impact study, the unskilled and semi-skilled workers (90%) are expected to utilise public transport to the site from neighbouring towns, most notably Belfast, located approximately 15km northwest. It is assumed that the public transport vehicles will not remain on site during the workday. Therefore, all these vehicles will arrive and depart during the AM and PM peaks. For people in the community that used to commute to work and school, there might be a change to their everyday routines

Table 9-121 – Construction Impact on traffic

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Increase in traffic									
Without Mitigation	2	3	1	1	4	**35**	**Moderate**	(-)	Moderate
With Mitigation	2	3	2	3	2	**20**	**Low**	(-)	
Mitigation and Management Measures	▪ All vehicles that travel on-site must be roadworthy to ensure noise and emissions levels comply with national vehicle standards, thereby minimising noise and exhaust pollution. ▪ Install a temporary truck crossing warning sign (TW345) and junction warning sign (W108) on the western approach of the N4. ▪ Install a temporary truck crossing warning sign (TW344) and junction warning sign (W107) on the eastern approach of the N4.								

	- Install a temporary truck crossing warning sign (TW345) and junction warning sign (W108) on the western approach of the N4. - Install a temporary truck crossing warning sign (TW344) and junction warning sign (W107) on the eastern approach of the N4. - Install a temporary truck crossing warning sign (TW345) and a priority cross-road warning sign (W102) on the western approach of the N4. - Install a temporary truck crossing warning sign (TW344) and a priority cross-road warning sign (W102) on the eastern approach of the N4.

During construction, social ills may also increase in the area because of an influx of outsiders seeking employment. The government's resources and essential services will not be sufficient for the new people. Due to overcrowding, crime is likely to increase.

Table 9-122 – Construction Impact on population

Potential Impact Population influx	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	3	2	1	3	2	**18**	**Low**	(-)	Moderate
With Mitigation	2	2	1	2	2	**14**	**Very low**	(-)	
Mitigation and Management Measures	- Local employment should be a priority for the developer. - Training programmes must be implemented to recognise prior learning and enable local participants for employment. - Increase security in the Project area to regulate safety and population influx.								

The Safety, Health and Environment (SHE) study (Chemical Process Safety Engineers, 2023) highlights the risk to employees and investors. This would be caused by potential hi-jacking of valuable but hazardous load, on-site theft of construction equipment and battery installation facilities, civil unrest or violent strike by employees. The impact rating is from moderate to low with mitigation.

Table 9-123 – Construction Impact on health and safety

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Health & safety risk									
Without Mitigation	2	3	1	1	4	35	Moderate	(-)	Moderate
With Mitigation	3	2	1	3	2	18	Low	(-)	
Mitigation and Management Measures	▪ Fencing around electrical infrastructure to SANS standard and Eskom Guidelines. ▪ The hazardous nature of the electrical and battery equipment should be clearly indicated – e.g., Skull and Cross Bones or other signs. ▪ Isolated location both helps and hinders security. Night lighting should be provided both indoors and outdoors where necessary.								

9.16.2 OPERATIONAL PHASE

The average annual wind speed in Dalmanutha ranges between 6 m/s to 7 m/s which is a sufficient resource to ensure the economic viability of a WEF (ENERTRAG, 2022). In this specific site, many conditions, such as the location of Eskom power stations, grid connection, topography, site access, and land availability, are beneficial for the proposed Project.

Table 9-124 – Operational Impact on power generation

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Increased power generation capacity									
Without Mitigation	1	2	3	4	2	20	Low	(+)	Moderate
With Mitigation	4	3	3	4	4	56	Moderate	(+)	
Mitigation and Management Measures	▪ Ensuring that the power generated from the Dalmanutha WEF Project provides for homesteads, farms and businesses in the surrounding communities. ▪ Dalmanutha WEF should be used to encourage more renewable sources of energy that are more environmentally friendly to other								

	municipalities and provinces across South Africa. ▪ Recording and publishing the economic benefit or development of the Dalmanutha WEF to the regional and national economy to encourage more renewable energy sources for South Africa.

The operational phase of the Dalmanutha WEF and the connection of the powerlines to the Gumeni MTS requires expertise and labour to deliver the final product. The maintenance of the facility and its functioning over the years will create employment, which will contribute positively to the economy in nearby communities The Project will aid in solving two of the leading challenges faced by most municipalities in the country, namely the need for electricity and the lack of adequate employment opportunities.

Table 9-125 – Operational Impact on employment

Potential Impact Creation of employment	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	1	2	1	2	2	**12**	**Very low**	(+)	Moderate
With Mitigation	3	3	3	3	4	**48**	**Moderate**	(+)	
Mitigation and Management Measures	▪ During the operation phase, locally employed individuals should receive training and be put under skill development programmes. ▪ Employees should be allowed the opportunity to participate in mentorship programmes								

During the Operational phase, the employee's wage bill will result in a substantial injection of cash into the economies of the local and regional areas. This aspect will stimulate development in formal and informal retail and downstream secondary industries. Furthermore, the contribution of renewable energy resources contributes to electricity production.

Table 9-126 – Operational Impact on economic development

Potential Impact Increase in economic development	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	2	3	3	2	3	**30**	**Low**	(+)	Moderate
With Mitigation	4	3	4	4	4	**60**	**Moderate**	(+)	
Mitigation and Management Measures	▪ Communities within the vicinity of the Project should be given special consideration regarding the benefits arising from the Project because they will be the most affected. ▪ The developer shall first give preference to appropriate subcontractors located in the surrounding communities, followed by those located in the municipal area and those located elsewhere or outside the province. ▪ The developer should support development initiatives for communities near the Project.								

Depending on age and different medical conditions, people that stay in farmhouses 2km from the site (as identified by the acoustic assessment) may find it challenging to deal with the noise

Table 9-127 – Operational Impact on noise-alternative 1

Potential Impact Increase in noise-alternative 1	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	1	2	3	4	2	**20**	**Low**	(-)	Moderate
With Mitigation	1	2	1	2	2	**12**	**Very low**	(-)	
Mitigation and Management Measures	▪ As per the noise impact mitigation measures in Section 9.1								

Table 9-128 – Operational Impact on noise-alternative 2

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Increase in noise-alternative 2									
Without Mitigation	4	3	3	4	4	**56**	**Moderate**	(-)	Moderate
With Mitigation	4	3	3	4	4	**56**	**Moderate**	(-)	
Mitigation and Management Measures	▪ As per the noise impact mitigation measures in Section 9.1								

The operational phase of the proposed Dalmanutha West WEF and its associated infrastructure will have a high visual impact on the study area, especially within (but not restricted to) a 5-10km radius of the proposed facility. The visual impact will differ amongst places, depending on the distance from the facility. Tourists travelling through the region and residents of homesteads will likely experience visual impacts where the wind turbine structures are visible. The index indicates that potentially sensitive visual receptors within a 5km radius of the WEF may experience a very high visual impact. The magnitude of visual impact on sensitive visual receptors subsequently subsides with distance; high within a 5 – 10 km radius (where sensitive receptors are present) and moderate within a 10 – 20 km radius (where sensitive receptors are present). Receptors beyond 20km are expected to have a low potential visual impact. The wind turbine (WTG11) is 800m from Manyoni Primary (alternative 1). Activities within the school will be impacted during the construction phase. Leeuwkloof estate will be a receptor of the turbine, and residents of the estate will be direct receptors (1.3km away from WTG28).

Several homesteads are located within the 1.2km buffer of all the turbines (WTG1-4). Of note is that most of the homesteads are located on properties that stand to benefit from the development, thereby offsetting the impact. However, one homestead situated within 140 m from WTG 1 is not located on a property earmarked for the Project. This homestead may need to be compensated or the impact mitigated.

Table 9-129 – Operational Impact on visual receptors

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Operational Impact on visual receptors									
Without Mitigation	4	4	4	4	4	**64**	**High**	(-)	Mode rate
With Mitigation	3	3	3	2	3	**33**	**Mode rate**	(-)	
Mitigation and Management Measures	▪ During operation, the maintenance of the turbines, ancillary structures, and infrastructure must be undertaken to ensure that the facility does not degrade, aggravating the visual impact. ▪ For the observer, 5-20 km, no mitigation of this impact is possible (i.e. the structures will be visible regardless), but general mitigation and management measures are recommended as best practice. ▪ Maintain the general appearance of the facility as a whole. ▪ It is recommended that vegetation cover (i.e., natural or cultivated) be maintained in all areas outside the actual development footprint (but still within the Project site) during the construction and operation of the proposed WEF. This aspect will minimise the visual impact due to cleared areas and areas denuded of vegetation. ▪ Existing roads should be utilised wherever possible. New roads should be planned, taking due cognisance of the topography to limit cut and fill requirements. Construction/upgrade of roads should be undertaken properly, with adequate drainage structures to forego potential erosion problems. ▪ Regarding on-site ancillary buildings and structures, it is recommended that it be planned so that vegetation clearing is minimised. This implies consolidating this infrastructure as much as possible and using already disturbed areas rather than undisturbed sites wherever possible.									

The operational phase of the WEF will require a low number of permanent staff. The vehicle trips generated by the personnel accessing the site for maintenance and other purposes will therefore be low, and the associated transport impact on the surrounding road network will be negligible.

Table 9-130 – Operational Impact on traffic

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Traffic									
Without Mitigation	1	2	3	4	2	**20**	**Low**	(+)	Moderate
With Mitigation	2	1	1	1	1	**5**	**Very low**	(+)	
Mitigation and Management Measures	▪ All vehicles that travel on the R33 and N4 must not be overloaded, and abnormal vehicles must comply with relevant legislation for overweight loads to ensure the lowest possible road surface damage. ▪ All vehicles that travel on-site must be roadworthy to ensure compliance with national vehicle standards. ▪ All site vehicles should be marked and regularly maintained to avoid accidents and poor road functioning.								

Table 9-131 – Operational Impact on health and safety

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
SHE risk									
Without Mitigation	4	3	3	4	4	**56**	**Moderate**	(-)	Moderate
With Mitigation	3	4	3	5	2	**30**	**Low**	(-)	
Mitigation and Management Measures	▪ There are numerous different battery technologies, but using one consistent battery technology system for the BESS installations associated with all the developments in the Dalmanutha area related to the Dalmanutha Project would allow for ease of training,								

	maintenance, and emergency response and could significantly reduce risks. ▪ The overall design should be subject to a full Hazop before the finalisation of the design. ▪ An updated risk assessment should be in place. ▪ The design of the turbines should ensure continuous noise does not exceed 85dB within the facilities or at any other location on site or 61 dB at the site boundary, e.g., emergency generator, air compressor and so forth. ▪ Employees must be provided hearing protection if working near equipment exceeding the noise limits.

9.16.3 DECOMMISSIOING PHASE

During the closure phase, the operational phase workforce will lose their jobs. Unfortunately, this may contribute to various adverse social consequences in the municipality and labour-sending area, such as:

- Increase or return the unemployment rate to previous levels within the Project area.
- Financial hardship and poverty.
- Family tensions and breakdown.
- Alienation, shame, stigma, and
- Crime.

Table 9-132 – Decommissioning Impact on employment

Potential Impact Loss of employment	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	4	4	3	4	3	45	Mode rate	(-)	Mode rate
With Mitigation	2	1	2	4	3	27	Low	(-)	
Mitigation and Management Measures	▪ ENERTRAG should have timely retrenchment consultations with employees who are dependent on the Project. ▪ Employees could be assisted with seeking employment at other projects dealing with solar and wind. ▪ Training and educating employees to equip them with skills that could benefit them in other industries should be considered.								

There will be reduced local spending by operator and its employees, including royalty and tax payments. Consequently, local businesses and the area may be affected negatively financially.

Table 9-133 – Decommissioning Impact on regional economy

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Reduced regional economic impact									
Without Mitigation	3	4	3	3	3	45	Moderate	(-)	Moderate
With Mitigation	2	1	2	4	3	27	Low	(-)	
Mitigation and Management Measures	▪ Engage local and regional government concerning the decommissioning phase.								

Structures used during construction and operation will be abandoned and might attract criminals. Maintenance of these structures might decrease after the Project operation, leading to hazards to the health and welfare of the community. The batteries/equipment may have reached the end of life and may leak.

Table 9-134 – Decommissioning Impact on infrastructure

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Damaged/abandoned infrastructure									
Without Mitigation	3	3	3	3	4	48	Moderate	(-)	Moderate
With Mitigation	2	2	1	3	2	16	Low	(-)	
Mitigation and Management Measures	▪ End of Life shutdown procedure includes a risk assessment of the activities involved. ▪ Where possible, re-purpose the solid-state batteries/containers and equipment with the associated environmental impact considered. ▪ Disposal according to local regulations and other directives such as the European Batteries Directive. ▪ End of life, which is affected by temperature and time, cycles etc, should be predefined, and monitoring should be in place to determine if it has been reached.								

9.17 SHE RISK

9.17.1 CONSTRUCTION PHASE

Solid State Lithium-Ion Battery Energy Storage Systems

Human Health - Chronic Exposure to Toxic Chemical or Biological Agents

Exposure to materials such as cement, paints, solvents, welding fumes, truck fumes etc. during construction can result in employee / contractor illness. The construction impact associated with chronic exposure to toxic chemical or biological agents is outlined in **Table 9-135.**

Table 9-135: Construction Impact on Human Health chronic exposure to toxic chemical or biological agents

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Chronic exposure to toxic chemical or biological agents									
Without Mitigation	3	1	3	4	4	44	Moderate	(-)	Moderate
With Mitigation	1	1	3	4	2	18	Low	(-)	
Mitigation and Management Measures	▪ The construction phase must be managed according to all the requirements of the Occupational Health and Safety Act 85 of 1993 specifically the Construction Regulations. ▪ A SHEQ policy and procedure must be compiled and implemented. ▪ A detailed construction risk assessment must be undertaken prior to construction work. ▪ The necessary Personal Protective Equipment (PPE) must be provided and worn at the required working areas. ▪ Ensure that relevant SHE appointees are in place. ▪ Contractor's safety files must be in place and kept up to date. ▪ All necessary health controls/ practices must be in place, e.g. ventilation of welding and painting areas. ▪ SHE monitoring and reporting programs must be in place and implemented. ▪ An emergency response plan must be compiled prior to construction, which must include aspects such as appointment of emergency controller, provision of first aid, first responder contact numbers.									

Human Health - Exposure to Noise

Exposure to drilling, piling, generators, air compressors during construction could lead to an adverse impact on hearing of workers as well as a possible nuisance factor in near-by areas. The construction impact associated with exposure to noise is outlined in **Table 9-136.**

Table 9-136: Construction Impact on human health - exposure to noise

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Human Health - exposure to noise									
Without Mitigation	3	1	5	5	4	**56**	**Moderate**	(-)	Easy
With Mitigation	2	1	5	5	2	**26**	**Low**	(-)	
Mitigation and Management Measures	▪ A health risk assessment must be undertaken to determine if equipment continuous noise exceeds 85dB at workstation and 61dB at the boundary of the site. ▪ Employees to be provided with hearing protection if working near equipment that exceeds the noise limits.								

Human Health - Exposure to Temperature Extremes and/or Humidity

During construction workers will be exposed to heat during the day and cold in winter. This could result in heat stroke or Hypothermia. The construction impact associated with exposure to temperature extremes and/or humidity is outlined in in **Table 9-137.**

Table 9-137: Construction Impact on human health - exposure to temperature extremes

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Human Health -exposure to temperature extremes and/or humidity									
Without Mitigation	3	2	3	1	2	**18**	**Low**	(-)	Easy
With Mitigation	2	2	3	1	1	**8**	**Very low**	(-)	
Mitigation and Management Measures	▪ Construction site facilities to comply with Occupational Health and Safety Act 85 of 1993, specifically the thermal, humidity, lighting and ventilation requirements of the Environmental Regulations for Workplaces.								

	▪ Adequate potable water to be provided for employees during all phases of the project. Bore hole, bowser and tank or small water treatment plant may be required to provide potable water for the BESS installation staff during all phases of the project.

Human Health - Chronic Exposure to Psychological Stress

The construction of large projects brings many contractor workers into a small, isolated community. This may lead to a lack of sufficient accommodation, entertainment etc, resulting in an increase in alcohol abuse and violence. The construction impact associated with psychological stress is outlined in **Table 9-138.**

Table 9-138: Construction Impact on human health – exposure to psychological stress

Potential Impact Human Health - exposure to psychological stress	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	2	3	3	2	2	20	Low	(-)	Easy
With Mitigation	2	3	3	2	2	20	Low	(-)	
Mitigation and Management Measures	Refer to Social Impact Assessment for this project (Section 9.15).								

Human Health - Chronic Exposure to Ergonomic Stress

Lifting of heavy equipment and movement at awkward angles during construction may result in back and other injuries. The construction impact associated with ergonomic stress is outlined in **Table 9-139.**

Table 9-139: Construction impact on human health – exposure to ergonomic stress

Potential Impact Human Health - exposure to ergonomic stress	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	4	1	3	2	3	30	Low	(-)	Moderate
With Mitigation	4	1	3	2	2	20	Low	(-)	
Mitigation and Management Measures	▪ Training in lifting techniques must be provided. ▪ Ensure that despite the isolated location, all the necessary equipment is available (and well maintained) during construction. Otherwise, employees may revert to unsafe practices. The								

	▪ necessary equipment must be available prior to the commencement of the project. ▪ Isolated location, maintenance of construction equipment to ensure safe operation is critical. Ensure this is in place prior to project beginning. ▪ Consider supporting the development of local service providers when sourcing and maintaining equipment. ▪ First aid provision on site.

Human and Equipment Safety – Exposure to Fire Radiation

The construction phase could result in activities that pose a fire risk. This includes fire involving fuels used in construction vehicles or vehicles themselves (e.g. tyre fire), fire due to uncontrolled welding or other hot-work. This will result in injuries due to radiation especially amongst first responders and bystanders. Fatalities are unlikely from the heat radiation as not highly flammable nor massive fire. The construction impact associated with exposure to fire radiation is outlined in **Table 9-140.**

Table 9-140: Construction impact on human and equipment safety – exposure to fire radiation

Potential Impact Human and Equipment Safety - exposure to fire radiation	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	4	2	3	5	4	**56**	**Moderate**	(-)	Complex
With Mitigation	4	2	3	5	2	**28**	**Low**	(-)	
Mitigation and Management Measures	▪ Fuels stored on site must be situated in dedicated, demarcated and bunded areas. ▪ Suitable fire-fighting equipment must be available on site near source of fuel, e.g. diesel tank, generators, mess, living quarters, workshops etc ▪ The company responsible for the facility at this stage is to have: ▪ An emergency plan must be in place prior to commencement of construction. ▪ Fuel spill containment procedures and equipment must be provided for and in place. ▪ Hot-work permit and management system must be in place.								

Solid state battery containers damaged on route e.g. dropped in port (drops do happen about 1/2000 containers) and importing of possibly approximately 100 containers for the site. With this it is possible, although unlikely, that one will be dropped, or a traffic accident may occur on-route. This includes involvement in an external fire e.g. at the port or on route. Data indicates installed facility events are 0.001/year. Transport of 100 units per installation is assumed to take 4 weeks each so f= 0.008 once in 125 years, so the likelihood is very low. A consequence of this could be injuries due to radiation especially amongst first responders and bystanders. Fatalities are unlikely from the heat radiation as it is not highly flammable nor massive. The construction impact on human and equipment safety - exposure to fire radiation is outlined in **Table 9-141.**

Table 9-141: Construction Impact on human and equipment safety - exposure to fire radiation for SSL BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Human and Equipment Safety - exposure to fire radiation									
Without Mitigation	5	2	5	5	2	**34**	**Moderate**	(-)	Complex
With Mitigation	5	2	5	5	1	**17**	**Low**	(-)	
Mitigation and Management Measures	▪ Solid state battery design must include abuse tests such as drop test, impact, rapid discharge etc. Propagation tests for systems, e.g. heat insulating materials between cells/modules must be conducted. Factory acceptance test prior to leaving manufacture must be conducted. Batteries are usually stored at 50% charge to prolong life but may be shipped fully discharged. This level of detail should be understood so as to assess the risk during transport and storage. ▪ The appointed contractor should ensure suitably competent transport companies are appointed. The company responsible for transportation should ensure: ▪ Compliance with National Road Traffic Act Regulation 8 – dangerous goods. ▪ Port Authorities should be alerted to the overall project and the hazardous nature of the contents of battery containers being imported. Note. If, as per one of the typical suppliers (Tesla) indications, the containers are classified as IMDG Class 9 – the containers will not receive any special care in the ports and may be stored next to flammables. Port emergency response in particular need training on mitigating battery hazards. ▪ Prior to bringing any containers into the country a full Emergency response plan should be in place for the full route from the ship to the site. Drivers must be trained in the hazards of containerized batteries. The emergency plan to determine and address: ▪ What gases would be released in a fire and are there inhalation hazards.									

	- Extinguishing has two important elements, put out fire and to provide cooling. Different approaches may be needed for small fire – e.g. put out, and for large fires e.g. cool with copious quantities of water. Note inert gases and foam may put out the initial fire but fail to control thermal runaway or to cool the batteries resulting in reignition. - What initial fire extinguishing medium should be used? - Are there any secondary gases or residues from use of extinguishers? - If water is appropriate, may need outside connections to inside sprinklers. - First responders need to know what media to use, especially if water totally unsuitable and if there are no connection points for water etc. - PPE to be specified including possible exposure to chemicals and fumes as well as radiate heat. - Containment of residues/water/damaged equipment. - Compile and implement a disposal plan that manages the handling of partially and/or fully charged damaged units, contaminated surfaces (e.g. HF residues) and other associated dangerously charged components.

Human and Equipment Safety - Exposure to Explosion over pressures

With solid state lithium containers, flammable gases generated by thermal run away reach explosive limits. The consequence of this is potential fatalities amongst first responders; damage to container, transport truck or other nearby items, e.g. other containers in the port. The construction impact on human and equipment safety - exposure to explosion over pressures is outlined in **Table 9-142.**

Table 9-142: Construction Impact on human and equipment safety - exposure to explosion over pressures

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Human and Equipment Safety - exposure to explosion over pressures									
Without Mitigation	5	4	5	5	3	57	Moderate	(-)	N/A
With Mitigation	5	4	5	5	1	19	Low	(-)	
Mitigation and Management Measures	- Develop and implement an emergency response plan that deals with all emergency responses applicable to the BESS, including during transportation.								

	- For simplicity one transport route would be preferable. The route needs to be assessed in terms of responding local services, rest places for drivers, refuelling if required, break down services available etc. - Once an import route has been chosen, e.g. Richards Bay or Durban and along N2/N3/N11 etc, then the appointed transport company should ensure key emergency services on route could be given awareness training in battery fire/accident response. - Emergency response planning and training referred to above may be important for key locations such as the mountain passes / tunnels.

Human and Equipment Safety - Exposure to Acute Toxic Chemical and Biological Agents

Human pathogens and diseases, sewage, food waste as well as snakes, insects, wild and domesticated animals and harmful plants can cause illness and at worst without mitigation, possibly extending to fatalities. Effects can vary from discomfort to fatalities for venomous snakes or bee swarms etc. The construction impact on human and equipment safety - exposure to acute toxic chemical and biological agents is outlined in **Table 9-143.**

Table 9-143: Construction Impact on human and equipment safety - exposure to acute toxic chemical and biological agents

Potential Impact Human and Equipment Safety - exposure to acute toxic chemical and biological agents	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	4	2	3	2	3	33	Moderate	(-)	Complex
With Mitigation	3	2	3	2	2	20	Low	(-)	
Mitigation and Management Measures	- All necessary good hygiene practices to be in place, e.g. provision of toilets, eating areas, infectious disease controls. - Policies and practice for dealing with known vectors of disease such as Aids, TB, COVID 19 and others must be developed and implemented. - Conduct awareness training for persons on site, safety induction to include animal hazards. - First aid and emergency response to consider the necessary anti-venom, anti-histamines, topical medicines etc.								

	- Due to isolated locations and distance from town, the ability to treat with anti-venom and extreme allergic reactions on site is critical to mitigate the impacts.

Damaged solid-state batteries release fumes, leak electrolyte, are completely broken exposing hazardous chemicals and thermal runaway and hazardous fumes released can cause mild skin irritation from exposure to small leaks to serious corrosive burns or lung damage. The construction impact on human and equipment safety - exposure to acute toxic chemical and biological agents is outlined in **Table 9-144.**

Table 9-144: Construction Impact on human and equipment safety - exposure to acute toxic chemical and biological agents for SSL BESS

Potential Impact Human and Equipment Safety - exposure to acute toxic chemical and biological agents	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	4	3	3	5	3	45	Moderate	(-)	Complex
With Mitigation	4	3	3	5	2	30	Low	(-)	
Mitigation and Management Measures	- Appointed transport company to ensure transport in accordance with Regulation 8 of the National Road Traffic Act 93 of 1996, Dangerous Goods. The transportation of prescribed goods in manner that is not consistent with the prescriptions, e.g. consignor and consignee responsibilities is not permitted. Prescription are found in SANS 10228/29 and international codes for battery transport etc. - SSL BESS must be transported in sealed packages that are kept upright, protected from movement damage etc. - These must be packaged to ensure no short-circuiting during transport. - Consideration must be taken to prevent excessive vibration as battery internal may be damaged leading to thermal run-away during commissioning. - Pre-assembled containers will most likely be supplied. These will be fitted with the necessary protective measures by the supplier considering marine and road transport as well as lifting, setting down etc. - Route selection to consider possible incidents along the way and suitable response, e.g. satellite tracking, mobile communication, 24/7 helpline response. - Standard dangerous goods requirements for Hazmat labels must be adhered to, Transport									

	Emergency Card (Trem cards) must be carried/held, and the driver/s must be trained on the hazards of the load.

Human and Equipment Safety - Exposure to Violent Release of Kinetic or Potential Energy

Exposure to construction moving equipment, heavy loads, elevated loads, and working at heights can cause injury or possibly fatality, as well as damage to equipment, delays in starting the project and financial losses. The construction impact on human and equipment safety - exposure to violent release of kinetic or potential energy is outlined in **Table 9-145.**

Table 9-145: Construction Impact on human and equipment safety - exposure to violent release of kinetic or potential energy

Potential Impact Human and Equipment Safety - exposure to violent release of kinetic or potential energy	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	5	1	5	5	4	64	High	(-)	Complex
With Mitigation	5	1	5	5	1	16	Low	(-)	
Mitigation and Management Measures	▪ The construction phase must be managed according to all the requirements of the Occupational Health and Safety Act 85 of 1993 specifically the Construction Regulations. ▪ A SHEQ policy must be compiled and implemented. ▪ Develop a detailed construction risk assessment prior to construction work. ▪ A SHE procedure must be developed and implemented. ▪ The necessary PPE to be worn must specified. ▪ Ensure that relevant SHE appointees are in place. ▪ Contractor's safety files must be in place and kept up to date. ▪ SHE monitoring and reporting programs must be developed and implemented. ▪ Standard construction site rules regarding traffic, reversing sirens, rigging controls, cordoning off excavations etc must be developed and adhered to. ▪ Civil works and building structures must adhere to the National Building Regulations and building Standards Act 103 of 1977 SANS 10400 and other relevant codes.									

	- Other constructions such as roads, sewers etc must also adhere to relevant SANS standards. - All normal procedures for working at heights, hot work permits, confined space entry, cordon off excavations etc must be developed before construction begins. - An emergency response plan must be compiled before construction begins.

Human and Equipment Safety - Exposure to Electromagnetic Waves

Construction activities will include the use of electrical machines, generators etc. Hot dry area static generation is highly likely as well as lightning strikes. This may cause electrocution, ignition, burns, injury and death, as well as damage to electrical equipment. The construction impact on exposure to electromagnetic waves is outlined in **Table 9-146.**

Table 9-146: Construction Impact on human and equipment safety - exposure to electromagnetic waves

Potential Impact Human and Equipment Safety – exposure to electromagnetic waves	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	5	2	5	5	3	51	Moderate	(-)	Complex
With Mitigation	5	2	5	5	1	17	Low	(-)	
Mitigation and Management Measures	- Implement standard maintenance of condition of electrical equipment and adhere to safe operating instructions. - Consideration should be given, where required, for remote isolation devices or switching measures on equipment, plant and machinery to ensure the ability to shut off power to systems in use on site. - If persons are decanting fuels or dealing with other highly flammable materials care should be taken regarding possible static discharge, installations to be suitably designed and maintained. - Lightning strike rate in the study area is very high. Outside work must be stopped during thunderstorms. - Lighting conductors may be required for the final installation, to be confirmed during design phase.									

Environment - Emissions to Air

Dust from construction and generally hot dry area may cause adverse impact on employee health. The construction impact of emissions to air is indicated in **Table 9-147.**

Table 9-147: Construction Impact on the environment - emissions to air

Potential Impact Environment – emissions to air	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	3	2	1	1	4	**28**	**Low**	(-)	Easy
With Mitigation	2	2	1	1	2	**12**	**Very Low**	(-)	
Mitigation and Management Measures	▪ Implement dust control measures such as dampening of roads etc., particularly during dry or windy weather conditions, as per normal construction practices. ▪ Construction workers to make use of necessary PPE (dust masks) when required.								

Environment - Emissions to Water

The construction phase will make use of diesel for equipment, paints and solvents. There is also a possibility of Transformer oil spills and Sewage and kitchen/mess area wastewater generation. This could lead to environmental damage, particularly to the surface and underground water in the area if not managed correctly. The construction impact on environment due to emissions to water is outlined in **Table 9-148.**

Table 9-148: Construction impact on the environment - emissions to water

Potential Impact Environment - emissions to water	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	2	2	3	2	3	**27**	**Low**	(-)	Moderate
With Mitigation	2	2	3	2	2	**18**	**Low**	(-)	
Mitigation and Management Measures	▪ Normal construction site practices for preventing and containing fuels/paint/oil etc spills must be adhered to. ▪ Appropriate bunding under any temporary tanks, curbing under truck offloading areas and sealed surfaces (e.g. concrete) under truck parking area is particularly important and must be provided for. ▪ Spill clean-up procedures to be in place before commencing construction.								

	▪ Sewage and any kitchen liquids must have containment and suitable treatment/disposal must be followed.

Environment - Emissions to Earth

The construction phase will generate solid waste. Improper management of this waste will result in environmental pollution. The construction impact on waste generation is outlined in **Table 9-149.**

Table 9-149: Construction impact on the environment - emissions to earth

Potential Impact Environment – emissions to earth	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	2	2	3	3	3	30	Low	(-)	Easy
With Mitigation	1	2	3	3	2	18	Low	(-)	
Mitigation and Management Measures	▪ Solid waste, including packaging materials, must be collected and stored within designated areas on site and thereafter removed for disposal at a licensed waste disposal facility on a regular basis, as well as after regular maintenance. ▪ Implement system for waste segregation (e.g. electronic equipment, chemicals) and management on the site.								

Environment – Waste of Resources

The construction phase will require the usage of water and power, however if the usage is not controlled it will result in wastages. Furthermore, battery containers may be damaged during handling and/or transportation and may lead to construction delays. The construction impact of waste of resources e.g. water, power etc., is outlined in **Table 9-150.**

Table 9-150: Construction impact on the environment – waste of resources

Potential Impact Environment - waste of resources e.g. water, power etc	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	1	1	1	2	4	20	Low	(-)	Easy
With Mitigation	1	1	1	2	2	10	Very low	(-)	
Mitigation and Management Measures	▪ Water usage to be monitored on site during construction.								

	▪ Handling protocols must be provided by the battery supplier. ▪ End of Life plan needs to be in place before any battery containers enter the country as there may be damaged battery unit from day 1. ▪ Develop and implement a water management plan and spill containment plan.

