KANGRA COAL (PTY) LTD

KUSIPONGO

DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT IN SUPPORT OF AN ENVIRONMENTAL AUTHORIZATION AND WASTE MANAGEMENT LICENCE APPLICATION FOR THE PROPOSED AMENDMENT OF THE KUSIPONGO UNDERGROUND AND OPENCAST DEVELOPMENT

MPUMALANGA

ENVIRONMENTAL IMPACT ASSESSMENT

&

ENVIRONMENTAL MANAGEMENT PROGRAMME

REFERENCE: (MP) 30/5/1/2/3/2/1 (10099) EM

DRAFT FOR PUBLIC COMMENT

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ENVIRONMENTAL IMPACT ASSESSMENT

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ENVIRONMENTAL MANAGEMENT PROGRAMME

FOR PUBLIC PARTICIPATION AND SUBMISSION TO THE DMR

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REF NUMBER: (MP) 30/5/1/23/2/1 (10099) EM

TO BE SUBMITTED FOR AUTHORISATION IN TERMS OF:

SECTION 102 OF THE MINERALS AND PETROLEUM RESOURCES DEVELOPMENT ACT

LISTED ACTIVITIES UNDER THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT AND NATIONAL ENVIRONMENTAL MANAGEMENT: WASTE ACT

PREPARED BY: EXM Advisory Services (Pty) Ltd

Date: 30 October 2019

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TABLE OF CONTENTS

1. EXECUTIVE SUMMARY 16

1.1 Introduction and Background 16

1.2 Project Overview 16

1.2.1 Alternatives 17

1.3 Environmental Legislation 21

1.4 Environmental Impacts 21

1.5 Conclusions and Recommendations 22

2. CONTACT PERSON AND CORRESPONDENCE ADDRESS 24

2.1 Details and expertise of EAP who prepared the report 24

2.2 Declaration of Independence 24

3. DESCRIPTION OF THE PROPERTY 25

4. DESCRIPTION OF THE SCOPE OF THE PROPOSED OVERALL ACTIVITY 30

4.1 Listed and specified activities 30

4.2 Description of activities to be undertaken 33

4.2.1 Project Background 33

4.2.2 Kusipongo Mining Right 34

4.3 Project Description 37

4.3.1 Description of Mining Operations 39

4.3.1.1 Opencast Pits 39

4.3.1.2 Underground Mine 39

4.3.1.3 Transportation 40

4.3.1.4 Water Management 40

4.3.1.5 Waste 40

4.3.1.6 Sewage 40

4.3.1.7 Electricity 40

5. POLICY AND LEGISLATIVE CONTEXT 41

5.1 Mineral and Petroleum Resources Development Act (Act No. 28 of 2002) 41

5.2 National Environmental Management Act (Act No. 107 of 1998) (as amended) 42

5.3 National Environmental Management: Waste Act (Act No. 59 of 2008) (as amended) 46

5.4 National Environmental Management Act: Air quality Act (Act No. 39 of 2004) 47

5.5 National Environmental Management: Biodiversity Act (Act No. 10 of 2004) 47

5.6 Mpumalanga Biodiversity Conservation Plan 47

5.7 National Water Act (Act No. 36 of 1998) 48

5.8 National Heritage Resources Act (Act No. 25 of 1999) 49

6. NEED AND DESIRABILITY OF THE PROPOSED ACTIVITIES 49

6.1 Importance of Coal in South Africa 50
6.2 Period for which the environmental authorisation is required 50

7. MOTIVATION FOR THE PREFERRED DEVELOPMENT FOOTPRINT WITHIN THE APPROVED SITE INCLUDING A FULL DESCRIPTION OF THE PROCESS FOLLOWED TO REACH THE PROPOSED DEVELOPMENT FOOTPRINT WITHIN THE APPROVED SITE 51

7.1 Site Layout Alternatives 51
7.2 Details of the development footprint alternatives considered 58
7.2.1 The type of activity to be undertaken 58
7.2.2 The technology to be used 58
7.2.3 Operational aspects of the activity 58
7.2.4 No-Go Alternative 59

8. DETAILS OF THE PUBLIC PARTICIPATION PROCESS FOLLOWED 60

8.1.1 Identification of Interested and Affected Parties 60
8.1.2 Notifications 61
8.1.3 Media Advertisements and Site Notices 61
8.1.4 Public meetings 68
8.1.5 Public and authority review of draft scoping report 68
8.1.6 EIA Phase PPP 69
8.1.6.1 Advertisements and meetings 69
8.1.6.2 Public and authority review of the draft EIA Report 69
8.1.6.3 Environmental Authorisation 69
8.2 Summary of issues raised by IAPs 70

9. THE ENVIRONMENTAL ATTRIBUTES ASSOCIATED WITH THE DEVELOPMENT FOOTPRINT ALTERNATIVES 82

9.1 Climate 82
9.1.1 Rainfall 82
9.1.2 Wind 82
9.1.3 Topography 82
9.2 Geology 84
9.3 Soils, Land Use and Land capability 84
9.3.1 Land Use 84
9.3.2 Soils 87
9.3.3 Land capability classification 90
9.4 Air Quality 93
9.4.1 Baseline Dust Fall Rates 94
9.4.2 Surrounding Sources of Air Pollution 95
9.4.3 Vehicle Dust Entrainment on Unpaved Roads 96
9.4.4 Commercial Agricultural Activities 96

9.4.5 Forestry and Plantations 96
9.5 Noise 97
9.5.1 Baseline noise characteristics 97
9.5.2.1 KCKELTSL01 - Measurement representing sound levels typical dwelling: 103
9.5.2.2 KCKELTSL02 - Measurement representing sound levels typical dwelling: 103
9.5.2.3 Short-term measurements in vicinity of project area: 103
9.6 Biodiversity (Flora and Fauna) 104
9.6.1 Baseline Biodiversity Environment 104
9.6.2 Faunal Habitat Units 105
9.6.2.1 Grassland 105
9.6.2.2 Rocky Habitat: 105
9.6.2.3 Freshwater Habitat: 106
9.6.2.4 Wooden Ravine Habitat 106
9.6.2.5 Modified Habitat Unit: 106
9.6.3 Faunal Species of Conservation Concern 108
9.6.4 Sensitivity Mapping 110
9.6.5.1 Grassland Habitat Unit: 110
9.6.5.2 Rocky Habitat Unit: 111
9.6.5.3 Wetland Habitat Unit: 111
9.6.5.4 Woody Habitat Unit: 111
9.6.5.5 Modified Habitat Unit: 111
9.6.6 Floral SCC and Medicinally Important Species 113
9.6.7 Alien and Invasive Plant Species 114
9.6.8 Floral Habitat Sensitivity 114
9.7 Surface Water Resources 121
9.7.1 Watercourse verification 121
9.7.2 Freshwater Resource System Classification 121
9.7.2.1 Twyfelhoek Watercourse Assessment 122
9.7.2.2 Donkerhoek Watercourse Assessment 131
9.7.2.3 Balgarthen Watercourse Assessment 142
9.7.3 Aquatic Ecology 154
9.7.4 Aquatic Ecological Assessment 156
9.7.4.1 Balgarthen Focus Area 158
9.7.4.2 Donkerhoek Focus Area 167
9.7.4.3 Twyfelhoek Focus Area 171
9.7.5 Aquatic Ecological Importance and Sensitivity 173
9.7.6 Hydropedology 174
9.7.6.1 Transect 3 175
9.7.6.2 Transect 4 177
9.7.6.3 Transect 5 178
9.7.6.4 Transect 6 180
9.7.6.5 Transect 7 182

9.7.6.6 Balgarthen Transects 183
9.7.6.7 Transect 3 184
9.7.6.8 Transect 4 185
9.8 Groundwater 186
9.8.1 Hydrocensus 186
9.8.2 Monitoring Boreholes 187
9.8.3 Aquifer Testing 190
9.8.3.1 Hydrogeological Setting 190
9.8.3.2 Aquifer Parameters 191
9.8.4 Hydrochemistry 191
9.8.4.1 Sampling and Screening results 192
9.8.5 Aquifer Classification and Vulnerability 196
9.9 Land Tenure 196
9.10 Cultural Heritage 200
9.10.1.1 General Desktop Study 200
9.10.1.2 Fieldwork 200
9.10.2 Palaeontology 207
9.11 Socio-Economic Environment 208
9.12 Roads and Traffic 212
9.12.1 Baseline traffic conditions 212
9.12.1.1 Existing Road Network and Access 212
9.12.1.2 Current traffic volumes 213
10. IMPACTS AND RISKS IDENTIFIED INCLUDING THE NATURE, SIGNIFICANCE, CONSEQUENCE, EXTENT, DURATION IN AND PROBABILITY OF THE IMPACTS, INCLUDING THE DEGREE TO WHICH THESE IMPACTS CAN BE REVERSED, AVOIDED, MANAGED, MITIGATED AND EXTENT TO WHICH THEY MAY CAUSE IRREPLACEABLE LOSS OF RESOURCES 215
10.1 Methodology used in determining the significance of environmental impacts 215
10.1.1 Impact Ranking Criteria 215
10.2 Impact Mitigation Hierarchy 217
10.3 The positive and negative impacts that the proposed activity (in terms of the initial site layout) will have on the environment and the community that may be affected 218
10.3.1 Groundwater Impacts 218
10.3.1.8 Scenario 4a and 4b: LOM and Post-Closure sulphate pollution plume 223
10.3.2 Contamination of Underlying Aquifers 230
10.3.3 Air Quality 232
10.3.4 Noise Impacts 235
10.3.5 Soils, Land Capability and Land Use 237
10.3.6 Terrestrial Biodiversity 237
10.3.6.1 Critical Biodiversity Areas 237
10.3.6.2 Floral Impacts 240

10.3.6.3 Faunal Impacts 242
10.3.7 Freshwater Resources and Wetlands 243
10.3.8 Socio-Economic 244
10.3.9 Blasting 244
10.3.9.1 Project Sensitivity 244
10.3.9.2 Ground Vibration Levels 247
10.3.9.3 Potential that vibration will upset adjacent communities 248
10.3.9.4 Structural Damage 249
10.3.9.5 Air Blast 249
10.3.9.6 Fly-rock Unsafe Zone 250
10.3.9.7 Possible Relocation 250
10.3.10 Traffic 250
10.3.10.1 Trip Generation 250
10.3.10.2 Roads 251
10.3.11 Cultural Heritage 252
10.3.11.1 Palaeontology 253
10.4 The possible mitigation measures that could be applied and the level of residual risk 254
10.5 Motivation where no alternative sites were considered 254
10.6 Statement motivating the alternative development location within the overall site 254
10.7 Full description of the process undertaken to identify, assess and rank the impacts and risks the activity will impose on the preferred site (in respect of the final site layout plan) through the life of the activity 254
10.8 Assessment of each identified potentially significant impact risk 254
11. SUMMARY OF SPECIALIST REPORTS 277
12. ENVIRONMENTAL IMPACT STATEMENT 293
12.1 SUMMARY OF KEY FINDINGS OF THE ENVIRONMENTAL IMPACT ASSESSMENT 293
12.1.1 Groundwater 293
12.1.2 Waste 300
12.1.3 Air Quality 300
12.1.4 Noise 301
12.1.5 Soils, Land Capability and Land-use 301
12.1.6 Biodiversity 302
12.1.7 Surface Water Resources (including Wetlands) 304
12.1.8 Traffic 305
12.1.9 Heritage Sites 305
12.2 Final site map 308
12.3 Summary of the positive and negative implications and risks of the proposed activity and identified alternatives 310
12.4 Proposed management objectives and the impact management outcomes for inclusion in the EMPr 322

12.5 Final proposed alternatives 322
12.6 Aspects for inclusion as conditions in the authorisation 325
12.7 Description of any assumptions, uncertainties and gaps in knowledge 326
12.8 Reasoned opinion as to whether the proposed activity should or should not be authorised 327
12.9 Rehabilitation Objectives 328
12.9.1 Closure Vision, Objectives and Targets 328
12.9.2 Physical stability 328
12.9.3 Environmental quality 329
12.9.4 Health and safety 329
12.9.5 Land capability/land-use 330
12.9.6 Aesthetic quality 330
12.9.7 Socio-economic aspects 330
12.10 Period for which the environmental authorisation is required 331
13. FINANCIAL PROVISION 331
13.1 Derivation of quantum 332
13.1.1 Annual (Premature) Closure Provision 333
13.2 Amount to be provided for from operating expenditure 333
14. DEVIATIONS FROM THE APPROVED SCOPING REPORT AND PLAN OF STUDY 333
14.1 Deviations from the methodology used in determining the significance of the potential environmental impacts and risks 333
14.2 Motivation for deviation 333
15. OTHER INFORMATION REQUIRED BY COMPETENT AUTHORITY 333
16. OTHER MATTERS REQUIRED IN TERMS OF SECTIONS 24(4)(A) AND (B) ON NEMA 333
17. UNDERTAKING 333
18. REFERENCES 335

LIST OF FIGURES

FIGURE 1-1: ALTERNATIVE A LAYOUT **18**
FIGURE 1-2: ALTERNATIVE B LAYOUT (PREFERRED) **19**
FIGURE 1-3: ALTERNATIVE C LAYOUT **20**
FIGURE 3-1: PROPOSED PROJECT LOCATION **29**
FIGURE 4-1: OVERVIEW OF THE MAQUASA OPERATIONS **35**
FIGURE 4-2**:** KUSIPONGO MINING RIGHT AREA AND APPROVED MINING OPERATIONS **36**
FIGURE 4-3: GENERAL LOCALITY OF PROPOSED MINING AREAS **38**
FIGURE 7-1: ALTERNATIVE A LAYOUT **51**
FIGURE 7-2: ALTERNATIVE C LAYOUT **53**
FIGURE 7-3: ALTERNATIVE B LAYOUT **54**
FIGURE 7-4: BALGARTHEN CONCEPTUAL LAYOUT PLAN FOR ALTERNATIVE B **55**
FIGURE 7-5: DONKERHOEK CONCEPTUAL LAYOUT PLAN FOR ALTERNATIVE B **56**
FIGURE 7-6: TWYFELHOEK CONCEPTUAL LAYOUT PLAN FOR ALTERNATIVE B **57**
FIGURE 8-1: MAP SHOWING WHERE SITE NOTICES WERE PLACED IN PROXIMITY TO THE MINING RIGHT AREA **64**
FIGURE 9-1: LOCAL TOPOGRAPHY **83**
FIGURE 9-2: LAND-USE WITHIN THE BALGARTHEN FOCUS AREA **86**
FIGURE 9-3: LAND-USE WITHIN THE TWYFELHOEK FOCUS AREA **86**
FIGURE 9-4: LAND-USE WITHIN THE DONKERHOEK FOCUS AREA **87**
FIGURE 9-5: SOIL MAP DEPICTING IDENTIFIED SOIL FORMS WITHIN THE BALGARTHEN FOCUS AREA **88**
FIGURE 9-6: SOIL MAP DEPICTING IDENTIFIED SOIL FORMS WITHIN THE TWYFELHOEK FOCUS AREA **89**
FIGURE 9-7: SOIL MAP DEPICTING IDENTIFIED SOIL FORMS WITHIN THE DONKERHOEK FOCUS AREA **89**
FIGURE 9-8: MAP DEPICTING LAND CAPABILITY CLASSES OF SOILS ASSOCIATED WITH THE MINING INFRASTRUCTURE WITHIN THE BALGARTHEN AREA. **92**
FIGURE 9-9: MAP DEPICTING LAND CAPABILITY CLASSES OF SOILS ASSOCIATED WITH THE MINING INFRASTRUCTURE WITHIN THE TWYFELHOEK AREA. **92**
FIGURE 9-10: MAP DEPICTING LAND CAPABILITY CLASSES OF SOILS ASSOCIATED WITH DONKERHOEK AREA **93**
FIGURE 9-11: DUST-FALL RATES AT MAQUASA EAST AND WEST OPERATIONS (JAN 2018 – MAY 2019) **94**
FIGURE 9-12: IDENTIFIED SURROUNDING EMISSIONS SOURCES WITHIN 10KM OF KUSIPONGO **95**
FIGURE 9-13: LOCATION OF MONITORING POINTS **98**
FIGURE 9-14: HABITAT UNITS FOR THE BALGARTHEN AREA **106**
FIGURE 9-15: HABITAT UNITS FOR THE TWYFELHOEK AREA **107**
FIGURE 9-16: HABITAT UNITS FOR THE DONERHOEK AREA **108**
FIGURE 9-17: COMBINED FAUNAL SENSITIVITY MAP **110**

FIGURE 9-18: SENSITIVITY MAP FOR THE BALGARTHEN FOCUS AREA **119**
FIGURE 9-19: SENSITIVITY MAP FOR DONKERHOEK FOCUS AREA **120**
FIGURE 9-20: SENSITIVITY MAP FOR THE TWYFELHOEK FOCUS AREA **120**
FIGURE 9-21: DELINEATED WATERCOURSES WITHIN THE TWYFELHOEK FOCUS AREA **123**
FIGURE 9-22: CONCEPTUAL ILLUSTRATION OF THE PES AT TWYFELHOEK **130**
FIGURE 9-23: TWYFELHOEK CONCEPTUAL PRESENTATION OF THE ZONES OF REGULATION **131**
FIGURE 9-24: DONKERHOEK DELINEATED WATERCOURSES **132**
FIGURE 9-25: CONCEPTUAL ILLUSTRATION OF THE PES AT DONKERHOEK **141**
FIGURE 9-26: DONKERHOEK CONCEPTUAL PRESENTATION OF THE ZONES OF REGULATION **141**
FIGURE 9-27: DELINEATED WATERCOURSES ASSOCIATED WITH THE BALGARTHEN FOCUS AREA **142**
FIGURE 9-28: CONCEPTUAL ILLUSTRATION OF THE PES AT BALGARTHEN **153**
FIGURE 9-29: BALGARTHEN CONCEPTUAL PRESENTATION OF THE ZONES OF REGULATION **153**
FIGURE 9-30: RIVERS ASSOCIATED WITH THE FOCUS AREAS ACCORDING TO THE NFEPA DATABASE **154**
FIGURE 9-31: TRANSECTS 3 – 7 FOR DONKERHOEK AND TWYFELHOEK OPENCAST AREAS **175**
FIGURE 9-32: CONCEPTUAL HYDROPEDOLOGICAL RESPONSE MODEL FOR TRANSECT 3 **176**
FIGURE 9-33: INTERFLOW HYDROPEDOLOGICAL SOIL TYPE IN OBSERVATION 12 TRANSECT 3 **177**
FIGURE 9-34: CONCEPTUAL HYDROPEDOLOGICAL RESPONSE MODEL OF TRANSECT 4 **177**
FIGURE 9-35: INTERFLOW HYDROPEDOLOGICAL SOIL TYPE IN OBSERVATION 13 TRANSECT 4 **178**
FIGURE 9-36: CONCEPTUAL HYDROPEDOLOGICAL RESPONSE MODEL OF TRANSECT 5 **179**
FIGURE 9-37: RECHARGE HYDROPEDOLOGICAL SOIL TYPE OBSERVATION 17 TRANSECT 5 **179**
FIGURE 9-38: RESPONSIVE HYDROPEDOLOGICAL SOIL TYPE OBSERVATION 19 TRANSECT 5 **180**
FIGURE 9-39: CONCEPTUAL HYDROPEDOLOGICAL RESPONSE MODEL OF TRANSECT 6 **181**
FIGURE 9-40: RECHARGE HYDROPEDOLOGICAL SOIL TYPE OBSERVATION 21 TRANSECT 6 **181**
FIGURE 9-41: CONCEPTUAL HYDROPEDOLOGICAL RESPONSE MODEL TRANSECT 7 **182**
FIGURE 9-42: RECHARGE HYDROPEDOLOGICAL SOIL TYPE OBSERVATION 26 TRANSECT 7 **183**
FIGURE 9-43: HYDROPEDOLOGICAL SOIL TYPES IDENTIFIED FOR THE BALGARTHEN AREA **184**
FIGURE 9-44: CONCEPTUAL HYDROLOGICAL RESPONSE MODEL OF TRANSECT 3 **185**
FIGURE 9-45: CONCEPTUAL HYDROPEDOLOGICAL RESPONSE MODEL OF TRANSECT 4 **186**
FIGURE 9-46: HYDROCENSUS POINTS **187**
FIGURE 9-47: NEWLY DRILLED BOREHOLES **189**
FIGURE 9-48: LAND OWNERSHIP WITHIN THE KUSIPONGO MINING RIGHT **198**
FIGURE 9-49: NEIGHBOURING LAND OWNERSHIP TO THE KUSIPONGO MINING RIGHT **199**
FIGURE 9-50: HERITAGE SITES IDENTIFIED WITHIN THE BALGARTHEN AREA **206**
FIGURE 9-51: HERITAGE SITES IDENTIFIED WITHIN THE TWYFELHOEK AREA **206**
FIGURE 9-52: HERITAGE SITES IDENTIFIED WITHIN THE BALGARTHEN AREA **207**
FIGURE 9-53: SURFACE GEOLOGY OF THE PROPOSED KUSIPONGO MINING AREA **208**
FIGURE 9-54: ACCESS ROADS **212**
FIGURE 9-55: WESTBOUND OF D282 / ACCESS TO BALGARTHAN ADIT 1 **213**
FIGURE 9-56: POSTIION OF TRAFFIC COUNT **214**

FIGURE 10-1: IMPACT MITIGATION HIERARCHY **218**
FIGURE 10-2: SCENARIO 2B – TWYFELHOEK PIT DRAWDOWN AND GROUNDWATER CAPTURE ZONE **220**
FIGURE 10-3: SCENARIO 2C – DONKERHOEK PIT DRAWDOWN AND GROUNDWATER CAPTURE ZONE **221**
FIGURE 10-4: SCENARIO 2D – UNDERGROUND DRAWDOWN AND GROUNDWATER CAPTURE ZONE **222**
FIGURE 10-5: EXPECTED DECANT ZONES **223**
FIGURE 10-6: SCENARIO 4A – LOM POLLUTION PLUME BALGARTHEN PIT **224**
FIGURE 10-7: SCENARIO 4B – POST CLOSURE SULPHATE POLLUTION PLUME BALGARTHEN PIT **225**
FIGURE 10-8: SCENARIO 4A - LOM SULPHATE POLLUTION PLUME TWYFELHOEK PIT **226**
FIGURE 10-9: SCENARIO 4B – POST CLOSURE SULPHATE POLLUTION PLUME TWYFELHOEK PIT **226**
FIGURE 10-10: SCENARIO 4A – LOM SULPHATE POLLUTION PLUME DONKERHOEK PIT **227**
FIGURE 10-11: SCENARIO 4B – POST CLOSURE SULPHATE POLLUTION PLUME DONKERHOEK PIT **228**
FIGURE 10-12: SCENARIO 4A – LOM SULPHATE POLLUTION PLUME UNDERGROUND OPERATIONS (WEATHERED AQUIFER) **229**
FIGURE 10-13: SCENARIO 4A – LOM SULPHATE POLLUTION PLUME UNDERGROUND OPERATIONS (FRACTURED AQUIFER) **229**
FIGURE 10-14: SCENARIO 4B – POST CLOSURE SULPHATE POLLUTION PLUME UNDERGROUND OPERATIONS (WEATHERED AQUIFER) **230**
FIGURE 10-15: PREDICATED DUST FALL RATES ASSOCIATED WITH KUSIPONGO **233**
FIGURE 10-16: PREDICATED DAILY AVERAGE PM_{10} CONCENTRATIONS **234**
FIGURE 10-17: PREDICTED ANNUAL AVERAGE PM_{10} CONCENTRATIONS **234**
FIGURE 10-18: PREDICATED DAILY AVERAGE $PM_{2.5}$ CONCENTRATIONS **235**
FIGURE 10-19: PREDICATED ANNUAL AVERAGE $PM_{2.5}$ CONCENTRATIONS **235**
FIGURE 10-20: TWYFELHOEK CRITICAL BIODIVERSITY AREAS **238**
FIGURE 10-21: DONKERHOEK CRITICAL BIODIVERSITY AREAS **239**
FIGURE 10-22: BALGARTHEN CRITICAL BIODIVERSITY AREAS **239**
FIGURE 10-23: SENSITIVE AREAS FOR THE TWYFELHOEK OPENCAST AREAS **245**
FIGURE 10-24: SENSITIVE AREAS FOR THE DONKERHOEK OPENCAST AREAS **246**
FIGURE 10-25: SENSITIVE AREAS FOR THE BALGARTHEN B OPENCAST AREA **246**
FIGURE 10-26: SENSITIVE AREAS FOR THE BALGARTHEN B ADIT AREA **247**
FIGURE 10-27: TRAFFIC COUNT POSITIONS **251**
FIGURE 10-28: PROPOSED HAUL ROADS TO BE USED AT KUSIPONGO **251**
FIGURE 10-29: IMPACT ASSESSMENT **256**
FIGURE 12-1: BALGARTHEN B PIT MITIGATED SCENARIO DURING OPERATIONS **294**
FIGURE 12-2: BALGARTHEN B PIT MITIGATED SCENARIO POST CLOSURE **294**
FIGURE 12-3: TWYFELHOEK PITS MITIGATED SCENARIO DURING OPERATIONS **295**
FIGURE 12-4: TWYFELHOEK PITS MITIGATED SCENARIO POST CLOSURE **296**
FIGURE 12-5: DONKERHOEK PITS MITIGATED SCENARIO POST CLOSURE **297**

FIGURE 12-6: DONKERHOEK PITS MITIGATED SCENARIO POST CLOSURE **297**
FIGURE 12-7: PREFERRED LAYOUT PLAN **309**

LIST OF TABLES

TABLE 9-1: SUMMARY DISCUSSION LAND CAPABILITY CLASSES **90**
TABLE 9-2: SUMMARY OF MONITORING RESULTS FOR THE DAY TIME **99**
TABLE 9-3: SUMMARY OF MONITORING RESULTS FOR NIGHT TIME **101**
TABLE 9-4: SPECIES OF CONSERVATION CONCERN **108**
TABLE 9-5: QUICK GUIDE TO FLORAL COMMUNITIES WITHIN THE KUSIPONGO AREAS **112**
TABLE 9-6: LIST OF SPECIES PROTECTED UNDER THE MNCA THAT WERE RECORDED WITHIN THE FOCUS AREAS **113**
TABLE 9-7: A SUMMARY OF SENSITIVITY OF EACH HABITAT UNIT AND IMPLICATIONS FOR DEVELOPMENT **115**
TABLE 9-8: TWYFELHOEK WETLAND GROUPING **123**
TABLE 9-9: SUMMARY OF THE ASSESSMENT OF WETLAND SYSTEM 1 AT TWYFELHOEK **124**
TABLE 9-10: SUMMARY OF THE ASSESSMENT OF WETLAND SYSTEM 2 AT TWYFELHOEK **126**
TABLE 9-11: SUMMARY OF THE ASSESSMENT OF WETLAND SYSTEM 3 AT TWYFELHOEK **128**
TABLE 9-12: DONKERHOEK WETLAND GROUPING **132**
TABLE 9-13: SUMMARY OF THE ASSESSMENT OF WETLAND 1 AT DONKERHOEK **133**
TABLE 9-14: SUMMARY OF THE ASSESSMENT OF WATLAND 2 AT DONKERHOEK **135**
TABLE 9-15: SUMMARY OF THE ASSESSMENT OF WETLAND 3 AT DONKERHOEK **137**
TABLE 9-16: SUMMARY OF THE ASSESSMENT OF WETLAND 4 AT DONKERHOEK **139**
TABLE 9-17: SUMMARY OF THE ASSESSMENT OF HGM UNIT 1 (CVB WITH RIPARIAN VEGETATION) IN BALGARTHEN **143**
TABLE 9-18: SUMMARY OF THE ASSESSMENT OF HGM UNIT 2 (IMPACTED UCVB WETLANDS) IN BALGARTHEN **145**
TABLE 9-19: SUMMARY OF THE ASSESSMENT OF HGM UNIT 3 (UNIMPACTED SEEPS) IN BALGARTHEN **147**
TABLE 9-20: SUMMARY OF THE ASSESSMENT OF HGM UNIT 4 (SLIGHTLY IMPACTED SEEPS) IN BALGARTHEN **149**
TABLE 9-21: SUMMARY OF THE ASSESSMENT OF HGM UNIT 5 (BLOCKED CHANNEL UCVB PEAT WETLAND) IN BALGARTHEN **151**
TABLE 9-22: SUMMARY OF THE ECOLOGICAL STATUS OF THE SUB-QUATERNARY CATCHMENT REACH E51A 02082 (ASSEGAAI RIVER) BASED ON THE DWS PES/EIA DATABASE **155**
TABLE 9-23: SUMMARY OF THE ECOLOGICAL STATUS OF THE SUB-QUATERNARY CATCHMENT REACH W52A 01983 (HLELO RIVER) BASED ON THE DWS RQS PES/EIS DATABASE **156**
TABLE 9-24: RESULTS OF THE AQUATIC ECOLOGICAL ASSESSMENT AT SITE B1 (LOCATED IN THE NORTH-WESTERN CORNER OF THE BALGARTHEN FOCUS AREA ON A TRIBUTARY OF THE ASSEGAAI RIVER **158**
TABLE 9-25: RESULTS OF THE AQUATIC ECOLOGICAL ASSESSMENT AT SITE B2 (LOCATED DOWNSTREAM OF THE B1 SITE, ON A TRIBUTARY OF THE ASSEGAAI RIVER) **159**

TABLE 9-26: RESULTS OF THE AQUATIC ECOLOGICAL ASSESSMENT AT SITE PT (LOCATED OUTSIDE OF THE BALGARTHEN FOCUS AREA ON THE EXISTING BALGARTHEN ACCESS ROAD) **161**
TABLE 9-27: RESULTS OF THE AQUATIC ECOLOGICAL ASSESSMENT AT SITE ET (LOCATED WITHIN THE BALGARTHEN FOCUS AREA, APPROXIMATELY 457 M SOUTH-WEST OF THE PROPOSED ADIT (2) ON A TRIBUTARY OF THE ASSEGAAI RIVER) **163**
TABLE 9-28: RESULTS OF THE ASSESSMENT AT SITE NT (LOCATED WITHIN THE BALGARTHEN FOCUS AREA, APPROXIMATELY 76 M WEST OF THE PROPOSED DUMP AND THE BD SITE (LOCATED IN THE BALGARTHEN FOCUS AREA, APPROXMATELY 302 M SOUTH-EAST OF THE PROPOSED ADIT) **164**
TABLE 9-29: RESULTS OF THE ASSESSMENT AT SITE BCD1 [LOCATED WITHIN THE BALGARTHEN FOCUS AREA, NORTH-WEST OF THE AREA FOR THE PROPOSED ADIT (1)] AND THE BCD2 SITE [LOCATED WITHIN THE BALGARTHEN FOCUS AREA, WITHIN THE AREA FOR THE PROPOSED ADIT (1)]. **165**
TABLE 9-30: RESULTS OF THE AQUATIC ECOLOGICAL ASSESSMENT AT SITE D1 (LOCATED DIRECTLY NORTH OF THE DONKERHOEK FOCUS AREA, ON A TRIBUTARY OF THE HLELO RIVER) **167**
TABLE 9-31: RESULTS OF THE ASSESSMENT AT SITE DD (LOCATED WITHIN THE DONKERHOEK FOCUS AREA, APPROXIMATELY 118 M SOUTH EAST OF THE PROPOSED DONKERHOEK OPENCAST PIT) **169**
TABLE 9-32: RESULTS OF THE ASSESSMENT AT THE DONKER SPRING SITES. SITE DSW (APPROXIMATELY 163 M WEST OF THE PROPOSED DONKERHOEK OPENCAST PIT) AND SITE DSE (APPROXIMATELY 137 M SOUTH OF THE PROPOSED DUMP AND NORTH OF THE NORTHERN ACCESS ROAD) **170**
TABLE 9-33: RESULTS OF THE AQUATIC ECOLOGICAL ASSESSMENT AT SITE T1 (LOCATED ON A TRIBUTARY OF THE HLELO RIVER BELOW THE NORTHERN ACCESS ROAD WITHIN THE TWYFELHOEK FOCUS AREA AND SERVES AS A SPATIAL REFERENCE SITE FOR THE T2 SITE) **171**
TABLE 9-34: RESULTS OF THE AQUATIC ECOLOGICAL ASSESSMENT AT SITE T2 (LOCATED DIRECTLY NORTH OF THE TWYFELHOEK FOCUS AREA, DOWNSTREAM OF THE T1 SITE ON A TRIBUTARY OF THE HLELO RIVER) **172**
TABLE 9-35: RESULTS OF THE EIA ASSESSMENT OF THE FOCUS AREAS **173**
TABLE 9-36: HYDROCENSUS POINTS **186**
TABLE 9-37: NEWLY DRILLED MONITORING BOREHOLES **188**
TABLE 9-38: AVERAGE AQUIFER DEPTHS **191**
TABLE 9-39: MEAN AQUIFER PARAMETERS **191**
TABLE 9-40: SAMPLES TAKEN FOR HYDROCHEMICAL ANALYSIS **192**
TABLE 9-41: GROUNDWATER HYDROCHEMISTRY RESULTS FOR KUSIPONGO **193**
TABLE 9-42: SURFACE WATER HYDROCHEMISTRY RESULTS FOR KUSIPONGO **194**
TABLE 9-43: DETAILS OF HERITAGE SITES IDENTIFIED **201**
TABLE 10-1: SEVERITY CRITERIA FOR ASSESSING THE IMPACT SIGNIFICANCE **216**
TABLE 10-2: CATCHMENT WATER BALANCE – SCENARIO 01 STEADY STATE PRE-MINING **219**