Public - Aesthethics

The construction site will likely have bright surfaces reflecting light and tall structures in a flat area. This is likely to cause irritation/annoyance to the public. The construction impact on public aesthetics is outlined in **Table 9-151.**

Table 9-151: Construction impact on public - aesthetics

Potential Impact Public - Aesthetics	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	3	2	3	4	4	48	Moderate	(-)	Moderate
With Mitigation	1	2	3	4	2	20	Low	(-)	
Mitigation and Management Measures	Refer to visual impact assessment (Section 9.11)								

Investors - Financial

The result of possible defective technology and extreme project delays could result in financial loss for investors. The construction impact on investors – financial is outlined in **Table 9-152.**

Table 9-152: Construction impact on Investors - Financial

Potential Impact Investors - Financial	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	5	1	3	4	3	39	Moderate	(-)	Moderate
With Mitigation	3	1	3	4	2	22	Low	(-)	
Mitigation and Management Measures	▪ Undertake adequate research during the planning and design phase to select the supplier and/contractor with the best technology that is internationally recognized and proven.								

	▪ Project management to include deviation monitoring systems.

Employees and Investors – Security

During the construction phase there is a potential for hi-jacking of valuable but hazardous load while en-route to site. Theft of construction equipment and battery installation facilities is also a possibility on site. Civil unrest or violent strike by employees can also arise. The construction impact of security is outlined in **Table 9-153.**

Table 9-153: Construction impact on employees and investors - security

Potential Impact Employees and investors - Security	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	4	1	3	2	4	**40**	**Moderate**	(-)	Complex
With Mitigation	4	1	3	2	4	**27**	**Low**	(-)	
Mitigation and Management Measures	▪ Fencing around the electrical infrastructure to adhere to SANS standard and Eskom Guidelines. ▪ The hazardous nature of the electrical and battery equipment should be clearly indicated – e.g. Skull and Cross Bones or other signs. ▪ Night lighting to be provided both indoors and outdoors where necessary.								

Emergencies

During the construction phase, there is the potential for fires, explosions, noxious smoke, large spills, traffic accidents and equipment/structural collapse. Inadequate emergency response to small event can lead to escalation. Consequences of these include injuries which can turn to fatalities, and small losses become extended down time. The construction impact of emergencies is outlined in **Table 9-154.**

Table 9-154: Construction impact on emergencies

Potential Impact Emergencies	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation

Without Mitigation	4	2	3	5	4	**56**	**Moderate**	(-)	Complex
With Mitigation	4	2	3	5	2	**28**	**Low**	(-)	
Mitigation and Management Measures	▪ All safety measures listed in Table 9-153 must be implemented. ▪ Emergency procedures need to be practiced prior to commencement of construction. ▪ BESS units should not be stored any closer to each other than they would be in the final installation so that propagation is prevented, i.e. laydown area needs to be considered. ▪ The company in charge of the containers at each stage in the transport process needs to be very clear so that responsibility for the integrity of the load and protection of the persons involved in transfer and coordination of emergency response on-route. E.g. if purchased from Tesla where does hand over occur to the South African contractor / owner, at the factory door in USA, at the port in RSA, at the site fence. For example, who will be accountable if there's thermal runway event on a truck with a container that stops in a small town for driver refreshments.								

Investors Legal

The battery industry is evolving quickly with new guides, codes and regulations happening at the same time as evolving technology. This could result in unknown hazards manifest due to using "cheaper supplier or less developed technology". The construction impact of battery technology on investors is outlined in **Table 9-155.**

Table 9-155: Construction impact on investors - legal

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Investors - legal									
Without Mitigation	3	1	3	3	4	**40**	**Moderate**	(-)	Moderate
With Mitigation	2	1	3	3	2	**18**	**Low**	(-)	
Mitigation and Management Measures	▪ Use only internationally reputable technology suppliers who comply with all known regulations/guideline at the time of purchasing.								

	▪ Ensure only latest state of the art technology systems are used and not old technologies prone to fires/explosions etc..

VRF BESS

Human Health - Chronic Exposure to Toxic Chemical or Biological Agents

Exposure to materials such as cement, paints, solvents, welding fumes, truck fumes etc. during construction can result in employee / contractor illness. The construction impact associated with chronic exposure to toxic chemical or biological agents is outlined in **Table 9-156.**

Table 9-156: Construction Impact on human health – exposure to toxic chemical or biological agents

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Human health - Chronic exposure to toxic chemical or biological agents									
Without Mitigation	3	1	3	4	4	**44**	**Moderate**	(-)	Moderate
With Mitigation	1	1	3	4	2	**18**	**Low**	(-)	
Mitigation and Management Measures	▪ The construction phase must be managed according to all the requirements of the Occupational Health and Safety Act 85 of 1993 specifically the Construction Regulations. ▪ A SHEQ policy and procedure must be compiled and implemented. ▪ A detailed construction risk assessment must be undertaken prior to construction work. ▪ The necessary Personal Protective Equipment (PPE) must be provided and worn at the required working areas. ▪ Ensure that relevant SHE appointees are in place. ▪ Contractor's safety files must be in place and kept up to date. ▪ All necessary health controls/ practices must be in place, e.g. ventilation of welding and painting areas. ▪ SHE monitoring and reporting programs must be in place and implemented. ▪ An emergency response plan must be compiled prior to construction, which must include aspects such as appointment of emergency controller, provision of first aid, first responder contact numbers.									

Human Health - Exposure to Noise

Exposure to drilling, piling, generators, air compressors during construction could lead to an adverse impact on hearing of workers as well as a possible nuisance factor in near-by areas. The construction impact associated with exposure to noise is outlined in **Table 9-157.**

Table 9-157: Construction Impact on human health - exposure to noise

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Human Health - exposure to noise									
Without Mitigation	3	1	5	5	4	**56**	**Moderate**	(-)	Easy
With Mitigation	2	1	5	5	2	**26**	**Low**	(-)	
Mitigation and Management Measures	▪ A health risk assessment must be undertaken to determine if equipment continuous noise exceeds 85dB at workstation and 61dB at the boundary of the site. ▪ Employees to be provided with hearing protection if working near equipment that exceeds the noise limits.								

Human Health - Exposure to Temperature Extremes and/or Humidity

During construction workers will be exposed to heat during the day and cold in winter. This could result in Heat stroke or Hypothermia. The construction impact associated with exposure to temperature extremes and/or humidity is outlined in in **Table 9-158.**

Table 9-158: Construction Impact on human health - exposure to temperature extremes

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Human Health -exposure to temperature extremes and/or humidity									
Without Mitigation	3	2	3	1	2	**18**	**Low**	(-)	Easy
With Mitigation	2	2	3	1	1	**8**	**Very low**	(-)	
Mitigation and Management Measures	▪ Construction site facilities to comply with Occupational Health and Safety Act 85 of 1993, specifically the thermal, humidity, lighting and								

	ventilation requirements of the Environmental Regulations for Workplaces. ▪ Adequate potable water to be provided for employees during all phases of the project. Bore hole, bowser and tank or small water treatment plant may be required to provide potable water for the BESS installation staff during all phases of the project.

Human Health - Chronic Exposure to Psychological Stress

The construction of large projects brings many contractor workers into a small, isolated community. This may lead to a lack of sufficient accommodation, entertainment etc, resulting in an increase in alcohol abuse and violence. The construction impact associated with psychological stress is outlined in **Table 9-159.**

Table 9-159: Construction Impact on human health – exposure to psychological stress

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Human Health - exposure to psychological stress									
Without Mitigation	2	3	3	2	2	**20**	**Low**	(-)	Easy
With Mitigation	2	3	3	2	2	**20**	**Low**	(-)	
Mitigation and Management Measures	Refer to Social Impact Assessment for this project (Section 9.15)								

Human Health - Chronic Exposure to Ergonomic Stress

Lifting of heavy equipment and movement into awkward angles during construction may result in back and other injuries. The construction impact associated with ergonomic stress is outlined in **Table 9-160.**

Table 9-160: Construction impact on human health – exposure to ergonomic stress

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Human Health - exposure to ergonomic stress									
Without Mitigation	4	1	3	2	3	**30**	**Low**	(-)	Moderate
With Mitigation	4	1	3	2	2	**20**	**Low**	(-)	

Mitigation and Management Measures	▪ Training in lifting techniques must be provided. ▪ Ensure that despite the isolated location, all the necessary equipment is available (and well maintained) during construction. Otherwise, employees may revert to unsafe practices. ▪ Isolated location, maintenance of construction equipment to ensure safe operation is critical. Ensure this is in place prior to project beginning. ▪ Ensure First aid provision on site.

Human and Equipment Safety – Exposure to Fire Radiation

The construction phase could result in activities that pose a fire risk. This includes fire involving fuels used in construction vehicles or vehicles themselves (e.g. tyre fire), fire due to uncontrolled welding or other hot-work. This will result in injuries due to radiation especially amongst first responders and bystanders. Fatalities are unlikely from the heat radiation as not highly flammable nor massive fire. The construction impact associated with exposure to fire radiation is outlined in **Table 9-161.**

Table 9-161: Construction impact on human and equipment safety – exposure to fire radiation

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Human and Equipment Safety - exposure to fire radiation									
Without Mitigation	4	2	3	5	4	**56**	**Moderate**	(-)	Complex
With Mitigation	4	2	3	5	2	**28**	**Low**	(-)	
Mitigation and Management Measures	▪ Fuels stored on site must be situated in dedicated, demarcated and bunded areas. ▪ Suitable fire-fighting equipment must be available on site near source of fuel, e.g. diesel tank, generators, mess, living quarters, workshops etc ▪ The company responsible for the facility at this stage is to have: ▪ An emergency plan must be in place prior to commencement of construction. ▪ Fuel spill containment procedures and equipment must be provided for and in place. ▪ Hot-work permit and management system must be in place.								

Human and Equipment Safety - Exposure to Acute Toxic Chemical and Biological Agents

Human pathogens and diseases, sewage, food waste as well as snakes, insects, wild and domesticated animals and harmful plants can cause illness and at worst without mitigation, possibly extending to fatalities. Effects can vary from discomfort to fatalities for venomous snakes or bee swarms etc. The construction impact on human and equipment safety - exposure to acute toxic chemical and biological agents is outlined in **Table 9-162.**

Table 9-162: Construction Impact on human and equipment safety - exposure to acute toxic chemical and biological agents

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Human and Equipment Safety - exposure to acute toxic chemical and biological agents									
Without Mitigation	4	2	3	2	3	33	Moderate	(-)	Complex
With Mitigation	3	2	3	2	2	20	Low	(-)	
Mitigation and Management Measures	▪ All necessary good hygiene practices to be in place, e.g. provision of toilets, eating areas, infectious disease controls. ▪ Policies and practice for dealing with known vectors of disease such as Aids, TB, COVID 19 and others must be developed and implemented. ▪ Conduct awareness training for persons on site, safety induction to include animal hazards. ▪ First aid and emergency response to consider the necessary anti-venom, anti-histamines, topical medicines etc. ▪ Due to isolated locations and distance from town, the ability to treat with anti-venom and extreme allergic reactions on site is critical to mitigate the impacts.								

Human and Equipment Safety - Exposure to Violent Release of Kinetic or Potential Energy

Exposure to construction moving equipment, heavy loads, elevated loads, and working at heights can cause injury or possibly fatality, as well as damage to equipment, delays in starting the project and financial losses. The construction impact on human and equipment safety - exposure to violent release of kinetic or potential energy is outlined in **Table 9-163.**

Table 9-163: Construction Impact on human and equipment safety - exposure to violent release of kinetic or potential energy

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Human and Equipment Safety - exposure to violent release of kinetic or potential energy									
Without Mitigation	5	1	5	5	4	64	High	(-)	Complex
With Mitigation	5	1	5	5	1	16	Low	(-)	
Mitigation and Management Measures	▪ The construction phase must be managed according to all the requirements of the Occupational Health and Safety Act 85 of 1993 specifically the Construction Regulations. ▪ A SHEQ policy must be compiled and implemented. ▪ Develop a detailed construction risk assessment prior to construction work. ▪ A SHE procedure must be developed and implemented. ▪ The necessary PPE to be worn must specified. ▪ Ensure that relevant SHE appointees are in place. ▪ Contractor's safety files must be in place and kept up to date. ▪ SHE monitoring and reporting programs must be developed and implemented. ▪ Standard construction site rules regarding traffic, reversing sirens, rigging controls, cordoning off excavations etc must be developed and adhered to. ▪ Civil works and building structures must adhere to the National Building Regulations and building Standards Act 103 of 1977 SANS 10400 and other relevant codes. ▪ Other constructions such as roads, sewers etc must also adhere to relevant SANS standards. ▪ All normal procedures for working at heights, hot work permits, confined space entry, cordon off excavations etc must be developed before construction begins. ▪ An emergency response plan must be compiled before construction begins.									

Human and Equipment Safety - Exposure to Electromagnetic Waves

Construction activities will include the use of electrical machines, generators etc. Hot dry area static generation is highly likely as well as lightning strikes. This may cause electrocution, ignition, burns, injury and death, as well as damage to electrical equipment. The construction impact on exposure to electromagnetic waves is outlined in **Table 9-164.**

Table 9-164: Construction Impact on human and equipment safety - exposure to electromagnetic waves

Potential Impact Human and Equipment Safety – exposure to electromagnetic waves	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	5	2	5	5	3	51	Moderate	(-)	Complex
With Mitigation	5	2	5	5	1	17	Low	(-)	
Mitigation and Management Measures	▪ Implement standard maintenance of condition of electrical equipment and adhere to safe operating instructions. ▪ Consideration should be given, where required, for remote isolation devices or switching measures on equipment, plant and machinery to ensure the ability to shut off power to systems in use on site. ▪ If persons are decanting fuels or dealing with other highly flammable materials care should be taken regarding possible static discharge, installations to be suitably designed and maintained. ▪ Lightning strike rate in the study area is very high. Outside work must be stopped during thunderstorms. ▪ Lighting conductors may be required for the final installation, to be confirmed during design phase.									

Environment - Emissions to Air

Dust from construction and generally hot dry area may cause adverse impact on employee health. The construction impact of emissions to air is indicated in **Table 9-165.**

Table 9-165: Construction Impact on the environment - emissions to air

Potential Impact Environment – emissions to air	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	3	2	1	1	4	28	Low	(-)	Easy
With Mitigation	2	2	1	1	2	12	Very Low	(-)	

Mitigation and Management Measures	▪ Implement dust control measures such as dampening of roads etc., particularly during dry or windy weather conditions, as per normal construction practices. ▪ Construction workers to make use of necessary PPE (dust masks) when required.

Environment - Emissions to Water

The construction phase will make use of diesel for equipment, paints and solvents. There is also a possibility of Transformer oil spills and Sewage and kitchen/mess area wastewater generation. This could lead to environmental damage, particularly to the surface and underground water in the area if not managed correctly. The construction impact on environment due to emissions to water is outlined in **Table 9-166.**

Table 9-166: Construction impact on the environment - emissions to water

Potential Impact Environment - emissions to water	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	2	2	3	2	3	**27**	**Low**	(-)	Moderate
With Mitigation	2	2	3	2	2	**18**	**Low**	(-)	
Mitigation and Management Measures	▪ Normal construction site practices for preventing and containing fuels/paint/oil etc spills must be adhered to. ▪ Appropriate bunding under any temporary tanks, curbing under truck offloading areas and sealed surfaces (e.g. concrete) under truck parking area is particularly important and must be provided for. ▪ Spill clean-up procedures to be in place before commencing construction. ▪ Sewage and any kitchen liquids must have containment and suitable treatment/disposal must be followed.								

Environment - Emissions to Earth

The construction phase will generate solid waste. Improper management of this waste will result in environmental pollution. The construction impact on waste generation is outlined in **Table 9-167.**

Table 9-167: Construction impact on the environment - emissions to earth

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Environment – waste generation									
Without Mitigation	2	2	3	3	3	**30**	**Low**	(-)	Easy
With Mitigation	1	2	3	3	2	**18**	**Low**	(-)	
Mitigation and Management Measures	▪ Solid waste, including packaging materials, must be collected and stored within designated areas on site and thereafter removed for disposal at a licensed waste disposal facility on a regular basis, as well as after regular maintenance. ▪ Implement system for waste segregation (e.g. electronic equipment, chemicals) and management on the site.								

Environment – Waste of Resources

The construction phase will require the usage of water and power, however if the usage is not controlled it will result in wastages. Furthermore, battery containers may be damaged during handling and/or transportation and may lead to construction delays. The construction impact of waste of resources e.g. water, power etc., is outlined in **Table 9-168.**

Table 9-168: Construction impact on the environment – waste of resources

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Environment - waste of resources e.g. water, power etc									
Without Mitigation	1	1	1	2	4	**20**	**Low**	(-)	Easy
With Mitigation	1	1	1	2	2	**10**	**Very low**	(-)	
Mitigation and Management Measures	▪ Water usage to be monitored on site during construction. ▪ Handling protocols must be provided by the battery supplier. ▪ Develop and implement a water management plan and spill containment plan.								

Public - Aesthethics

The construction site will likely have bright surfaces reflecting light and tall structures in a flat area. This is likely to cause irritation/annoyance to the public. The construction impact on public aesthetics is outlined in **Table 9-169.**

Table 9-169: Construction impact on public - aesthetics

Potential Impact Public - Aesthetics	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	3	2	3	4	4	**48**	**Moderate**	(-)	Moderate
With Mitigation	1	2	3	4	2	**20**	**Low**	(-)	
Mitigation and Management Measures	▪ Visual impact assessment to include BESS installation when design details become available. Confirm height limitations for VRFB BESS building (if utility scale).								

Investors - Financial

The result of possible defective technology and extreme project delays could result in financial loss for investors. The construction impact on investors – financial is outlined in **Table 9-170.**

Table 9-170: Construction impact on Investors - Financial

Potential Impact Investors - Financial	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	5	1	3	4	3	**39**	**Moderate**	(-)	Moderate
With Mitigation	3	1	3	4	2	**22**	**Low**	(-)	
Mitigation and Management Measures	▪ Undertake adequate research during the planning and design phase to select the supplier and/contractor with the best technology that is internationally recognized and proven. ▪ Project management to include deviation monitoring systems.								

Employees and Investors – Security

During the construction phase there is a potential for hi-jacking of valuable but hazardous loads while en-route to site. Theft of construction equipment and battery installation facilities is also a possibility on site. Civil unrest or violent strike by employees can also arise. This may result in theft, injury to burglars, damage to equipment possibly setting off thermal runaway. The construction impact of security is outlined in **Table 9-171.**

Table 9-171: Construction impact on employees and investors - security

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Employees and investors - Security									
Without Mitigation	4	1	3	2	4	40	Moderate	(-)	Complex
With Mitigation	4	1	3	2	4	27	Low	(-)	
Mitigation and Management Measures	▪ Fencing around the electrical infrastructure to adhere to SANS standard and Eskom Guidelines. ▪ The hazardous nature of the electrical and battery equipment should be clearly indicated – e.g. Skull and Cross Bones or other signs. ▪ Night lighting to be provided both indoors and outdoors where necessary.								

Emergencies

During the construction phase, there is the potential for fires, explosions, noxious smoke, large spills, traffic accidents and equipment/structural collapse. Inadequate emergency response to small event can lead to escalation. Consequences of these include injuries which can turn to fatalities, and small losses become extended down time. The construction impact of emergencies is outlined in **Table 9-172.**

Table 9-172: Construction impact on emergencies

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Emergencies									
Without Mitigation	4	2	3	4	3	39	Moderate	(-)	Complex
With Mitigation	4	2	3	4	2	26	Low	(-)	

Mitigation and Management Measures	▪ All safety measures listed in Table 9-171 must be implemented. ▪ Emergency procedures need to be practiced prior to commencement of construction.

Investors - Legal

The Battery sector is evolving quickly with new guides, codes and regulations happening at the same time as evolving technology. This could result in unknown hazards manifest due to using "cheaper supplier or less developed technology". The construction impact of battery technology on investors is outlined in **Table 9-173.**

Table 9-173: Construction impact on investors - legal matters

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Investors - legal									
Without Mitigation	3	1	3	3	4	**40**	**Moderate**	(-)	Moderate
With Mitigation	2	1	3	3	2	**18**	**Low**	(-)	
Mitigation and Management Measures	▪ Use only internationally reputable technology suppliers who comply with all known regulations/guideline at the time of purchasing. ▪ Ensure only latest state of the art technology systems are used and not old technologies prone to fires/explosions etc..								

9.17.2 OPERATIONAL PHASE (INCLUDING COMMISSIONING)

SOLID STATE LITHIUM-ION BATTERY ENERGY STORAGE SYSTEMS

From the details of accidents that have happened both with BESS installations and chemical plants in general, it is clear that many potential problems manifest during the commissioning phase when units are first powered up to test functionality. This phase is critical and all controls, procedures, mitigation measures etc that would be in place for full operation should be in place before commissioning commences.

Human Health - Chronic Exposure to Toxic Chemical or Biological Agents

Operation and maintenance materials such as spare parts, paints, solvents, welding fumes, transformers oils, lubricating oils and greases etc., may cause occupational illness. The operational impact on human health - chronic exposure to toxic chemical or biological agents is outlined in **Table 9-174.**

Table 9-174: Operational Impact on human health - chronic exposure to toxic chemical or biological agents

Potential Impact Chronic exposure to toxic chemical or biological agents	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	2	1	3	4	5	**50**	**Moderate**	(-)	Easy
With Mitigation	1	1	3	4	2	**18**	**Low**	(-)	
Mitigation and Management Measures	▪ The operation and maintenance phase must be managed according to all the requirements of the Occupational Health and Safety Act 85 of 1993. ▪ A SHEQ policy must be in place prior to commissioning. ▪ A detailed risk assessment of all normal operating and maintenance activities on site to be compiled, and form the basis of operating instructions, prior to commencing commissioning. ▪ A SHE procedure must be in place prior to commissioning, and must include, but not limited to, PPE requirements, management of change, integrity monitoring. ▪ Ensure that relevant SHE appointees are in place. ▪ Training of staff on general hazards on site must be conducted. ▪ All necessary health controls/ practices to be in place, e.g. ventilation of confined areas, occupational health monitoring if required and reporting programs must be in place and implemented. ▪ An emergency response plan for full operation and maintenance phase to be in place prior to beginning commissioning and to include aspects such as: ▪ appointment of emergency controller, ▪ emergency isolation systems for electricity, ▪ emergency isolation and containment systems for electrolyte, ▪ provision of PPE for hazardous materials response, ▪ provision of emergency facilities for staff at the main office building, ▪ provision of first aid facilities, ▪ first responder contact numbers etc.									

Compromised battery compartment vapours accumulate in the containers, as well as release solids/liquids on surfaces. Maintenance of battery components can cause corrosive and mildly toxic liquid on surfaces. This can result in dermatitis, and skin /eye/lung irritation. The operational impact on human health - chronic exposure to toxic chemical or biological agents is outlined in **Table 9-175.**

Table 9-175: Operational Impact on human health - chronic exposure to toxic chemical or biological agents for SSL BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Human Health - Chronic exposure to toxic chemical or biological agents									
Without Mitigation	3	1	3	5	4	48	Moderate	(-)	Complex
With Mitigation	1	1	3	5	2	20	Low	(-)	
Mitigation and Management Measures	▪ Maintenance procedures must be in place should equipment need to be opened, e.g. pumps drained and decontaminated prior to repair in workshop etc. ▪ Ensure PPE for handling battery parts and other equipment on site is specified and worn when required. ▪ Training of staff on general hazards on site must be conducted. ▪ Install a leak detection system with local alarms if regulated occupational exposure limits are exceeded etc prior to entry for inspection of battery containers. ▪ Provide signage or labels on all equipment. ▪ Confined space entry procedures must be developed and adhered to when entering tanks and possibly battery containers. ▪ There needs to be careful thought given to procedures to be adopted before entering into the BESS or a container under normal circumstances (confined space) but particularly after a BMS shut down where there may be flammable or toxic gases present, a fire etc. Any situation could await those entering. ▪ Safety Data Sheets (SDSs) must be available on site. ▪ Operating manuals must be provided including start-up, shut-down, steady state, monitoring requirements. ▪ Maintenance manuals with make safe, decontamination and repair procedures must also be in place.									

	- A maintenance schedule must be developed and implemented to include the required daily, weekly, monthly, annual etc maintenance. - Provided portable equipment for calibration and for testing/verification of defective equipment, e.g. volt/current meters, infrared camera.

Human Health - Exposure to Noise

Moving parts inside containers, buildings, pumps, compressors, cooling systems etc., can cause adverse impact on hearing of workers, or may be a nuisance factor at near -by residences or other activities. The operational impact on human health - exposure to noise is outlined in **Table 9-176.**

Table 9-176: Operational Impact on human health - exposure to noise

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Human Health - exposure to noise									
Without Mitigation	2	1	5	5	4	**52**	**Moderate**	(-)	Easy
With Mitigation	2	1	5	5	2	**26**	**Low**	(-)	
Mitigation and Management Measures	- Design the system to ensure continuous noise does not exceed 85dB within the facilities or at any other location on site or 61 dB at the site boundary, e.g. emergency generator, air compressor etc. - Employees to be provided with hearing protection if working near equipment that exceeds the noise limits.								

Human Health - Exposure to Temperature Extremes and/or Humidity

Workers may be exposed to extreme temperatures and/or humidity such as heat during the day and cold weather in winter. Batteries can also generate heat within enclosed buildings / containers, and night work requires lighting which can generate heat. This could result in heat stroke or hypothermia. The operational impact on human health - exposure to temperature extremes and/or humidity is outlined in **Table 9-177.**

Table 9-177: Operational Impact on human health - exposure to temperature extremes and/or humidity

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Human Health -exposure to temperature extremes and/or humidity									
Without Mitigation	4	2	3	1	2	**20**	**Low**	(-)	Easy
With Mitigation	3	2	3	1	1	**9**	**Very Low**	(-)	
Mitigation and Management Measures	▪ Building and container facilities to comply with Occupational Health and Safety Act 85 of 1993 specifically the thermal, humidity, lighting and ventilation requirements of the Environmental Regulations for Workplaces. ▪ Ensure containers are temperature controlled as required to remain within the optimal battery operating temperature range. ▪ Lighting to be provided inside any buildings, inside the containers, possibly linked to the door opening and outdoors where necessary. ▪ Adequate potable water to be provided during all phases of the project. ▪ Suitable lighting to be provided including emergency lighting for safe building exit in the event of power failure. ▪ PPE for operations and maintenance staff to be suitable for the weather conditions.								

Human Health - exposure to psychological stress

Isolated workstation and monotonous repetitive work can cause low performance, and system productivity suffers. The operational impact on human health - exposure to psychological stress is outlined in **Table 9-178.**

Table 9-178: Operational Impact on human health - exposure to psychological stress

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Human Health - exposure to psychological stress									
Without Mitigation	2	3	3	2	2	**20**	**Low**	(-)	Easy
With Mitigation	1	3	3	2	1	**9**	**Very Low**	(-)	

Mitigation and Management Measures	▪ Implement staff rotation to other activities within the site where necessary. ▪ Performance monitoring of inspections / maintenance tasks in particular must be undertaken.

Human Health - Chronic Exposure to Ergonomic Stress

Lifting heavy equipment and movement at awkward angles during maintenance, stretching to reach high level and bending to low level, including working at heights if equipment is located on top of roofs or elevated electrical equipment (e.g. pylons), can result in back and other injuries. The operational impact on human health - exposure to ergonomic stress is outlined in **Table 9-179.**

Table 9-179: Operational Impact on human health - exposure to ergonomic stress

Potential Impact Human Health - exposure to ergonomic stress	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	5	1	3	2	3	**33**	**Moderate**	(-)	Easy
With Mitigation	4	1	3	2	2	**20**	**Low**	(-)	
Mitigation and Management Measures	▪ Training in lifting techniques must be provided. ▪ Working at heights training must be provided. ▪ If equipment is at height, ensure suitable safe (electrically and physically) ladders / harnesses etc. are available. ▪ A working at height procedure needs to be in place.								

Human and Equipment Safety – Exposure to Fire Radiation

During the operation of the facility there are chances of involvements in an external fire e.g. veld fire, maintenance vehicle fire, electrical systems fire. Manufacturing defects or damage to batteries leading to shorting and heating can also be an issue along with high humidity condensation of water or ingress of water or flooding leading to shorting. Dust accumulation on electrical parts leading to overheating. Excessive electrical loads and/or surges. Operator abuse, Battery management System (BMS) failure or software failure. Incorrect extinguishing mediums can escalate the fire. Consequences include contaminated run off. Radiation burns unlikely to be severe as no highly flammable materials on site. Damaged equipment. Fire spreads to other units or offsite if grass/vegetation not controlled. The operational impact on human and equipment safety - exposure to fire radiation is outlined in **Table 9-180.**

Table 9-180: Operational Impact on human and equipment safety - exposure to fire radiation

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
Human and Equipment Safety - exposure to fire radiation									
Without Mitigation	5	1	5	5	4	64	High	(-)	Complex
With Mitigation	5	1	5	5	1	16	Low	(-)	
Mitigation and Management Measures	▪ Grass cutting and fire breaks must be maintained around the BESS installations to prevent veld fires. No combustible materials to be stored in or near the batteries or electrical infrastructure. Ensure separation of site diesel tank, transformers from BESS and vice versa. ▪ The Facility to comply with prescribed design standards such as the BESS design codes from the USA and standards of practice that (e.g. UL9540, NFPA 855 and DNV GL RP 43). ▪ A detailed Failure Modes and Effects Analysis (FMEA) / (Hazard and Operability Analysis (HAZOP) / Bowtie methodology must be developed during design at the component level and system levels. ▪ Conduct safety integrity level rating of equipment (failure probably) with suitable redundancy if required. ▪ Conduct Site Acceptance Testing as part of commissioning of each unit and the overall system. ▪ Abuse tests to be conducted by supplier. ▪ Ensure an effective Battery Management System (BMS) is included in the design. BMS should be checking individual cell voltage as well as stack, module, container, system voltages/current etc. BMS tripping the cell and possibly the stack/ building unit or module/rack/container, if variations in voltage. ▪ Diagnostics must be easily accessible. Diagnostics are able to distinguish cell from stack or cell from module faults. Protective systems are only as good as their reliability and functionality testing is important, e.g. testing that all battery trips actually work. ▪ Fire resistant barrier between the batteries and the PCS side if in the same container, or									

	separate containers must form part of the design. ▪ Suitable ingress protection level to be provided for electrical equipment, e.g. IP55 - 66. If air cooling into container, suitable dust filters to be provided. ▪ Install smoke detectors linked to BMS & alerts in control room. ▪ Effects of battery aging to be considered. Solid state battery life starts to be impacted above 40 deg C and significant impacts above 50 deg C with thermal run away starting at 65-70 deg C. BMS trips system at 50 deg C. Temperature monitoring to be in place. Regular infrared scanning. Data needs to be stored for trend analysis. ▪ An Emergency plan, from transport and construction phase, must be extended to operational phase. The plan must include the hazards of the electrically live system. This Plan must include procedures to address solid state container fires - extinguishing, ventilating, entering as appropriate or not. ▪ PPE for container firefighting must include fire retardant, chemically resistant, nitrile gloves, antistatic acid resistant boots, fill face shields, BA sets. ▪ A planned fire response to prevent escalation to an explosion or an environmental event must be developed. ▪ Suitable supply of fire extinguishing medium and cooling medium must be provided. Consider fire water for cooling adjacent equipment for BESS units. Fogging nozzles can be used to direct smoke. ▪ Ensure procedures in place for clean up after event Lingering HF and other toxic residues in the soil and on adjacent structures. ▪ Procedures to be in place for Infrared (IR) scanning (or other suitable method) to determine if batteries are still smouldering / are sufficient cooled to handle as batteries may still be active some weeks after an event. ▪ Smoke or gas detector systems that are not part of the original battery container package, need to be linked to the main control panel for the entire system so that issues can be detected and responded to rapidly.

A Power Conversion System's (PCS – DC to AC) cooling failure can result in electrical fire. The consequence of this is that a fire can start in PCS or another section or room and spread to the battery area. The operational impact on human and equipment safety - exposure to fire radiation is outlined in **Table 9-181.**

Table 9-181: Operational Impact on human and equipment safety - exposure to fire radiation for SSL BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Human and Equipment Safety - exposure to fire radiation									
Without Mitigation	5	2	5	5	4	68	High	(-)	Moderate
With Mitigation	5	2	5	5	1	17	Low	(-)	
Mitigation and Management Measures	▪ Consider modern lithium container design - put the PCS in another part of the container with a fire rated wall separating it from the battery. Alternately the PCS is another container altogether.								