TABLE 12-1: SUMMARY OF KEY POSITIVE AND NEGATIVE IMPACTS IDENTIFIED FOR THE MITIGATED AND UNMITIGATED SCENARIOS **310**

LIST OF APPENDICES

APPENDIX A: ENVIRONMENTAL MANAGEMENT PROGRAMME

APPENDIX B: PROOF OF EAP REGISTRATION AND CURRICULUM VITAE OF EAP

APPENDIX C: PUBLIC PARTICIPATION DOCUMENTATION

APPENDIX D: SPECIALIST STUDIES

APPENDIX E: CLOSURE AND REHABILITATION PLAN

ACRONYMS AND ABBREVIATIONS

Abbreviation	Explanation
BAP	Biodiversity Action Plan
BID	Background Information Document
CBA	Critical Biodiversity Area
DMR	Department of Mineral Resources
DWS	Department of Water and Sanitation
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EMC	Ecological Management Class
EMPr	Environmental Management Programme
ESA	Ecological Support Area
GNR	Government Notice
IAP	Interested and Affected Party
LOM	Life of Mine
Mtpa	Million tons per annum
mamsl	Metres above mean sea level
mbgl	Metres below ground level
Mbs	Metres below surface
MPRDA	Mineral and Petroleum Resources Development Act
NAAQS	South African National Ambient Air Quality Standards
NDCR	National Dust Control Regulations
NEMA	National Environmental Management Act
NEM: AQA	National Environmental Management Air Quality Act
NEM: BA	National Environmental Management Biodiversity Act
NEM: WA	National Environmental Management Waste Act
NFEPA	National Freshwater Ecosystem Priority Areas
NHRA	National Heritage Resources Act
PES	Present Ecological Status
PM10	Particulate matter less than 10 microns
PM2.5	Particulate matter less than 2.5 microns
PCD	Pollution Control Dam
ROM	Run of Mine
SACNASP	South African Council for Natural & Scientific Professionals
SAHRA	South African Heritage Resource Agency
SCC	Species of Conservational Concern
SLP	Social Labour Plan
TOPS	Threatened or Protected Species
WML	Waste Management Licence

1. EXECUTIVE SUMMARY

1.1 Introduction and Background

The Kusipongo project, owned by Kangra Coal (Pty) Ltd ("Kangra Coal"), has a mining right and an approved Environmental Management Programme (EMPr) in terms of the Minerals and Petroleum Resources Development Act, 2002 ("MPRDA"), authorised by the Mpumalanga Department of Mineral Resources (DMR) in July 2017.

Kangra Coal has been extracting coal from the neighbouring Maquasa operations and processing at the washing plant at Maquasa East since the late 1990's. The Colliery currently operates on the Maquasa East, Maquasa West and Maquasa West Extension properties and is situated in the Gert Sibande District Municipality, Mpumalanga, located about 51km west of Piet Retief.

The proposed project is a key factor from a strategic point of view for Kangra Coal to extend its life of mine. Given that the existing operation, which currently mines the Maquasa West and Maquasa West Extension Mining Rights is approaching depletion, a new resource is required to maintain the current levels of production and employment. Should Kangra Coal have to close, many jobs will be lost, both directly at the mine and indirectly in terms of local contractors and businesses providing goods and services to the operation as well as the people dependent on those working for Kangra Coal (both directly and/or indirectly). The Kusipongo resource has been identified as a feasible option to extend the life of the mine as Kangra Coal has an approved Mining Right to mine the underground resource and the coal is in close proximity to the current Maquasa operations.

1.2 Project Overview

Kangra Coal propose accessing the underground coal resource from three adit positions and utilising additional sections to allow for efficient mining that will sustain the current production tonnages. In order to do this, three additional adits to access the underground resource will be required.

One of these adits, known as the Twyfelhoek adit, is the subject of a separate application process although infrastructure associated with the adit and opencast areas form part of this application.

Due to shallow outcrops that can only be effectively mined through opencast truck and shovel methodologies, three additional opencast areas have been included in this authorisation process. Opencast mining involves the removal of shallow coal via opencast methods (strip opencast mining with continuous rehabilitation) and utilising the high wall of some of these pits to improve access to the underground coal through the above mentioned adit development.

The three (3) proposed opencast areas include:

- Twyfelhoek pits (north-east section);
- Donkerhoek pits (north-west section); and
- Balgarthen pit (southern section).

There are three (3) proposed adits to access the underground coal resource, which will be located at the Twyfelhoek and Balgarthen (A: existing and B: proposed) opencast mining areas. As stated previously Balgarthan A and B adits and the 3 proposed opencast pits will be the subject of this authorisation.

Kangra Coal also propose to align the EMPr with the Water Use Licence application to include the entire underground resource by amending the existing approved underground mining plan to include the southern and western sections.

1.2.1 Alternatives

There were initially three site layout alternatives that were included in the Scoping Report. A desktop screening assessment was undertaken which identified the major bio-physical environmental sensitivities associated with the proposed opencast mining operations. The potential impacts associated with Alternative A, which included three large opencast mining areas, were found to be of very high significance and modifications to the proposed opencast mining areas were undertaken.

The modifications resulted in Alternative B, which includes the two proposed adits at Balgarthen A and B, but the opencast areas were significantly modified with only six mini pits being proposed for opencast mining at Balgarthen, Donkerhoek and Twyfelhoek.

Alternative B is the preferred site layout for the Kusipongo mining project.

A third alternative, Alternative C, was also included in the Scoping Report. This alternative only included the two Balgarthen adits to access to the underground coal resources and therefore removed all of the opencast mining areas (The Twyfelhoek adit forms part of a separate authorisation process and is therefore excluded from Alternative B and Alternative C). Alternative C is not the preffered option as it further compromises the economic viability of this project and the socio economic benefit. The aim of Alternative C is to guide an amended Alternative B where environmental impacts are signifcant. It shoud further be noted that the outcomes of the impact assessment can change either option or create new options.

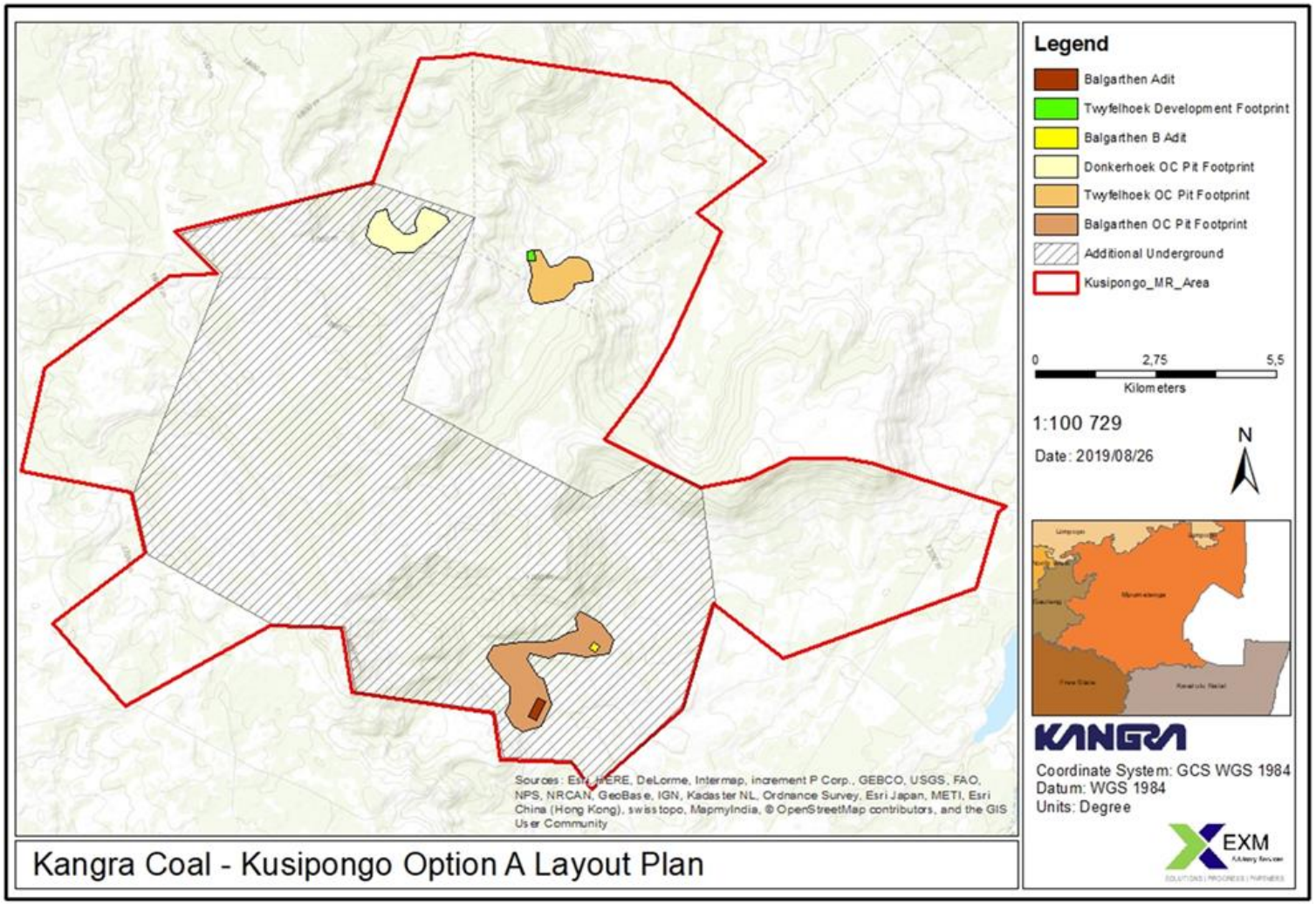


FIGURE 1-1: ALTERNATIVE A LAYOUT

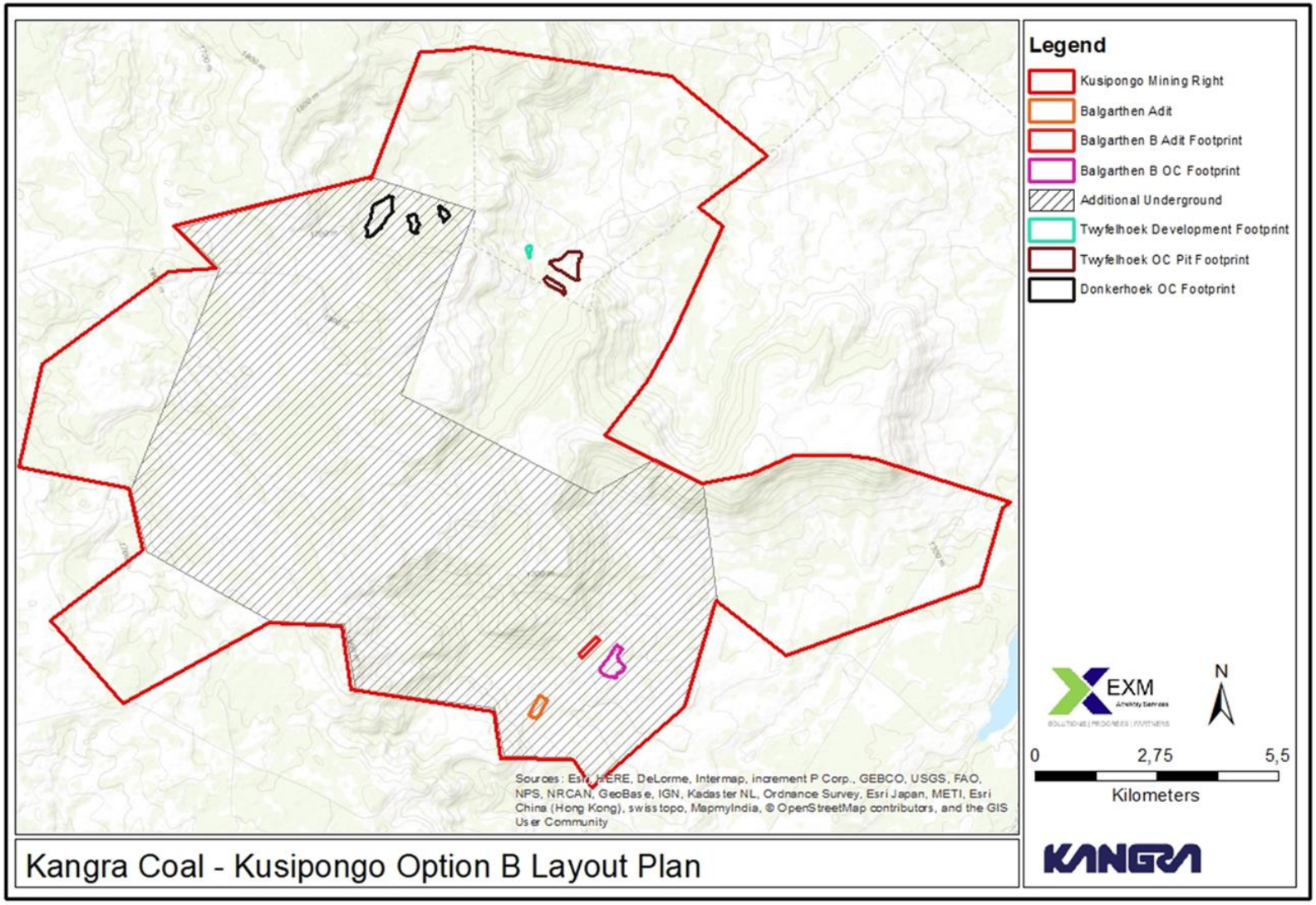


FIGURE 1-2: ALTERNATIVE B LAYOUT (PREFERRED)

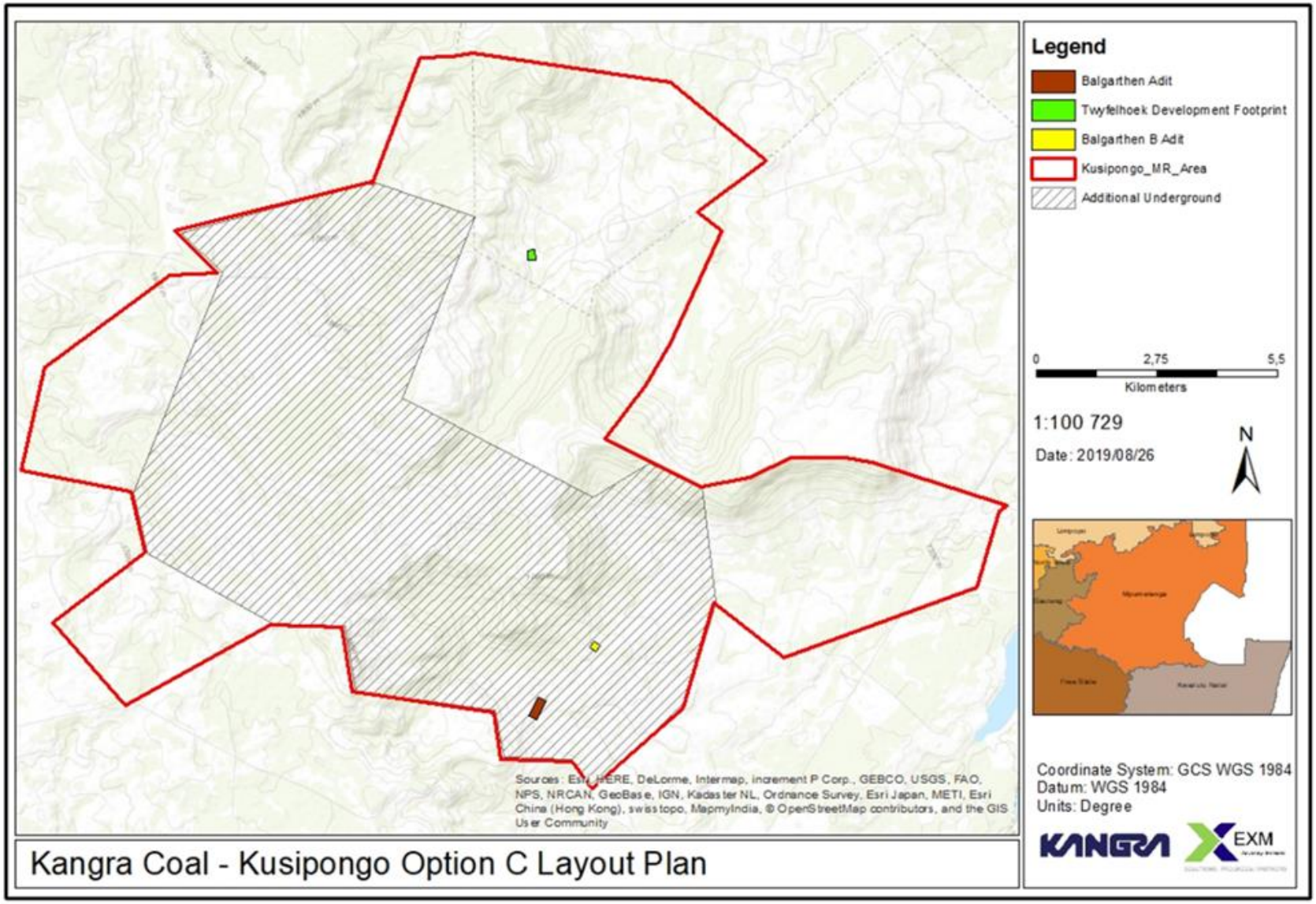


FIGURE 1-3: ALTERNATIVE C LAYOUT

1.3 Environmental Legislation

The EIA been prepared in accordance with the Department of Mineral Resources (DMR) Report template format and was informed by the guidelines posted on the official DMR website. This is in accordance with the requirements of the Mineral and Petroleum Resources Development Act (Act No. 28 of 2002) (MPRDA). In addition, this report complies with the requirements of the National Environmental Management Act (NEMA) (Act No. 107 of 1998) (as amended), the EIA Regulations 2014 (as amended in 2017) and the National Environmental Management Waste Act (NEMWA) (Act No. 59 of 2008).

1.4 Environmental Impacts

The following specialist studies were undertaken to inform the potential environmental impacts associated with the proposed project:

- Groundwater;
- Stormwater management;
- Freshwater Aquatic Assessment;
- Floral and Faunal Assessment;
- Soils and Land Capability Assessment;
- Air Quality Assessment;
- Noise Assessment;
- Blasting and vibration assessment;
- Cultural Heritage and Palaeontology; and
- Road and Traffic Assessment

The primary potential impacts associated with the proposed mining operations are listed below:

Groundwater

- Change in groundwater levels due to de-watering;
- Decanting of the mine post closure;
- Pollution plume modelling.

Surface Water

- Modification of wetland functioning; and
- Loss of aquatic habitat.

Flora (vegetation) and Fauna (animals)

- Floral diversity and habitat, especially to the grassland and rocky habitat units; and
- Impact on Species of conservation concern.

Air Quality

- Increase in fallout dust due to mining operations and vehicles transporting coal on haul roads.

Noise

- Increase in noise levels due to mining operations, especially at night-time.

Soils and Land Capability

- Loss of soils and land use

Blasting

- Impacts due to ground vibration, airblast and fly rock

Cultural Heritage and Palaeontology

- Disturbance of heritage sites including graves;
- Presence of possible palaeontological items.

Socio-Economic

- Local employment (loss and gains)

1.5 Conclusions and Recommendations

Based on the specialist assessments undertaken, the severity of the impacts identified, the probability of successfully mitigating the impacts, and the impact mitigation hierarchy, it is the opinion of the EAP that the final alternatives are as detailed below:

- **Twyfelhoek:** The opencast pits be mined as proposed in Alternative B, with strict adherence to all mitigation measures proposed. The area where the proposed pits are to be located has been previously disturbed by cultivation activities and a large portion of the area where the proposed pits and associated infrastructure are located has a low or moderately low sensitivity. The majority of potential impacts on the flora, fauna, wetlands and biodiversity are not can be mitigated to a low or medium-low significance post mitigation.
- **Donkerhoek:** Consists of the 3 opencast pits, referred to as western, central and eastern pit. The first two tiers in the mitigation hierarchy include avoidance/prevention of the impact and minimising impacts where avoidance is not possible. The initial Alternative A was revised to Alternative B in order to avoid and minimise impacts. Specialist studies undertaken included mitigation measures for potential impacts. However, certain impacts, particularly those associated with biodiversity, flora, fauna and wetlands still have a high significance, even after mitigation.

  The third tier in the mitigation hierarchy is rehabilitation, where an area is returned to a condition similar to its pre-mining state. The sensitivity of the habitats that will be lost and impacts on faunal species are such that it will be very difficult to rehabilitate the land back to its pre-mining state and successfully re-establish ecological functions. It is for this reason that offsets are recommended for the Donkerhoek central and eastern opencast pits.

Irreplaceable CBAs cannot be offset and it is therefore recommended that the western pit should not be mined. However, should the central and eastern opencast pits be approved, it is recommended that it be approved conditional to a viable offset strategy be agreed upon for the residual impacts by the competent authority.

- **Balgarthen A**: It is recommended that the Balgarthen A adit be authorised as proposed in Alternative B. The area has been previously mined and is therefore already disturbed. The potential impacts can be mitigated and managed.
- **Balgarthen B**: The first two tiers in the mitigation hierarchy include avoidance/prevention of the impact and minimising impacts where avoidance is not possible. As previously stated, the initial Alternative A was revised to Alternative B in order to avoid and minimise impacts. Specialist studies undertaken included mitigation measures for potential impacts. However, certain impacts, particularly those associated with biodiversity, flora, fauna and wetlands still have a medium-high to high significance, even after mitigation.

  The third tier in the mitigation hierarchy is rehabilitation, where an area is returned to a condition similar to its pre-mining state. The sensitivity of the habitats that will be lost and impacts on faunal species and wetlands are such that it will be very difficult to rehabilitate the land back to its pre-mining state and successfully re-establish ecological functions.

  It is recommended that the adit footprint be minimised to the minimum required for underground access, in order to reduce potential surface impacts.

  Should authorisation for mining of the Balgarthen B opencast pit be granted, it is recommended that an offset strategy in accordance with the impact mitigation hierarchy should be undertaken, in conjunction with the relevant authorities, to ensure a no net loss of biodiversity is achieved.
- **Southern Section of underground Mining**: It is recommended that the southern section of the proposed underground mine be undertaken, provided all mitigation measures and monitoring controls are implemented and managed.

2. CONTACT PERSON AND CORRESPONDENCE ADDRESS

2.1 Details and expertise of EAP who prepared the report

Name of Practitioner	Divan van der Merwe	Vivienne Vorster
Affiliation	Director	Senior Environmental Scientist
Telephone	073 378 7845	082 449 5356
E-mail address	divan@exm.co.za	vivienne@exm.co.za
Experience	11 years	13 years
Qualifications	MSc Environmental Science	BA Honours Environmental Management
Professional Registration	LaRRSA	EAPASA; Pr Sci Nat

2.2 Declaration of Independence

The undersigned declare that this report represents an independent and objective assessment of the risks associated with the proposed development.

Curriculum vitae and proof of registration of the EAP is provided in Appendix B.

Name	Affiliation	Designation	Signature	Date
Divan van der Merwe	EXM Advisory Services (Pty) Ltd	Director	Draft Signed	October 2019
Vivienne Vorster	EXM Advisory Services (Pty) Ltd	Senior Environmental Scientist	Draft Signed	October 2019

3. DESCRIPTION OF THE PROPERTY

Farm Name:	**All farms within the mining right area:** Beelzebub 13 HT (Portions 1, 3, 4, 6 and Remainder) Blinkwater 34 HT (Portions 1, 2 and Remainder) Boschbank 11 HT (Portions 2 and Remainder) Donkerhoek 10 HT (Portions 1, 3 and Remainder) Donkerhoek 14 HT (Portions 2, 4, 5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 21, 22, Remainder and Re of 11) Kikvorschfontein 35 HT (Portions 1 and Remainder) Kransbank 15 HT Re Langverwacht 20 HT (Portions 1, 2 and 3) Mooihoek 12 HT (Portions 1 and Remainder) Nauuwhoek 37 HT 1 Oogiesfontein 17 HT (Portions 1 and Remainder) Roodepoort 38 HT (Portions 0, 1, 2 and 3) Twyfelhoek 379 IT (Portions 1, 2, 3, 4, 5 and Remainder
Application area (Ha)	The total mining right area is 17 986 ha
Magisterial district:	Gert Sibande District Municipality (Dr Pixley Ka Isaka Seme Local Municipality)
Distance and direction from nearest town	Piet Retief is located approximately 54 km to the east of the Kusipongo mining right area. Ermelo is located approximately 64km north-west of the Kusipongo mining right area.

21 digit Surveyor General Code for each farm portion

Farm Name:	SG 21 Digit Code
Beelzebub 13 HT Portion 1	T0HT00000000001300001
Beelzebub 13 HT Portion 3	T0HT00000000001300003
Beelzebub 13 HT Portion 4	T0HT00000000001300004
Beelzebub 13 HT Portion 6	T0HT00000000001300006
Beelzebub 13 HT Remainder	T0HT00000000001300000
Blinkwater 34 HT Portion 1	T0HT00000000003400001
Blinkwater 34 HT Portion 2	T0HT00000000003400002
Blinkwater 34 HT Remainder	T0HT00000000003400000
Boschbank 11 HT Portion 2	T0HT00000000001100002

Boschbank 11 HT Remainder	T0HT00000000001100000	
Donkerhoek 10 HT Portion 1	T0HT00000000001000001	
Donkerhoek 10 HT Portion 3	T0HT00000000001000003	
Donkerhoek 10 HT Remainder	T0HT00000000001000000	
Donkerhoek 14 HT Portion 2	T0HT00000000001400002	
Donkerhoek 14 HT Portion 3	T0HT00000000001400003	
Donkerhoek 14 HT Portion 5	T0HT00000000001400005	
Donkerhoek 14 HT Portion 6	T0HT00000000001400006	
Donkerhoek 14 HT Portion 7	T0HT00000000001400007	
Donkerhoek 14 HT Portion 8	T0HT00000000001400008	
Donkerhoek 14 HT Portion 9	T0HT00000000001400009	
Donkerhoek 14 HT Portion 10	T0HT00000000001400010	
Donkerhoek 14 HT Portion 12	T0HT00000000001400012	
Donkerhoek 14 HT Portion 13	T0HT00000000001400013	
Donkerhoek 14 HT Portion 14	T0HT00000000001400014	
Donkerhoek 14 HT Portion 15	T0HT00000000001400015	
Donkerhoek 14 HT Portion 21	T0HT00000000001400021	
Donkerhoek 14 HT Portion 22	T0HT00000000001400022	
Donkerhoek 14 HT Portion 11 Re	T0HT00000000001400011	
Donkerhoek 14 HT Remainder	T0HT00000000001400000	
Kikvorschfontein 35 HT Portion 1	T0HT00000000003500001	
Kikvorschfontein 35 HT Remainder	T0HT00000000003500000	
Kransbank 15 HT Remainder	T0HT00000000001500000	
Langverwacht 20 HT Portion 1	T0HT00000000002000001	

	Langverwacht 20 HT Portion 2	T0HT00000000002000002	
	Langverwacht 20 HT Portion 3	T0HT00000000002000003	
	Mooihoek 12 HT Portion 1	T0HT00000000001200001	
	Mooihoek 12 HT Remainder	T0HT00000000001200000	
	Nauuwhoek 37 HT Portion 1	T0HT00000000003700001	
	Oogiesfontein 17 HT Portion 1	T0HT00000000001700001	
	Oogiesfontein 17 HT Remainder	T0HT00000000001700000	
	Roodepoort 38 HT Portion 1	T0HT00000000003800001	
	Roodepoort 38 HT Portion 2	T0HT00000000003800002	
	Roodepoort 38 HT Portion 3	T0HT00000000003800003	
	Roodepoort 38 HT Remainder	T0HT00000000003800000	
	Twyfelhoek 379 IT Portion 1	T0IT00000000037900001	
	Twyfelhoek 379 IT Portion 2	T0IT00000000037900002	
	Twyfelhoek 379 IT Portion 3	T0IT00000000037900003	
	Twyfelhoek 379 IT Portion 4	T0IT00000000037900004	
	Twyfelhoek 379 IT Portion 5	T0IT00000000037900005	
	Twyfelhoek 379 IT Remainder	T0IT00000000037900000	
Locality map	Attach a locality map at a scale not smaller than 1:250 000 and included as Figure 3-1		
Description of the overall activity. **(Indicate Mining Right, Mining Permit, Prospecting right, Bulk Sampling, Production Right, Exploration Right, Reconnaissance permit, Technical co-operation**	The Kusipongo project, owned by Kangra Coal (Pty) Ltd ("Kangra Coal"), has a mining right and an approved Environmental Management Programme (EMPr) in terms of the Minerals and Petroleum Resources Development Act, 2002 ("MPRDA"), authorised by the Mpumalanga Department of Mineral Resources (DMR) in July 2017. The life of Kangra Coal's Maquasa operations is nearing its end and Kangra Coal is planning to develop new mining areas as a natural extension of the current mine workings. Mining the Kusipongo resource situated directly to the west of existing operations will extend the life of the Kangra Coal operations.		

permit, Additional listed activity)	The preferred option (Option B) for Kusipongo consists of both opencast and underground mining operations as three locations: Balgarthen, Donkerhoek and Twyfelhoek.