Human and Equipment Safety - Exposure to Explosion over pressures

Transformer shorting / overheating / explosion or flammable gases generated by thermal run away reach explosive limits. Ignition on hot surfaces can cause static. Lithium Cobalt Oxide generates O2 during decomposition which can cause escalation. This can result in potential fatalities amongst first responders, or damage to container or other nearby items, e.g. other container. The operational impact on human and equipment safety - exposure to explosion over pressures is outlined in **Table 9-182.**

Table 9-182: Operational Impact on human and equipment safety - exposure to explosion over pressures

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Human and Equipment Safety - exposure to explosion over pressures[5]									
Without Mitigation	5	1	5	5	2	32	Moderate	(-)	Moderate

[5] Refer to Appendix A of the SHE Risk Assessment (**Appendix H-12**) for an initial approximation of worst-case possible explosion impact zones

With Mitigation	5	1	5	5	1	16	Low	(-)	
Mitigation and Management Measures	Electrical equipment will be specified to suit application. An Emergency response plan must be in place as referred to above and employee training on the plan must be provided. Undertake a hazardous area classification of the inside of the container to confirm the rating of electrical equipment. Might be zone 2 due to possible leaks of electrolyte or generation of flammable gases under thermal run away. Suitable training of selected emergency responders who may be called out to the facility must be undertaken.								

Human and Equipment Safety - Exposure to Acute Toxic Chemical and Biological Agents

Human pathogens and diseases, sewage, food waste as well as snakes, insects, wild and domesticated animals and harmful plants can cause illness and at worst without mitigation, possibly extending to fatalities. Effects can vary from discomfort to fatalities for venomous snakes or bee swarms etc. The operational impact on human and equipment safety - exposure to acute toxic chemical and biological agents is outlined in **Table 9-183.**

Table 9-183: Operational Impact on human and equipment safety - exposure to acute toxic chemical and biological agents

Potential Impact Human and Equipment Safety - exposure to acute toxic chemical and biological agents	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	4	1	3	2	3	30	Low	(-)	Moderate
With Mitigation	3	1	2	2	2	16	Low	(-)	
Mitigation and Management Measures	▪ All necessary good hygiene practices to be in place, e.g. provision of toilets, eating areas, infectious disease controls. ▪ Policies and practice for dealing with known vectors of disease such as Aids, TB, COVID 19 and others must be developed and implemented. ▪ Conduct awareness training for persons on site, safety induction to include animal hazards. ▪ First aid and emergency response to consider the necessary anti-venom, anti-histamines, topical medicines etc.								

	▪ Due to isolated locations and distance from town, the ability to treat with anti-venom and extreme allergic reactions on site is critical to mitigate the impacts.

Damaged battery components, leakage of electrolyte, or if the components are completely broken exposing hazardous chemicals, and thermal runaway and hazardous fumes are released, this can cause mild skin irritation from exposure to small leaks to serious corrosive burns for large exposure. The operational impact on human and equipment safety - exposure to acute toxic chemical and biological agents is outlined in **Table 9-184.**

Table 9-184: Operational Impact on human and equipment safety - exposure to acute toxic chemical and biological agents for SSL BESS

Potential Impact Human and Equipment Safety - exposure to acute toxic chemical and biological agents[6]	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	4	3	3	5	3	**45**	**Moderate**	(-)	Moderate
With Mitigation	3	3	3	5	2	**28**	**Low**	(-)	
Mitigation and Management Measures	▪ Acid resistant PPE (e.g. overalls, gloves, eyeglasses) to be specified for all operations in electrolyte areas. ▪ PPE to be increased (e.g. full-face shield, aprons, chemical suits) for operations that involve opening equipment and potential exposure, e.g. sampling, maintenance. ▪ All operators/maintenance staff to be trained in the hazards of chemicals on site. ▪ Refer to fire above as all the protective measures apply to prevent toxic smoke. ▪ Refer to fire above as all the measures apply to mitigate toxic smoke. ▪ Ensure a 24/7 helpline response. ▪ Adhere to standard dangerous goods requirements for Hazmat labels.								

[6] Refer to Appendix A of the SHE Risk Assessment (**Appendix H-12**) for an initial approximation of worst-case possible noxious smoke impact zones

	▪ All operators/maintenance staff to be trained in the hazards.

Human and Equipment Safety - Exposure to Violent Release of Kinetic or Potential Energy

Moving equipment, pumps, heavy equipment at elevation, nip points, working at heights, traffic accidents and earthquake/tremors can cause injury or possibly fatality in unlikely worst case, damage to equipment, spills, and environment pollution. The operational impact on human and equipment safety - exposure to violent release of kinetic or potential energy is outlined in **Table 9-185.**

Table 9-185: Operational Impact on human and equipment safety - exposure to violent release of kinetic or potential energy

Potential Impact Human and Equipment Safety - exposure to violent release of kinetic or potential energy	Magnitude	Extent	Reve'sibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	5	1	5	5	3	48	Moderate	(-)	Moderate
With Mitigation	5	1	5	5	1	16	Low	(-)	
Mitigation and Management Measures	▪ Maintenance equipment to be serviced and personnel suitably trained in the use thereof. ▪ Traffic signs, rules etc to be in place on site. ▪ All normal working at heights, hot work permits, confined space entry, cordon off unsafe areas/works etc procedures to be in place. ▪ An emergency response plan must be in place. ▪ Civil design to take seismic activity into account.								

Human and Equipment Safety - Exposure to Electromagnetic Waves

The operational phase will include the use of electrical machines, generators etc. In hot dry areas, static generation is highly likely, as well as lightning strike. This may cause electrocution, ignition, burns, injury and death, as well as damage to electrical equipment. The operational impact on human and equipment safety - exposure to electromagnetic waves is outlined in **Table 9-186.**

Table 9-186: Operational Impact on human and equipment safety - exposure to electromagnetic waves

Potential Impact Human and Equipment Safety – exposure to electromagnetic waves	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	5	2	5	5	3	51	Moderate	(-)	Complex
With Mitigation	5	2	5	5	1	17	Low	(-)	
Mitigation and Management Measures	▪ Adhere to codes and guidelines for electrical insulation. ▪ Provide suitable PPE. ▪ Low voltage equipment (e.g. batteries) to be separated from high voltage (e.g. transmission to grid). ▪ Personnel to be trained in line with IEE 1657 – 2018 (Recommended Practice for Personnel Qualifications for Installation and Maintenance of Stationary Batteries). ▪ Adhere to Eskom Operating Regulations for high voltage systems including access control, permit to work, safe work procedures, live work, abnormal and emergency situations, keeping records. ▪ Software also need to be kept as update to date as reasonably practicable. ▪ Consider suitably located Emergency stop buttons for the facility and the other equipment on site. ▪ PPE to consider static accumulation for entering the facility, and particularly the battery containers especially after a high temperature shut down where there could possibly be flammable materials. ▪ The procedures for responding to alarm and auto shut down on containers, needs to consider that there may be a dangerous environment inside and how to protect personnel who may enter to respond. ▪ All outside work must be stopped during thunder storms. ▪ Lighting conductors may be required for the installation, to be confirmed during design									

Environment - Emissions to Air

Refrigerant may be an asphyxiant if accidentally released indoors it can accumulate and displace oxygen. It is however noted that this is not expected on a normal basis. The operational impact on environment - emissions to air is outlined in **Table 9-187.**

Table 9-187: Operational Impact on environment - emissions to air

Potential Impact Environment – emissions to air	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	3	1	1	1	3	**18**	**Low**	(-)	Easy
With Mitigation	3	1	1	1	1	**6**	**Very Low**	(-)	
Mitigation and Management Measures	▪ Containers could be treated as entering a confined space and similar procedures entering confined spaces could be in place, e.g. do not enter alone, gas testing prior to entering, ensure adequate ventilation. Particularly after any warning alarms have gone off, but possibly even normally.								

Environment - Emissions to Water

Waste will be generated during the operation of the facility. This may include cooling water blow-down, laboratory waste (if included in the design), maintenance waste, e.g. oils, spills from batteries, coolant system, diesel trucks, transformers, oil drips from parked vehicles, fire water runoff control, kitchen waste and sewage, refrigerant release. These can cause pollution if not contained and excessive disposal costs if emissions are not limited. The operational impact on environment - emissions to water is outlined in **Table 9-188.**

Table 9-188: Operational Impact on environment - emissions to water

Potential Impact Environment - emissions to water	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	2	2	3	2	3	**27**	**Low**	(-)	Moderate
With Mitigation	2	2	3	2	2	**18**	**Low**	(-)	
Mitigation and Management Measures	▪ Implement bunding under any outdoors tanks, curbing under truck offloading areas and sealed surfaces (e.g. concrete) under truck parking area. ▪ Provide containment and suitable treatment/disposal for sewage and any kitchen liquids.								

	- Procedures for dealing with damaged/leaking equipment as well as clean-up of spills to be in place and implemented. - Conduct normal site practices for preventing and containing diesel/paint etc spills. - Waste management plan to be in place and provide measures for, but not limited to, liquid waste treatment or suitable removal and disposal. - Spill clean-up procedures to be in place before bringing container on site, including spill kits – non-combustible materials, hazmat disposal. - Undertake reporting of reportable quantities in line with NEMA.

Environment - Emissions to Earth

The operation phase will generate solid waste. The disposal of solid-state batteries can cause environmental damage. The operational impact on environment - emissions to earth is outlined in **Table 9-189.**

Table 9-189: Operational Impact on environment - emissions to earth

Potential Impact Environment – waste generation	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	2	2	3	3	3	**30**	**Low**	(-)	Easy
With Mitigation	2	2	3	3	1	**10**	**Very Low**	(-)	
Mitigation and Management Measures	- Implement system for waste segregation (e.g. electronic equipment, chemicals) and management on the site.								

Environment – Waste of Resources

The operation phase will require the usage of water and power, however if the usage is not controlled it will result in wastages. Operations will include the disposal of batteries or components, or disposal of containers. This may result in delays, excessive costs and disposal of large volumes of hazardous waste. The operational impact on environment - waste of resources e.g. water, power etc is outlined in **Table 9-190.**

Table 9-190: Operational Impact on environment - waste of resources e.g. water, power

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Environment - waste of resources e.g. water, power etc									
Without Mitigation	1	1	1	2	4	20	Low	(-)	Easy
With Mitigation	1	1	1	2	2	10	Very Low	(-)	
Mitigation and Management Measures	▪ Water usage to be monitored on site during construction. ▪ Handling protocols must be provided by the battery supplier. ▪ Develop and implement a water management plan and spill containment plan. ▪ Investigate end of Life plan for solid state batteries including options for reuse / recovery / reconditioning. ▪ Similarly, for decommissioned containers consider reuse / recovery / repurpose.								

Public - Aesthethics

Bright surfaces reflecting light and tall structures in a flat area may cause irritation. The operational impact on public - aesthetics is outlined in **Table 9-191.**

Table 9-191: Operational Impact on public

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Public - Aesthetics									
Without Mitigation	1	2	4	4	2	22	Low	(-)	Easy
With Mitigation	1	2	4	4	2	22	Low	(-)	
Mitigation and Management Measures	▪ Refer to Visual Impact Assessment which is to include the BESS installation once design details are available.								

Investors - Financial

The result of possible defective technology and extreme project delays can cause financial loss. The operational impact on investors - financial is outlined in **Table 9-192.**

Table 9-192: Operational Impact on investors – financial

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Investors - Financial									
Without Mitigation	5	1	3	4	3	**39**	**Moderate**	(-)	Easy
With Mitigation	3	1	3	4	2	**22**	**Low**	(-)	
Mitigation and Management Measures	▪ Undertake adequate research during the planning and design phase to select the supplier and/or contractor with the best technology that is internationally recognized and proven. ▪ Project management with deviation monitoring.								

Employees and Investors – Security

On route to the operational site there is a risk of potential hi-jacking of valuable but hazardous loads. On site there is a risk of theft of operational equipment and battery installation facilities. There may also be civil unrest or violent strike by employees. This may result in theft, injury to burglars, damage to equipment possibly setting off thermal runaway. The operational impact on employees and investors – security is outlined in **Table 9-193.**

Table 9-193: Operational Impact on employees and investors – security

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Employees and investors - Security									
Without Mitigation	3	1	3	2	4	**36**	**Moderate**	(-)	Moderate
With Mitigation	3	1	3	2	2	**18**	**Low**	(-)	
Mitigation and Management Measures	▪ Fencing around electrical infrastructure to adhere to SANS standard and Eskom Guidelines. ▪ Consider motion detection lights and CCTV. ▪ The hazardous nature of the electrical and battery equipment should be clearly indicated – e.g. Skull and Cross Bones or other signs. ▪ Night lighting to be provided both indoors and outdoors where necessary.								

Cyber security attacks aimed at the National Electricity Grid may result in the ransom of the National Electricity Grid. The operational impact on employees and investors – security is indicated in **Table 9-194.**

Table 9-194: Operational Impact on employees and investors – security

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Employees and investors - Security									
Without Mitigation	4	4	3	1	4	**48**	**Moderate**	(-)	Complex
With Mitigation	4	4	3	1	2	**24**	**Low**	(-)	
Mitigation and Management Measures	▪ Cyber security needs monitoring. ▪ Remote access to system needs to be negotiated and controlled. ▪ Install password controls, levels of authority etc. Protection of the National Electricity Grid from Cyber-attacks accessing through the BESS to be implemented. ▪ Cyber emergency procedures should be in place prior to commissioning.								

Emergencies

During the operational phase, there is the potential for fires, explosions, noxious smoke, large spills, traffic accidents and equipment/structural collapse. Inadequate emergency response to small event can lead to escalation. Consequences of these include injuries which can turn to fatalities, and small losses become extended down time. The operational impact on emergencies is outlined in **Table 9-195.**

Table 9-195: Operational Impact on emergencies

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Emergencies									
Without Mitigation	4	2	3	4	3	**39**	**Moderate**	(-)	Complex
With Mitigation	4	2	3	4	2	**26**	**Low**	(-)	
Mitigation and Management Measures	▪ All safety measures listed above must be implemented. ▪ Emergency procedures need to be practiced prior to commencement of operations.								

	▪ Ensure escape door open outwards, and doors hooked open when persons are inside, i.e. they should not be automatically self-closing. ▪ There must be more than one exit from buildings. ▪ Storage of spare batteries (e.g. in stores on site or elsewhere) also needs to consider possible thermal run away.

Investors Legal

The battery industry is evolving quickly with new guides, codes and regulations happening at the same time as evolving technology. This may result in unknown hazards that may manifest due to using "cheaper supplier or less developed technology". The operational impact on investors – legal is indicated in **Table 9-196.**

Table 9-196: Operational Impact on investors – legal

Potential Impact Investors - legal	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	3	1	3	3	4	40	Moderate	(-)	Moderate
With Mitigation	3	1	3	3	2	20	Low	(-)	
Mitigation and Management Measures	▪ Use only internationally reputable battery suppliers who comply with all known regulations/guideline at the time of purchasing. ▪ Ensure only latest state of the art battery system are used and not old technologies prone to fires/explosions etc..								

VRF BESS

From the details of accidents that have happened both with BESS installations and chemical plants in general, it is clear that many potential problems manifest during the commissioning phase when units are first powered up to test functionality. This phase is critical and all controls, procedures, mitigation measures etc that would be in place for full operation should be in place before commissioning commences.

Human Health - Chronic Exposure to Toxic Chemical or Biological Agents

Operation and maintenance materials such as spare parts, paints, solvents, welding fumes, transformers oils, lubricating oils and greases etc., can result in occupational illness. The operational impact on human health - chronic exposure to toxic chemical or biological agents is indicated in **Table 9-197.**

Table 9-197: Operational Impact on human health - chronic exposure to toxic chemical or biological agents

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Human health - Chronic exposure to toxic chemical or biological agents									
Without Mitigation	2	1	3	4	5	**50**	**Moderate**	(-)	Easy
With Mitigation	1	1	3	4	2	**18**	**Low**	(-)	
Mitigation and Management Measures	▪ The operation and maintenance phase to be managed according to all the requirements of the Occupational Health and Safety Act 85 of 1993. ▪ A SHEQ policy to be in place. ▪ A detailed risk assessment of all normal operating and maintenance activities on site to be compiled, and form the basis of operating instructions, prior to commencing commissioning. ▪ A SHE procedure to be in place, and include but not limited to, PPE specifications, management of change, integrity monitoring. ▪ Ensure that relevant SHE appointees are in place. ▪ Undertake training of staff on general hazards on site. ▪ All necessary health controls/ practices to be in place, e.g. ventilation of confined areas, occupational health monitoring if required and reporting programs in place. ▪ Emergency response plan for full operation and maintenance phase to be in place prior to beginning commissioning and to include aspects such as: ▪ appointment of emergency controller, ▪ emergency isolation systems for electricity, ▪ emergency isolation and containment systems for electrolyte, ▪ provision of PPE for hazardous materials response, ▪ provision of emergency facilities for staff at the main office building, ▪ provision of first aid facilities, ▪ first responder contact numbers etc.									

Compromised battery compartment vapours accumulate in the containers, as well as release solids/liquids on surfaces. Maintenance of battery components can cause corrosive and mildly toxic liquid on surfaces. This can result in dermatitis, and skin /eye/lung irritation. The operational impact on human health - chronic exposure to toxic chemical or biological agents is outlined in **Table 9-198.**

Table 9-198: Operational Impact on human health - chronic exposure to toxic chemical or biological agents

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Human Health - Chronic exposure to toxic chemical or biological agents									
Without Mitigation	2	1	3	5	4	**44**	**Moderate**	(-)	Complex
With Mitigation	1	1	3	5	2	**20**	**Low**	(-)	
Mitigation and Management Measures	▪ Maintenance procedures to be in place should equipment need to be opened, e.g. pumps drained and decontaminated prior to repair in workshop etc. ▪ Ensure PPE for handling battery parts and other equipment on site is specified and worn when required. ▪ Training of staff on general hazards on site must be conducted. ▪ Provide signage or labels on all equipment. ▪ Confined space entry procedures if entering tanks and possibly battery containers. ▪ Safety Data Sheets (SDSs) to be available on site. ▪ Operating manuals to be provided including start-up, shut-down, steady state, monitoring requirements. ▪ Maintenance manuals with make safe, decontamination and repair procedures to be in place. ▪ A maintenance schedule must be developed and implemented to include the required daily, weekly, monthly, annual etc maintenance. ▪ Provided portable equipment for calibration and for testing/verification of defective equipment, e.g. volt/current meters, infrared camera									

Human Health - Exposure to Noise

Moving parts inside containers, buildings, pumps, compressors, cooling systems etc. can cause adverse impact on hearing of workers, or may be a nuisance factor at near - by residences or other activities. The operational impact on human health - exposure to noise is outlined in **Table 9-199.**

Table 9-199: Operational Impact on human health - exposure to noise

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Human Health - exposure to noise									
Without Mitigation	2	1	5	5	4	52	Moderate	(-)	Easy
With Mitigation	2	1	5	5	2	26	Low	(-)	
Mitigation and Management Measures	▪ Design the system to ensure continuous noise does not exceed 85dB within the facilities or at any other location on site or 61 dB at the site boundary, e.g. emergency generator, air compressor etc. ▪ Employees to be provided with hearing protection if working near equipment that exceeds the noise limits.								

Human Health - Exposure to Temperature Extremes and/or Humidity

Workers may be exposed to extreme temperatures and/or humidity such as heat during the day and cold weather in winter. Batteries can also generate heat within enclosed buildings / containers, and night work requires lighting which can generate heat. This could result in heat stroke or hypothermia. The operational impact on human health - exposure to temperature extremes and/or humidity is indicated in **Table 9-200.**

Table 9-200: Operational Impact on human health - exposure to temperature extremes and/or humidity

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Human Health -exposure to temperature extremes and/or humidity									
Without Mitigation	4	2	3	1	2	20	Low	(-)	Easy
With Mitigation	3	2	3	1	1	9	Very Low	(-)	
Mitigation and Management Measures	▪ Building and container facilities to comply with Occupational Health and Safety Act 85 of 1993 specifically the thermal, humidity, lighting and ventilation requirements of the Environmental Regulations for Workplaces. ▪ Suitable lighting to be provided including emergency lighting for safe building exit in the event of power failure.								

	- Adequate potable water to be provided during all phases of the project. - PPE for operations and maintenance staff to be suitable for the weather conditions.

Human Health - exposure to psychological stress

Isolated workstation and monotonous repetitive work can cause low performance, and system productivity suffers. The operational impact on human health - exposure to psychological stress is outlined in **Table 9-201.**

Table 9-201: Operational Impact on human health - exposure to psychological stress

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Human Health - exposure to psychological stress									
Without Mitigation	2	3	3	2	2	20	Low	(-)	Easy
With Mitigation	1	3	3	2	1	9	Very Low	(-)	
Mitigation and Management Measures	- Implement staff rotation to other activities within the site where necessary. - Performance monitoring of inspections / maintenance tasks in particular must be undertaken.								

Human Health - Chronic Exposure to Ergonomic Stress

Lifting heavy equipment and movement at awkward angles during maintenance, stretching to reach high level and bending to low level, including working at heights if equipment is located on top of roofs or elevated electrical equipment (e.g. pylons), can result in back and other injuries. The operational impact on human health - exposure to ergonomic stress is outlined in **Table 9-202.**

Table 9-202: Operational Impact on human health - exposure to ergonomic stress

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Human Health - exposure to ergonomic stress									
Without Mitigation	5	1	3	2	3	33	Moderate	(-)	Easy

With Mitigation	4	1	3	2	2	**20**	**Low**	(-)	
Mitigation and Management Measures	▪ Training in lifting techniques must be provided. ▪ Working at heights training must be provided. ▪ If equipment is at height, ensure suitable safe (electrically and physically) ladders / harnesses etc. are available. ▪ A working at height procedure needs to be in place.								

Human and Equipment Safety – Exposure to Fire Radiation

During the operation of the facility there are chances of involvements in an external fire e.g. veld fire, maintenance vehicle fire, electrical systems fire. Manufacturing defects or damage to batteries leading to shorting and heating can also be an issue along with high humidity condensation of water or ingress of water or flooding leading to shorting. Dust accumulation on electrical parts leading to overheating. Excessive electrical loads and/or surges. Operator abuse, BMS failure or software failure. Incorrect extinguishing mediums can escalate the fire. Consequences include contaminated run off. Radiation burns unlikely to be severe as no highly flammable materials on site. Damaged equipment. Fire spreads to other units or offsite if grass/vegetation not controlled. The operational impact on human and equipment safety - exposure to fire radiation is outlined in **Table 9-203.**

Table 9-203: Operational Impact on human and equipment safety - exposure to fire radiation

Potential Impact Human and Equipment Safety - exposure to fire radiation	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	5	1	5	5	4	**48**	**Moderate**	(-)	Complex
With Mitigation	5	1	5	5	1	**16**	**Low**	(-)	
Mitigation and Management Measures	▪ Grass cutting and fire breaks around the BESS installations. No combustible materials to be stored in or near the batteries or electrical infrastructure, e.g. separation of site diesel tank. Fire resistant barrier between the batteries and the PCS side if in the same container. ▪ The Facility to comply with prescribed design standards such as the BESS design codes from the USA and standards of practice that (e.g. UL9540, NFPA 855 and DNV GL RP 43). ▪ A detailed Failure Modes and Effects Analysis (FMEA) / (Hazard and Operability Analysis (HAZOP)								

	/ Bowtie methodology must be developed during design at the component level and system levels. ▪ Conduct safety integrity level rating of equipment (failure probably) with suitable redundancy if required. ▪ Conduct Site Acceptance Testing as part of commissioning of each unit and the overall system. ▪ Abuse tests to be conducted by supplier. ▪ Ensure an effective Battery Management System (BMS) is included in the design. BMS should be checking individual cell voltage as well as stack, module, container, system voltages/current etc. BMS tripping the cell and possibly the stack/ building unit or module/rack/container, if variations in voltage. ▪ Diagnostics must be easily accessible. Diagnostics are able to distinguish cell from stack or cell from module faults. ▪ Fire resistant barrier between the batteries and the PCS side if in the same container, or separate containers must form part of the design. ▪ As per SANS Standards, suitable ingress protection level to be provided for electrical equipment, e.g. IP55 - 66. If air cooling into container, suitable dust filters to be provided if needed. ▪ Install smoke detectors linked to BMS & alerts in control room. ▪ Effects of battery aging to be considered. Temperature monitoring to be in place. Regular infrared scanning. Data needs to be stored for trend analysis. ▪ An Emergency plan, from transport and construction phase, must be extended to operational phase. The plan must include the hazards of the electrically live system. This Plan must include procedures to address solid state container fires - extinguishing, ventilating, entering as appropriate or not. ▪ PPE for container firefighting must include fire retardant, chemically resistant, nitrile gloves, antistatic acid resistant boots, fill face shields, BA sets. ▪ A planned fire response to prevent escalation to an explosion or an environmental event must be developed. ▪ Suitable supply of fire extinguishing medium and cooling medium must be provided. Fogging nozzles can be used to direct smoke. ▪ Ensure procedures in place to clean up after event Lingering toxic residues in the soil and on adjacent structures.

A Power Conversion System's (PCS – DC to AC) cooling failure can result in electrical fire. The consequence of this is that a fire can start in PCS or another section or room and spread to the battery area. The operational impact on human and equipment safety - exposure to fire radiation is outlined in **Table 9-204.**

Table 9-204: Operational Impact on human and equipment safety - exposure to fire radiation

Potential Impact Human and Equipment Safety - exposure to fire radiation	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	5	2	5	5	3	51	Moderate	(-)	Moderate
With Mitigation	5	2	5	5	1	17	Low	(-)	
Mitigation and Management Measures	▪ Consider separating the VRF building systems PCS from the batteries and other equipment and place it in another area.								

Human and Equipment Safety - Exposure to Explosion over pressures

Transformer shorting / overheating / explosion can result in potential fatalities amongst first responders; or damage to nearby equipment. The operational impact on human and equipment safety - exposure to explosion over pressures is indicated in **Table 9-205.**

Table 9-205: Operational Impact on human and equipment safety - exposure to explosion over pressures

Potential Impact Human and Equipment Safety - exposure to explosion over pressures	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	5	1	5	5	2	32	Moderate	(-)	Moderate
With Mitigation	5	1	5	5	1	16	Low	(-)	
Mitigation and Management Measures	Electrical equipment to be specified to suit application. An emergency response plan must be in place as referred to above and employee training on the plan must be provided.								

Human and Equipment Safety - Exposure to Acute Toxic Chemical and Biological Agents

Human pathogens and diseases, sewage, food waste as well as snakes, insects, wild and domesticated animals and harmful plants can cause illness and at worst without mitigation, possibly extending to fatalities. Effects can vary from discomfort to fatalities for venomous snakes or bee swarms etc. The operational impact on human and equipment safety - exposure to acute toxic chemical and biological agents is outlined in **Table 9-206.**

Table 9-206: Operational Impact on human and equipment safety - exposure to acute toxic chemical and biological agents

Potential Impact Human and Equipment Safety - exposure to acute toxic chemical and biological agents	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	4	1	3	2	3	30	Low	(-)	Moderate
With Mitigation	3	1	2	2	2	16	Low	(-)	
Mitigation and Management Measures	▪ All necessary good hygiene practices to be in place, e.g. provision of toilets, eating areas, infectious disease controls. ▪ Policies and practice for dealing with known vectors of disease such as Aids, TB, COVID 19 and others must be developed and implemented. ▪ Conduct awareness training for persons on site, safety induction to include animal hazards. ▪ First aid and emergency response to consider the necessary anti-venom, anti-histamines, topical medicines etc. ▪ Due to isolated locations and distance from town, the ability to treat with anti-venom and extreme allergic reactions on site is critical to mitigate the impacts.								

Damaged battery components, leakage of electrolyte, or if the components are completely broken exposing hazardous chemicals, and thermal runaway and hazardous fumes are released, this can cause mild skin irritation from exposure to small leaks to serious corrosive burns for large exposure. The operational impact on human and equipment safety - exposure to acute toxic chemical and biological agents is outlined in **Table 9-207.**

Table 9-207: Operational Impact on human and equipment safety - exposure to acute toxic chemical and biological agents for VRF BESS

Potential Impact Human and Equipment Safety - exposure to acute toxic chemical and biological agents	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	4	3	3	5	3	45	Moderate	(-)	Moderate
With Mitigation	3	3	3	5	2	28	Low	(-)	
Mitigation and Management Measures	▪ Corrosion resistant PPE (e.g. overalls, gloves, eyeglasses) to be specified for all operations in electrolyte areas. ▪ PPE to be increased (e.g. full-face shield, aprons, chemical suits) for operations that involve opening equipment and potential exposure, e.g. sampling, maintenance. ▪ All operators/maintenance staff trained in the hazards of chemicals on site. ▪ Ensure a 24/7 helpline response. ▪ Adhere to standard dangerous goods requirements for Hazmat labels. ▪ All operators/maintenance staff to be trained in the hazards.								

Human and Equipment Safety - Exposure to Violent Release of Kinetic or Potential Energy

Moving equipment, pumps, heavy equipment at elevation, nip points, working at heights, traffic accidents and earthquake/tremors can cause injury or possibly fatality in unlikely worst case, damage to equipment, spills, and environment pollution. The operational impact on human and equipment safety - exposure to violent release of kinetic or potential energy is outlined in **Table 9-208.**

Table 9-208: Operational Impact on human and equipment safety - exposure to violent release of kinetic or potential energy

Potential Impact Human and Equipment Safety - exposure to violent release of kinetic or potential energy	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	5	1	5	5	3	48	Moderate	(-)	Moderate
With Mitigation	5	1	5	5	1	16	Low	(-)	

Mitigation and Management Measures	▪ Maintenance equipment to be serviced and personnel suitably trained in the use thereof. ▪ Traffic signs, rules etc to be in place on site. ▪ All normal working at heights, hot work permits, confined space entry, cordon off unsafe areas/works etc procedures to be in place. ▪ An emergency response plan must be in place. ▪ Civil design to take seismic activity into account.

Human and Equipment Safety - Exposure to Electromagnetic Waves

The operational phase will include the use of electrical machines, generators etc. In hot dry areas, static generation is highly likely, as well as lightning strike. This may cause electrocution, ignition, burns, injury and death, as well as damage to electrical equipment. The operational impact on human and equipment safety - exposure to electromagnetic waves is outlined in **Table 9-209.**

Table 9-209: Operational Impact on human and equipment safety - exposure to electromagnetic waves

Potential Impact Human and Equipment Safety – exposure to electromagnetic waves	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	5	2	5	5	3	51	Moderate	(-)	Complex
With Mitigation	5	2	5	5	1	17	Low	(-)	
Mitigation and Management Measures	▪ Adhere to codes and guidelines for electrical insulation. ▪ Provide suitable PPE. ▪ Low voltage equipment (e.g. batteries) to be separated from high voltage (e.g. transmission to grid). ▪ Personnel to be trained in line with IEE 1657 – 2018 (Recommended Practice for Personnel Qualifications for Installation and Maintenance of Stationary Batteries). ▪ Adhere to Eskom Operating Regulations for high voltage systems including access control, permit to work, safe work procedures, live work, abnormal and emergency situations, keeping records. ▪ Consider suitably located Emergency stop buttons for the facility and the other equipment on site. ▪ Software also need to be kept as update to date as reasonably practicable.								

	- Consider suitably located Emergency stop buttons for the facility and the other equipment on site. - PPE to consider static accumulation for entering the facility, and particularly the battery containers especially after a high temperature shut down where there could possibly be flammable materials. - The procedures for responding to alarm and auto shut down on containers, needs to consider that there may be a dangerous environment inside and how to protect personnel who may enter to respond. - All outside work must be stopped during thunder storms. - Lighting conductors may be required for the installation, to be confirmed during design

Environment - Emissions to Air

Refrigerant may be an asphyxiant if accidentally released indoors it can accumulate and displace oxygen. It is however noted that this is not expected on a normal basis. The operational impact on environment - emissions to air is outlined in **Table 9-210.**

Table 9-210: Operational Impact on environment - emissions to air

Potential Impact Environment – emissions to air	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	3	1	1	1	3	**18**	**Low**	(-)	Easy
With Mitigation	3	1	1	1	1	**6**	**Very Low**	(-)	
Mitigation and Management Measures	- Containers could be treated as entering a confined space and similar procedures entering confined spaces could be in place, e.g. do not enter alone, gas testing prior to entering, ensure adequate ventilation. Particularly after any warning alarms have gone off, but possibly even normally.								

Environment - Emissions to Water

Waste will be generated during the operation of the facility. This may include cooling water blow-down, laboratory waste (if included in the design), maintenance waste, e.g. oils, spills from batteries, coolant system, diesel trucks, transformers, oil drips from parked vehicles, fire water runoff control, kitchen waste and sewage, refrigerant release or VRF electrolyte purging. These can cause pollution if not contained and excessive disposal costs if emissions not limited. These can cause pollution if not contained and excessive disposal costs if emissions are not limited. The operational impact on environment - emissions to water is outlined in **Table 9-211.**

Table 9-211: Operational Impact on environment - emissions to water

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Environment - emissions to water									
Without Mitigation	3	2	3	2	3	30	Low	(-)	Moderate
With Mitigation	3	2	3	2	2	20	Low	(-)	
Mitigation and Management Measures	▪ Electrolyte areas to be fully bunded to 110% of largest tank, or more. ▪ Implement bunding under any outdoors tanks, curbing under truck offloading areas and sealed surfaces (e.g. concrete) under truck parking area. ▪ Provide containment and suitable treatment/disposal for sewage and any kitchen liquids. ▪ Procedures for dealing with damaged/leaking equipment as well as clean-up of spills to be in place and implemented. ▪ Conduct normal site practices for preventing and containing diesel/paint etc spills. ▪ Waste management plan to be in place and provide measures for, but not limited to, liquid waste treatment or suitable removal and disposal. ▪ Spill clean-up procedures to be in place before bringing container on site, including spill kits – non-combustible materials, hazmat disposal. ▪ Undertake reporting of reportable quantities in line with NEMA. ▪ Process controls to be in place to prevent contamination and deterioration of electrolyte leading to excessive purging. ▪ Ensure proposed locations of the BESS facilities are a suitable distance from the closest water course. In the event of a major spill if this is too close it may not allow time for mitigation to be taken. Adequate secondary and possibly tertiary containment systems may then be needed on site.									

Environment - Emissions to Earth

The operation phase will generate solid waste. The disposal of battery components can cause environmental damage. The operational impact on environment - emissions to earth is outlined in **Table 9-212.**

Table 9-212: Operational Impact on environment - emissions to earth

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Environment – emissions to earth									
Without Mitigation	2	2	3	3	3	**30**	**Low**	(-)	Easy
With Mitigation	2	2	3	3	1	**10**	**Very Low**	(-)	
Mitigation and Management Measures	▪ Implement system for waste segregation (e.g. electronic equipment, chemicals) and management on the site.								

Environment – Waste of Resources

The operation phase will require the usage of water and power. Operations will include the disposal of batteries or components. However, if the usage is not controlled it will result in wastages. Excessive purging of deteriorated or contaminated electrolyte may occur. These may result in delays, excessive costs and disposal of large volumes of hazardous waste. The operational impact on environment - waste of resources e.g. water, power etc is outlined in **Table 9-213.**

Table 9-213: Operational Impact on environment - waste of resources e.g. water, power etc

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Environment - waste of resources e.g. water, power etc									
Without Mitigation	2	1	1	2	4	**24**	**Low**	(-)	Easy
With Mitigation	2	1	1	2	2	**12**	**Very Low**	(-)	
Mitigation and Management Measures	▪ Water usage to be monitored on site. ▪ Handling protocols to be provided by supplier of electrolyte. ▪ Water management plan and spill containment plans to be in place.								

	▪ Investigate end of Life plan for electrolyte batteries including options for reuse / recovery / reconditioning. ▪ Similarly, for decommissioned containers / equipment, consider reuse / recovery / repurpose.

Public - Aesthethics

Bright surfaces reflecting light and tall structures in a flat area may cause irritation. The operational impact on public - aesthetics is outlined in **Table 9-214.**

Table 9-214: Operational Impact on public - aesthetics

Potential Impact Public - Aesthetics	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	2	2	4	4	4	48	Moderate	(-)	Moderate
With Mitigation	1	2	4	4	2	22	Low	(-)	
Mitigation and Management Measures	▪ Visual impact assessment to include BESS installation when design details become available. Confirm any height limitations for VRFB BESS building (if utility scale).								

Investors - Financial

The result of possible defective technology and extreme project delays can cause financial loss. The operational impact on investors - financial is outlined in **Table 9-215.**

Table 9-215: Operational Impact on investors - financial

Potential Impact Investors - Financial	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	5	1	3	4	3	39	Moderate	(-)	Easy
With Mitigation	3	1	3	4	2	22	Low	(-)	
Mitigation and Management Measures	▪ Undertake adequate research during the planning and design phase to select the supplier and/or contractor with the best technology that is internationally recognized and proven.								

	▪ Project management with deviation monitoring.

Employees and Investors – Security

On route to the operational site there is a risk of potential hi-jacking of valuable but hazardous loads. On site there is a risk of theft of operational equipment and battery installation facilities. There may also be civil unrest or violent strike by employees. This may result in theft, injury to burglars, damage to equipment possibly setting off thermal runaway. The operational impact on employees and investors – security is outlined in **Table 9-216.**

Table 9-216: Operational Impact on employees and investors – security

Potential Impact Employees and investors - Security	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	3	1	3	2	4	36	Moderate	(-)	Moderate
With Mitigation	3	1	3	2	2	18	Low	(-)	
Mitigation and Management Measures	▪ Fencing around electrical infrastructure to adhere to SANS standard and Eskom Guidelines. ▪ Consider motion detection lights and CCTV. ▪ The hazardous nature of the electrical and battery equipment should be clearly indicated – e.g. Skull and Cross Bones or other signs. ▪ Night lighting to be provided both indoors and outdoors where necessary.								

Cyber security attacks aimed at the National Electricity Grid may result in the ransom of the National Electricity Grid. The operational impact on employees and investors – security is indicated in **Table 9-217.**

Table 9-217: Operational Impact on employees and investors – security

Potential Impact Employees and investors - Security	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	4	4	3	1	4	48	Moderate	(-)	Complex
With Mitigation	4	4	3	1	2	24	Low	(-)	
Mitigation and Management Measures	▪ Cyber security needs monitoring.								

	▪ Remote access to system needs to be negotiated and controlled. ▪ Install password controls, levels of authority etc. Protection of the National Electricity Grid from Cyber-attacks accessing through the BESS to be implemented. ▪ Cyber emergency procedures should be in place prior to commissioning.

Emergencies

During the operational phase, there is the potential for fires, explosions, noxious smoke, large spills, traffic accidents and equipment/structural collapse. Inadequate emergency response to small event can lead to escalation. Consequences of these include injuries which can turn to fatalities, and small losses become extended down time. The operational impact on emergencies is outlined in **Table 9-218.**

Table 9-218: Operational Impact on emergencies

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Emergencies									
Without Mitigation	4	2	3	4	3	**39**	**Moderate**	(-)	Complex
With Mitigation	4	2	3	4	2	**26**	**Low**	(-)	
Mitigation and Management Measures	▪ All safety measures listed above must be implemented. ▪ Emergency procedures need to be practiced prior to commencement of operations. ▪ Escape doors should swing open outwards and not into the building/container. ▪ There must be more than one exit from buildings.								

Investors Legal

The battery industry is evolving quickly with new guides, codes and regulations happening at the same time as evolving technology. This may result in unknown hazards that may manifest due to using “cheaper supplier or less developed technology”. The operational impact on investors – legal is indicated in **Table 9-219.**

Table 9-219: Operational Impact on investors – legal

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Investors - legal									
Without Mitigation	3	1	3	3	4	**40**	**Moderate**	(-)	Moderate
With Mitigation	3	1	3	3	2	**20**	**Low**	(-)	
Mitigation and Management Measures	▪ Use only internationally reputable battery suppliers who comply with all known regulations/guideline at the time of purchasing. ▪ Ensure only latest state of the art battery system are used and not old technologies prone to fires/explosions etc..								

9.17.3 DECOMMISSIONING PHASE

SSL and VRF BESS

Battery components may have a limited lifespan, there are damaged equipment, waste electrolyte etc. There could already be "waste" on the first day of commissioning and plans should be in place to deal with this. Ideally an End-of-Life plan needs to be in place before the first electrolyte / container / equipment is brought on site.

Human Health - Chronic Exposure to Toxic Chemical or Biological Agents

The decommissioning impact on human health - chronic exposure to toxic chemical or biological agents is outlined in **Table 9-220.**

Table 9-220: Decommissioning Impact on human health - chronic exposure to toxic chemical or biological agents for both BESS types

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Human health - Chronic exposure to toxic chemical or biological agents									
Without Mitigation	1	1	1	1	1	**4**	**Very Low**	(-)	Easy
With Mitigation	1	1	1	1	1	**4**	**Very Low**	(-)	
Mitigation and Management Measures	As per construction and operational phases.								

Human Health - Exposure to Noise

The decommissioning impact on human health - exposure to noise is outlined in **Table 9-221.**

Table 9-221: Decommissioning Impact on human health - exposure to noise for both BESS types

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Human Health - exposure to noise									
Without Mitigation	1	1	1	1	1	**4**	**Very Low**	(-)	Easy
With Mitigation	1	1	1	1	1	**4**	**Very Low**	(-)	
Mitigation and Management Measures	As per construction and operational phases.								

Human Health - Exposure to Temperature Extremes and/or Humidity

The decommissioning impact on human health - exposure to noise is outlined in **Table 9-222.**

Table 9-222: Decommissioning Impact on human health - exposure to temperature extremes and/or humidity for both BESS types

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Human Health -exposure to temperature extremes and/or humidity									
Without Mitigation	1	1	1	1	1	**4**	**Very Low**	(-)	Easy
With Mitigation	1	1	1	1	1	**4**	**Very Low**	(-)	
Mitigation and Management Measures	As per construction and operational phases.								

Human Health - exposure to psychological stress

The decommissioning impact on human health - exposure to psychological stress is outlined in **Table 9-223.**

Table 9-223: Decommissioning Impact on human health - exposure to psychological stress for both BESS types

Potential Impact Human Health - exposure to psychological stress	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	1	1	1	1	1	**4**	**Very Low**	(-)	Easy
With Mitigation	1	1	1	1	1	**4**	**Very Low**	(-)	
Mitigation and Management Measures	As per construction and operational phases.								

Human Health - Chronic Exposure to Ergonomic Stress

The decommissioning impact on human health - exposure to ergonomic stress is outlined in **Table 9-224.**

Table 9-224: Decommissioning Impact on human health - exposure to ergonomic stress for both BESS types

Potential Impact Human Health - exposure to ergonomic stress	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	1	1	1	1	1	**4**	**Very Low**	(-)	High
With Mitigation	1	1	1	1	1	**4**	**Very Low**	(-)	High
Mitigation and Management Measures	As per construction and operational phases.								

Human and Equipment Safety – Exposure to Fire Radiation

The decommissioning impact on human and equipment safety - exposure to fire radiation is outlined in **Table 9-225.**

Table 9-225: Decommissioning Impact on human and equipment safety - exposure to fire radiation for both BESS types

Potential Impact Human and Equipment Safety - exposure to fire radiation	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	1	1	1	1	1	4	Very Low	(-)	Easy
With Mitigation	1	1	1	1	1	4	Very Low	(-)	
Mitigation and Management Measures	As per construction and operational phases.								

Human and Equipment Safety - Exposure to Explosion over pressures

The decommissioning impact on human and equipment safety - exposure to explosion over pressures is outlined in **Table 9-226.**

Table 9-226: Decommissioning Impact on human and equipment safety - exposure to explosion over pressures for both BESS types

Potential Impact Human and Equipment Safety - exposure to explosion over pressures	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	1	1	1	1	1	4	Very Low	(-)	Easy
With Mitigation	1	1	1	1	1	4	Very Low	(-)	
Mitigation and Management Measures	As per construction and operational phases.								

Human and Equipment Safety - Exposure to Acute Toxic Chemical and Biological Agents

The decommissioning impact on human and equipment safety - exposure to acute toxic chemical and biological agents is outlined in **Table 9-227.**

Table 9-227: Decommissioning Impact on human and equipment safety - exposure to acute toxic chemical and biological agents for both BESS types

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Human and Equipment Safety - exposure to acute toxic chemical and biological agents									
Without Mitigation	1	1	1	1	1	4	Very Low	(-)	Easy
With Mitigation	1	1	1	1	1	4	Very Low	(-)	
Mitigation and Management Measures	As per construction and operational phases.								

Human and Equipment Safety - Exposure to Violent Release of Kinetic or Potential Energy

The decommissioning impact on human and equipment safety - exposure to violent release of kinetic or potential energy is outlined in **Table 9-228.**

Table 9-228: Decommissioning Impact on human and equipment safety - exposure to violent release of kinetic or potential energy for both BESS types

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Human and Equipment Safety - exposure to violent release of kinetic or potential energy									
Without Mitigation	1	1	1	1	1	4	Very Low	(-)	Easy
With Mitigation	1	1	1	1	1	4	Very Low	(-)	
Mitigation and Management Measures	As per construction and operational phases.								

Human and Equipment Safety - Exposure to Electromagnetic Waves

The decommissioning impact on human and equipment safety - exposure to electromagnetic waves is outlined in **Table 9-229.**

Table 9-229: Decommissioning Impact on human and equipment safety - exposure to electromagnetic waves for both BESS types

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Human and Equipment Safety – exposure to electromagnetic waves									
Without Mitigation	1	1	1	1	1	4	Very Low	(-)	Easy
With Mitigation	1	1	1	1	1	4	Very Low	(-)	
Mitigation and Management Measures	As per construction and operational phases.								

Environment - Emissions to Air

The decommissioning impact on environment - emissions to air is outlined in **Table 9-230.**

Table 9-230: Decommissioning Impact on environment - emissions to air for both BESS types

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Environment – emissions to air									
Without Mitigation	1	1	1	1	1	4	Very Low	(-)	Easy
With Mitigation	1	1	1	1	1	4	Very Low	(-)	
Mitigation and Management Measures	As per construction and operational phases.								

Environment - Emissions to Water

The decommissioning impact on environment - emissions to water is outlined in **Table 9-231.**

Table 9-231: Decommissioning Impact on environment - emissions to water for both BESS types

Potential Impact Environment - emissions to water	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	1	1	1	1	1	4	Very Low	(-)	Easy
With Mitigation	1	1	1	1	1	4	Very Low	(-)	
Mitigation and Management Measures	As per construction and operational phases.								

Environment - Emissions to Earth

Batteries / equipment will reach its end of life and may leak. This may result in environment damage from heavy metal ions. The decommissioning impact on environment - emissions to earth is outlined in **Table 9-232.**

Table 9-232: Decommissioning Impact on environment - emissions to earth for both BESS types

Potential Impact Environment – emissions to earth	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	4	3	3	5	4	60	Moderate	(-)	Complex
With Mitigation	4	3	3	5	2	30	Low	(-)	
Mitigation and Management Measures	Develop and implement End of Life shutdown procedure including a risk assessment of the specific activities involved. Re-purpose the solid-state batteries / containers and equipment with associated Environmental impact considered. Undertake disposal according to local regulations and other directives such as the European Batteries Directive. End of life can be predefined and the monitoring can be in place to determine if it has been reached. Consider impact of temperature and time, cycles								

Environment – Waste of Resources

The decommissioning impact on environment - waste of resources e.g. water, power etc is outlined in **Table 9-233.**

Table 9-233: Decommissioning Impact on environment - waste of resources e.g. water, power etc for both BESS types

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Environment - waste of resources e.g. water, power etc									
Without Mitigation	1	1	1	1	1	**4**	**Very Low**	(-)	Easy
With Mitigation	1	1	1	1	1	**4**	**Very Low**	(-)	
Mitigation and Management Measures	As per construction and operational phases.								

Public - Aesthetics

The decommissioning impact on public - aesthetics is outlined in **Table 9-234.**

Table 9-234: Decommissioning Impact on public - aesthetics for both BESS types

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Public - Aesthetics									
Without Mitigation	1	1	1	1	1	**4**	**Very Low**	(-)	Easy
With Mitigation	1	1	1	1	1	**4**	**Very Low**	(-)	
Mitigation and Management Measures	As per construction and operational phases.								

Investors - Financial

The decommissioning impact on investors - financial is indicated in **Table 9-235**.

Table 9-235: Decommissioning Impact on investors - financial for both BESS types

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
INVESTORS - FINANCIAL									
Without Mitigation	1	1	1	1	1	**4**	**Very Low**	(-)	Easy
With Mitigation	1	1	1	1	1	**4**	**Very Low**	(-)	
Mitigation and Management Measures	As per construction and operational phases.								

Employees and Investors – Security

Table 9-236: Decommissioning Impact on employees and investors – security for both BESS types

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Employees and investors - Security									
Without Mitigation	1	1	1	1	1	**4**	**Very Low**	(-)	Easy
With Mitigation	1	1	1	1	1	**4**	**Very Low**	(-)	
Mitigation and Management Measures	As per construction and operational phases.								

Emergencies

The decommissioning impact on emergencies is outlined in **Table 9-237.**

Table 9-237: Decommissioning Impact on emergencies for both BESS types

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
EMERGENCIES									
Without Mitigation	1	1	1	1	1	**4**	**Very Low**	(-)	Easy

With Mitigation	1	1	1	1	1	**4**	**Very Low**	(-)	
Mitigation and Management Measures	As per construction and operational phases.								

Investors Legal

Disposal of hazardous "waste" is rife with difficulties and numerous regulations that need to be complied with. The decommissioning impact on investors – legal is outlined in **Table 9-238.**

Table 9-238: Decommissioning Impact on investors – legal for both BESS types

Potential Impact Investors - legal	**Magnitude**	**Extent**	**Reversibility**	**Duration**	**Probability**	**Significance**		**Character**	**Ease of mitigation**
Without Mitigation	3	1	3	3	4	**40**	**Moderate**	(-)	Complex
With Mitigation	3	1	3	3	3	**30**	**Low**	(-)	
Mitigation and Management Measures	Applicants should seek the opinion from a waste consultant on how to correctly dispose of hazardous waste.								

10 CUMULATIVE IMPACTS

Although the S&EIR process is essential to assessing and managing the environmental and social impacts of individual projects, it often may be insufficient for identifying and managing incremental impacts on areas or resources used or directly affected by a given development from other existing, planned, or reasonably defined developments at the time the risks and impacts are identified.

IFC PS 1 recognizes that, in some instances, cumulative effects need to be considered in the identification and management of environmental and social impacts and risks. For private sector management of cumulative impacts, IFC considers good practice to be two pronged:

- effective application of and adherence to the mitigation hierarchy in environmental and social management of the specific contributions by the project to the expected cumulative impacts; and
- best efforts to engage in, enhance, and/or contribute to a multi-stakeholder, collaborative approach to implementing management actions that are beyond the capacity of an individual project proponent.

Even though Performance Standard 1 does not expressly require, or put the sole onus on, private sector clients to undertake a cumulative impact assessment (CIA), in paragraph 11 it states that the impact and risk identification process “will take into account the findings and conclusions of related and applicable plans, studies, or assessments prepared by relevant government authorities or other parties that are directly related to the project and its area of influence” including “master economic development plans, country or regional plans, feasibility studies, alternatives analyses, and cumulative, regional, sectoral, or strategic environmental assessments where relevant.”

Cumulative impacts are those that result from the successive, incremental, and/or combined effects of an action, project, or activity when added to other existing, planned, and/or reasonably anticipated future ones. For practical reasons, the identification and management of cumulative impacts are limited to those effects generally recognized as important on the basis of scientific concerns and/or concerns of affected communities (IFC GPH).

Evaluation of potential cumulative impacts is an integral element of an impact assessment. In reference to the scope for an impact assessment, IFC’s Performance Standards specify that “Risks and impacts will be analysed in the context of the project’s area of influence. This area of influence encompasses…areas potentially impacted by cumulative impacts from further planned development of the project, any existing project or condition, and other project-related developments that are realistically defined at the time the Social and Environmental Assessment is undertaken; and (iv) areas potentially affected by impacts from unplanned but predictable developments caused by the project that may occur later or at a different location.” (IFC 2006).

A cumulative impact assessment is the process of (a) analysing the potential impacts and risks of proposed developments in the context of the potential effects of other human activities and natural environmental and social external drivers on the chosen Valued Environmental and Social Components (VECs) over time, and (b) proposing concrete measures to avoid, reduce, or mitigate such cumulative impacts and risk to the extent possible (IFC GPH).

Cumulative impacts with existing and planned facilities may occur during construction and operation of the proposed facility and associated infrastructure. While one project may not have a significant negative impact on sensitive resources or receptors, the collective impact of the projects may increase the severity of the potential impacts.

Potential cumulative impacts identified are summarised below. Other planned or existing projects that can interact with the Project will be identified during stakeholder engagement and finalisation of the S&EIA process.

10.1 NOISE

The proposed Dalmanutha WEF is located adjacent to the proposed Dalmanutha West WEF, with the Haverfontein wind energy facility near Carolina, 9km south of the site. Common receptors shared between the Dalmanutha and Dalmanutha West WEFs are Rec 01, Rec 49 and Rec 50. Based on the close proximity of these receptors to the wind turbines at the Dalmanutha West WEF, cumulative noise impacts at these two locations may be noted.

It is also understood that a Prospecting Right Application for coal has been lodged by Elispec Mining (DMRE Ref No. MP 30/5/1/1/2/17337 PR) for a portion of the northern part of the proposed Dalmanutha WEF. It is noted that a wind facility would have significantly less impact on the noise climate of the area than the proposed mining activities, should the prospecting right be granted and later converted to a mining right.

10.2 SURFACE WATER

The proposed Dalmanutha Wind Energy Facility is located in a fairly remote part of the Komati River catchment where current impacts to the aquatic resources are largely related to agropastoral activities, isolated small rural residential dwellings and growing informal rural settlements. Conversion of isolated grasslands and croplands to forestry was also observed. The Mpumalanga Highveld region contains one of the highest concentrations of FEPAs in the country. Therefore, although the study area is not situated in a Strategic Water Source Areas, it is situated in a region that is considered the source of several of the country's major rivers, which collectively contribute 28% of South Africa's available water yield (biodiversityadvisor.sanbi.org, accessed December 2022). Beneath the surface, however, the Mpumalanga Highveld straddles coalfields that are estimated to collectively contain 51% of national recoverable coal reserves and the water resources associated with the study area are continually under threat from ever encroaching coal mining activities in the greater catchment.

Furthermore, the impacts of coal mining and the associated use for energy production has the potential to result in significant carbon emissions, which in turn, contributes to climate change. The effects of climate change are far reaching and have been proven to result in disruptions to weather patterns, with increasing impacts to water availability (Kusangaya *et al.,* 2013). The extraction and use of coal-fired energy can contribute to greenhouse gas (GHG) emissions by as much as 67.5 to 1,689.0 grams of CO^2-equivalents per kilowatt-hour, depending on the technologies being used. In contrast, while wind energy facilities have been shown to result in carbon emissions over the course of their life cycles (construction phase, operational phase and decommissioning phase), these fall within a range of about five to 26.0 grams of CO^2-equivalents per kilowatt hour, with the largest emissions associated with the construction phase which largely involves the materials used in construction and the associated transport (yaleclimateconnections.org; Mello *et al*., 2020).

During the operational phase, however, wind energy is known for its low carbon footprint, with no to negligible generation of water or air pollution other than that potentially related to maintenance activities. Wind energy facilities also generally do not require water for cooling purposes, which is an extremely important consideration given South Africa’s scarcity of water. Unlike fossil fuels and nuclear power plants, wind energy has one of the lowest water-consumption footprints, which makes it key for conserving hydrological resources.

The sterilisation of this area from mining rights in support of renewable energy therefore has significant potential to contribute to the long-term conservation of water resources and result in positive long-term benefits for the catchment.

Table 10-1 – Cumulative Impact on surface water

Potential Impact Sterilisation from mining rights Maintenance of biodiversity	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	3	3	3	4	5	65	High	(+)	Easy
With Mitigation	3	3	3	4	5	65	High	(+)	
Mitigation and Management Measures	As per section 8.8 of the EMPr (**Appendix I**)								

10.3 SOILS AND AGRICULTURE

Sheep, dairy, maize, potato and timber farming take place in the area. The project site vegetation includes maize, grasses and trees. Coal and black granite are mined in the area.

There are three approved renewable energy projects in the Mpumalanga Province within 40km of the Dalmanutha Project site. These are:

- The 14MW Machadodorp PV 1 solar energy facility on portion 8 of the farm De Kroon 363, 11km northeast of the site,
- The Haverfontein wind energy facility near Carolina, 9km south of the site, and
- The Eskom Arnot PV Facility at the Arnot Power Station on the Remainder of Portion 24 of Rietkuil 491 JS near Middleburg, 31km southwest of the site.

These sites are too far from the Dalmanutha Project site to have a cumulative effect on soil compaction, erosion and contamination at this stage. Following this, a very recent (late 2022) coal prospecting right application was submitted on all portions of the Farm Berg-en dal, potentially reducing the agricultural land on these portions significantly. Should both the Dalmanutha energy project and the coal prospecting project go ahead, construction and operation of a coal mine (should the prospecting right eventually be converted into a mining right) in the immediate vicinity of the proposed wind farm will lead to the following cumulative impacts: loss of agricultural land, soil erosion and soil contamination. The cumulative impact significance ratings have been calculated assuming this coal prospecting project does go ahead.

Table 10-2 – Cumulative Impact on soil loss

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Cumulative Impact on soil loss									
Without Mitigation	5	3	3	5	5	80	High	(-)	Moderate
With Mitigation	3	3	3	4	4	52	Moderate	(-)	
Mitigation measures	As per section 9.3								

Table 10-3 – Cumulative Impact on Loss of Arable Land

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Cumulative Impact on Loss of Arable Land									
Without Mitigation	5	3	3	5	5	80	High	(-)	Moderate
With Mitigation	3	3	3	4	4	52	Moderate	(-)	
Mitigation measures	As per section 9.3								

Table 10-4 – Cumulative Impact on Disturbance to Agricultural Practices

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Disturbance to Agricultural Practices									
Without Mitigation	5	3	3	5	5	**80**	**High**	(-)	Moderate
With Mitigation	3	3	3	4	3	**39**	**Moderate**	(-)	
Mitigation measures	As per section 9.3								

Table 10-5 – Cumulative Impact on Erosion and Sedimentation

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Cumulative Impact on Erosion and Sedimentation									
Without Mitigation	4	3	3	5	5	**75**	**High**	(-)	Moderate
With Mitigation	2	3	3	4	5	**60**	**Moderate**	(-)	
Mitigation measures	As per section 9.3								

Table 10-6 – Cumulative Impact on soil contamination

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Cumulative Impact on soils contamination									
Without Mitigation	4	3	3	5	5	**75**	**High**	(-)	Moderate
With Mitigation	2	3	3	4	5	**60**	**Moderate**	(-)	
Mitigation measures	As per section 9.3								

10.4 AVIFUANA

In relation to an activity, cumulative impact "means the past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity, that in itself may not be significant, but may be significant when added to the existing and reasonably foreseeable impacts eventuating from similar or diverse activities" (NEMA EIA Reg GN R982 of 2014).

There are three approved renewable energy projects within 40km of Dalmanutha **Figure 10-1**

- The construction of the 14MW Machadodorp PV 1 solar energy facility on portion 8 0f the farm De Kroon 363 in Mpumalanga Province – 11km NE of the Site
- Proposed establishment of the Haverfontein wind energy facility near Carolina, Mpumalanga Province – 9km S of the Site
- Eskom Arnot PV Facility at the Arnot Power Station on Remainder of Portion 24 of Reitkuil 491 JS near Middleburg in Mpumalanga – 31km SW of the site

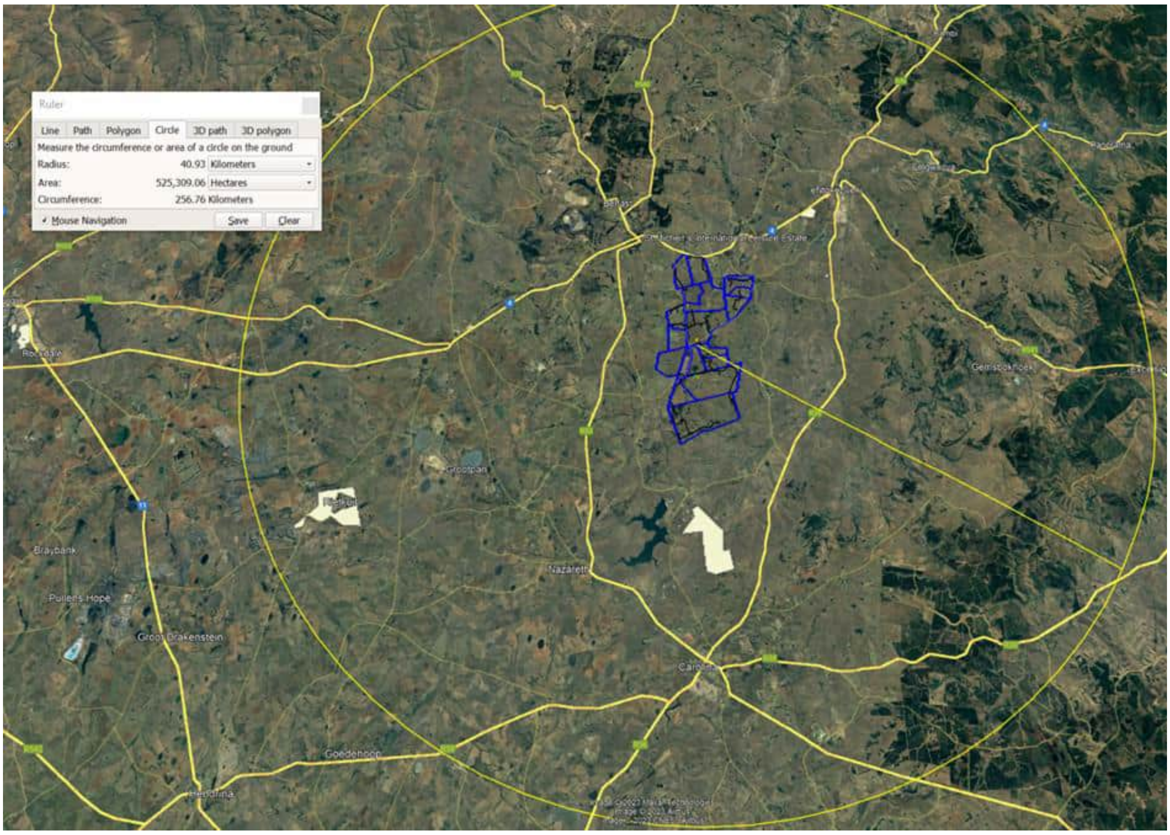


Figure 10-1 – Renewable energy projects within 40km of the proposed site.

The cumulative impact of wind energy (and solar PV) on avifauna in the proposed area has been assessed according to the guidance in the DEA (DEAT (2004) Cumulative Effects Assessment, Integrated Environmental Management, Information Series 7, Department of Environmental Affairs and Tourism (DEAT), Pretoria); and the IFC guidelines (Good Practice Handbook - Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets).