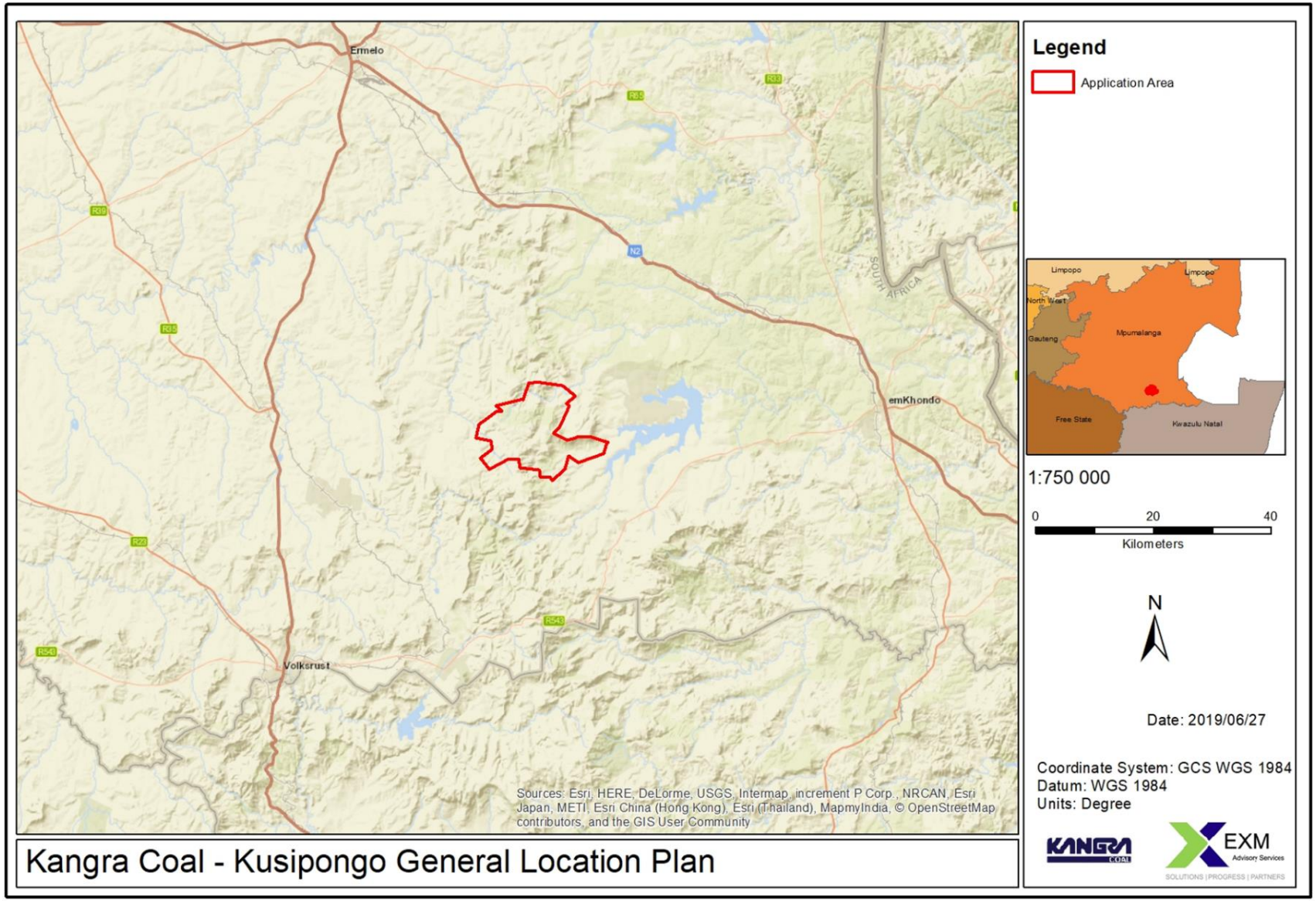


FIGURE 3-1: PROPOSED PROJECT LOCATION

4. DESCRIPTION OF THE SCOPE OF THE PROPOSED OVERALL ACTIVITY

4.1 Listed and specified activities

NAME OF ACTIVITY **(E.g. For prospecting -** drill site, site camp, ablution facility, accommodation, equipment storage, sample storage, site office, access route **etc…etc…etc** **E.g. for mining**,- excavations, blasting, stockpiles, discard dumps or dams, Loading, hauling and transport, Water supply dams and boreholes, accommodation, offices, ablution, stores, workshops, processing plant, storm water control, berms, roads, pipelines, power lines, conveyors, etc…etc…etc.)	**Aerial extent of the Activity** **Ha or m²**	**LISTED ACTIVITY** (Mark with an **X** where applicable or affected).	**APPLICABLE LISTING NOTICE** ***(GNR 983, GNR 984 or GNR 985) as amended by (GNR 327, GNR 325 or GNR 324)***	**WASTE MANAGEMENT AUTHORISATION** (Indicate whether an authorisation is required in terms of the Waste Management Act). **(Mark with an X)**	**APPLICABLE LISTING NOTICE** ***(GNR 921 as amended by GN 633))***
OPENCAST PITS					
Development of the Balgarthen, Donkerhoek and Twyfelhoek pits.	Balgarthen OC Pit 16.7 ha; Donkerhoek OC pits ~33 ha; and Twyfelhoek OC pits, ~26 ha footprint). Total ~ 75 ha	**X**	**GNR 983** Activity 27 (site clearance) **GNR 984** Activity 15 (site clearance) **GNR 984** Activity 17 (mining right requirement) **GNR 985** Activity 12 (clearance of vegetation in a Critical Biodiversity Area)		
Construction of road culverts within watercourses		**X**	**GNR 983** Activity 19 (deposition or removal of material within watercourse)		

NAME OF ACTIVITY **(E.g. For prospecting -** drill site, site camp, ablution facility, accommodation, equipment storage, sample storage, site office, access route **etc…etc…etc** **E.g. for mining**,- excavations, blasting, stockpiles, discard dumps or dams, Loading, hauling and transport, Water supply dams and boreholes, accommodation, offices, ablution, stores, workshops, processing plant, storm water control, berms, roads, pipelines, power lines, conveyors, etc…etc…etc.)	**Aerial extent of the Activity** **Ha or m²**	**LISTED ACTIVITY** (Mark with an **X** where applicable or affected).	**APPLICABLE LISTING NOTICE** ***(GNR 983, GNR 984 or GNR 985) as amended by (GNR 327, GNR 325 or GNR 324)***	**WASTE MANAGEMENT AUTHORISATION** (Indicate whether an authorisation is required in terms of the Waste Management Act). **(Mark with an X)**	**APPLICABLE LISTING NOTICE** ***(GNR 921 as amended by GN 633))***
Stormwater management infrastructure		**X**	**GNR 983** Activity 9 (pipelines)		
Dust Suppression (use of dirty water for dust suppression)		**X**	**GNR 984** Activity 6 (water use licence required)		
Storage of hazardous substances		**X**	**GNR 983** Activity 14 (storage of hazardous substances) **GNR 985** Activity 10 (storage of hazardous substances in a CBA)		
ADITS					
Underground access	Each adit will be ~ 300m x 300m		**GNR 983** Activity 27 (site clearance) **GNR 984** Activity 17 (mining right requirement)		

NAME OF ACTIVITY **(E.g. For prospecting -** drill site, site camp, ablution facility, accommodation, equipment storage, sample storage, site office, access route **etc…etc…etc** **E.g. for mining**,- excavations, blasting, stockpiles, discard dumps or dams, Loading, hauling and transport, Water supply dams and boreholes, accommodation, offices, ablution, stores, workshops, processing plant, storm water control, berms, roads, pipelines, power lines, conveyors, etc…etc…etc.)	**Aerial extent of the Activity** **Ha or m²**	**LISTED ACTIVITY** (Mark with an **X** where applicable or affected).	**APPLICABLE LISTING NOTICE** ***(GNR 983, GNR 984 or GNR 985) as amended by (GNR 327, GNR 325 or GNR 324)***	**WASTE MANAGEMENT AUTHORISATION** (Indicate whether an authorisation is required in terms of the Waste Management Act). **(Mark with an X)**	**APPLICABLE LISTING NOTICE** ***(GNR 921 as amended by GN 633))***
Dewatering of underground workings			**GNR 983** Activity 9 (pipelines)		
OVERBURDEN AND ROM STOCKPILES DUMPS					
Disposal of overburden during mining. Run of mine stockpiles	Size of all overburden dumps combined is estimated at ~100 ha		**GNR 983** Activity 27 (site clearance)	**X**	**GNR 633** Activity 7 of Category B (disposal of hazardous waste to land) **GNR 633** Activity 11 of Category B (establishment of residue stockpile)
POLLUTION CONTROL DAM					
Storage of dirty stormwater	Balgarthen A PCD Balgarthen B PCD 1, 2, 3, 4 Twyfelhoek PCD 1 & 2 Donkerhoek PCD 1 Total ~3ha	**X**	**GNR 984** Activity 6 (water use licence required)		
Pipelines		**X**	**GNR 983** Activity 10 (pipelines)		

NAME OF ACTIVITY **(E.g. For prospecting -** drill site, site camp, ablution facility, accommodation, equipment storage, sample storage, site office, access route **etc…etc…etc** **E.g. for mining**,- excavations, blasting, stockpiles, discard dumps or dams, Loading, hauling and transport, Water supply dams and boreholes, accommodation, offices, ablution, stores, workshops, processing plant, storm water control, berms, roads, pipelines, power lines, conveyors, etc…etc…etc.)	Aerial extent of the Activity **Ha or m²**	LISTED ACTIVITY (Mark with an **X** where applicable or affected).	APPLICABLE LISTING NOTICE ***(GNR 983, GNR 984 or GNR 985) as amended by (GNR 327, GNR 325 or GNR 324)***	WASTE MANAGEMENT AUTHORISATION (Indicate whether an authorisation is required in terms of the Waste Management Act). **(Mark with an X)**	APPLICABLE LISTING NOTICE ***(GNR 921 as amended by GN 633))***
ROADS					
Upgrading of haul roads		**X**	**GNR 983** Activity 56 (upgrade roads) **GNR 983** Activity 12 (infrastructure within 32 m of a watercourse) **GNR 985** Activity 18 (upgrade roads in a CBA)		

4.2 Description of activities to be undertaken

4.2.1 Project Background

The Kusipongo project, owned by Kangra Coal (Pty) Ltd ("Kangra Coal"), has a mining right and an approved Environmental Management Programme (EMPr) in terms of the Minerals and Petroleum Resources Development Act, 2002 ("MPRDA"), authorised by the Mpumalanga Department of Mineral Resources (DMR) in July 2017. This report has been compiled for certain listed activities associated with the adits, the opencast areas and the associated infrastructure.

Kangra Coal has been extracting coal from the neighbouring Maquasa operations and processing at the washing plant at Maquasa East since the late 1990's. Kangra Coal was bought by the Canyon Coal Group of Companies, and the Section 11 Approval for the transfer was approved in December 2018.

The Colliery currently operates on the Maquasa East, Maquasa West and Maquasa West Extension properties and is situated in the Gert Sibande District Municipality, Mpumalanga, located about 51km west of Piet Retief. (Error! Reference source not found.)

The proposed project is a key factor from a strategic point of view for Kangra Coal to extend its life of mine. Given that the existing operation, which currently mines the Maquasa West and Maquasa West Extension Mining Rights is approaching depletion, a new resource is required to maintain the current levels of production and employment. Should Kangra Coal have to close, many jobs will be lost, both directly at the mine and indirectly in terms of local contractors and businesses providing goods and services to the operation as well as the people dependent on those working for Kangra Coal (both directly and/or indirectly). The Kusipongo resource has been identified as a feasible option to extend the life of the mine as Kangra Coal has an approved Mining Right for the area and the coal is in close proximity to the operations.

4.2.2 Kusipongo Mining Right

Kangra Coal has an existing mining right and approved Environmental Management Programme (EMPr) for the Kusipongo resource which was authorised by the Mpumalanga Department of Mineral Resources (DMR) in July 2017. The mining right authorises underground mining within the north-eastern section of the mining rights area, with access being from an adit located at the Maquasa West Extension operations (Adit 5).

The adit (Adit 5) that was planned in the original mine plan, does not provide feasible access to the Kusipongo Resource, as there are approximately 1,2 km of faults to mine through before gaining access to the coal. The distance will not sustain continuous employment nor meet market requirements for coal supply.

Error! Reference source not found. below depicts the mining right area (purple boundary) and the approved underground mining plan.