Specifically, the steps undertaken in the cumulative impact assessment section of the study were as follows:

- Identify and obtain details for all operational and authorised overhead power lines and wind farms (within 30km radius of the proposed project).
- Identify impacts of the proposed project which are also likely or already exist at the other projects. The primary impacts that are common to the various projects are: habitat destruction; and collision of birds with wind turbines.
- Obtain reports and data for other projects (if possible). The specialist obtained the report for the Haverfontein wind farm only.
- As far as possible quantify the effect of all projects on key bird species local populations (will need to be defined and estimated). The Haverfontein wind farm was proposed to be 33 turbines. Assuming all factors equal, this would have roughly half the turbine collision fatality impact of the proposed Dalmanutha facility (70 turbines).
- Express the likely impacts associated with the proposed project as a proportion of the overall impacts on key species. The proposed Dalmanutha project will have approximately two-thirds of the full impact on birds through turbine collision.
- A reasoned overall opinion will be expressed on the suitability of the proposed development against the above background (i.e. whether the receiving environment can afford to accommodate additional similar impacts). This will include a cumulative impact assessment statement. The impacts of wind turbines on birds in this area is a significant concern as expressed elsewhere. The fatality impact is directly proportional to the number of turbines, so the cumulative impact is certainly greater than that of one project alone.

Table 10-7 – Cumulative Impact on avifauna

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Collision of birds with turbines									
Without Mitigation	2	3	5	4	5	70	High	(-)	Moderate
With Mitigation	2	3	5	4	5	70	High	(-)	

10.5 ANIMAL SPECIES

Large portions of the study area and the surrounding landscape are modified and fragmented as a consequence of various anthropogenic land uses, most notably agriculture. Moreover, coal mining, although not present in the study area itself, is prevalent across the surrounding landscape. These anthropogenic activities, amongst others, have caused and continue to cause, ongoing habitat loss, disturbance and fragmentation, and this is placing additional pressure on the functioning and integrity of remaining patches of natural and semi-natural habitat in the landscape.

The proposed Project will have a direct negative impact on terrestrial fauna, primarily through habitat loss, disturbance and fragmentation. The cumulative loss of fauna habitat in the region is a concern with respect to the preservation of local fauna populations, particularly fauna SCC.

In comparison to other anthropogenic land uses in the landscape (such as mining), the impacts associated with the proposed Project are limited in extent and can be effectively mitigated through correct on-site management. Prior to any form of mitigation, the cumulative impacts on terrestrial fauna linked to the proposed Project are rated High. However, provided the management and mitigation measures presented in this report are implemented, the cumulative impacts on terrestrial fauna can be reduced to Low significance.

Table 10-8 – Cumulative impact on terrestrial fauna

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Cumulative impact on terrestrial fauna									
Without Mitigation	5	2	5	5	4	68	High	(-)	High
With Mitigation	4	1	1	2	2	16	Low	(-)	
Mitigation and Management Measures	▪ As per the impact assessment Section 9.8								

10.6 PLANT SPECIES

Large portions of the study area and the surrounding landscape are modified and fragmented as a consequence of various anthropogenic land uses, most notably agriculture. Moreover, coal mining, although not present in the study area itself, is prevalent across the surrounding landscape. These anthropogenic activities, amongst others, have caused and continue to cause ongoing habitat loss, disturbance and fragmentation, and this is placing additional pressure on the functioning and integrity of remaining patches of natural and semi-natural habitat in the landscape.

The proposed Project will have a direct negative impact on terrestrial flora in the study area through habitat loss, disturbance and fragmentation. The cumulative loss of flora habitat, particularly areas designated CBA Irreplaceable and CBA Optimal under the MBSP, is a concern with respect to meeting biodiversity conservation targets and the preservation of individual flora SCC.

In comparison to other anthropogenic land uses in the landscape (such as mining), the impacts associated with the proposed Project are limited in extent and can be effectively mitigated through correct on-site management. Prior to any form of mitigation, the cumulative impacts on terrestrial flora linked to the proposed Project are rated High. However, provided the management and mitigation measures presented in this report are implemented, the cumulative impacts on terrestrial flora can be reduced to Low significance.

Table 10-9 – Cumulative Impact on terrestrial flora

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	5	2	5	5	4	68	High	(-)	Easy
With Mitigation	4	1	1	2	2	16	Low	(-)	
Mitigation and Management Measures	As per the mitigation measures in Section 9.7								

10.7 AQUATIC BIODIVERSITY

The loss and fragmentation of the wetland ecosystems as a result of access road construction will add to cumulative impacts on these ecosystems in the landscape, in combination with wetland loss as a result of agricultural and mining activities in the larger catchment. The direct losses of wetlands cannot be mitigated outright, and as such the Project will contribute to the cumulative rate of loss of wetlands in the Mpumalanga Highveld ecoregion.

The effective implementation of the recommended mitigation measures, and the implementation of the offsite offset to address the loss of wetlands in the catchment will be key in ensuring that the Project's contribution to cumulative effects on wetlands are minimised, through protecting and conserving currently unprotected wetland habitat in the study area, and rehabilitating targeted wetlands in the Project area to improve their condition and thus enhance their level of functioning; thereby offsetting the anticipated losses.

Table 10-10 – Cumulative impact on aquatic biodiversity

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Cumulative impact on aquatic biodiversity									
Without Mitigation	5	2	5	5	4	68	High	(-)	High
With Mitigation	2	1	3	2	3	24	Low	(-)	

Mitigation and Management Measures	▪ As per the impact assessment Section 9.9

10.8 PALAEONTOLOGY

As far as the palaeontology is concerned, there are no cumulative impacts because each site is unique and may or may not have fossils. Fossil bones may be scattered over the landscape but their distribution is erratic and unpredictable. If a bone-bed or plant outcrop occurs this would be an aerially small concentration of fossils and very unlikely to extend beyond tens of metres. Therefore, projects on adjacent land parcels are unlikely to add any impact on this project.

10.9 HERITAGE

The project will alter the sense of place and cultural landscape and can contribute to the depletion of the heritage record of the area.

Table 10-11 – Cumulative Impact Cultural landscape

Potential Impact Cultural landscape and record of the area	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	4	3	5	5	3	**51**	**Moderate**	(-)	Easy
With Mitigation	3	2	4	4	2	**26**	**Low**	(-)	
Mitigation and Management Measures	▪ Implement best practice to preserve heritage resources and reduce visual impacts on the landscape.								

10.10 VISUAL AND LANDSCAPE

The cumulative visual impact of the proposed Dalmanutha WEF, the other associated WEF in the Cluster and grid connection will primarily occur on the plains. It is also important to note that the proposed WEF is located directly adjacent to the Emalaheni REDZ. The cumulative visual impact is expected to be moderate, depending on the observer's sensitivity to wind turbine structures.

Table 10-12 – Cumulative Impact of wind farms on the visual quality of the landscape

Potential Impact Cumulative Impact of wind farms on the visual quality of the landscape	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	
Overall impact of the proposed project considered in isolation	8	7	1	4	3	**39**	**Moderate**	(-)	
Cumulative impact of the project and other projects in the area	8	1	1	4	4	**52**	**Moderate**	(-)	

10.11 TRAFFIC

The known potential developments in the vicinity of the Dalmanutha WEF are the following:

The Dalmanutha West WEF is planned to be located directly west of the Dalmanutha WEF. It will take access off the D1477 and R33 during its construction and operational phases.

The proposed Elispec coal prospecting project will be located on the Farm Berg-en-Dal. Refer to **Figure 10-2** for a location map.

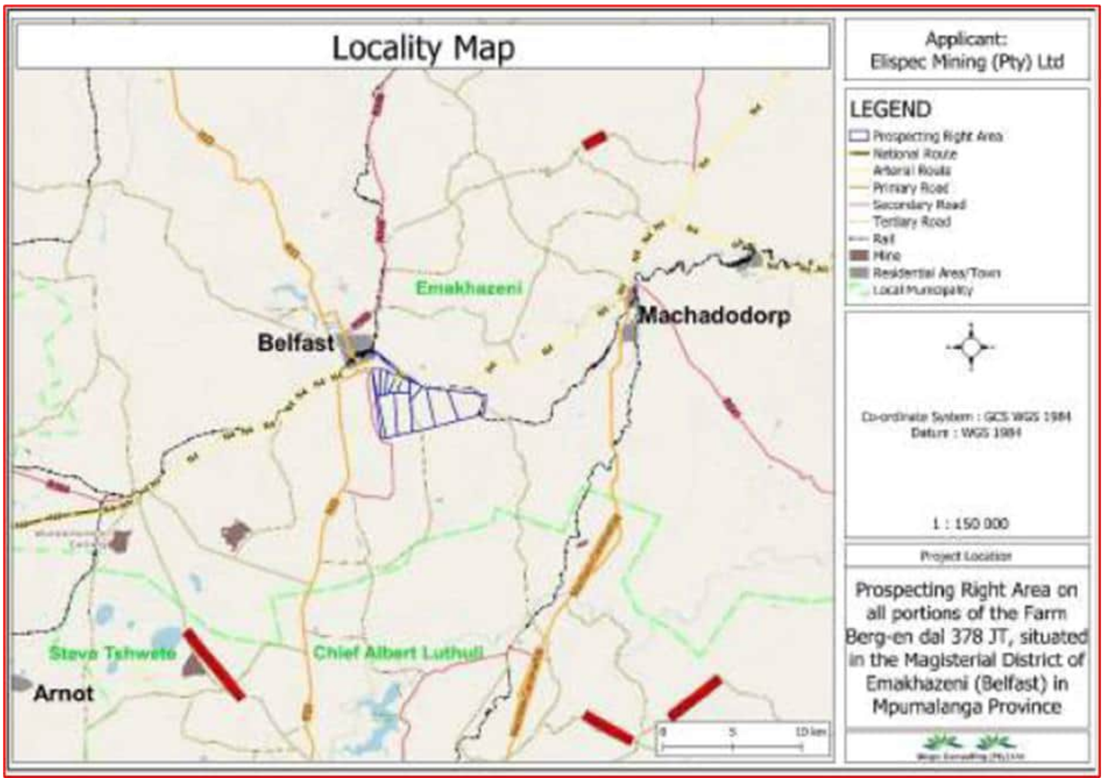


Figure 10-2 – Location of Proposed Elispec coal prospecting project

Access to the Dalmanutha West WEF will only be via the R33 and the D1477. The cumulative traffic impact of this facility during construction and operation on the Dalmanutha WEF (Alternative 1 & 2) is zero and was not assessed further as they do not share the local district roads for access.

The cumulative impact of the prospecting project was not assessed as no traffic and access information was made available. Note that the mine may take access off the same accesses of the N4 that the WEF will utilise, and this may have a cumulative impact.

The cumulative impact of the decommissioning phases of the WEF and the potential developments were not assessed, as it cannot be determined if and when decommissioning will occur.

10.12 SOCIAL

The Dalmanutha WEF Project impacts on the social environment have been indicated in this report. However, within a 40km radius of Dalmanutha, other approved renewable energy projects will further impact communities. These projects are:

- The construction of the 14MW Machadodorp PV 1 Solar Energy Facility on Portion 8 of the farm De Kroon 363 in Mpumalanga Province – 11km NE of the Site
- The proposed establishment of the Haverfontein WEF near Carolina, Mpumalanga Province – 9km S of the Site
- Eskom Arnot PV Facility at the Arnot Power Station on Remainder of Portion 24 of Rietkuil 491 JS near Middleburg in Mpumalanga – 31km SW of the site

The impacts of the projects mentioned above are likely to be similar to the ones discussed in this study for the Dalmanutha Facility. It should be noted that the landowners whose land the Project is on fully agree with the development. The developer has full consent to use the land for this Project.

Collectively these projects will have the following impacts:

- Change in the sense of place from a rural setting to one of light industry. Intrusion impacts such as noise, visual change and traffic may increase.
- Enhanced electricity generation for the national grid.
- Increased economic development during the construction of the facilities and the operation of the facilities.
- Positive economic inputs into the local economy.
- Increased local employment.

10.13 GEOTECHNICAL

The cumulative impacts associated with the project are outlined below.

Table 10-13 – Cumulative Impact of erosion

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Soil Erosion									
Without Mitigation	3	2	3	3	4	**44**	**Moderate**	(-)	Easy
With Mitigation	2	1	1	2	2	**12**	**Very Low**	(-)	
Mitigation and Management Measures	▪ Use existing road network and access tracks where possible. ▪ Use temporary berms and drainage channels to divert surface water. ▪ Minimize earthworks and demolish footprints. ▪ Rehabilitate affected areas (such as revegetation). ▪ Develop a chemical spill response plan. Reinstate channelized drainage features.								

Table 10-14 – Cumulative Impact on geology from potential oil spillages

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Potential Oil Spillages									
Without Mitigation	4	3	5	5	4	**68**	**High**	(-)	Easy
With Mitigation	2	1	3	1	2	**14**	**Very Low**	(-)	
Mitigation and Management Measures	▪ Vehicle and construction machinery repairs to be undertaken in designated areas with proper soil protection. ▪ Frequent checks and conditional monitoring of vehicles and equipment on site								

10.14 BATS

There are currently no operational renewable energy facilities within 50km of the proposed Dalmanutha WEF, but there are three facilities that have been approved. Two of these are solar facilities (Machadodorp PV 1 solar energy facility and Eskom

Arnot PV Facility), but no data on the occurrence of bats or their abundance is available as bat monitoring is not a requirement for SEFs.

The third facility is the Haverfontein WEF located 9 km south of the Dalmanutha WEF. A Sensitivity Assessment confirmed the presence of *L.capensis* and *T.aegyptiaca* on site, but no data is currently available on bat activity across a 12-month period for this site.

There is little data available on the cumulative impact that WEFs may have on bat populations, and this is largely due to data obtained from other WEF not being readily available. This said, it is not expected that the nearby Haverfontein WEF should result in a fatal flaw for the Dalmanutha WEF. Few roosts were found on Haverfontein WEF, and it is thus expected that the bat abundance, and subsequent activity, should be relatively low.

11 ENVIRONMENTAL IMPACT STATEMENT

The essence of any S&EIR process is aimed at ensuring informed decision-making, environmental accountability, and to assist in achieving environmentally sound and sustainable development. In terms of NEMA, the commitment to sustainable development is evident in the provision that “development must be socially, environmentally, and economically sustainable and requires the consideration of all relevant factors…” NEMA also imposes a duty of care, which places a positive obligation on any person who has caused, is causing, or is likely to cause damage to the environment to take reasonable steps to prevent such damage. In terms of NEMA’s preventative principle, potentially negative impacts on the environment and on people’s environmental rights (in terms of the Constitution of the Republic of South Africa, Act No. 108 of 1996) should be anticipated and prevented, and where they cannot be altogether prevented, they must be minimised and remedied in terms of “reasonable measures”.

In assessing the environmental feasibility of the proposed Dalmanutha Energy Facility, the requirements of all relevant legislation have been considered. The identification and development of appropriate management and mitigation measures that should be implemented in order to minimise potentially significant impacts associated with the project, has been informed by best practice principles, past experience and the relevant legislation (where applicable).

The conclusions of this EIA are the result of comprehensive assessments. These assessments were based on issues identified through the S&EIR process and the parallel process of public participation. The public consultation process has been undertaken according to the requirements of NEMA and every effort has been made to include representatives of all stakeholders within the process.

11.1 SPECIALIST CONCLUSIONS

11.1.1 NOISE / ACOUSTIC ASSESSMENT

Wind turbines have the potential to generate noise and as such a specialist Environmental Acoustic Impact Assessment is required as part of the ESIA process for the WEF.

Based on the IFC EHS Guidelines for Wind Energy a preliminary modelling exercise was executed using a simple model which assumes hemispherical propagation of noise from each turbine to determine potential impact on receptors within a 2 km radius of the turbines.

If LA90 noise levels at all sensitive receptors are below 35 dB(A) at a wind speed of 10 m/s (at a height of 10 m) during day and night times, this would be sufficient to assess the noise impact of the proposed facility, offering adequate protection of amenity at these receptors. If LA90 levels at any receptor location are above 35 dB(A), then impacts at these receptors may be perceived and potential turbine relocations may need to be considered. In low noise environments, the ETSU-R-97 report itself, however, stipulates that noise from wind farms should be limited to a range between 35 and 40 dB(A) (daytime). Additionally, a fixed limit of 43 dB(A) should be implemented during night-time. This should increase to 45 dB(A) (day and night) if the potential receptors have financial investments in the facility. With the Dalmanutha WEF being located within a low noise environment a combination of the IFC and ETSU methodology was followed in this assessment.

Fifty sensitive receptors (farmhouses) were identified within 2 km of the site.

Based on WSP's preliminary model (following the IFC methodology), the following was determined:

Alternative 1 (70 Wind Turbines)

- Results indicate that predicted LA90 noise levels during both day and night are below the 35 dB(A) threshold, as stipulated in the IFC EHS guidance, at twenty of the 50 receptors.
- However, being a low noise environment, with reference to the ETSU daytime limit range of 35 – 40 dB(A), LA90 noise levels at 36 of the 50 receptor locations are below this threshold. Additionally, at night, LA90 levels at 49 of the 50 receptor locations are below the ETSU 43 dB(A) threshold.
- It is, however, understood that all of the receptors within the project boundary have direct interest and are vested in the Project, thus a blanket threshold value of 45 dB(A) (day and night) applies. Predicted LA90 noise levels at all onsite receptor locations are below this 45 dB(A) threshold. Additionally, predicted LA90 noise levels at all receptors outside of the project boundary (Rec 01, Rec 05, Rec 06, Rec 09, Rec 10 – 18, Rec 24 – 25, Rec 27 – 28, Rec 38 – 41 and Rec 50) are below the ETSU 40 dB(A) threshold. As such, complaints are not anticipated as a result of the operation of the Dalmanutha WEF.

Alternative 2 (44 Wind Turbines)

- Results indicate that predicted LA90 noise levels during both day and night are below the 35 dB(A) threshold, as stipulated in the IFC EHS guidance, at 26 of the 50 receptors.
- However, being a low noise environment, with reference to the ETSU daytime limit range of 35 – 40 dB(A), LA90 noise levels at 41 of the 50 receptor locations are below this threshold. Additionally, at night, LA90 levels at 49 of the 50 receptor locations are below the ETSU 43 dB(A) threshold.
- It is, however, understood that all of the receptors within the project boundary have direct interest and are vested in the Project, thus a blanket threshold value of 45 dB(A) (day and night) applies. Predicted LA90 noise levels at all onsite receptor locations are below this 45 dB(A) threshold. Predicted LA90 noise levels at all receptors outside of the project boundary, except for Rec 17 and Rec 18 are below the ETSU 40 dB(A) threshold. As such, complaints may be anticipated at these two receptors as a result of the operation of the Dalmanutha WEF. It is recommended that the turbines in closest proximity to these receptors (WTG 09 and WTG 10) be relocated slightly southwards to drop the noise levels at these receptors below the acceptable 40 dB(A) threshold. Alternatively, financial incentives for these receptors may also need to be considered.

The resultant environmental acoustic risks associated with the construction phase of the Project are anticipated to be “low” to “very low” with general mitigation options employed. For the operational phase (Alternative 1), impacts are anticipated to be “low” as it is understood that the direct surrounding receptors are all vested in the Project. For the operational phase (Alternative 2), impacts are anticipated to be “moderate” especially at Rec 17 and Rec 18. Should the nearby turbines be relocated slightly, impacts are anticipated to become “low”. Ultimately, should no complaints from receptors arise, it is recommended that the Project (Alternative 1) can be considered for authorisation.

11.1.2 AVIFAUNA ASSESSMENT

The proposed site is located in an area of the country which provides a mosaic of land uses or micro habitats. As a result, a rich diversity of birds occur here, many of which are regionally Red Listed. The most important of these for the proposed project are: Wattled Crane (regionally Critically Endangered); Grey-crowned Crane (regionally Endangered); African Marsh-Harrier (regionally endangered); Cape Vulture (regionally Endangered); Black-rumped Buttonquail (regionally Endangered); White-bellied Korhaan (regionally Vulnerable); Southern Bald Ibis (regionally Vulnerable); Denham’s Bustard (regionally Vulnerable); Lanner Falcon (regionally Vulnerable); Secretarybird (regionally Vulnerable); and Blue Crane (regionally Near-threatened) (Taylor et al, 2015).

All bird species will to some extent be susceptible to habitat destruction and disturbance if the wind farm is built. However, it is the direct mortality risk through collision with turbines, and collision and electrocution on overhead power lines (should they be required) which is of most concern. The larger species are particularly at risk of these impacts.

Although these risks have to a certain extent been avoided by the application of No-Go sensitivity mapping, there is a need for extensive mitigation should the project go ahead. The following measures should be included in the EA conditions and EMPr:

The sensitive (No-Go) areas identified by this study should be adhered to.

- A pre-construction avifaunal walk down should be conducted to confirm final layout and identify any sensitivities that may arise between the conclusion of the EIA process and the construction phase.
- All human activities associated with construction, operation and decommissioning should be strictly managed according to generally accepted environmental best practice standards, so as to avoid any unnecessary impact on the receiving environment.
- Use should be made of existing roads as far as possible.
- All staff, vehicle and machinery activities should be strictly controlled at all times so as to ensure that the absolute minimum of surface area is impacted.
- Care should be taken not to introduce or propagate alien plant species/weeds during construction.

- No internal medium voltage power lines should be overhead. All such cables should be buried, and follow road verges at all times, unless specifically agreed to by the avifaunal specialist.
- Any overhead conductors or earth wires should be fitted with an Eskom approved anti-bird collision line-marking device to make cables more visible to birds in flight and reduce the likelihood of collisions.
- The pole design of any overhead power line should be approved by an ornithologist in terms of the electrocution risk it may pose to large birds such as eagles and vultures.
- The combination of turbine hub height and rotor diameter must be optimised to maximise the lower blade tip height above ground. Raising the lower turbine blade tip height from a typical 30m above ground to approximately 50m above ground will reduce collision risk for most species, as most flight is low over the ground.
- A post-construction site inspection must be conducted by an avifaunal specialist to confirm that all aspects have been appropriately handled and in particular that road and hard stand verges do not provide additional substrate for raptor prey species. It is essential that the new facility does not create favourable conditions for such mammals in high risk areas. We therefore recommend that within the first year of operations a full assessment of this aspect be made by the ornithologist contracted for post-construction monitoring. If such conditions have been created, case-specific solutions will need to be developed and implemented by the project operator.
- It is strongly recommended that rodenticides not be used at the newly established Operation and Maintenance (O&M) buildings or around auxiliary infrastructure on the project site. While pest control of this nature may be effective, even so-called "environmentally friendly" rodenticides are toxic and pose significant secondary poisoning risk to predatory avifauna, especially owls.
- A 'Cape Vulture Food Management Programme' must be implemented on site to ensure all dead livestock/wildlife on site are removed as soon as possible and made unavailable to vultures for feeding. This programme will reduce the amount of available vulture food on site and reduce vulture-turbine collision risk. This programme will require the deployment of a dedicated (i.e. no other tasks) and adequately resourced (transport, binoculars, GPS, cameras, training) team of staff to patrol the full site and immediate surrounds during all daylight hours. The co-operation of landowners will also be essential to ensure that reported carcasses are disposed of effectively. This programme must be operational by the time the first turbine blades are turning on site and should not wait for Commercial Operations Date (COD). A full detailed method statement for this programme must be designed by an ornithologist prior to COD, and included in the EMPr.
- The landowner agreements should ensure specifically that any vulture feeding sites be stopped from the start of wind farm construction and not used for the full lifespan of the wind farm. Landowners should also be sensitised to the need to cooperate with the above Cape Vulture Food Management Programme.
- Cape Vultures will have to be effectively deterred from roosting on overhead power lines on site. This will need to be achieved well before turbines are operational and maintained through the project lifespan. Eskom Bird Guards (perch deterrents) must be installed on all pylons at the two roost sites, with full coverage of steel cross

members (not just above live phases as per Eskom standard). In addition, the team of staff employed to implement the Cape Vulture Food Management Programme described above should also be tasked with patrolling the relevant sections of power line early morning and late evenings to scare any perching vultures away. This should first be trialled by in collaboration with an avifaunal specialist to ensure that such actions don't increase turbine collision risk in the short term by flushing vultures into turbines.

- An Observer-Led Turbine Shutdown on Demand (OLSDOD) programme must be implemented on site from COD. This is required in order to mitigate the risk of turbine collision for priority bird species. This programme must consist of a suitably qualified, trained, dedicated and resourced team of observers present on site for all daylight hours 365 days of the year. This team must be stationed at vantage points with full visible coverage of all turbine locations. The observers must detect incoming priority bird species, track their flights, judge when they enter a turbine proximity threshold, and alert the control room to shut down the relevant turbine/s until the risk has reduced. A full detailed method statement must be designed by an ornithologist prior to COD, and included in the EMPr. The effectiveness of this programme is highly dependent on hiring the correct staff and managing them appropriately. The project must pay careful attention to this aspect to minimise collision risk.
- All turbines must have one of their blades painted according to the approval to be obtained by the South African Civil Aviation Authority (SACAA) from the outset. Provision must be made by the developer for the resolution of any technical, warranty or supplier challenges that this may present.
- A bird fatality threshold and adaptive management plan must be designed by an ornithologist for the site prior to the Commercial Operation Date (COD) and included in the EMPr. This plan should identify most importantly the number of bird fatalities of priority species which will trigger a management response, appropriate responses, and time lines for such responses. Fatalities of priority bird species are usually rare events (but with very high consequence) and it is difficult to analyse trends or statistics related to these fatalities as they occur. It is therefore important to have a threshold policy in place proactively to assist adaptive management.
- Any residual impacts recorded during operations by operational phase bird monitoring after all possible mitigation measures have been implemented will need to be mitigated off site. The facility will need to address other sources of mortality of priority species in a measurable way so as to compensate for residual effects on the facility itself. This will need to be detailed in a Biodiversity Action Plan to be developed as part of the operational phase bird monitoring programme.
- The "during construction" and "post-construction" monitoring programme outlined in Appendix 10 of the Avifaunal impact assessment (**Appendix H.2**) should be implemented according to the latest available version of the Best Practice Guidelines at the time. The findings from Operational Phase monitoring should inform the adaptive management programme to mitigate any impacts on avifauna to acceptable levels.
- This is a rapidly evolving field and as more wind farms become operational, the learning curve steepens in terms of mitigation of risks to birds. A number of new

technology options are possibly on the horizon, including: blade illumination; radar technology; and acoustic deterrents. The project must keep abreast of these developments and implement if deemed necessary and reasonable as per the projects' adaptive management plan.

The proposed project is in a highly sensitive area for avifauna. The applicant has applied a substantial amount of risk avoidance through the application of No-Go areas and the reduction in the number of turbines (from 77 to 70 in the EIA phase – Alternative 1) and more so through the presentation of Alternative 2 which includes a further reduction to 44 wind turbines (plus solar PV). The specialist recommends strongly against the selection of Alternative 1, given that Alternative 2 has far fewer wind turbines. Alternative 2 is strongly preferred from an avifaunal perspective, since fewer turbines should cause fewer turbine collision bird fatalities. However, 44 turbines (Alternative 2) is still a large wind farm in a highly sensitive area, and the estimated number of bird fatalities pre-mitigation are still high for priority species. The significance of the turbine collision risk for multiple Red Listed (including Critically Endangered & Endangered) bird species is judged to be Very High pre-mitigation and High post-mitigation for Alternative 2.

11.1.3 TERRESTRIAL BIOIVERSITY ASSESSMENT

From a terrestrial biodiversity perspective, it is preferable to site infrastructure in areas of land that have already been transformed, such as cultivated fields; however, landowners within the study area, with whom the Developer will enter lease agreements for the construction and operation of the WEF, prefer that infrastructure is not sited in cultivated areas for economic reasons. This challenges the ability to minimise the loss of natural habitat through Project design. Nevertheless, existing access tracks have been used to the extent possible so that a minimum area of new road construction will be required.

For Alternative 2, where an increase in Project footprint will occur due to the bigger area needed for solar development, the use of areas currently colonised by wattle will be optimised in an effort to minimise potential losses of natural habitat. This, together with the reduced collision risk to bird SCC, makes Alternative 2 a preferred option in terms of acceptability of the proposed development, whether it should receive approval or not.

At a minimum, the following conditions to any approval are recommended:

- The indiscriminate clearing of vegetation in natural habitats where solar developments are proposed is not recommended; instead, minimally invasive construction techniques whereby only the supports for PV panels are cleared in such areas will significantly reduce the potential extent of habitat loss in these areas;
- Mowing regimes beneath solar panels situated in natural habitats should be scheduled to ensure that native plant SCC flowering seasons are avoided. Consideration should be given to use of grazing animals for maintenance of vegetation in solar developments;
- A Project Biodiversity Action Plan (BAP) should be developed and implemented;

- Monitoring of impacts on vegetation communities should be done during construction; follow up monitoring should be done subsequent to completion of rehabilitation activities, to ensure that re-vegetation is occurring and confirm that the sites have been rehabilitated;
- Significant residual impacts on biodiversity should be addressed via onsite/offsite offsets as appropriate, in agreement with the relevant conservation authorities;
- A wetland rehabilitation plan with the objective of offsetting the predicted Project losses of wetland habitat should be developed and implemented prior to commencement of the construction phase.

11.1.4 TERRESTIAL PLANT ASSESSMENT

Notwithstanding, localised sites of disturbance, the study area is characterised by a large network of natural grassland and wetland habitat that supports a rich botanical community. A large proportion of this habitat in the centre of the study area is designated as CBA Irreplaceable, with smaller areas designated CBA Optimal and ESA Local Corridors. Based on floristic data collected during the field survey and data obtained from a local landowner, several flora SCC (Red List and/or protected) are confirmed to be present in the study area, and habitat suitability assessments suggest that a high number of other flora SCC are also likely to be present.

The development of proposed Project infrastructure in areas of natural habitat, will have negative impacts on terrestrial flora. Several mitigation measures have been recommended to avoid and minimise identified impacts (**Section 9.7**).

The loss and disturbance of natural habitat, particularly CBA Irreplaceable and CBA Optimal land, remains a residual impact of concern with an overall after-mitigation rating of 'medium' significance for both proposed Project alternatives. Pursuant to this, considering the greater extent (hectares) of direct natural habitat loss and disturbance associated with Alternative 2 (which includes the large solar facilities) relative to Alternative 1, Alternative 1 is rated as having a lower impact significance score for this impact and is therefore the preferred options from a terrestrial flora perspective.

Despite which Project alternative is ultimately selected for implementation, a biodiversity offset will be required for the loss of CBA Irreplaceable and CBA Optimal land. It is recommended that this takes the form of a combined biodiversity offset programme that accounts for and integrates all elements of the Dalmanutha Wind Energy Complex initiative. The proposed Project is not deemed to present significant negative environmental issues or impacts, and it should thus be authorised.

11.1.5 TERRESTRIAL ANIMAL ASSESSMENT

The development of the proposed Project infrastructure in areas of natural habitat will have negative impacts on terrestrial fauna. Key amongst these, is the direct loss and disturbance of habitat during construction. This will occur for both proposed alternatives – although to different extents. Due to the presence of the large solar facility footprints, a substantially larger area of habitat will be lost/disturbed because of Alternative 2, compared to Alternative 1. Therefore, although both alternatives have the same significance rating for this impact (i.e., 'high' before mitigation and 'medium' after mitigation), the impact significance score for Alternative 2 was higher than for

Alternative 1. Accordingly, of the two Project alternatives, Alternative 1 is the preferred option from a terrestrial fauna perspective.

Several mitigation measures have been recommended to avoid and minimise identified impacts (presented in Section 9.8). The loss of natural habitat, particularly land designated as CBA by the MPTA, remains a residual impact of concern ('medium' significance) for both alternatives. It is therefore recommended that a biodiversity offset initiative should be identified and implemented for the proposed Project.

In addition to the impact mitigation and monitoring measures presented in Section 9.8, in line with NEMBA's Draft National Biodiversity Offset Policy (2017) a biodiversity offset initiative should be identified and implemented under agreement with MTPA.

The proposed Project is not deemed to present significant negative environmental issues or impacts, and it should thus be authorised.

11.1.6 AQUATIC BIODIVERSITY ASSESSMENT

The proposed Dalmanutha WEF is located in landscape that is dominated by agricultural land and semi-natural and natural grassland. The proposed Project area covers an area of approximately 9 197ha for both alternative 1 and alternative 2, and includes the development of a wind energy facility for alternative 1 and a hybrid development, including a wind energy facility and solar PV for alternative 2.

Both Project alternatives intercept wetland habitat, resulting in the loss of approximately 1.9ha and 1.4ha of wetland habitat respectively. The majority of these wetlands have a Moderately Low to Moderate PES, which infers that while there has been a moderate change in ecosystem processes, the habitat remains predominately intact. Similarly, most wetlands have a moderate EIS in the context of the surrounding cultivated landscape. However, some wetlands in the study area are considered to have a high EIS – primarily as a result of their support of threatened plant species, migration/feeding/breeding sites for fauna (birds), and the regional context of their ecological integrity given the extent of loss/modification of wetland systems in the region.

The key Project impacts are direct loss of wetland habitat as a result of construction of new access tracks, interruption in the hydrology of wetlands downstream of road crossings, soil erosion in the vicinity of construction areas, and the establishment and spread of alien invasive plant species. These impacts are expected to have high-moderate impact on wetlands prior to mitigation and can generally be reduced to a low residual impact with the implementation of mitigation measures - with the exception of the direct loss of wetland habitat which cannot be mitigated (i.e. avoided, minimised, rehabilitated) and must be offset.

The implementation of a wetland rehabilitation and management plan for the Project as well as an approved wetland offset strategy is therefore necessary to address significant residual impacts and ensure that any areas specifically set aside for biodiversity conservation (including on-site wetland offsets, and any off-site mitigation / offset areas) are protected and managed accordingly.

It is recommended that the alternative 2 option be the option of preference due to slightly reduced extent of predicted direct loss of wetland habitat.

11.1.7 SURFACE WATER

The layout of the Dalmanutha WEF consists of discrete points where turbines are erected, interconnected by linear infrastructure (access roads), as well as minor auxiliary buildings and substations. The specialist study for the concluded that development is spread over a large area of approximately 9 197ha meaning that the gross surface area occupied by the components mentioned is small in comparison to the entire footprint of the Dalmanutha WEF.

As hydrology is controlled by sub-catchment surface area characteristics, and the alteration of the surface characteristics is minimal, it can be concluded that the net impact of the development on hydrology is minor. However, local management of surface runoff is required at the turbine positions (turbine foundation and adjacent hardstand) and along the roads. Interventions to avoid, manage and mitigate potential impacts during both construction and operational phase are specified in Section 8.8 of the EMPr (**Appendix I**) prepared by WSP. It was found that the most impacts and risks to surface water resources occurs during the construction phase at the excavation for the turbine foundation.

It is recommended that the proposed activity and all associated infrastructure be authorised as it has been found that surface water impacts resulting from the activity are minimal and within an acceptable level of change. These impacts are summarised below:

- Level of change to runoff regime is minimal, i.e., frequency and magnitude of peak discharges from sub-catchments is not expected to be changed and baseflow is not expected to be impacted.
- Erosion and sedimentation are a risk at the locations of the wind turbines and along the access roads and thus would only occur at localized points which can be prevented.
- As all turbines are positioned at high elevations, it is unlikely that their zone of influence will extend to the watercourses within the site footprint.
- It was found that no turbines are positioned within watercourses and therefore no risk of impact to the riverbeds or banks exists.

11.1.8 HERITAGE ASSESSMENT

The study has found the project area is to be situated in an expansive landscape known to be culturally significant and rich in heritage resources. This was confirmed during the survey of the Dalmanutha WEF cluster, and numerous sites were recorded dating from the Stone Age, through the Iron Age to the historical period. The impacts to tangible heritage resources can be mitigated by micro siting of the Project components to avoid all known significant heritage resources. The main impacts of concern relate to the two cultural landscapes identified and sense of place of the study area where the visual impacts to the cultural landscapes of the area are the key impacts of concern. The precolonial landscape of Iron Age occupation and the historical cultural landscape of the 20th century farmsteads and the ‘Berg en Dal’ battlefield will be impacted contextually through the addition of wind turbines and related infrastructure.

In terms of the palaeontological heritage the study area is indicated as low to high, to very high palaeontological significance and an independent study by Prof Marion Bamford concluded that it is extremely unlikely that any fossils would be preserved in the overlying soils and sands of the Quaternary and was confirmed during a site visit and walkthrough in February 2023 that confirmed that there were no fossils of the *Glossopteris* flora on the surface.

Direct impacts on tangible heritage resources can be mitigated to an acceptable level however the visual impacts to the cultural landscapes of the area are the key impacts of concern. The following conditions should be included as part of the authorisation should one be issued, based on the South African Heritage Resource Authority (SAHRA) ’s approval.

Recommendations for condition of authorisation

- The following recommendations for Environmental Authorisation apply and the project may only proceed based on approval from SAHRA:
- Micro siting of Project components to preserve recorded heritage features with a 30m buffer;
- Regular monitoring of the development footprint by the ECO to implement the Chance Find Procedure for heritage and palaeontology resources (outlined in Section 10.2) in case heritage resources are uncovered during the course of construction.
- Implementation of mitigation measures from a visual impact assessment to minimise visual impacts to the cultural landscapes;
- Heritage walkdown of the final layout prior to construction with recommendations made for mitigation as required; and
- Compilation of a heritage management plan for the Dalmanutha WEF Project.

11.1.9 DESKTOP GEOTECHNICAL ASSESSMENT

A detailed intrusive site investigation is recommended to further characterize site conditions, to better understand the key geotechnical risks characteristics to refine the development of the WEF. Based on the current lack of previous geotechnical investigation data, the primary objectives of the proposed intrusive investigation must include:

- Determination of the founding conditions for all structures. The scope of the intrusive investigation should comprise test pitting, the drilling of a representative number of boreholes and laboratory testing.
- Investigation of subgrade conditions for service roads.
- Investigation for materials to be used during construction.
- Non-intrusive investigation techniques, such as geophysical (seismic refraction) surveys, thermal and electrical resistivity for ground earthing requirement.

Based on the overall desktop study, the proposed Dalmanutha site is suitable for the operation of a WEF. A “negative moderate to very high” impact was assessed, from a geotechnical perspective, for the pre-mitigation situation for the Dalmanutha WEF. Post-mitigation, the assessed impact decreases significantly to “very low to low.”

A geotechnical site investigation must be undertaken to provide detailed geotechnical information for the design of the proposed structures and roads.

The WEF application site is considered suitable for the proposed development provided that the recommendations presented in the specialist report are adhered too and which need to be verified by more detailed geotechnical investigations during detailed design.

11.1.10 SOCIO-ECONOMIC ASSESSMENT

The social impact assessment takes into consideration how all impacts involve the communities. Findings show that the Project will positively impact the bulk of the community, including power generation, employment and economic benefits. The negative impacts include visual (depending on how one is from the Project site, some farmers and communities will be impacted more), intrusion impacts (mostly noise) and traffic. After mitigation, most of the negative impacts have a low significance.

Based on the SIA result, the proposed Project is recommended to proceed on the condition that the mitigation measures are implemented robustly and consistently.

11.1.11 PALAEONTOLOGY ASSESSMENT

Based on site visit verification and walkdown, as well as the lack of any previously recorded fossils from the area, it is extremely unlikely that any fossils would be preserved in the overlying soils and sands of the Quaternary. The site visit and walkthrough in February 2023 confirmed that there were NO FOSSILS (stromatolites or fossil plants) on the surface.

There were very few rocky outcrops that could potentially preserve fossils. There is a very small chance that fossils may occur below ground in the dolomites or quartzites, if present, or in the below-ground shales of the early Permian Vryheid Formation so a Fossil Chance Find Protocol should be added to the EMPr. If fossils are found by the contractor, environmental officer, or other responsible person once excavations for foundations, amenities, infrastructure or underground cables have commenced then they should be rescued and a palaeontologist called to assess and collect a representative sample. The impact on the palaeontological heritage would be low to very low. There is no cumulative impact. There are no no-go areas.

11.1.12 VISUAL ASSESSMENT

There are likely to be supporters of the Dalmanutha WEF (as renewable energy generation is a global priority) amongst the population of the larger region, but they are normally expected to be indifferent to the construction of the WEF/PV and not as vocal in their support for the wind farm/PV arrays as potential detractors thereof (should any be identified).

It is expected that the construction and operation of the proposed Dalmanutha WEF and its associated infrastructure, will have a high visual impact on the study area, especially within (but not restricted to) a 5-10km radius of the proposed facility. The visual impact will differ amongst places, depending on the distance from the facility. Tourists travelling through the region and residents of homesteads will likely experience visual impacts where the wind turbine structures are visible.

The proposed Dalmanutha WEF is located on the eastern boundary of the Emalahleni Renewable Energy Development Zone (REDZ). Within this REDZ numerous Solar PV and wind energy projects have been proposed and/or already approved resulting in the area directly west of the Dalmauntha West WEF having a high cumulative exposure.

While the Dalmanutha WEF does not fall within the REDZ, the visual impact thereof will contribute to the overall cumulative visual impact of renewable energy projects within the greater region and the frequency of visual exposure to such infrastructure is expected to increase beyond the boundaries of the REDZ, especially considering the other already approved REFs (i.e. Haverfontein WEF and Machadodorp PV1) also located outside of the REDZ within 40km of the proposed Dalmanutha WEF.

Owing to the location of the Emalahleni REDZ and the location of other already approved REFs outside the REDZ the cumulative visual impact associated with the proposed Dalmanutha WEF is expected to moderate to high. However still considered to be within acceptable limits.

Conventional mitigation (e.g. such as screening of the structures) of the potential visual impacts is highly unlikely to succeed due to the nature of the development and the receiving environment. A number of mitigation measures have been proposed (Section 9.12). The proposed mitigation measures will primarily be effective in terms of mitigating lighting and construction phase visual impacts.

Note: Regardless of whether or not mitigation measures will reduce the significance of the anticipated visual impacts, they are considered to be good practice and should all be implemented and maintained throughout the construction, operation and decommissioning phases of the proposed facility, should it be authorised.

With regards to the shadow flicker likely to be experienced by homesteads that are located nearby, it is recommended, as per the IFC Performance Standards, that further consultation is undertaken as part of the EIA consultation process with these specific sensitive receptors of the identified homesteads, in order to establish their understanding and concerns regarding this possible impact. Should it be found during the consultation process that these specific receptors are concerned with the impact associated with shadow flicker, it is then recommended that the positioning of these specific turbines be revised or removed.

According to the Provincial Government of the Western Cape, Department of Environmental Affairs and Development Planning (DEA&DP) Guideline for Involving Visual and Aesthetic Specialists in the EIA Process (Oberholzer, 2005), the criteria that determine whether or not a visual impact constitutes a potential fatal flaw are categorised as follows:

- Non-compliance with Acts, Ordinances, By-laws and adopted policies relating to visual pollution, scenic routes, special areas or proclaimed heritage sites.
- Non-compliance with conditions of existing Records of Decision.

- Impacts that may be evaluated to be of high significance and that are considered by the majority of the stakeholders and decision-makers to be unacceptable.

In terms of the above and to the knowledge of the author the proposed development is compliant with all Acts, Ordinances, By-laws and adopted policies relating to visual pollution, scenic routes, special areas or proclaimed heritage sites, as well as, conditions of existing Records of Decisions.

Since objections have been reported from stakeholders or decision-makers within the region, this assessment has adopted a risk averse approach by assuming that the perception of most (if not all) of the sensitive visual receptors (bar the landowners of the properties earmarked for the development), would be predominantly negative towards the development. While keeping in mind that there are also likely to be supporters of the Dalmanutha WEF (as renewable energy generation is a global priority) amongst the population of the larger region, but they are largely expected to be indifferent to the construction of the WEF and not as vocal in their support for the wind farm as the detractors thereof.

Therefore, with the information available to the specialist at the time of writing this report, it cannot be empirically determined that the statistical majority of objecting stakeholders were exceeded. If evidence to the contrary surfaces during the progression of the development application, the specialist reserves the right to revise the statement below.

Overall, the significance of the visual impacts associated with the proposed Dalmanutha WEF for both Alternative 1 and 2 is expected to be moderate to high as a result of the generally undeveloped character of the landscape. Post mitigation significance for receptors within 5 km of the facility is anticipated to be very high. The facility would be visible within an area that contains certain sensitive visual receptors who could consider visual exposure to this type of infrastructure to be intrusive. Such visual receptors include people travelling along the national, arterial and secondary roads, as well as, residents of homesteads and tourists to the numerous protected/conservation areas.

Two (2) Alternatives have been proposed for the Dalmanutha WEF. Based on the above analyses, taking into consideration the number of sensitive visual receptors within close proximity, the different types of technology and number of turbines and existing infrastructure already in the study area, the visual impact is expected to be the same for each Alternative. Owing to this the specialist has no preferred alternative, however, it must be noted that the frequency of exposure to the turbines for Alternative 2 will be slightly reduced owing to the reduced number of wind turbines proposed. It must be noted that none of the Project Alternatives are considered fatally flawed from a visual perspective.

In spite of a few high residual ratings (as assessed in Section 9.12) and the likelihood that the proposed development will be met with concern and objections from some of the affected sensitive receptors and landowners in the region, this report cannot categorically state that any of the above conditions were transgressed. As such these visual impacts are not considered to be fatal flaws for a development of this nature. It is, therefore, suggested that the proposed Dalmanutha WEF, as per the assessed layout be supported from a visual perspective, subject to the implementation of the suggested best practice mitigation measures, as provided in this report.

It should be noted that the results/deductions in the specialist report are based solely from a visual perspective in relation to potential visual impacts and sensitive visual receptors and exclude any potential issues/comments/fatal flaws identified by other specialist studies

11.1.13 TRAFFIC IMPACT ASSESSMENT

Based on specialist study, the following key conclusions and recommendations are relevant:

The Scope of the TIA was informed by the Committee of Transport Officials' South African Traffic Impact and Site Traffic Assessment Manual, TMH16, Vol. 1, Version 1, August 2012.

A 2-year construction phase was assumed for traffic generation and impact analysis.

There are no known planned National or Provincial roads or road upgrades in the study area that will affect the site, or vice-versa.

There are no known large scale latent developments in the vicinity of the site that may have a cumulative impact on the local road network, except for the proposed

Access to the Dalmanutha site will be via three existing accesses off National Road N4:

Site access roads off the D1039, a district unsurfaced road that takes access off the N4 at a formal junction.

Site access roads off the D2636, a district unsurfaced road that connects to the D2524, which takes direct access off the N4 at a formal junction.

A site access road that will connect to the access road to the Berg-en-Dal memorial. This road takes direct access off the N4 at a formal junction. The provisional site access roads indicate a new direct access off the N4 west of the Berg-en-Dal memorial. This proposed access will not be utilised.

All construction and operational phase parking will be accommodated on-site.

There is no need for dedicated public transport or non-motorised transport infrastructure to serve the site during the construction and operational phases.

Alternative 1 WEF - The estimated peak construction trip generation will be 51 veh/hr during normal weekday AM and PM peaks. This trip generation estimate represents a conservative (high) calculation. Due to these low volumes distributed to three formal accesses off the N4, the impact on these accesses during the workday AM and PM peak hours are expected to be negligible and therefore do not require a capacity analysis as per the requirements of TMH16.

Alternative 2 WEF and SEF - The estimated peak construction trip generation will be 51 veh/hr during normal weekday AM and PM peaks. This trip generation estimate represents a conservative (high) calculation. Due to these low volumes distributed to three formal accesses off the N4, the impact on these accesses during the workday AM and PM peak hours are expected to be negligible and therefore do not require a capacity analysis as per the requirements of TMH16.

The expected traffic increase on the unsurfaced district roads during construction may result in the requirement for maintenance, as they are not designed for abnormal vehicles. The repairs, if required, should be the responsibility of the Contractor and the Provincial Road authority.

The transport route/s of the wind turbine components between their origin of manufacture to the site may be National, Provincial or Local roads; and each authority will be required to provide the necessary permits for the transportation of any oversized or abnormally heavy components.

It is recommended that an abnormal vehicle route management plan be undertaken when the port/s of entry of the tower components (masts, blades, rotor nacelles, generators, etc.) are known. These plans should include all aspects such as horizontal and vertical requirements along the routes, bridges along the route, speed limits, etc. These plans and the application for the abnormal permits is normally the responsibility of the logistics company that will transport the components to site.

The Operational phase trip generation of the Alternative 1 WEF or Alternative 2 WEF and SEF is expected to be negligible due to the low number of daily permanent staff trips. The associated transport impact on the surrounding road network will be negligible.

The safety of the intersections off the N4 may be compromised due to the increase in especially heavy vehicle volumes. It is recommended that additional temporary road signage is installed at the intersections of the N4 with the D1039, D2524 and Berg-en-Dal access roads to improve the safety of the intersections. The developer has undertaken to implement the required signage to the relevant Provincial and SANRAL standards, if allowed to do so.

It is not possible to determine the volume of traffic that will be generated during the decommissioning phases of the Alternative 1 WEF or Alternative 2 WEF and SEF. It can however be expected that the volumes will be lower than during the construction phase, these trips may not occur concurrently, and the resultant transport impact on the local access roads will therefore be lower than during the Construction phase for either alternatives.

The overall significance of each impact during the Construction Phase of the Alternative 1 WEF or Alternative 2 WEF and SEF is Moderate and Low without mitigation, and Very Low with mitigation. The impacts are limited to the peak construction period only and is fully reversible.

The proposed mitigating measures are easy to implement and will assist to either prevent or reduce the impacts of increased vehicle engine and tyre noise, exhaust fumes and generation of dust on unsurfaced roads.

The overall significance of each impact during the Operation Phase of the WEF or WEF and SEF is Moderate without mitigation, and Very Low with mitigation. The impacts are for the duration of the Project life, site/local and regional, and is fully reversible.

The recommended mitigating measures with regards to vehicle operations (roadworthiness, loading, etc.) are standard requirements for all vehicles operating on public roads and must always be adhered to. These measures will assist to either prevent or reduce the impacts of increased vehicle engine and tyre noise, exhaust fumes and road damage due to overloaded vehicles.

It is concluded that the proposed Dalmanutha Facility (Alternative 1 or 2) will have a low transport impact on the adjacent road network and environment, if the recommended mitigation measures are implemented.

It is recommended that the TIA should be accepted as part of the EIA application.

11.1.14 BAT ASSESSMENT

Data presented here is based on a full 12-month monitoring period between June 2021 and June 2022. Even though detectors were down due to battery failure and lost SD cards, enough data was collected to accurately represent bat activity on the project area across this period.

A total of nine species were detected throughout the course of the year, with *L. capensis* being the most frequently recorded species. All other species were recorded to a lesser extent and with varying degrees of frequency. Although other species may occur in the area, we expect that it is unlikely that any priority species should be found.

As the area falls within the grassland ecoregion, the risk is classified as Medium based on the median of 0,27 bat passes per hour that we recorded. As we had a median of 0,00 bat passes per hour in the rotor sweep zone, this is classified as Low Risk (MacEwan et al., 2020). There are, however, large influxes of bats during specific times of the year, and during these times adaptive mitigation measures may be required. This will include increasing the cut in speeds of turbines to 4 m/s as this has been shown to reduce bat fatalities.

The largest concern for the proposed Dalmanutha WEF is the presence of three confirmed bat roosts, two small roosts and one large roost. The appropriate buffers have however been implemented around these roosts, and if these No-Go areas are respected it is expected that the resulting impact should be minimal.

In summary, the current location of the project area falls in a Medium Risk area for bat fatalities, and sporadic peaks of bat activity in late summer and autumn will require specific and targeted mitigation. A suitable cut-in speed should be implemented for all turbines that optimises energy production and reduces fatality. A higher cut-in speed must be implemented over the summer and autumn months from dawn to dusk and ongoing operational monitoring must inform adaptive mitigation measures, which includes curtailment as necessary. Solar facilities have very limited impact on bats, and as such Alternative 2 would have a lower impact on bats in the area. Alternative 2 will make use of fewer turbines, and this will thus greatly reduce the impact on bats. As such, it is strongly recommended that the layout of Dalmanutha WEF Alternative 2 is followed.

11.1.15 SHE RISK ASSESSMENT

GENERAL

This Risk Assessment has found that with suitable preventative and mitigative measures in place, none of the identified potential risks are excessively high, i.e., from a Safety, Health and Environment (SHE) perspective no fatal flaws were found with either type of technology for the proposed BESS installation at the Dalmanutha Wind or Hybrid Wind and Solar Energy Facility near Belfast, Mpumalanga.

At a large facility, without installation of the state-of-the art battery technology that includes protective features, there can be significant risks to employees and first responders. The latest battery designs include many preventative and mitigative measures to reduce these risks to tolerable levels. (**Section 9.17**). State-of-the-art technology should be used, i.e., not old technology that may have been prone to fire and explosion risks.

The design should be subject to a full Hazard and Operability Study (HAZOP) prior to commencement of procurement. A HAZOP is a detailed technical systematic study that looks at the intricacies of the design, the control system, the emergency system etc. and how these may fail under abnormal operating conditions. Additional safeguards may be suggested by the team doing the study.

LITHIUM SOLID STATE CONTAINERIZED BATTERIES

With lithium solid-state batteries, the most significant hazard with battery units is the possibility of thermal runaway and the generation of toxic and flammable gases. There have been numerous such incidents around the world with batteries at all scales and modern technology providers include many preventative and mitigative features in their designs. This type of event also generates heat which may possibly propagate the thermal runaway event to neighbouring batteries if suitable state of the art technology is not employed.

The flammable gases generated may ignite leading to a fire which accelerates the runaway process and may spread the fire to other parts of the BESS or other equipment located near-by.

If the flammable gases accumulate within the container before they ignite, they may eventually ignite with explosive force. This type of event is unusual but has happened with an older technology container installed at McMicken in the USA in 2019.

Due to a variety of causes, thermal runaway could happen at any point during transport to the facility, during construction or operation / maintenance at the facility or during decommissioning and safe making for disposal.

Due to the containerized approach as well as the usual good practice of separation between containers, which should be applied on this project, and therefore the likely restriction of events to one container at a time, the main risks are close to the containers i.e., to transport drivers, employees at the facilities and first responders to incidents.

In terms of a worst conceivable case container fires, the significant impact zone is likely to be limited to within 10m of the container and mild impacts to 20m. Based on the current proposed layout, impacts at the closest isolated farmhouses are not expected.

In terms of a worst conceivable case explosion, the significant impact zone is likely to be limited to with 10m of the container and minor impacts such as debris within 50m. Based on the current proposed layout, impacts at the closest isolated farmhouses are not expected.

In terms of a worst reasonably conceivable toxic smoke scenario, provided the units are placed suitably far apart to prevent propagation from one unit to another and large external fires are prevented, the amount of material burning should be limited to one container at any one time. In this case, beyond the immediate vicinity of the fire, the concentrations of harmful gases within the smoke should be low. The proposed BESS installation location is over 500m from any occupied development / farmhouse and therefore the risks posed by BESS are negligible.

VANADIUM REDOX FLOW BATTERY INSTALLATIONS

The most significant hazard with VRF battery units is the possibility of spills of corrosive and environmentally toxic electrolyte. Many preventative and mitigative features will be included in the design and operation, e.g., full secondary containment, level control on tanks, leak detection on equipment etc. (Refer to tables in section 9.17 under preventative and mitigative measures).

VRF batteries do not present significant fire and electrical arcing hazards provided they are correctly designed, operated, maintained and managed. Suitable Battery Management System (BMS), safety procedures, operating instructions, maintenance procedures, trips, alarms and interlocks should be in place. (**Section 9.17**).

TECHNOLOGY AND LOCATION OF BESS FACILITIES

From a safety and health point of view, the above Risk Assessment shows that risks posed by VRFB systems may be slightly lower than those of SSL facilities, particularly with respect to fire and explosion risks. From an environmental spill and pollution point of view the VRFB systems present higher short-term risks than the SSL systems.

However, the above conclusions may be due to the fact that the VRFB technology is not as mature as SSL technology and therefore there is not as much operating experience and accident information available for the VRFB. Overall, from and SHE RA points of view, there is no specific preference for a type of technology.

From a SHE risks assessment point of view, where there is a choice of location that is further from public roads, water courses or isolated farmhouses/occupied developments, this would be preferred. VRFB hazards are mostly related to possible loss of containment of electrolyte and SSL batteries to fires producing toxic smoke and fire fighting which may result in contaminated of firewater runoff.

One would not want these liquids to enter water courses nor the smoke to pass close to houses / public traffic.

The following recommendations have been made:

There are numerous different battery technologies but using one consistent battery technology system for the BESS installations associated with all the developments in the Dalmanutha area associated with the Dalmanutha Project would allow for ease of training, maintenance, emergency response and could significantly reduce risks.

Where reasonably practicable, state-of-the-art battery technology should be used with all the necessary protective features e.g., draining of cells during shutdown and standby-mode, full BMS with deviation monitoring and trips, leak detection systems.

There are no fatal flaws associated with the proposed Wind or Hybrid Wind and Solar Energy battery installation for either technology type.

The tables in Section 9.16 of this report contains technical and systems suggestions for managing and reducing risks. Ensure the items listed in these tables under preventative and mitigative measures are included in the design.

The overall design should be subject to a full Hazop prior to finalization of the design.

For the VRFB systems an end of life (and for possible periodic purging requirements) solution for the

large quantities of hazardous electrolyte should be investigated, e.g., can it be returned to the supplier for re-conditioning.

Prior to bringing any solid-state battery containers into the country, the contractor should ensure that:

- An Emergency Response Plan is in place that would be applicable for the full route from the ship to the site. This plan would include details of the most appropriate emergency response to fires both while the units are in transit and once they are installed and operating.
- An End-of-Life plan is in place for the handling, repurposing or disposal of dysfunctional, severely damaged batteries, modules and containers.

The site layout and spacing between lithium solid-state containers should be such that it mitigates the risk of a fire or explosion event spreading from one container to another.

Under certain weather conditions, the noxious smoke from a fire in a lithium battery container could travel some distance from the unit. The smoke will most likely be acrid and could cause irritation, coughing, distress etc. Close to the source of the smoke, the concentration of toxic gases may be high enough to cause irreversible harmful effects. Location of the facilities needs to ensure a suitable separation distance from public facilities/residences etc. The proposed BESS location is over 500m from isolated farmhouses/developments and are therefore suitable in this context.

VRFB hazards are mostly related to possible loss of containment of electrolyte and solid-state systems may experience fires that may result in loss of containment of liquids or the use of large amounts of fire water which could be contaminated. One would not want these run-offs to enter water courses directly. The buffer distance between water bodies and the facilities containing chemicals should be set in consultation with a water specialist and is therefore not specified in this SHE RA. It is noted that there are no tributaries of the main water courses in the area within 500m of the proposed BESS Location.

Finally, it is suggested once the technology has been chosen and more details of the actual design are available, the necessary updated Risk Assessments should be in place.

11.1.16 SOIL AND AGRICULTURAL ASSESSMENT

The potential impacts of Alternatives 1 and 2 of the proposed Dalmanutha energy development centre on a loss of agriculture and include a loss of arable soils, loss of agricultural land, interference with agricultural practices, soil erosion and consequent sedimentation and soil contamination. If the recommended mitigation measures are correctly implemented and appropriate monitoring is undertaken, all the potential impacts can be reduced to Low except for the potential loss of agricultural land as a result of the permanent project infrastructure. The small footprints of the turbines would not significantly reduce the area available for cropping or cutting and baling.

It is highly recommended that additional micro-siting soil surveys be undertaken for any infrastructure that is repositioned when the solar PV and/or wind turbine layout plan is finalised in order to establish with certainty the soil forms and characteristics underlying the solar PV infrastructure, wind turbine hardstanding, access roads, buildings and all related infrastructure. It is also recommended that infrastructure be sited away from agricultural land wherever possible – such as on the high points underlain by Glenrosa and Mispah soils.

11.2 IMPACT SUMMARY

A summary of the identified impacts and corresponding significance ratings for the proposed Dalmanutha Energy Facility alternatives is provided in **Table 11-1** for the construction, operational and decommissioning phase below.