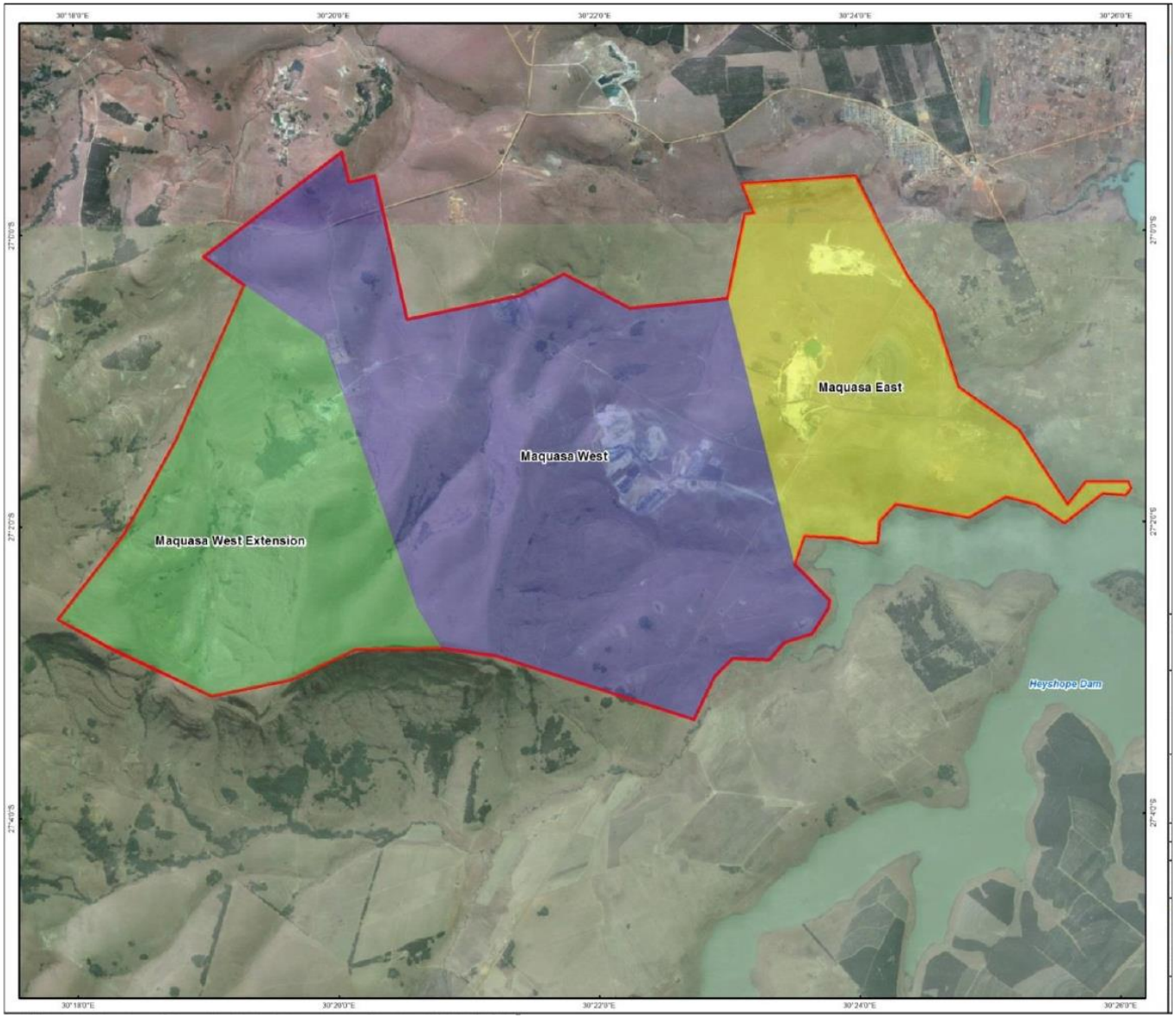


FIGURE 4-1: Overview of the Maquasa Operations

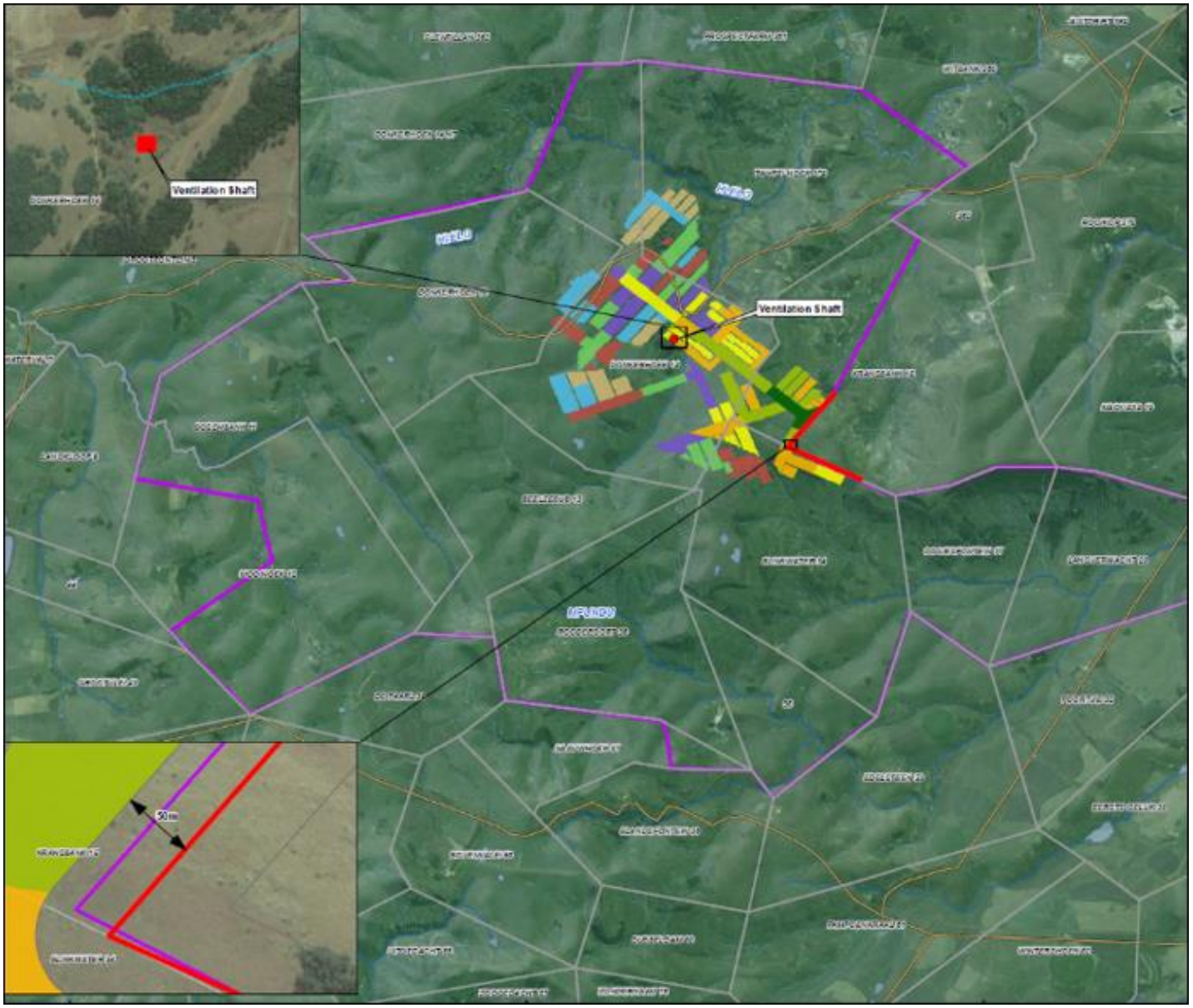


FIGURE 4-2: KUSIPONGO MINING RIGHT AREA AND APPROVED MINING OPERATIONS

4.3 Project Description

Kangra Coal propose accessing the underground coal resource from alternative adit positions and utilising additional sections to allow for efficient mining that will sustain the current production tonnages. In order to do this, three additional adits to access the underground resource will be required.

One of these adits, known as the Twyfelhoek adit, is the subject of a separate application process although infrastructure associated with the adit and opencast areas form part of this application.

Due to shallow outcrops that can only be effectively mined through opencast truck and shovel methodologies, three additional opencast areas have been included in this authorisation process. Opencast mining involves the removal of shallow coal via opencast methods (strip opencast mining with continuous rehabilitation) and utilising the high wall of some of these pits to improve access to the underground coal through the above mentioned adit development.

The three (3) proposed opencast areas include:

- Twyfelhoek pit (north-east section);
- Donkerhoek pit (north-west section); and
- Balgarthen pit (southern section).

Please refer to Alternatives in Section 9 for description and layout maps of the preferred mining plan.

There are three (3) proposed adits to access the underground coal resource, which will be located at the Twyfelhoek and Balgarthen opencast mining areas.

As detailed above, the Twyfelhoek adit, is the subject of a separate application process. The Balgarthen A adit is a historical adit and has been previously mined while the third (3) adit is proposed at the Balgarthen opencast pit, known as the Balgarthen B adit. (Refer to **Figure 4-3**:)

Kangra Coal also propose to align the Water Use Licence application to include the entire underground resource by amending the existing approved underground mining plan to include the southern and western sections. Please refer to **Figure 4-3**: for the proposed underground mining plan.

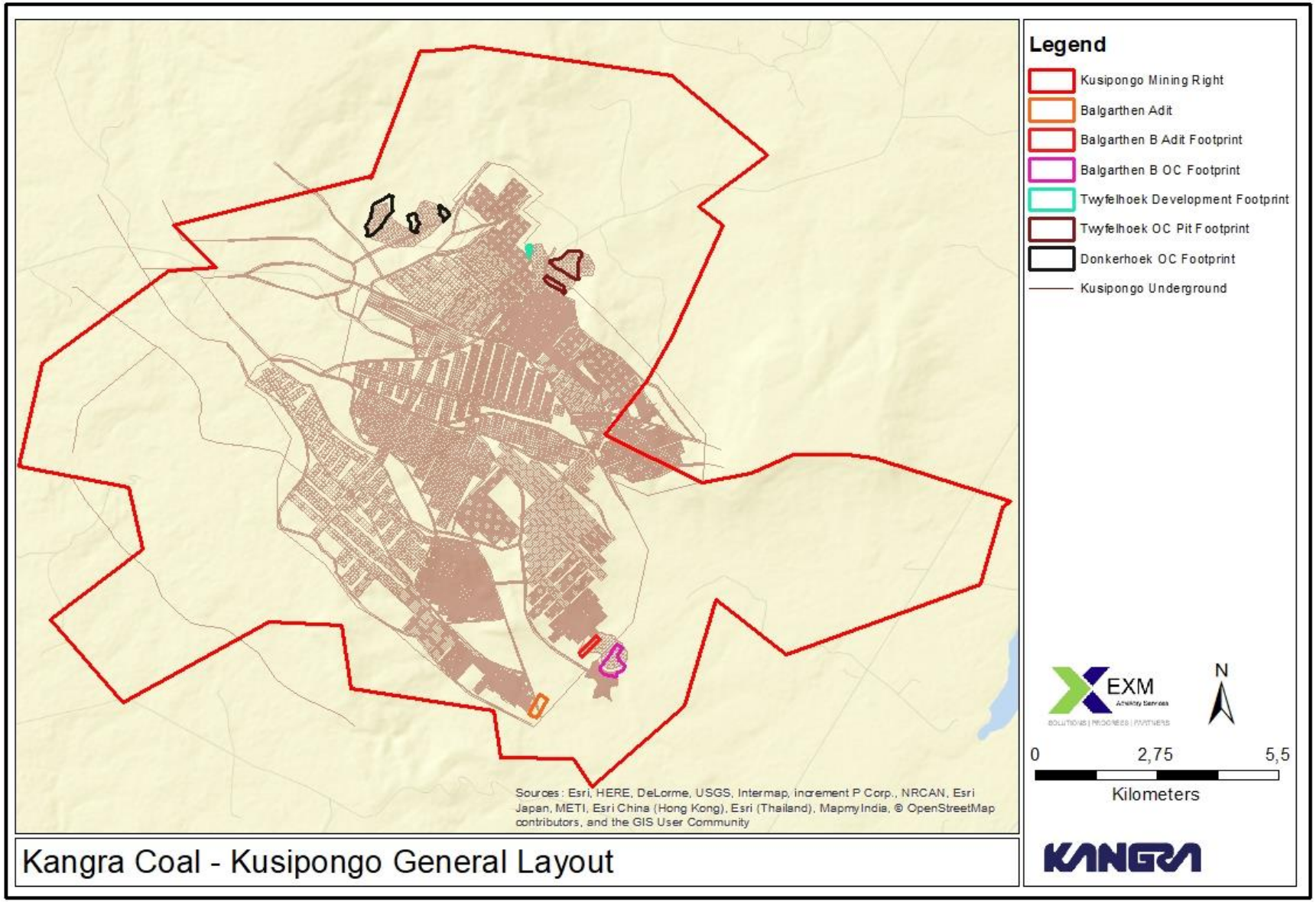


FIGURE 4-3: GENERAL LOCALITY OF PROPOSED MINING AREAS

4.3.1 Description of Mining Operations

4.3.1.1 Opencast Pits

Opencast pits are proposed in order to mine the shallow coal near the surface using conventional opencast strip mining and the roll-over method. This entails that the overburden will be stripped from the initial cut and stockpiled. With each successive cut taken the overburden and soils stripped will be used to backfill and top-dress the previous cut. In this way the soil is replaced from where it was removed thereby minimising the impact of soil removal. The overburden and soils that are stripped and stockpiled for use in the final void will need to be protected from wind and water erosion as well as compaction.

It is anticipated that the opencast pits will yield approximately 65 000 tonnes run of mine (ROM) coal per month and mining will be undertaken for 2 years, where after the opencast pits will be rehabilitated and closed except for the access point to the underground mine sections.

4.3.1.2 Underground Mine

Underground mining is undertaken using conventional bord-and-pillar layouts with checker bord stooping. Checker bord stooping is the removal of every second pillar as to leave a checker bord effect after stooping and still allows for the roof to be stable and not collapse. Entry to the coal reserves is achieved by adits or high walls from opencast mining pits which includes infrastructure such as a lamp room, workshop, small office, change room, luffing and slewing conveyor and coal loading area.

The main coal seams currently mined at Maquasa West and Maquasa West Extensions are the GUS and DUN (Dundas) coal seams. The GUS coal seam is located above the DUN coal seam. It is only proposed for that the GUS seam be mined due to current mine economic and coal market conditions. The proposed mining extent of this coal seam for the Project is illustrated in **Figure 4-3**:**.**

The GUS seam in the Kusipongo area can be divided into two, the lower GUS (mainly bright coal) and the upper GUS (mainly dull shale coal and carbonaceous shale). The contact between the upper and lower GUS is a very prominent thin sandstone band. The GUS seam in the Kusipongo area is typically 3.5 to 4 m thick.

It is anticipated the Run of Mine (ROM) coal will be approximately 42 000 tonnes per month from the underground mining operations. The underground mining operations will operate for approximately 10 years based on the proposed mining plan.

4.3.1.3 Transportation

ROM coal from the proposed opencast and underground mining operations at Balgarthen will be transported by road to the existing processing plant located at Maquasa East. ROM coal from the Donkerhoek and Twyfelhoek operations will be transported by road to Maquasa West, where it will be loaded onto the existing conveyor belt and transported to the processing plant at Maquasa East.

The haul roads are existing gravel roads of approximately 24 kms and 8 kms respectively. These roads will require upgrading to accommodate this traffic.

4.3.1.4 Water Management

The underground workings will require dewatering and there are currently a few options with regard to excess water from mine dewatering. The water will either be stored underground or piped to the pollution control dam. It is anticipated that water will also be recycled and used for dust suppression.

Following mine closure, if decant occurs, water will be treated depending on the quality of the decant. The selection of an appropriate water treatment process will be dependent on the mine decant volumes and decant water quality at the time. A strategy to manage acid mine drainage and to also plan the decant has been developed for the Kusipongo and Maquasa Mine's. The focus of the plan is to re-introduce clean water to the natural system.

4.3.1.5 Waste

General waste from employees will temporarily be stored on site before being disposed of at a licensed landfill site.

4.3.1.6 Sewage

Toilet facility requirements for the underground workings will be met with water-less toilets that will be brought to the surface when full for disposal to the portable sewage plant near Maquasa or taken to the municipal sewage works with a septic tank that will be discharged and cleaned regularly by an authorized company. Conservancy tanks will be installed for ablution facilities to be located above ground at various locations such as site offices and changing areas.

4.3.1.7 Electricity

Each area will be provided with Eskom electricity supplied from an existing sub-station and distributed by overhead lines. Electricity supply will mainly be used for the operation of ventilation equipment, workshops, offices and lighting.

5. POLICY AND LEGISLATIVE CONTEXT

This document has been prepared in accordance with the Department of Mineral Resources (DMR) Report template format and was informed by the guidelines posted on the official DMR website. This is in accordance with the requirements of the Mineral and Petroleum Resources Development Act (MPRDA). In addition, this report complies with the requirements of the National Environmental Management Act (NEMA) (Act No. 107 of 1998) (as amended), the EIA Regulations 2014 (as amended in 2017) and the National Environmental Management Waste Act (NEMWA) (Act No. 59 of 2008).

This section outlines the key legislative requirements applicable to the project.

5.1 Mineral and Petroleum Resources Development Act (Act No. 28 of 2002)

The Mineral and Petroleum Resources Development Act (MPRDA) (Act No. 28 of 2002) was enacted, together with its associated Regulations (published 23 April 2004), on 01 May 2004. The DMR is the custodian of the country's mineral and petroleum resources, although the MPRDA provides that these resources belong to the nation. The MPRDA promotes equitable access to resources, as well as give effect to Section 24 of the South African Constitution by ensuring the nation's mineral and petroleum resources are developed in an efficient and ecologically sustainable manner. The MPRDA further requires the holder of a mining right not to cause any significant pollution or environmental degradation.

The MPRDA regulates the requirements for a mining right in order to mine a mineral and undertake associated activities. Mining can either include removal of an underground mineral or mineral occurring in a residue deposit or residue stockpile. The MPRDA requires the holder of a mining right not to cause any significant pollution or environmental degradation.

In terms of Section 102 (as amended 21 April 2009) of the MPRDA, a mine may not amend a Mining Right, a Mining Works Programme, environmental management programme (EMPr) or an environmental authorisation (EA) issued in terms of the National Environmental Management Act, 1998, without the written consent of the Minister.

The Kusipongo mining right was issued in March 2017 and remains valid until March 2027.

The proposed updating of the underground mining plan, the three access adits and the opencast pits are not included in the current approved EMPr.

The EMPr thus requires amendment to include:

- A description of the additional activities to take place;
- A description of the baseline environment to be affected;

- A description of additional impacts due to the new activities; and
- Identification of additional mitigation measures required.

This requires the submission of an Environmental Impact Assessment (EIA) and EMPr to the DMR for authorisation in conjunction to the Environmental Authorisation for the listed activities being granted. Furthermore, an updated Mine Works Programme (MWP) will be submitted to the DMR together with the amended EIA and EMPr.

Sections 53 and 54 of the Regulations require the holder of a mining right to make financial provision for rehabilitation and to action closure objectives of the Mine. These sections are however a consequence of Section 41 of the MPRDA (now repealed) that require the holder to make financial provision for closure and rehabilitation of the Mine. Financial provision for mine rehabilitation and closure is now regulated under NEMA and subsequent regulations. However, since the MPRDA Regulations are not repealed, Section 53 and 54 can still be considered to applicable.

This report serves as an application terms of Section 102 of the MPRDA for the amendment of the Kusipongo EMPr to include the additional activities.

An updated Mining Works Programme, to amend the Mining Works Programme will also be submitted in terms of Section 102, to include the updated mining plans.

5.2 National Environmental Management Act (Act No. 107 of 1998) (as amended)

Section 24 of NEMA provides for the Minister of Environmental Affairs to include activities in a list that require environmental authorisation prior to commencement. This has resulted in the promulgation of Listing Notices 1 (GNR. 983), 2 (GNR. 984) and 3 (GNR. 985) and the Environmental Impact Assessment (EIA) Regulations (GNR. 982) of December 2014. The EIA Regulations were amended on 07 April 2017 by GNR 326, while Listing Notices 1 – 3 were amended by GNR 327, GNR 325 and GNR 324 respectively, thus guiding the requirements to undertake an EIA and apply for an environmental authorisation should a listed activity be triggered. As of 4 December 2014, activities at mining operations are also to be authorised under NEMA, with the DMR acting as the Competent Authority.

From the initial review, activities under Listing Notice 2 (GNR 984) are triggered and thus the application for environmental authorisation requires completion of a scoping and environmental impact assessment (EIA) process in support of environmental authorisation for the listed activities.