Table 11-1 – Construction, Operation and Decommissioning Impact Summary

No	Impact	Phase	Alternative 1				Alternative 2				Preferred Alternative	
			Pre- Mitigation		Post Mitigation		Pre- Mitigation		Post Mitigation		Alt 1	Alt 2
Noise												
	Construction phase impacts of noise on sensitive receptors	Construction	Low	(-)	Very low	(-)	Low	(-)	Very low	(-)	✓	
	Operational phase impacts of noise on sensitive receptors	Operation	Low	(-)	Low		Moderate	(-)	Low	(-)		
Geology												
	Soil Erosion	Construction	High	(-)	Very low	(-)	High	(-)	Very low	(-)	✓	✓
	Oil Spillages	Construction	Very high	(-)	Low	(-)	Very high	(-)	Low	(-)		
	Soil Erosion	Operation	Low	(-)	N/A	(-)	Low	(-)	N/A	(-)		
	Oil Spillages	Operation	Moderate	(-)	Low	(-)	Moderate	(-)	Low	(-)		
	Soil Erosion	Decommissioning	Moderate	(-)	Very Low	(-)	Moderate	(-)	Very Low	(-)		

No	Impact	Phase	Alternative 1				Alternative 2				Preferred Alternative	
			Pre- Mitigation		Post Mitigation		Pre- Mitigation		Post Mitigation		Alt 1	Alt 2
	Oil Spillages	Decommissioning	High	(-)	low	(-)	High	(-)	low	(-)		
Soils												
	Loss of Soil	Construction	Moderate	(-)	Low	(-)	Moderate	(-)	Low	(-)	✓	✓
	Loss of Arable Land	Construction	High	(-)	Moderate	(-)	High	(-)	Moderate	(-)		
	Disturbance to Agricultural Practices	Construction	Moderate	(-)	Low	(-)	Moderate	(-)	Low	(-)		
	Erosion and Sedimentation	Construction	Moderate	(-)	Low	(-)	Moderate	(-)	Low	(-)		
	Soil Contamination	Construction	High	(-)	Low	(-)	High	(-)	Low	(-)		
	Loss of Soil	Operation	Moderate	(-)	Low	(-)	Moderate	(-)	Low	(-)		
	Loss of Arable Land	Operation	Moderate	(-)	Moderate	(-)	Moderate	(-)	Moderate	(-)		
	Disturbance to Agricultural Practices	Operation	Moderate	(-)	Very low	(-)	Moderate	(-)	Very low	(-)		
	Erosion and Sedimentation	Operation	Moderate	(-)	Low	(-)	Moderate	(-)	Low	(-)		
	Soil Contamination	Operation	Moderate	(-)	Low	(-)	Moderate	(-)	Low	(-)		
Surface water												
	Clearing of vegetation and stripping of top soil	Construction	Moderate	(-)	Low	(-)	Moderate	(-)	Low	(-)	✓	✓

No	Impact	Phase	Alternative 1				Alternative 2				Preferred Alternative	
			Pre- Mitigation		Post Mitigation		Pre- Mitigation		Post Mitigation		Alt 1	Alt 2
	Earthworks	Construction	Moderate	(-)	Low	(-)	Moderate	(-)	Low	(-)		
	Materials management	Construction	Moderate	(-)	Very low	(-)		(-)	Very low	(-)		
	Construction of turbines, road network and substations	Construction	Moderate	(-)	Low	(-)	Moderate	(-)	Low	(-)		
	Movement of vehicles and machinery	Construction	Moderate	(-)	Low	(-)	Moderate	(-)	Low	(-)		
	Physical presence of turbines, road network and substations	Operation	High	(-)	low	(-)	High	(-)	low	(-)		
	Materials management	Operation	Moderate	(-)	Very low	(-)	Moderate	(-)	Very low	(-)		
	Movement of vehicles and machinery for maintenance activities	Operation	Moderate	(-)	Very low	(-)	Moderate	(-)	Very low	(-)		
	Physical presence of former turbines, road network and substations	Decommissioning	High	(-)	low	(-)	High	(-)	low	(-)		

No	Impact	Phase	Alternative 1				Alternative 2				Preferred Alternative	
			Pre- Mitigation		Post Mitigation		Pre- Mitigation		Post Mitigation		Alt 1	Alt 2
	Use of vehicles and heavy machinery to remove infrastructure	Decommissioning	Moderate	(-)	Low	(-)	Moderate	(-)	Low	(-)		
Terrestrial animals												
	Loss and disturbance of fauna habitat	Construction	High	(-)	Moderate	(-)	High	(-)	Moderate	(-)	✓	
	Fragmentation of habitat and disruption of fauna movement/dispersal	Construction	Moderate	(-)	Low	(-)	Moderate	(-)	Low	(-)		
	Injury, mortality and disturbance of fauna	Construction	Moderate	(-)	Low	(-)	Moderate	(-)	Low			
	Loss of fauna species of conservation concern	Construction	High	(-)	Moderate	(-)	High	(-)	Moderate	(-)		
	Establishment and spread of alien invasive species resulting in degradation of fauna habitat.	Construction	Moderate	(-)	Low	(-)	Moderate	(-)	Low	(-)		
	Injury and mortality of fauna, including SCC	Operation	Moderate	(-)	Low	(-)	Moderate	(-)	Low	(-)		

No	Impact	Phase	Alternative 1				Alternative 2				Preferred Alternative	
			Pre- Mitigation		Post Mitigation		Pre- Mitigation		Post Mitigation		Alt 1	Alt 2
	Establishment and spread of alien invasive species resulting in degradation of fauna habitat.	Operation	Moderate	(-)	Low	(-)	Moderate	(-)	Low	(-)		
	Vibration from operating wind turbines		Moderate	(-)	Low	(-)	Moderate	(-)	Low	(-)		
	Establishment and spread of alien invasive species resulting in degradation of fauna habitat.	Decommissioning	Moderate	(-)	Low	(-)	Moderate	(-)	Low	(-)		
	Injury, Mortality and Disturbance of Fauna, including SCC	Decommissioning	Moderate	(-)	Low	(-)	Moderate	(-)	Low	(-)		
Terrestrial plants												
	Loss and disturbance of flora habitat	Construction	High	(-)	Moderate	(-)	High	(-)	Moderate	(-)	✓	
	Disruption of ecosystem processes due to Project infrastructure	Construction	Moderate	(-)	Low	(-)	Moderate	(-)	Low	(-)		

No	Impact	Phase	Alternative 1				Alternative 2				Preferred Alternative	
			Pre- Mitigation		Post Mitigation		Pre- Mitigation		Post Mitigation		Alt 1	Alt 2
	Establishment and spread of alien invasive species	Construction	Moderate	(-)	Low	(-)	Moderate	(-)	Low	(-)		
	Loss of flora of conservation concern	Construction	High	(-)	Moderate	(-)	High	(-)	Moderate	(-)		
	Increased incidences of soil erosion	Construction	Moderate	(-)	Low	(-)	Moderate	(-)	Low	(-)		
	Establishment and spread of alien invasive species	Operation	Moderate	(-)	Low	(-)	Moderate	(-)	Low	(-)		
	Establishment and spread of alien invasive species	Decommissioning	Moderate	(-)	Low	(-)	Moderate	(-)	Low	(-)		
	Increased incidences of soil erosion	Decommissioning	Moderate	(-)	Low	(-)	Moderate	(-)	Low	(-)		
Avifauna												
	Habitat is destroyed and transformed	Construction	High	(-)	Moderate	(-)	High	(-)	Moderate	(-)		✓
	Birds are disturbed during construction activities	Construction	Low	(-)	Low	(-)	Low	(-)	Low	(-)		
	Birds are disturbed during operations of the facility	Operation	Low	(-)	Low	(-)	Low	(-)	Low	(-)		

No	Impact	Phase	Alternative 1				Alternative 2				Preferred Alternative	
			Pre- Mitigation		Post Mitigation		Pre- Mitigation		Post Mitigation		Alt 1	Alt 2
	Birds are displaced entirely from the site	Operation	Low	(-)	Low	(-)	Low	(-)	Low	(-)		
	Birds are killed through collision with turbines	Operation	Very high	(-)	High	(-)	Very high	(-)	High	(-)		
	Birds are killed through flying into & colliding with power lines, or through perching on pylons & being electrocuted	Operation	High	(-)	Low	(-)	High	(-)	Low	(-)		
	Birds are killed through colliding with panels or entanglement in fences	Operation	N/A		N/A		Low	(-)	Low	(-)		
Aquatic Biodiversity												
	Loss of wetland habitat	Construction	Moderate	(-)	N/A	(-)	Moderate	(-)	N/A	N/A		✓
	Interruption of wetland hydrology	Construction	Moderate	(-)	Low	(-)	Moderate	(-)	Low	(-)		
	Wetland water quality deterioration	Construction	Moderate	(-)	Very low	(-)	Moderate	(-)	Very low	(-)		
	Wetland soil erosion	Construction	Moderate	(-)	Low	(-)	Moderate	(-)	Low	(-)		
	Spread of AIS	Operation	Moderate	(-)	Very low	(-)	Moderate	(-)	Very low	(-)		

No	Impact	Phase	Alternative 1				Alternative 2				Preferred Alternative	
			Pre- Mitigation		Post Mitigation		Pre- Mitigation		Post Mitigation		Alt 1	Alt 2
Bats												
	Habitat and Roost destruction	Construction	Low	(-)	Very low	(-)	Low	(-)	Very low	(-)		✓
	Bat mortalities	Operational	High	(-)	Low	(-)	High	(-)	Low	(-)		
	Impacts on bats from artificial lights	Operational	Moderate	(-)	Low	(-)	Moderate	(-)	Low	(-)		
Visual												
	Potential visual impact of construction activities on sensitive visual receptors in close proximity to the proposed WEF.	Construction	High	(-)	Moderate	(-)	High	(-)	Moderate	(-)	✓	✓
	Potential visual impact on sensitive visual receptors located within a 5km radius of the wind turbine structures	Operational	Very high	(-)	Very high	(-)	Very high	(-)	Very high	(-)		
	Potential visual impact on sensitive visual receptors within the local area (5 –10km radius)	Operational	High	(-)	High	(-)	High	(-)	High	(-)		

No	Impact	Phase	Alternative 1				Alternative 2				Preferred Alternative	
			Pre- Mitigation		Post Mitigation		Pre- Mitigation		Post Mitigation		Alt 1	Alt 2
	Potential visual impact on sensitive visual receptors within the district (10 – 20km radius)	Operational	Moderate	(-)	Moderate	(-)	Moderate	(-)	Moderate	(-)		
	Potential visual impact on sensitive visual receptors within the region(beyond20 Km radius)	Operational	Low	(-)	Low	(-)	Low	(-)	Low	(-)		
	Potential visual impact on Protected Areas within the district	Operational	Moderate	(-)	Moderate	(-)	Moderate	(-)	Moderate	(-)		
	Shadow flicker	Operational	High	(-)	Moderate	(-)	High	(-)	Moderate	(-)		
	Potential visual impact of solar glint and glare as a visual distraction and possible air/road travel hazard	Operational	n/a		n/a		Low	(-)	Low	(-)		
	Potential visual impact of solar glint and glare on static ground-based receptors (residents of homesteads) in close proximity to the PV facility	Operational	n/a		n/a		Low	(-)	Low	(-)		

No	Impact	Phase	Alternative 1				Alternative 2				Preferred Alternative	
			Pre- Mitigation		Post Mitigation		Pre- Mitigation		Post Mitigation		Alt 1	Alt 2
	Potential visual impact of operational, safety and security lighting of the facility at night	Operational	High	(-)	Moderate	(-)	High	(-)	Moderate	(-)		
	Ancillary infrastructure	Operational	Low	(-)	Low	(-)	Low	(-)	Low	(-)		
	The potential impact on the sense of place of the region	Operational	Moderate	(-)	Moderate	(-)	Moderate	(-)	Moderate	(-)		
Palaeontology												
	Potential discovery of fossils on site	Construction	Low	(-)	Very Low	(+)	Low	(-)	Very Low	(+)	✓	✓
Heritage												
	Graves located within the proposed development area close to roads and wind turbines	Construction	High	(-)	Low	(-)	High	(-)	Low	(-)	✓	✓
	Historical infrastructure will be damaged / destroyed by the proposed development	Construction	Moderate	(-)	Very low	(-)	Moderate	(-)	Very low	(-)		
	Iron Age sites will be damaged/ destroyed by the development	Construction	Moderate	(-)	Very low	(-)	Moderate	(-)	Very low	(-)		

No	Impact	Phase	Alternative 1				Alternative 2				Preferred Alternative	
			Pre- Mitigation		Post Mitigation		Pre- Mitigation		Post Mitigation		Alt 1	Alt 2
	The project will alter the sense of place and impact on the cultural landscape.	Construction	Moderate	(-)	low	(-)	Moderate	(-)	low	(-)		
	Battlefield sites will be damaged/ destroyed.	Construction	n/a		n/a		Moderate	(-)	Very low	(-)		
	Graves located within the proposed development area close to roads and wind turbines	Operational	High	(-)	Low	(-)	High	(-)	Low	(-)		
	Historical infrastructure will be damaged / destroyed by the proposed development	Operational	Moderate	(-)	Very low	(-)	Moderate	(-)	Very low	(-)		
	Iron Age sites will be damaged/ destroyed by the development	Operational	Moderate	(-)	Very low	(-)	Moderate	(-)	Very low	(-)		
	The project will alter the sense of place and impact on the cultural landscape.	Operational	Moderate	(-)	low	(-)	Moderate	(-)	low	(-)		
	Battlefield sites will be damaged/ destroyed.	Operational	n/a		n/a		Moderate	(-)	Very low	(-)		
	Graves located within the proposed	Decommissioning	High	(-)	Low	(-)	High	(-)	Low	(-)		

No	Impact	Phase	Alternative 1				Alternative 2				Preferred Alternative	
			Pre- Mitigation		Post Mitigation		Pre- Mitigation		Post Mitigation		Alt 1	Alt 2
	development area close to roads and wind turbines											
	Historical infrastructure will be damaged / destroyed by the proposed development	Decommissioning	Moderate	(-)	Very low	(-)	Moderate	(-)	Very low	(-)		
	Iron Age sites will be damaged/ destroyed by the development	Decommissioning	Moderate	(-)	Very low	(-)	Moderate	(-)	Very low	(-)		
	The project will alter the sense of place and impact on the cultural landscape.	Decommissioning	Moderate	(-)	low	(-)	Moderate	(-)	low	(-)		
	Battlefield sites will be damaged/ destroyed.	Decommissioning	n/a		n/a		Moderate	(-)	Very low	(-)		
Social												
	Increase in economic benefits	Construction	Very low	(+)	Moderate	(+)	Very low	(+)	Moderate	(+)	✓	✓
	Preferential procurement	Construction	Low	(+)	Moderate	(+)	Low	(+)	Moderate	(+)		
	Noise	Construction	Low	(-)	Very low	(-)	Low	(-)	Very low	(-)		
	Visual	Construction	High	(-)	Low	(-)	High	(-)	Low	(-)		

No	Impact	Phase	Alternative 1				Alternative 2				Preferred Alternative	
			Pre- Mitigation		Post Mitigation		Pre- Mitigation		Post Mitigation		Alt 1	Alt 2
	Traffic	Construction	Moderate	(-)	Very low	(-)	Moderate	(-)	Very low	(-)		
	Population influx	Construction	Low	(-)	Very low	(-)	Low	(-)	Very low	(-)		
	Power generation	Operation	Low	(+)	Moderate	(+)	Low	(+)	Moderate	(+)		
	Employment	Operation	Very low	(+)	Moderate	(+)	Very low	(+)	Moderate	(+)		
	Economic development	Operation	Low	(+)	Moderate	(+)	Low	(+)	Moderate	(+)		
	Noise (alternative 1)	Operation	Low	(-)	Very low	(-)	Moderate	(-)	Moderate	(-)		
	Visual	Operation	High	(-)	Moderate	(-)	High	(-)	Moderate	(-)		
	Traffic	Operation	low	(-)	Very low	(-)	low	(-)	Very low	(-)		
	SHE Risk	Operation	Moderate	(-)	Low	(-)	Moderate	(-)	Low	(-)		
	Loss of employment	Decommissioning	Moderate	(-)	Low	(-)	Moderate	(-)	Low	(-)		
	Reduced regional economic development	Decommissioning	Moderate	(-)	Low	(-)	Moderate	(-)	Low	(-)		
	Associated infrastructure	Decommissioning	Moderate	(-)	Low	(-)	Moderate	(-)	Low	(-)		
Traffic												
	Noise, dust & exhaust pollution due to vehicle trips on-site	Construction	Low	(-)	Very low	(-)	Low	(-)	Very low	(-)	✓	✓

No	Impact	Phase	Alternative 1				Alternative 2				Preferred Alternative	
			Pre- Mitigation		Post Mitigation		Pre- Mitigation		Post Mitigation		Alt 1	Alt 2
	Noise, dust & exhaust pollution due to additional trips on unsurfaced district road D1039, D2524, D2636, D560	Construction	Moderate	(-)	Very low	(-)	Moderate	(-)	Very low	(-)		
	Noise & exhaust pollution due to additional trips on the surfaced R33 and N4	Construction	Moderate	(-)	Very low	(-)	Moderate	(-)	Very low	(-)		
	Noise, dust & exhaust pollution due to vehicle trips on-site	Operation	Low	(-)	Very low	(-)	Low	(-)	Very low	(-)		
	Noise, dust & exhaust pollution due to additional trips on unsurfaced district road D1039, D2524, D2636, D560	Operation	Low	(-)	Very low	(-)	Low	(-)	Very low	(-)		
	Noise & exhaust pollution due to additional trips on the surfaced R33 and N4	Operation	Moderate	(-)	Very low	(-)	Moderate	(-)	Very low	(-)		
Total											**11**	**11**

11.2.1 CUMULATIVE IMPACT SUMMARY

A summary of the identified cumulative impacts is outlined in **Table 11-2** below for both before and after mitigation measures have been considered for the current project as well as the combination of projects in the area.

Table 11-2: Cumulative impacts summary

Aspect	Impact Description	Current Project		Combination of projects	
		Significance	Status	Significance	Status
Noise	Cumulative acoustic impact	Very low	(-)	Very Low	(-)
Surface Water	Sterilisation from mining rights Maintenance of biodiversity	High	(+)	High	(+)
Soil	Soil loss	High	(-)	Moderate	(-)
	Loss of arable land	High	(-)	Moderate	(-)
	Disturbance to agricultural practices	High	(-)	Moderate	(-)
	Erosion & sedimentation	High	(-)	Moderate	(-)
	Soil contamination	High	(-)	Moderate	(-)
Avifauna	Cumulative Avifaunal impacts from the facility	High	(-)	High	(-)
Animal species	Loss of faunal habitat during construction	High	(-)	low	(-)
Plant species	Loss of individuals of Species of Conservation Concern	High	(-)	low	(-)
Aquatic Biodiversity	Cumulative impact on biodiversity	High	(-)	low	(-)
Heritage and Palaeontology	Damage or loss of heritage or palaeontological finds	Moderate	(-)	Low	(-)
Visual and landscape	Cumulative visual impact	Moderate	(-)	Moderate	(-)

Aspect	Impact Description	Current Project		Combination of projects	
		Significance	Status	Significance	Status
Geotechnical	Soil erosion and contamination	Moderate	(-)	Low	(-)

11.3 BIODIVERSITY OFFSET STRATEGY

Since direct loss of wetland and terrestrial habitats cannot be mitigated, these losses must be offset. The results of the application of wetland functional and ecosystem hectare equivalent calculations for wetland losses as a result of the proposed Project components using the revised SANBI and DWS offset guidelines (Macfarlane et al., 2014) and guidance provided in the draft Biodiversity Offset Guidelines (DFFE, 2022) are presented in the following sections.

11.3.1 WETLAND HABITAT

Details of wetland loss per affected hydrogeomorphic (HGM) unit, hectare equivalents and ecosystem conservation targets are provided in Appendix C; summary figures for loss are provided in **Table 11-3.**

Between 1.45 and 1.95 ha of wetland habitat will be directly and permanently lost as a result of proposed road construction/improvements, depending on whether Alternative 1 or 2 is chosen, translating to a loss of between 0.85 and 1.32 hectare equivalents (ha-eq) of functional wetland habitat.

It is noted that these figures are likely to change once the final road layout has been determined. The required wetland offset will then be determined, and implemented via the Water Use License.

Table 11-3 – Predicted wetland losses to proposed project infrastructure

Project	Wetland type	Extent (ha)	Functional Hectare Equivalents	Ecosystem Conservation Target (habitat ha-eq)
Alt.1	Channelled valley bottom	0.73	0.43	5.14
	Unchannelled valley bottom	0.22	0.14	1.72
	Depression	0.15	0.13	1.6
	Hillslope seep	0.85	0.61	7.35
Subtotal		1.95	1.32	15.81
Alt.2	Channelled valley bottom	0.72	0.42	5.07
	Unchannelled valley bottom	0.42	0.23	2.81
	Floodplain	0.02	0.01	0.12
	Hillslope seep	0.29	0.18	2.22
Subtotal		1.45	0.85	10.22

The loss of wetland habitat translates to an estimated ecosystem conservation target of between 10.22 and 15.81 habitat ha-eq, based on a calculated ecosystem conservation ratio of 12 (**Table 11-4).**

Table 11-4 – Wetland ecosystem offset ratio determination (after Macfarlane et al., 2014)

Determining offset ratios	Ecosystem Status	Wetland Vegetation Group (or type based on local classification)	Mesic Highveld Grassland Group 4, 5 and 6; Eastern Highveld Grassland	
		Threat status of wetland	Threat status	EN
			Threat status Score	7.5
		Protection level of wetland	Protection level	Not Protected
			Protection level Score	2
		Ecosystem Status Multiplier		15
	Regional and National Conservation context	Priority of wetland as defined in Regional and National Conservation Plans	High Importance	1
		Regional & National Context Multiplier		1.0
	Local site attributes	Uniqueness and importance of biota present in the wetland	High biodiversity value	1
		Buffer zone integrity (within 500m of wetland)	Buffer compatibility score	0.5
		Local connectivity	Good connectivity	0
		Local Context Multiplier		0.8
	Ecosystem Conservation Ratio			12.00

11.3.2 TERRESTRIAL HABITAT

Residual impacts on terrestrial habitat were defined as the extent of natural habitats supporting plant/fauna SCC that would be lost as a result of the proposed development options.

The basic and adjusted offset ratios for natural terrestrial habitats are set out in **Table 11-5**, based on the biodiversity offset ratios look-up table provided in the draft Biodiversity Offset Guideline. When the relevant habitats fall within a CBA1, the ratio is automatically set to 30:1, while the basic ratio for areas within CBA2 is adjusted by increasing it by a factor of 1.5. For other mapped categories, excluding 'heavily modified' and 'modified' areas (i.e. Ecological Support Areas - ESAs and Other Natural Areas - ONA) the basic ratio applies.

Table 11-5 – Basic and adjusted biodiversity offset ratios for terrestrial habitats

Criteria	Basic Ratio (DFFE, 2022)	CBA1	CBA2
Endangered ecosystems	10:1	30:1	15:1
Eastern Highveld Grassland (EN)	13:1	30:1	19.5:1
KaNgwane Montane Grassland (EN)	10:1	30:1	15:1
Steenkampsberg Montane Grassland (LC)	0	30:1	0

Mapped vegetation communities within the study area that will be lost as a result of the proposed developments were ranked according to their occurrence in CBA1, CBA2, ESA and ONA areas mapped by the MBSP, see Appendix C of the Biodiversity offset report (**Appendix J**). Targets were then set for areas of natural habitat loss (i.e. loss of Disturbed Grassland, Dry Mixed Grassland, and Rocky Grassland) only. Loss of areas of Alien Tree Plantations, Cultivated Fields, Infrastructure and Transformed areas was not included in target setting, even if they occurred within areas mapped as CBA, since their loss is not considered a significant impact. In addition, loss of areas mapped as 'Moist Grassland and Wetland' in the terrestrial vegetation dataset were not included, since these areas are already accounted for in the wetland habitat targets.

The calculated targets for each vegetation group within the study area, for each Project component, are summarised on **Table 11-6.** While it is clear that in its current incarnation, Alternative 2 would result in an increased area of natural habitat loss compared to Alternative 1, and as such would be subjected to a higher offset target; it is noted that there is much greater scope to optimise the layout of project components (particularly solar arrays, and BESS infrastructure) to reduce the amount of natural habitat loss within CBA1 and CBA2, which is expected to reduce the preliminary figures presented here. The layout optimisation will be done as part of the final layout design post environmental authorisation.

Table 11-6 – Terrestrial habitat offset targets

MBSP category and Vegetation Communities	Estimated extent of loss based on current design (ha)	Offset Target
Dalmanutha WEF, Alternative 1	**56.39**	**755.76**
CBA Irreplaceable	23.89	716.80
Eastern Highveld Grassland	17.31	519.42
KaNgwane Montane Grassland	5.77	173.12
Steenkampsberg Montane Grassland	0.81	24.26

MBSP category and Vegetation Communities	Estimated extent of loss based on current design (ha)	Offset Target
CBA Optimal	4.28	22.76
Eastern Highveld Grassland	0.39	7.65
KaNgwane Montane Grassland	1.01	15.11
Steenkampsberg Montane Grassland	2.88	0.00
ESA Landscape corridor	11.69	0.19
Eastern Highveld Grassland	0.01	0.19
Steenkampsberg Montane Grassland	11.68	0.00
ESA Local corridor	7.70	14.74
Eastern Highveld Grassland	0.00	0.06
KaNgwane Montane Grassland	1.47	14.69
Steenkampsberg Montane Grassland	6.23	0.00
ESA Protected Area buffer	0.10	0.99
KaNgwane Montane Grassland	0.10	0.99
Other Natural Areas	8.73	0.29
Eastern Highveld Grassland	0.02	0.23
KaNgwane Montane Grassland	0.01	0.05
Steenkampsberg Montane Grassland	8.71	0.00
Dalmanutha WEF, Alternative 2	**128.86**	**2088.51**
CBA Irreplaceable	67.39	2021.74
Eastern Highveld Grassland	61.13	1833.76
KaNgwane Montane Grassland	5.93	177.80
Steenkampsberg Montane Grassland	0.34	10.18
CBA Optimal	6.23	29.69
Eastern Highveld Grassland	0.32	6.26
KaNgwane Montane Grassland	1.56	23.43

MBSP category and Vegetation Communities	Estimated extent of loss based on current design (ha)	Offset Target
Steenkampsberg Montane Grassland	4.35	0.00
ESA Landscape corridor	39.89	11.64
KaNgwane Montane Grassland	1.16	11.64
Steenkampsberg Montane Grassland	38.73	0.00
ESA Local corridor	7.38	21.95
KaNgwane Montane Grassland	2.20	21.95
Steenkampsberg Montane Grassland	5.19	0.00
ESA Protected Area buffer	0.16	1.56
KaNgwane Montane Grassland	0.16	1.56
Other Natural Areas	7.80	1.93
Eastern Highveld Grassland	0.08	0.99
KaNgwane Montane Grassland	0.09	0.94
Steenkampsberg Montane Grassland	7.63	0.00

11.3.3 BIRD SPECIES

The significance of the turbine collision risk of Alternative 1 for multiple Red Listed (including Critically Endangered & Endangered) species remains High post mitigation. While Alternative 2 is strongly preferred from an avifaunal perspective (since fewer turbines should cause fewer collision fatalities) it remains a large wind farm in a highly sensitive area from the avifauna perspective, and the impact significance remains High post mitigation.

In numerical terms, the fatalities estimate for each wind facility/alternative pre-mitigation is summarised in **Table 11-7**. Since the residual impacts remain high post mitigation, the fatalities estimates are used to contextualise the level of offset/compensation that may be needed, using the worst case scenario based on the precautionary principle.

Table 11-7 – Bird fatalities due to collision with wind turbines (WildSkies, 2023)

Project	Aspect	Impact
Alternative 1 (70 turbines)	Scenario 1: Rotor Swept Area of 30 m - 230m.	Approximately 18.46 fatalities could be recorded at the wind farm per year across the target bird species recorded flying on site prior to the application of mitigation measures. This includes most notably the following regionally Red Listed

Project	Aspect	Impact
		species fatalities: Cape Vulture – 10.20 birds/year; Southern Bald Ibis – 1.14 birds/year; Blue Crane – 0.72 birds/year; White-bellied Bustard – 0.26 birds/year
	Scenario 2: Rotor Swept Area of 50 m to 250 m.	A total of approximately 15.64 fatalities could be recorded at the wind farm per year across the target bird species recorded flying on site, prior to the application of mitigation measures. This includes the following regionally Red Listed species fatalities: Cape Vulture – 9.76 birds/year; Southern Bald Ibis – 0.44 birds/year; Blue Crane – 0.68 birds/year; White-bellied Bustard – 0.04 birds/year.
Alternative 2 (44 turbines)	Scenario 3: Rotor Swept Area of 30 m – 230 m	Approximately 11.60 fatalities could be recorded at the wind farm per year across the target bird species recorded flying on site prior to the application of mitigation measures. This includes the following regionally Red Listed species fatalities: Cape Vulture – 6.41 birds/year; Southern Bald Ibis – 0.71 birds/year; Blue Crane – 0.45 birds/year; White-bellied Bustard – 0.16 birds/year
	Scenario 4: Rotor Swept Area of 50 m to 250 m	A total of approximately 9.83 fatalities could be recorded at the wind farm per year across the target bird species recorded flying on site, prior to the application of mitigation measures. This includes the following regionally Red Listed species fatalities: Cape Vulture – 6.13 birds/year; Southern Bald Ibis – 0.28 birds/year; Blue Crane – 0.43 birds/year; White-bellied Bustard – 0.03 birds/year

These residual impacts will need to be mitigated off site, with an aim of achieving no net loss of affected bird species.

Since an area-based offset for affected bird species is not feasible, the Project will instead need to address other sources of mortality of priority species in a measurable way so as to compensate for the residual effects of the Dalmanutha WEF and West facilities itself. Proposed measures are set out below. The required measures will need to be agreed with the relevant authorities and conservation agencies, and detailed in a Biodiversity Action Plan thereafter.

Key to the compensation process will be ongoing operation phase monitoring so that the exact number of fatalities can be documented and compensated accordingly.

11.3.4 PREFERRED ALTERNATIVE

The preferred alternative for a Project from an offsetting perspective, is typically that which has the least residual impact, and as such requires the least effort in terms of offset. While Alternative 1 is preferable for ecological receptors including terrestrial habitats and aquatic ecosystems, and Alternative 2 currently incurs a greater extent of offset for grassland habitat within CBAs; the critical issue for the Project is the residual impact as a result of collision risk for priority bird species – as such, Alternative 2 is the preferred alternative from an offsetting perspective since the reduced residual impact on priority bird species is of paramount importance.

Table 11-8 – Preferred alternative based on reduced need for biodiversity offsetting

	Preferred Alternative	
Ecological receptor	Alternative 1	Alternative 2
Wetland habitat	1.95 ha loss	1.45 ha loss - preferred
Terrestrial habitat	56.39 ha loss - preferred	128.86 ha loss – capacity to reduce
Avifauna	Approximately 18.46 fatalities per annum	Approximately 11.60 fatalities per annum - preferred

11.3.5 CANDIDATE OFFSET SITES

Wherever possible, a 'like-for-like' biodiversity offset is preferred so that residual negative impacts on affected biodiversity features are appropriately compensated – ensuring no net loss of that feature on a local or regional scale. In addition, the realities of securing offsets in the long-term depends heavily on securing appropriate areas from a land tenure and/or management perspective. For this reason, the selection of candidate offset sites focussed on nearby habitats within the LSA, where the Project Developer has established relationships with landowners and can capitalise on this for offset planning purposes.

The draft National Biodiversity Offset guideline (DFFE, 2022) requires that the below-listed principles – which are widely recognised in standard offset guidance (e.g. BBOP, 2009) – guide the selection of suitable candidate offset sites; these principles were also applied when identifying potentially suitable areas and required actions for offset:

- Biodiversity offset sites should be selected for ecological equivalence (the "like-for-like" principle) or, where appropriate, there could be "trading-up" to select an area of relatively high or more urgent conservation priority.
- Selection should be guided as far as possible by existing biodiversity priority areas in the landscape (for example, the CBA and ESA network, Freshwater Ecosystem Priority Areas, and focus areas for protected area expansion) and/or areas identified as strategic from an ecological infrastructure perspective (such as Strategic Water Source Areas).
- Biodiversity offsets should strive to secure the best examples of the features which have been impacted and to improve connectivity in the landscape between protected and priority areas for biodiversity.
- The final selection can be influenced by the reasonable consideration of factors other than the biodiversity value of the different candidate sites, such as: ease of the management of the site by a relevant management authority; and threats to conservation due to conflicting land use rights, claims or land use classification.

For biodiversity offsets in terrestrial ecosystems, rehabilitation and preferably restoration of areas in modified condition (i.e. no longer natural or near-natural) is seen as an integral part of the required management of the offset site. The guidelines state it is optimal for candidate biodiversity offset sites to be in a good ecological condition (natural or near-natural state), to minimise the additional burden of having to rehabilitate or restore an area (DFFE, 2022); however, some level of rehabilitation of natural habitats with a low level of disturbance is normally anticipated.

Wetland offsets, on the other hand, are often focussed in systems that are moderately modified, where the greatest potential for functional gain can be feasibly achieved via implementation of a wetland rehabilitation plan.

Candidate offset sites and required biodiversity outcomes for wetland and terrestrial habitat are therefore proposed to include:

- Unaffected wetland habitat within the study area:
- The presence of extensive areas of modified wetland habitat within the study area, representing each of the HGM units that will be lost, presents an opportunity for implementation of a wetland rehabilitation programme within the study area to compensate wetland loss, through securing functional gains via rehabilitation.
- In targeted wetlands, the objective will be to increase the PES score/category through improvement of wetland health as a result of rehabilitation activities, thereby securing functional gains.
- Both the ecosystem conservation target and functional ha-eq target will be easily achievable within the study area.
- It is envisaged that any necessary wetland offset will be secured via the necessary landowner agreement for the Water Use License that will be required for the implementation of rehabilitation structures/works in wetlands and watercourses. The wetland offset will therefore be done via the WULA process (separate to the EA process).
- Unaffected terrestrial habitat within the study area:
- Grassland: areas of natural habitat (i.e. Disturbed Grassland, Dry Mixed Grassland, and Rocky Grassland) within the study area; particularly those areas situated within CBA1/CBA2 areas, and adjacent to areas of loss; since landowners of areas where construction will take place are already engaged. The final areas and required extent of offset will be confirmed once the selected Alternative is finalised, final residual impacts quantified, and agreements with landowners secured.
- Stewardship agreements with landowners and local communities – support conservation and enhancement of dry mixed, disturbed and rocky grasslands, and linked fauna species, through management and protection of high ecological importance natural grasslands in the study area. Conservation servitudes may be utilised to give effect to landowner agreements.
- Areas where land use consists primarily of livestock grazing of open veld, if incorporated into protection-based offset areas, can potentially provide biodiversity support and demonstrate improved ecological integrity in the long-term, if targeted by suitable management plans e.g. grazing management plans, fire management.

The extent of suitable wetland and terrestrial habitat within the study area (candidate offset sites) from which suitable offset sites can be selected, is depicted in **Figure 11-1.** The likelihood of each sites availability and feasibility will need to be established via engagement with landowners, and acceptability as offset for natural habitat loss agreed with relevant stakeholders (e.g. MTPA, EWT, BLSA). Offsite offsets may also be considered, depending on the feedback received through the engagement process.

11.3.6 OFFSITE ACTIONS FOR PRIORITY BIRD SPECIES

Since area-based offsets for residual impacts on affected bird species are not feasible, several offsite actions have been proposed in an effort to achieve no net loss of these species. These include:

- Partnering with the Dullstroom Bird of Prey and Rehabilitation Centre to rehabilitate injured birds.
- Donating 5000 Bird diverters to EWT to target high-risk powerlines every 10 years of the project.
- Support of ongoing bird research programmes, particularly for threatened (e.g. White-winged Flufftail) and endemic species, in partnership with universities, and conservation NGOs (e.g. BLSA, EWT).
- Support of improved management of current or potential protected areas that are important sites for the species of concern present within the study area.
- Support of existing conservation programmes/sites, such as Middelpunt Wetland Trust Initiative, Verloren Valei Nature Reserve, African Crane Conservation and Threatened grasslands Species Programme.

It is noted that the finalised agreed offsite actions will be included in the Project BAP subject to determination of the final Project layout.

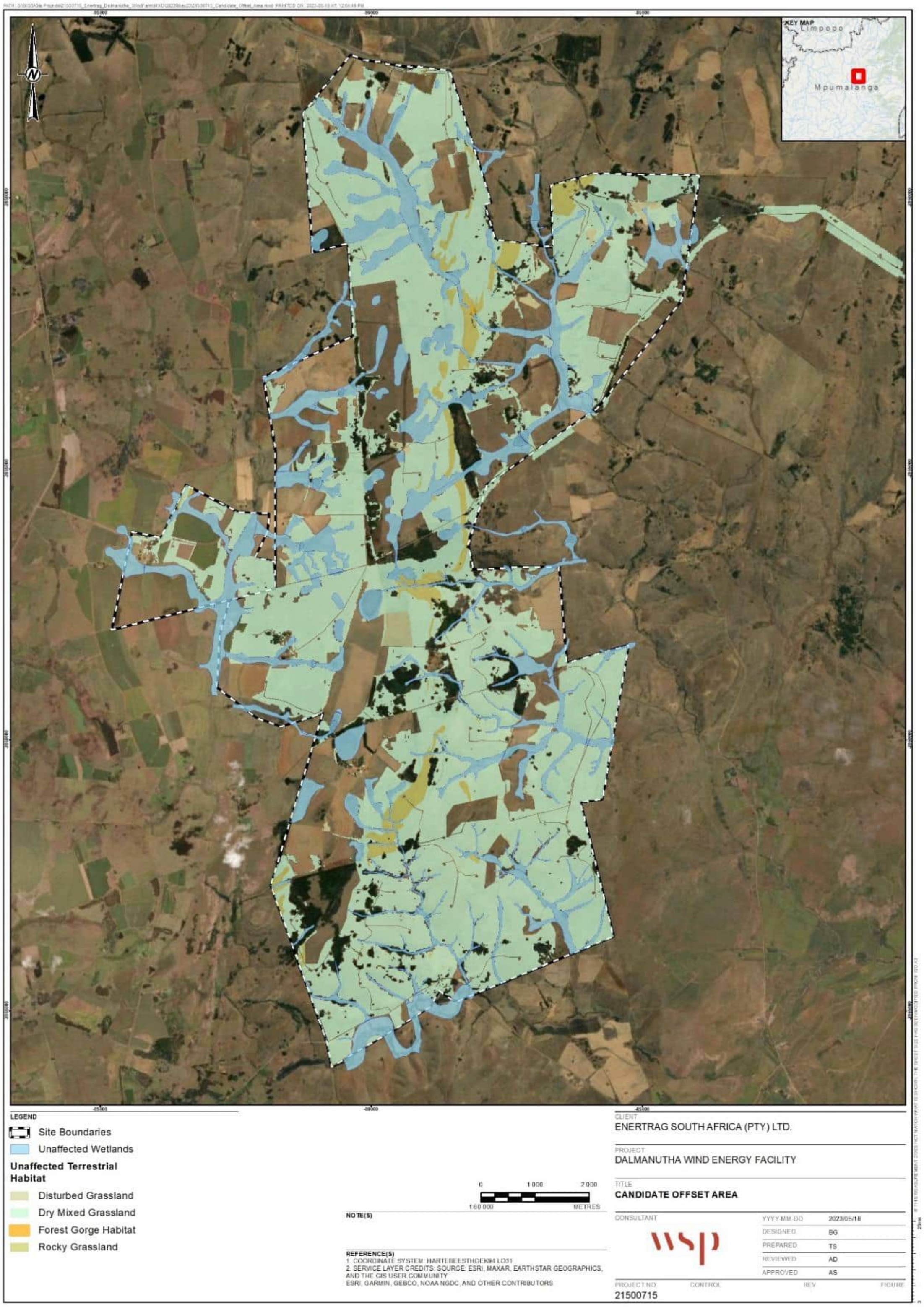


Figure 11-1 - Candidate offset areas - unaffected wetland and terrestrial habitat in LSA

11.4 ALTERNATIVES ASSESSMENT

The summary of the identified impacts concluded the following:

- Three specialist studies identified Alternative 1 as the preferred Alternative, namely Noise, terrestrial plant species and terrestrial animal species;
- Three specialist studies identified Alternative 2 as the preferred Alternative, namely Avifauna, Aquatic Biodiversity and Bats; and
- The remainder of the specialist studies showed no preference for either Alternative.

However, the noise study stated that should the turbines near Rec 17 and Rec 18 be relocated slightly, the impact significance for Alternative 2 would be reduced to low, thereby resulting in no preference between Alternative 1 and 2.

The above turbine relocation as well as the implementation of the Biodiversity Offset Strategy would result in Alternative 2 being preferred.

Figure 11-2 and **Figure 11-3** shown below represent the preferred Alternative 2 and associated infrastructure. **Table 11-9** outlines the co-ordinates of the solar fields and turbine locations included in the preferred Alternative 2.

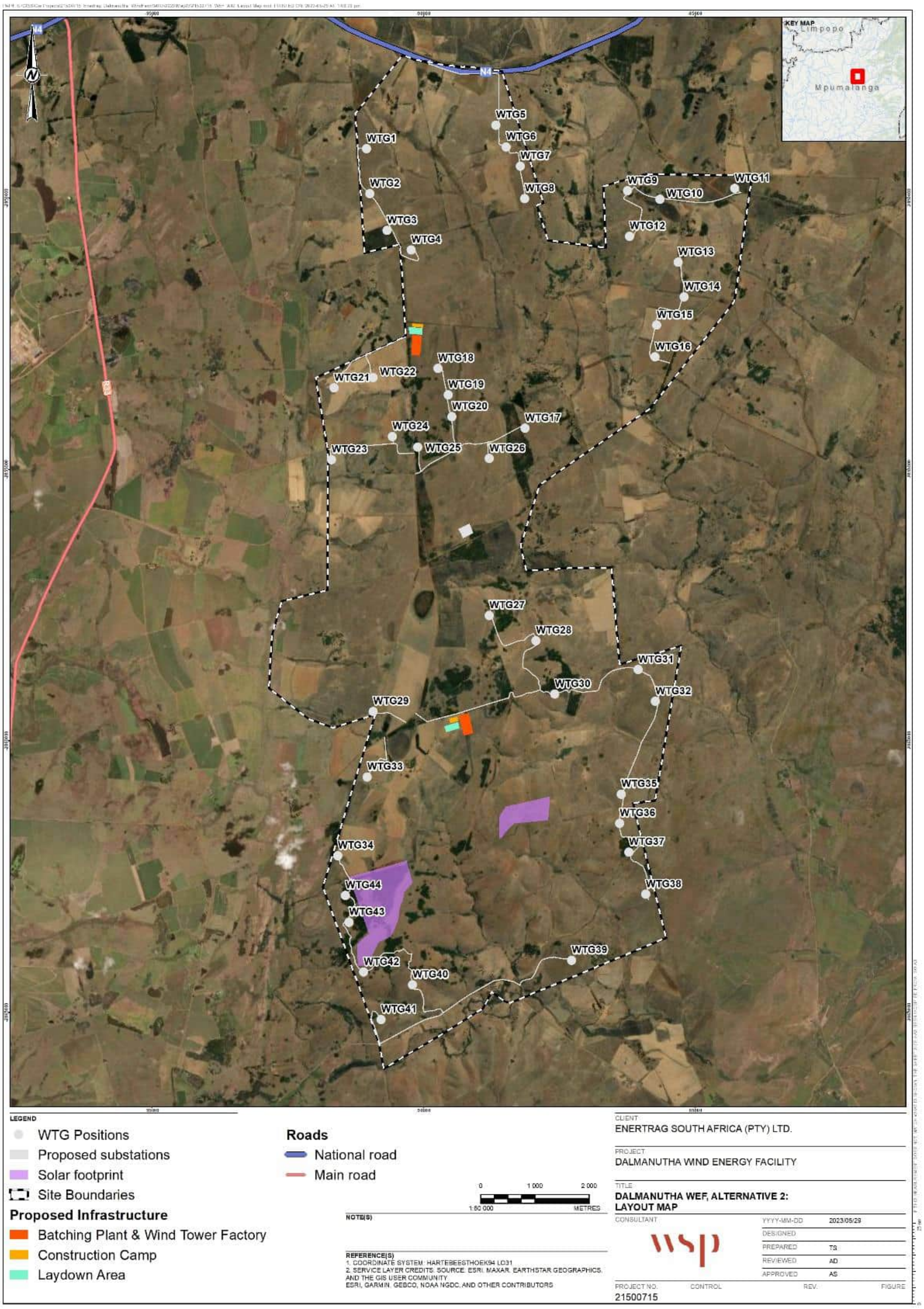


Figure 11-2 – Proposed Dalmanutha Hybrid facility layout -Alternative 2 44 WTG and Solar PV facility

Label	Longitude	Latitude
A	30° 7' 31.581" E	25° 51' 16.640" S
B	30° 7' 30.177" E	25° 51' 30.806" S
C	30° 7' 2.246" E	25° 51' 22.522" S
D	30° 6' 57.709" E	25° 51' 28.438" S
E	30° 6' 57.519" E	25° 51' 41.841" S
F	30° 6' 59.149" E	25° 51' 41.402" S
G	30° 7' 7.850" E	25° 51' 32.811" S
H	30° 5' 23.480" E	25° 52' 57.299" S
I	30° 5' 31.173" E	25° 52' 57.199" S
J	30° 5' 38.189" E	25° 52' 42.919" S
K	30° 5' 45.406" E	25° 52' 40.023" S
L	30° 5' 50.567" E	25° 52' 30.061" S
M	30° 5' 51.705" E	25° 52' 22.205" S
N	30° 5' 53.498" E	25° 52' 18.571" S
O	30° 5' 54.773" E	25° 52' 13.217" S
P	30° 6' 0.156" E	25° 52' 7.501" S
Q	30° 5' 56.173" E	25° 51' 54.368" S
R	30° 5' 17.940" E	25° 52' 3.978" S
S	30° 5' 31.279" E	25° 52' 38.210" S
T	30° 5' 27.044" E	25° 52' 40.581" S
U	30° 5' 22.950" E	25° 52' 44.806" S

Figure 11-3 - Proposed Dalmanutha Hybrid facility -Alternative 2 Solar PV facility co-ordinates

Table 11-9 - Preferred Alternative Co-ordinates

Label	Longitude	Latitude
Solar Fields		
A	30° 7' 31.581" E	25° 51' 16.640" S
B	30° 7' 30.177" E	25° 51' 30.806" S
C	30° 7' 2.246" E	25° 51' 22.522" S
D	30° 6' 57.709" E	25° 51' 28.438" S
E	30° 6' 57.519" E	25° 51' 41.841" S
F	30° 6' 59.149" E	25° 51' 41.402" S
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N	30° 5' 53.498" E	25° 52' 18.571" S
O	30° 5' 54.773" E	25° 52' 13.217" S
P	30° 6' 0.156" E	25° 52' 7.501" S
Q	30° 5' 56.173" E	25° 51' 54.368" S
R	30° 5' 17.940" E	25° 52' 3.978" S
S	30° 5' 31.279" E	25° 52' 38.210" S
T	30° 5' 27.044" E	25° 52' 40.581" S

Label	Longitude	Latitude
U	30° 5' 22.950" E	25° 52' 44.806" S
Application site Coordinates		
1	25°43'54.12"S	30° 5'55.66"E
2	25°43'57.22"S	30° 6'20.95"E
3	25°43'57.81"S	30° 6'20.86"E
4	25°43'59.86"S	30° 6'37.95"E
5	25°43'59.30"S	30° 6'38.10"E
6	25°44'2.41"S	30° 7'3.05"E
7	25°45'21.42"S	30° 7'29.79"E
8	25°45'22.62"S	30° 7'25.45"E
9	25°45'43.80"S	30° 7'32.58"E
10	25°45'48.28"S	30° 8'10.72"E
11	25°45'11.42"S	30° 8'9.34"E
12	25°45'4.36"S	30° 8'37.63"E
13	25°45'5.91"S	30° 9'47.70"E
14	25°46'20.77"S	30° 9'35.58"E
15	25°47'25.26"S	30° 8'38.98"E
16	25°48'10.27"S	30° 7'25.58"E
17	25°48'45.95"S	30° 7'13.05"E
18	25°49'2.15"S	30° 7'17.02"E

Label	Longitude	Latitude
19	25°49'0.79"S	30° 7'44.58"E
20	25°49'0.15"S	30° 8'13.15"E
21	25°49'58.08"S	30° 8'18.01"E
22	25°49'47.55"S	30° 8'59.06"E
23	25°51'19.72"S	30° 8'40.86"E
24	25°51'21.20"S	30° 8'26.42"E
25	25°52'41.96"S	30° 8'47.84"E
26	25°53'20.35"S	30° 7'4.42"E
27	25°53'14.51"S	30° 6'52.29"E
28	25°53'23.79"S	30° 6'45.87"E
29	25°53'59.19"S	30° 5'40.38"E
30	25°53'43.58"S	30° 5'37.07"E
31	25°52'9.95"S	30° 5'0.86"E
32	25°50'27.19"S	30° 5'36.02"E
33	25°50'34.72"S	30° 5'8.47"E
34	25°50'29.04"S	30° 4'51.84"E
35	25°50'10.84"S	30° 4'25.99"E
36	25°49'38.37"S	30° 4'28.47"E
37	25°49'18.75"S	30° 4'34.79"E
38	25°49'11.85"S	30° 5'5.10"E

Label	Longitude	Latitude
39	25°47'50.37"S	30° 5'6.15"E
40	25°47'5.08"S	30° 4'58.22"E
41	25°46'40.61"S	30° 5'58.12"E
42	25°45'45.56"S	30° 5'54.67"E
43	25°45'50.72"S	30° 5'30.95"E
44	25°44'28.78"S	30° 5'25.22"E
On-site IPP SS & BESS 4ha centre coordinates		
	25°48'37.63"S	30° 6'37.08"E
Laydown area and construction camp centre coordinates		
Laydown area 1	25°46'37.49"S	30° 6'4.25"E
Laydown area 2	25°50'34.80"S	30° 6'26.86"E
Construction camp 1	25°46'34.24"S	30° 6'5.96"E
Construction camp 2	25°50'30.40"S	30° 6'27.97"E
Batching plant & Wind tower factory centre coordinates		
Batching plant Wind tower factory 1	25°46'46.22"S	30° 6'4.94"E
Batching plant Wind tower factory 2	25°50'33.18"S	30° 6'36.52"E

11.5 LAYOUT OPTIMISATION

The Alternative 2 layout assessed within this Draft EIA Report was designed by the developer taking into consideration sensitive environmental and social features located within the site, which were identified by the specialists during the EIA process. This approach ensured the application of the mitigation hierarchy to the proposed project, which ultimately ensures that the development is appropriate from an environmental perspective and is suitable for development within the project site.

Considering this preferred alternative, Table 11-10 outlines the specialist studies that identified specific turbines and associated infrastructure to be unacceptably placed within the project.

Table 11-10 - Preferred Alternative Co-ordinates

Specialist finding	Turbines/associated infrastructure affected
The bat specialist indicated that there are three turbines that are located within the buffer zones of the confirmed roosts and a further three that are potentially too close to the boundary of the medium size roost located in the southern section of the property. The bats specialist also indicated that there is a proposed road in the southern section of the site that crosses two potential roosts.	WTG16, WTG30, WTG35 (within the buffer zones of the confirmed roosts WTG31, WTG32, WTG36 (too close of the medium size roost located in the southern section of the site) Road to WTG39
The noise specialist indicated that there are two turbines located close to Rec 17 and Rec 18 and recommended that the relocation of these turbines further south should be considered	WTG09, WTG10
The heritage specialist indicated that there are roads that may impact heritage sites which need to be micro sited and that the there is one wind turbine that falls within the extent of an identified heritage feature	WTG12 Road to WTG39 Road to WTG12

Based on these findings, a revision to the Alternative 2 layout was undertaken and an optimised layout provided (**Figure 11-4** and **Figure 11-5**) which addresses the need to relocate the turbines and associated infrastructure. It should be noted that the road that crosses the two potential roosts was not micro-sited as the proposed road has been aligned to an existing road and the habitat is therefore already disturbed.

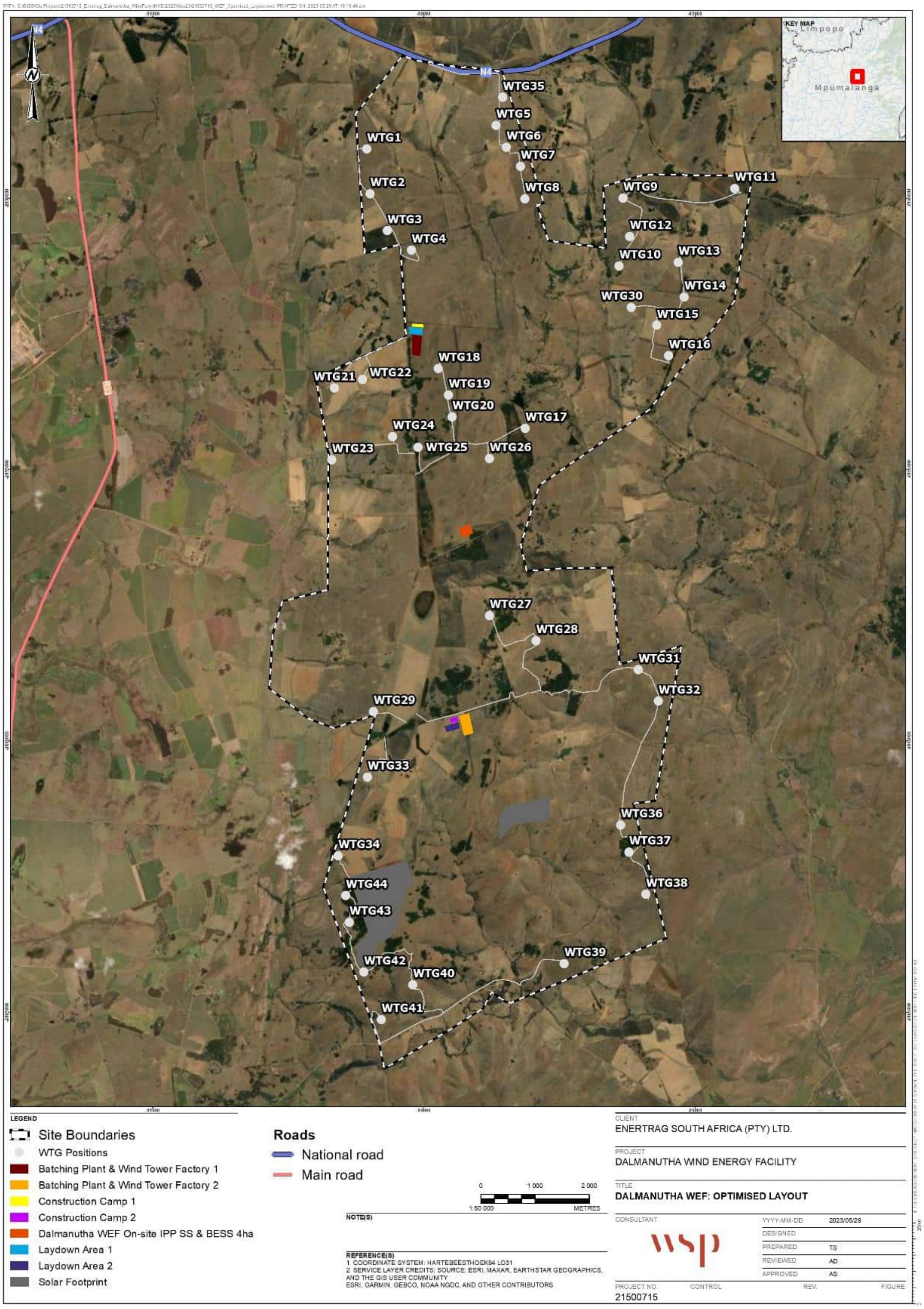

Figure 11-4 – Optimised Proposed Dalmanutha Hybrid facility layout -Alternative 2 44 WTG and Solar PV facility

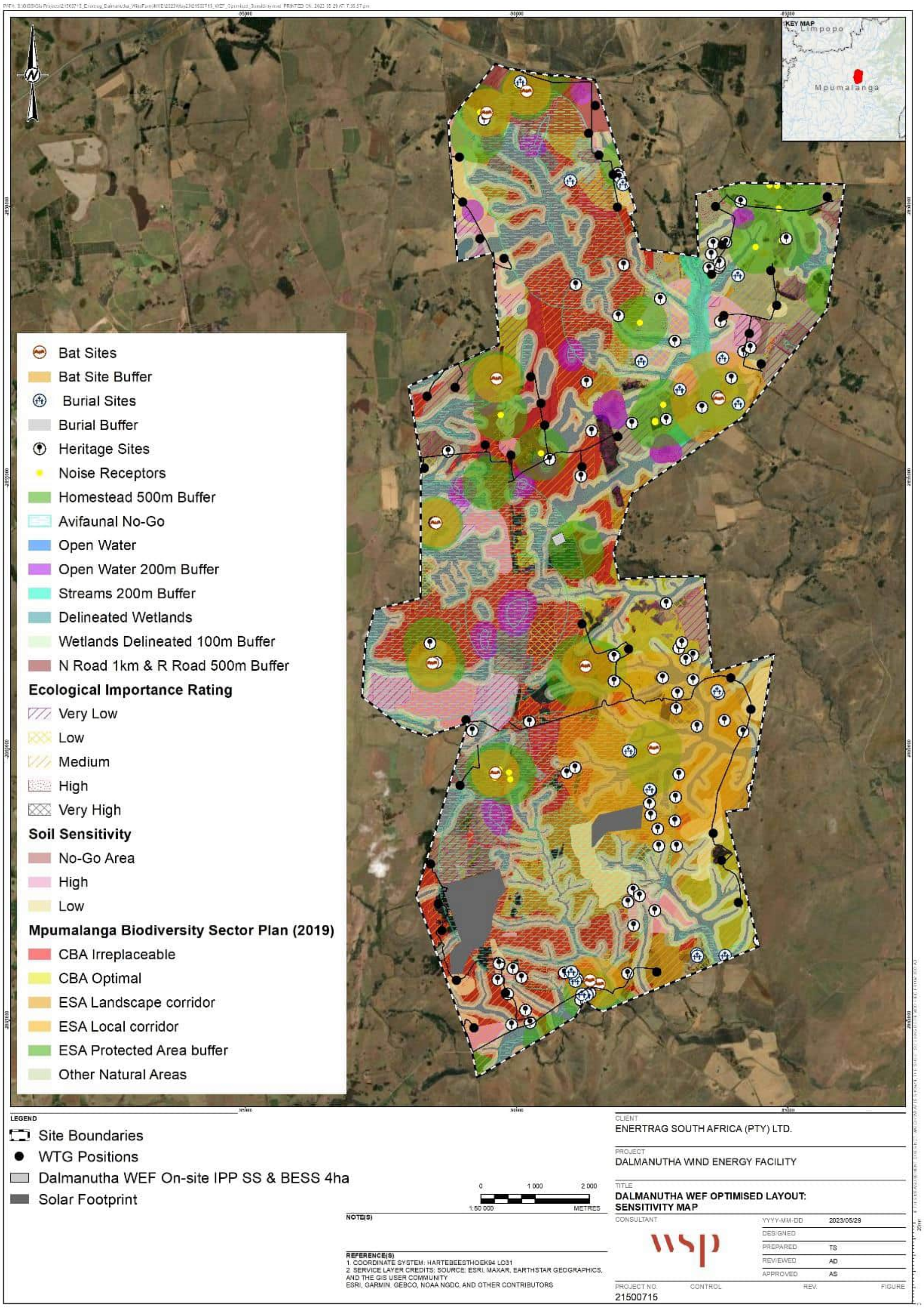

Figure 11-5 – Consolidated Sensitivity Optimised Proposed Dalmanutha Hybrid facility layout -Alternative 2 44 WTG and Solar PV facility

11.6 IMPACT STATEMENT

The overall objective of the EIA is to provide sufficient information to enable informed decision-making by the authorities. This was undertaken through consideration of the proposed project components, identification of the aspects and sources of potential impacts and subsequent provision of mitigation measures.

It is the opinion of WSP that the information contained in this document (read in conjunction the final scoping report) is sufficient for the DFFE to make an informed decision for the environmental authorisation being applied for in respect of this project.

Mitigation measures have been developed where applicable for the above aspects and are presented within the EMPr (**Appendix I**). It is imperative that all impact mitigation recommendations contained in the EMPr, of which the environmental impact assessment took cognisance, are legally enforced. Furthermore, where mitigation measures were not sufficient to reduce the residual impacts, the offset strategies have been developed (**Appendix J**).

Considering the findings of the respective studies, no fatal flaws were identified for the proposed Project. Should the avoidance and mitigation measures prescribed be implemented, and a Biodiversity Offset Management Plan be developed for implementation, the significance of the considered impacts for all negative aspects pertaining to the environmental aspects is expected to be low. It is thus the opinion of the EAP that the Project can proceed, and that all the prescribed mitigation measures and recommendations are considered by the issuing authority.

EA AUTHORISATION PERIOD

Appendix 1(3)(1)(q) of the NEMA EIA Regulations 2014, as amended requires “where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required, the date on which the activity will be concluded, and the post construction monitoring requirements finalised” must be included in the EIA Report.

The EA is required to be valid for a period of 10 years from the date of issuance of the EA. This is considered a reasonable period to allow the Applicant time to conduct relevant internal processes which can only begin after issuance of the EA.

FINALISATION OF THE EMPR AND LAYOUT

It is important to note that the EMPr (**Appendix I**) and project layout included in this EIR are not final and although included in this EIR, these are not submitted for approval at this stage. Subsequent to the decision-making phase, if environmental authorisation is granted for the project, the EMPr will have to be amended to include measures as dictated by the final layout map and micro-siting, including the requirements of the EA. The amended EMPr and final layout subjected to micro-siting will be submitted to DFFE for review and approval following detailed design. Areas put forward in the Biodiversity Offset Strategy (**Appendix J**) would then need to be further refined based on the final layout and the required offset then confirmed. At this point the biodiversity action plan should be compiled.

ASPECTS TO BE INCLUDED AS CONDITIONS IN THE EA

The following key aspects are recommended to be included as conditions of authorisation:

- The layouts submitted in the EIR are not final. The final layouts are to be submitted to the DFFE for approval prior to construction.
- The EMPr submitted in the EIR is not final. The final EMPr is to be submitted to the DFFE for approval prior to construction.
- Walkdown of the final layout will be required to be undertaken by suitably qualified terrestrial biodiversity, aquatic biodiversity, bat, avifauna and heritage specialists to inform final micro siting of the project infrastructure.
- All mitigation measures detailed in this EIR and the relevant specialist reports must be included in the EMPr or implemented where appropriate and as dictated by the walkthroughs.
- Recommendations for the layout as provided by the relevant specialists must be implemented as far as possible.
- Turbines positions should be adjusted to minimise shadow flicker of receptors if concerns are raised.
- The final EMPr must form part of all contractual documents with contractors during construction and operational phases of the project. Furthermore, a dedicated Environmental Control Officer (ECO) must be appointed to ensure compliance to all EA conditions and EMPr commitments throughout the construction phase.
- An Observer-Led Turbine Shutdown on Demand (OLSDOD) programme must be implemented on site from COD.
- A 'Cape Vulture Food Management Programme' must be implemented on site to ensure all dead livestock/wildlife on site are removed as soon as possible and made unavailable to vultures for feeding.
- Applications for all relevant and required permits must be submitted prior to construction.
- Micro siting of Project components to preserve recorded heritage features within a 30m buffer.
- Regular monitoring of the development footprint by the ECO to implement the Chance Find Procedure for heritage and palaeontology resources, outlined in Section 8.14 of the EMPr (**Appendix I**) in case heritage resources are uncovered during the course of construction.
- Compilation of a heritage management plan for the Dalmanutha WEF Project (Alternative 1 only).
- The Environmental Authorisation (EA) holder must select a biodiversity offset site(s) from the identified candidate portfolio that is sufficient to meet the targets for offset, to be confirmed based on the footprint of the final design (to be determined post EA).
- Only in situations that the proposed offset sites within the study area are not feasible can the EA holder select a biodiversity offset site that is not identified in the Biodiversity Offset Report, but still meets the requirements for a biodiversity offset under the circumstances – in this situation, the guidance of the relevant conservation planning authority, i.e. MPTA, DFFE will be sought.
- A request for the declaration of the chosen biodiversity offset site as a protected area should be submitted to the Minister or an MEC. Other means of securing the biodiversity offset site (such as the registration of a conservation servitude) may be pursued if the Minister or MEC refuses to declare a protected area under the circumstances.
- A Biodiversity Offset Management Plan must be prepared for the biodiversity offset site, and incorporated into the EMPr or a Biodiversity Offset Implementation Agreement.
- A Biodiversity Action Plan (BAP) should be prepared for the Project, subsequent to the finalised layout, in consultation with the relevant authorities and conservation organisations.
- A Water Use License must be obtained for road crossings in wetlands, and the need for an offset investigated as part of the Water Use License Application (WULA) process.

12 CONCLUSION

A number of environmental impacts have been identified as requiring some more in-depth investigation and the identification of detailed mitigation measures. Therefore, this detailed EIAR provides an assessment of these potential impacts and recommends appropriate mitigation measures as well a biodiversity offset strategy

The anticipated environmental impacts associated with the proposed development have been evaluated according to their significance, which is determined as a result of their extent, magnitude, probability and duration. All impacts were assessed with and without management measures in place. This draft EIAR has been structured to comply with the requirements of the Appendix 3 of GNR 982. The report provides a description of the proposed project and details the aspects associated with the construction, operation and decommissioning. The report also includes the methodology followed to undertake the S&EIR process. A detailed description on the existing environment (bio-physical as well as socio-economic) is provided based on findings from the specialist surveys. Stakeholder engagement was undertaken from the onset of the project in a transparent and comprehensive manner. Outcomes of all comments received from the public review periods were recorded and responded to in the S&EIR. Based on the environmental description, specialist surveys as well as the stakeholder engagement a detailed EIA rating has been undertaken and where relevant the necessary management measures have been recommended.

In summary, the S&EIR process assessed both biophysical and socio-economic environments and identified appropriate management and mitigation measures. The overall residual impact (i.e. post mitigation) of the proposed Project is Low to Medium, apart from the avifaunal and visual impacts which are High. It must be noted that the high residual visual impacts cannot be mitigated due to the nature of a WEF development they are always highly visible but the receiving environment is not identified to be visually sensitive. Furthermore, the high residual avifauna and associated biodiversity impacts can be addressed through the continued development of the proposed biodiversity offset strategy, compilation of the Biodiversity Offset Management Plan and preparation of a Biodiversity Action Plan once a final layout is determined. In addition, it should be noted that the overall socio-economic impacts associated with the project are positive.

Noting that a final layout is still to be approved, WSP is of the opinion that the Project should be authorised on condition that a Biodiversity Offset Management Plan be developed for implementation and all identified mitigation and management measures are implemented.

This draft EIAR will be made available for public review from **31 May 2023 to 03 July 2023**.

All issues and comments submitted to WSP during the scoping and EIA phase have been incorporated in the SER (**Appendix D**). The Final EIR will be submitted to the DFFE, as the competent authority, for review and decision -making.

If you have any further enquiries, please feel free to contact:

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