Listed Activities identified which are applicable to the project are detailed below:

Activity No	Description of listed activity	Part of project applicable
Listing Notice 1 (GNR 983) (as amended)		
9	The development of infrastructure exceeding 1,000 m in length for the bulk transportation of water or storm water – (i) with an internal diameter of 0.36 metres or more; or (ii) with a peak throughput of 120 litres per second or more.	Development of new pipelines at the Kusipongo opencast and underground mining areas
10	The development and related operation of infrastructure exceeding 1 000 metres in length for the bulk transportation of sewage, effluent, process water, waste water, return water, industrial discharge or slimes – (i) with an internal diameter of 0,36 metres or more; or (ii) with a peak throughput of 120 litres per second or more.	Development of new pipelines at the Kusipongo opencast and underground mining areas
11	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	Installation of overhead powerlines to each of the three sections
12	The development of – (ii) infrastructure or structures with a physical footprint of 100 m^2 or more; where such development occurs – (a) within a watercourse; (b) in front of a development setback; or	Upgrading of roads

Activity No	Description of listed activity	Part of project applicable
	(c) if no development setback exists, within 32 m of a watercourse, measured from the edge of a watercourse	
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 m^3 or more but not exceeding 500 m^3.	Storage of hazardous substances such as diesel and chemicals.
19	The infilling or depositing of any material of more than 10 m^3 into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 m^3 from a watercourse.	Installation of road culverts and bridges to cross watercourses
56	The widening of a road by more than 6 m, or the lengthening of a road by more than 1 km – (i) where the existing reserve is wider than 13.5 m; or (ii) where no reserve exists, where the existing road is wider than 8 m; excluding where widening or lengthening occur inside urban areas.	Existing roads will require upgrading in order to accommodate mine traffic.
Listing Notice 2 (GNR 984) (as amended)		
6	The development of facilities or infrastructure for any process or activity which requires a permit or licence or an amended permit or licence in terms of national or provincial legislation governing the generation or release of emissions, pollution or effluent.	A Water Use Licence (WUL) is required for the Kusipongo project.

Activity No	Description of listed activity	Part of project applicable
15	The clearance of an area of 20 ha or more of indigenous vegetation.	Clearance of vegetation for adits, opencast pits and other infrastructure.
17	Any activity including the operation of that activity which requires a mining right as contemplated in section 22 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002), including – (i) associated infrastructure, structures and earthworks, directly related to the extraction of a mineral resource; or (ii) the primary processing of a mineral resource including winning, extraction, classifying, concentrating, crushing, screening or washing;	Amendment of approved mining right and EMPr
Listing Notice 3 (GNR 985) (as amended)		
10	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 m^3 f. *Mpumalanga* *i. Outside urban areas:* *(ee) Critical biodiversity areas as identified in systematic biodiversity plans*	Storage of hazardous substances such as diesel and chemicals.
12	The clearance of an area of 300 m^2 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	Clearance of vegetation for adits, opencast pits and other infrastructure.

Activity No	Description of listed activity	Part of project applicable
	f. Mpumalanga *ii. Within critical biodiversity areas identified in bioregional plans*	
18	The widening of a road by more than 4 m, or the lengthening of a road by more than 1 km f. Mpumalanga *i. Outside urban areas:* *(ee) Critical biodiversity areas as identified in systematic biodiversity plans*	Existing roads will require upgrading in order to accommodate mine traffic.

Environmental Authorisation is being sought for activities applicable to the Kusipongo Coal Mine in terms of the EIA Listing Notices 1, 2 & 3 of GNR. 983, GNR 984 and GNR 985 (as amended).

5.3 National Environmental Management: Waste Act (Act No. 59 of 2008) (as amended)

In terms of the National Environmental Management: Waste Act (Act No. 59 of 2008) (NEM:WA), waste management activities that are listed in regulations published under NEM:WA may not be undertaken without a Waste Management License (WML). The listed activities for which a WML is required are contained in Government Notice (GN) 921. Category A activities require a WML and a Basic Impact Assessment (BA) process must be conducted, and Category B activities require a WML and a full Scoping and EIA process must be conducted.

In terms of Schedule 3 of NEM: WA, mining waste (residue stockpiles and deposits) are defined wastes falling under Category A – Hazardous Wastes of NEM: WA which includes waste rock. The Table below contains the waste management activities that are triggered:

Activity No	Description of listed activity	Part of project applicable
Category B		
7	The disposal of any quantity of hazardous waste to land.	The disposal of any quantity of hazardous waste to land i.e. overburden dumps and ROM pads at Kusipongo.

Activity No	Description of listed activity	Part of project applicable
11	The establishment or reclamation of a residue stockpile or residue deposit resulting from activities which require a mining right….in terms of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002).	The establishment of a residue stockpile i.e. overburden dumps at Kusipongo.

The overburden dumps will require authorisation in terms of NEM: WA. Note that the application is combined with this NEMA application and supported by the same process.

Application is made for a Waste Management Licence to authorise the Waste Management Activities (Regulation GN. 921 as amended by GN. 633 of 24 July 2015) in terms of NEM: WA for overburden dumps.

5.4 National Environmental Management Act: Air quality Act (Act No. 39 of 2004)

NEMA: AQA controls and regulates atmospheric emissions and provides for Listed Activities (GN. 893, November 2010) which have or may have a significant effect on the environment, including health, social conditions, economic conditions, ecological conditions or cultural heritage. Any activity captured under this list require the person undertaking the activity to apply for an Atmospheric Emission Licence (AEL). The project will not trigger any activities listed in the Regulation and there is therefore no need for an AEL.

Kusipongo mine will also be required to comply with the National Dust Control Regulations (GN. 827 of 1 November 2013) and the National Ambient Air Quality Standards (NAAQS, GN 1210 of 24 December 2009). The regulations provide limits for PM_{10} and dust fallout in residential and industrial areas.

5.5 National Environmental Management: Biodiversity Act (Act No. 10 of 2004)

Section 57 of NEM: BA restricts certain activities involving threatened and protected species (as listed in Regulation GN. 151 and 152, February 2007) without a permit. Restricted activities applicable to the project are limited to the potential removal of Threatened or Protected Species (TOPS) and plants during the clearance of vegetation.

5.6 Mpumalanga Biodiversity Conservation Plan

Mpumalanga Tourism and Parks Agency (MPTA) and Department of Agriculture and Land Administration (DALA) have jointly developed the Mpumalanga Biodiversity Conservation

Plan. The plan is intended to guide conservation and land use decisions. Its objectives are to guide MPTA in fulfilling its biodiversity mandate and to provide biodiversity information that supports land use planning and environmental decision making. The plan will need to be consulted in order to ensure that the project is in line with the provincial conservation plan

5.7 National Water Act (Act No. 36 of 1998)

Kangra Coal submitted an Integrated Water Use Licence Application (IWULA) for the Kusipongo project, although it is currently awaiting approval of this IWULA.

A new IWULA will be submitted for the proposed project and it is anticipated that the following Section 21 water uses will be applicable:

- (a) taking water from a water resource from one borehole at each section for potable and washing water
- (c) Impeding or diverting the flow of water in a watercourse – for mining activities within 500m of wetlands;
- (g) Disposing of waste in a manner which may detrimentally impact on a water resource – pollution control dams (PCD), Run of Mine Pads;
- (i) Altering the bed, banks, course or characteristics of a watercourse –for mining activities within 500 m of wetlands;
- (j) removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of the people – dewatering of underground workings.

Regulations for the use of water for mining and related activities aimed at protected water resources (GNR 704, June 1999) were promulgated in terms of Section 26 of the NWA. These provide for:

- Restrictions on the locality with respect to residue deposits, dam or reservoirs as well as mining activities within the proximity of a watercourse.
- Restriction on the use of material that can pollute a water resource for the purposes of construction.
- Capacity requirements of clean and dirty water systems.
- Protection of water resources from pollution sources at the mine in particular the separation of clean and dirty water and the prevention of spillages from dirty water containment facilities.

Exemption will need to be sought in terms of Regulation 3 for activities that do not comply with GNR 704.

5.8 National Heritage Resources Act (Act No. 25 of 1999)

The National Heritage Resources Act (NHRA) controls and regulates the interaction with heritage, archaeological, and paleontological artefacts and structures. Sections 34, 35 and 36 require that no person may demolish or alter any structure which is older than 60 years without a permit issued by the relevant provincial heritage resources agency. The NHRA further requires any person that disturbs any archaeological site, paleontological site or grave cannot do so without a permit.

A Heritage Impact Assessment was undertaken in order to identify any heritage sites within the Kusipongo footprint area. Should any site need to be altered or destroyed, a permit will need to be obtained in terms of the NHRA. The South African Heritage Resources Council (SAHRA) will be consulted in terms of Section 38 of the Act.

6. NEED AND DESIRABILITY OF THE PROPOSED ACTIVITIES

The proposed amendment to the Kusipongo mining works programme and associated environmental authorisations are required in order to extend the life of the Maquasa operations. The current coal resources at Maquasa East and West will be depleted at the end of 2019 and mining at Kusipongo must commence in 2020 in order to prevent significant financial and job losses. Should the coal resources at Kusipongo not be mined, it would potentially result in following socio-economic impacts:

- Loss of employment for 745 employees that are currently working at the Maquasa operations and approximately 900 direct jobs (contractors);
- Additional construction related jobs would not be created, as would be the case if the project were approved;
- It would impact on the local community that indirectly rely on Kangra Coal; and
- It would negatively affect the supply of coal to both international and local markets.

6.1 Importance of Coal in South Africa

Coal provides around 30.1% of global primary energy needs, generates over 40% of the world's electricity and is used in the production of 70% of the world's steel (World Coal Association, 2013) (1). South Africa possesses Africa's only significant coal reserves; over 95% of Africa's coal reserves are found in South Africa (US Energy Information Administration, 2014) (2), with coal reserves of 30,2 billion short tonnes at the end of 2012, which represents 4% of the world's total coal production. South Africa is the world's seventh largest coal producer and produced 3.3% of the world's coal in 2013 (256 million tonnes) (World Coal Association, 2013).

In 2013, South Africa used coal for 93% of its electricity generation needs and was the second most dependent coal-to-electricity country in the world, after Mongolia (World Coal Association, 2013). Apart from its domestic needs, South Africa is currently the world's sixth largest coal exporting country, with exports in excess of 70 million tonnes in 2013 (World Coal Association, 2013).

Coal plays a crucial role in the South African energy-economy and is fuelling local industry (Eberhard, 2010). The consumption of coal in South African coal-fired power stations will continue in the near future (Eberhard, 2010)

Increased demand in Eastern countries (driven by rapid economic growth rates) will result in an increased demand for South African coal exports (Eberhard, 2010). Coal exports are expected to increase to 105 million tonnes per annum by the year 2020. This will increase the country's export earnings, which in turn will reduce the country's negative trade balance and current account deficit (Eberhard, 2010).

Both local and international markets are, at present, highly dependent on South Africa being a main provider of coal, now and in the future. The identification and exploitation of new coal reserves in South Africa is thus a prerequisite in meeting this demand.

In addition, coal plays a crucial role in the provincial economy of Mpumalanga, where the proposed Project is located, and coal mining is a key economic activity in this Province.

6.2 Period for which the environmental authorisation is required

The Kusipongo mining right expires in 2027, the revised mining plan is however extending this period by a further two years until 2029. With rehabilitation envisioned for 2030 until 2034 it is required for the environmental authorisation to remain valid for 15 years.

7. MOTIVATION FOR THE PREFERRED DEVELOPMENT FOOTPRINT WITHIN THE APPROVED SITE INCLUDING A FULL DESCRIPTION OF THE PROCESS FOLLOWED TO REACH THE PROPOSED DEVELOPMENT FOOTPRINT WITHIN THE APPROVED SITE

(The determination of the site layout taking into consideration the comparison of the original site plan with a plan which takes environmental features, issues raised by IAPs and consideration of alternatives, into account.)

7.1 Site Layout Alternatives

There were initially three site layout alternatives that were included in the Scoping Report. A desktop screening assessment was undertaken which identified the major bio-physical environmental sensitivities associated with the proposed mining operations.

Alternative A

The potential impacts associated with Alternative A, which included three large opencast mining areas, were found to be of very high significance and modifications to the proposed mining areas were undertaken. (see **Figure 7-1** below for the original site layout plan). Alternative A will not be assessed as part of the EIA.

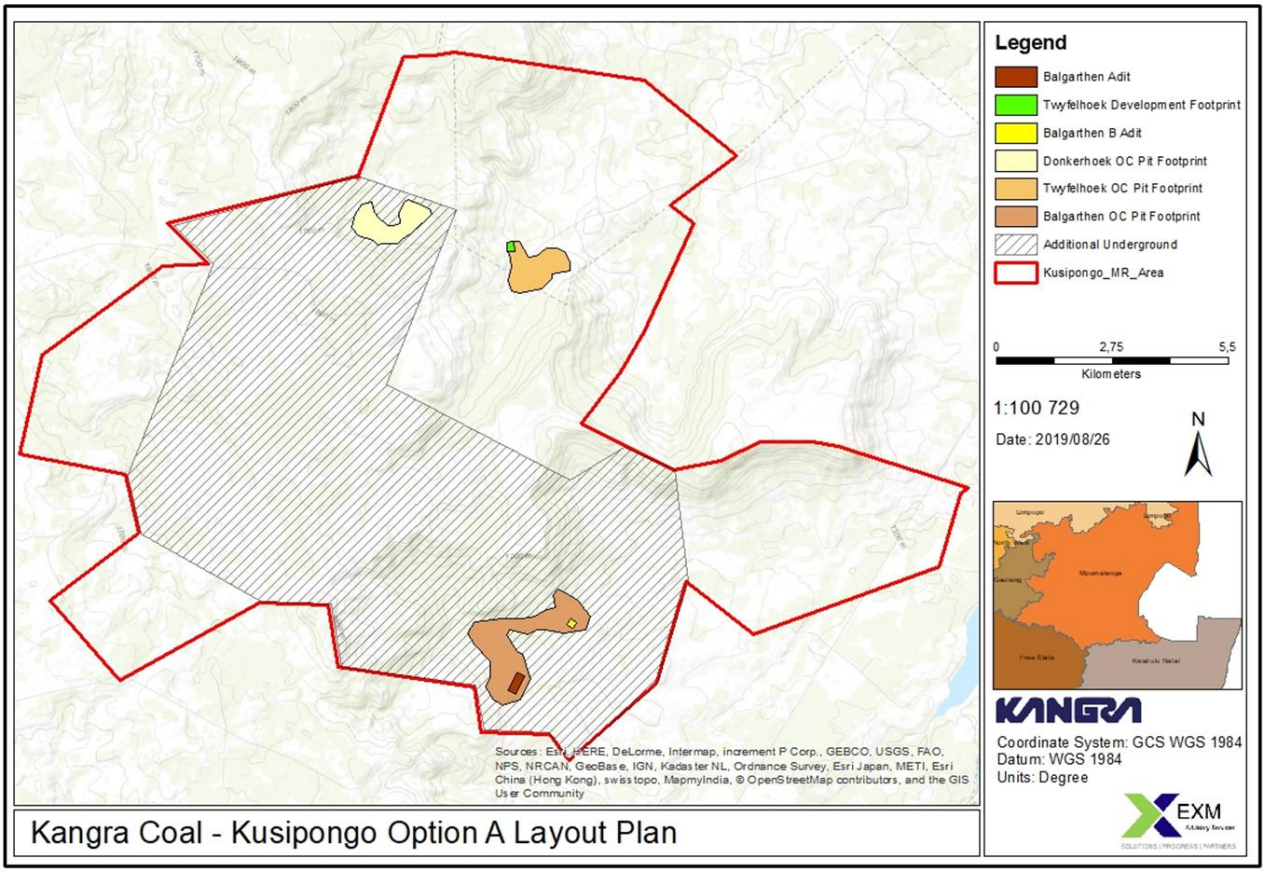


FIGURE 7-1: ALTERNATIVE A LAYOUT

Alternative B – Preferred Alternative

The modifications resulted in Alternative B, which includes the two proposed adits at Balgarthen A and B, but the opencast areas were significantly modified with only six mini pits being proposed for opencast mining at Balgarthen, Donkerhoek and Twyfelhoek. This alternative ensured the opencast pits are located outside of the 100 m regulatory buffer for watercourses and wetlands, thereby reducing the potential impacts to surface water resources. The smaller pits also reduce the need for clearance of vegetation and disturbance of corridors. Please refer to **Figure 7-3** for a layout of Alternative B. Alternative B is the preferred site layout for the Kusipongo mining project. Refer to detailed layouts in **Figure 7-4**, **Figure 7-5** and **Figure 7-6.**

Alternative C

A third alternative, Alternative C, was also included in the Scoping Report. This alternative only included the two Balgarthen adits to access to the underground coal resources and therefore removed all of the opencast mining areas (The Twyfelhoek adit forms part of a separate authorisation process and is therefore excluded from Alternative B and Alternative C)(**Figure 7-2**). Alternative C creates feasibility options for the mine specifically related to the continued employment of labourers due to slow access to underground resources and the likely retrenchment of all employees with opencast experience. Alternative C is not the prefered option as it further compromises the economic viability of this project and the socio economic benefit. The aim of Alternative C is to guide an amended Alternative B where environmental impacts are signifcant.

It should further be noted that the outcomes of the impact assessment can change either option or create new options based on the hierarchy of impacts.

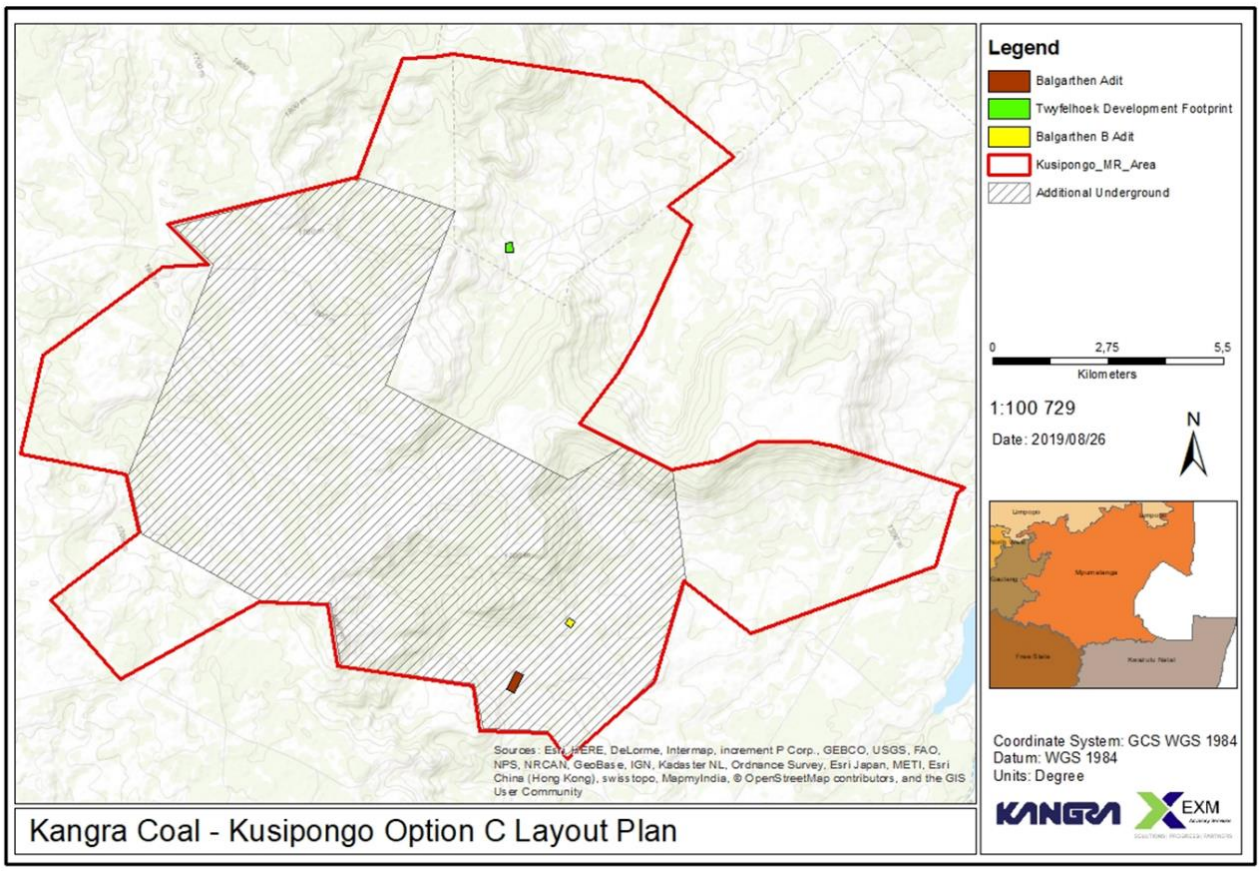


FIGURE 7-2: ALTERNATIVE C LAYOUT

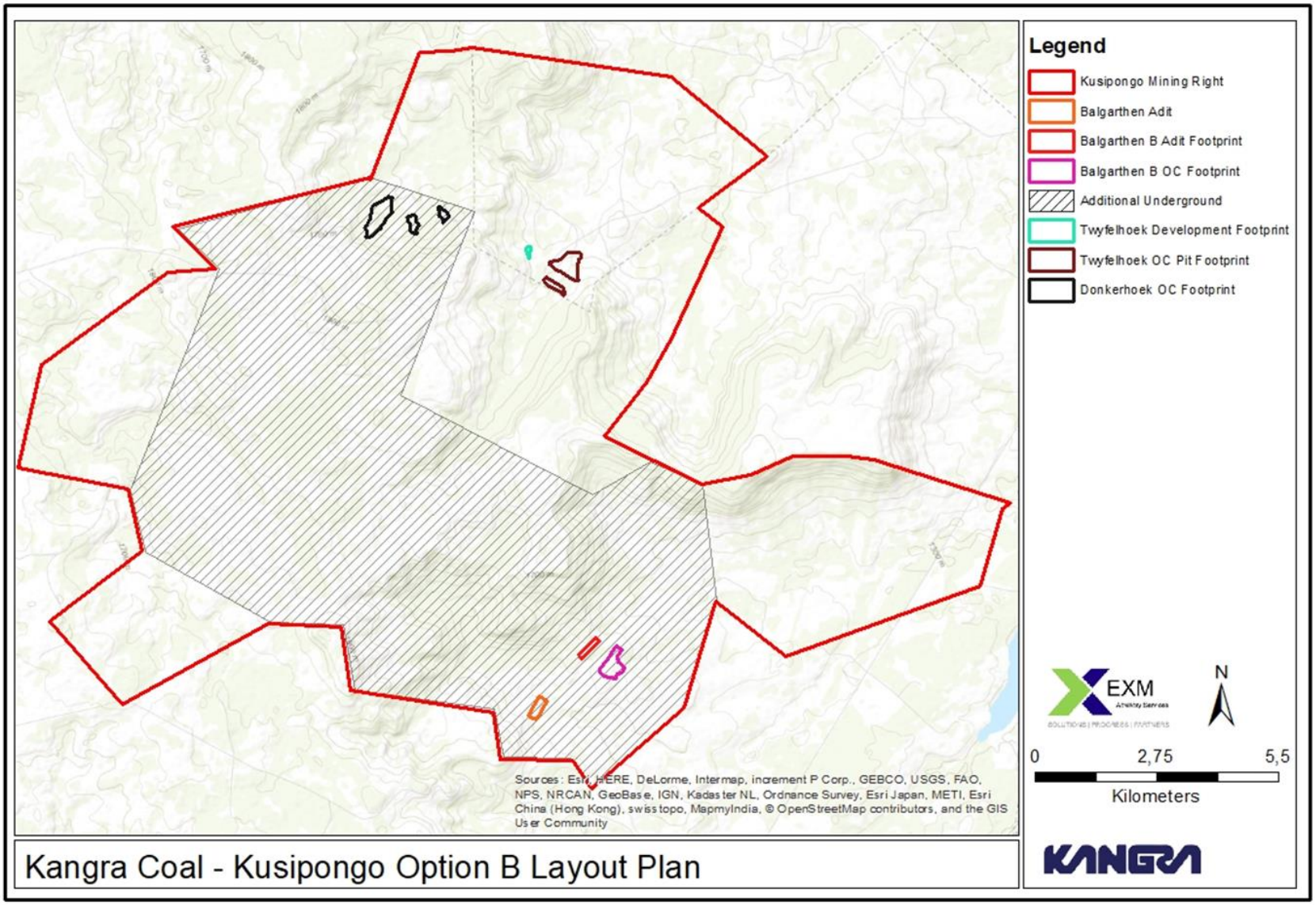


FIGURE 7-3: ALTERNATIVE B LAYOUT

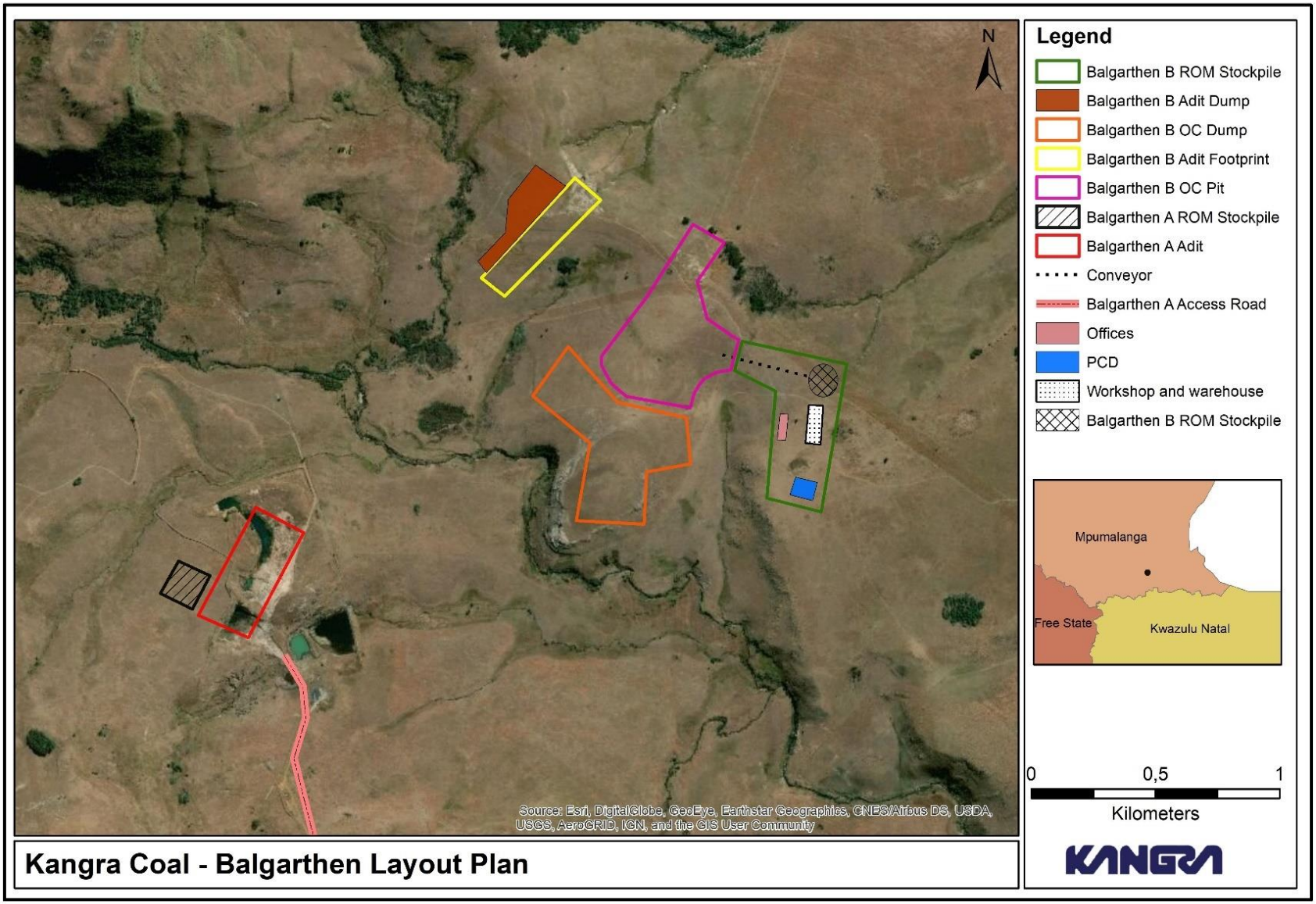


FIGURE 7-4: BALGARTHEN CONCEPTUAL LAYOUT PLAN FOR ALTERNATIVE B

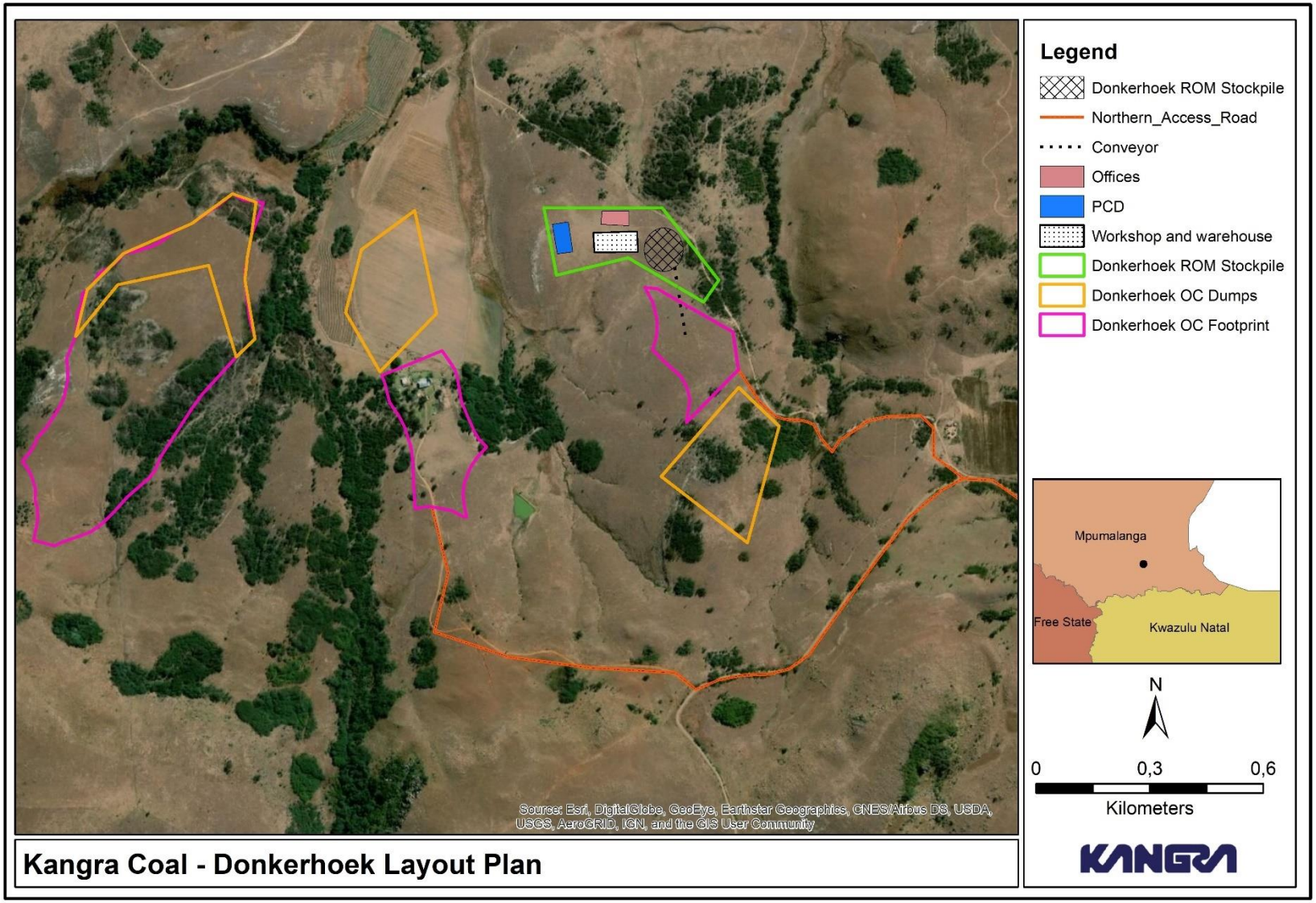


FIGURE 7-5: DONKERHOEK CONCEPTUAL LAYOUT PLAN FOR ALTERNATIVE B

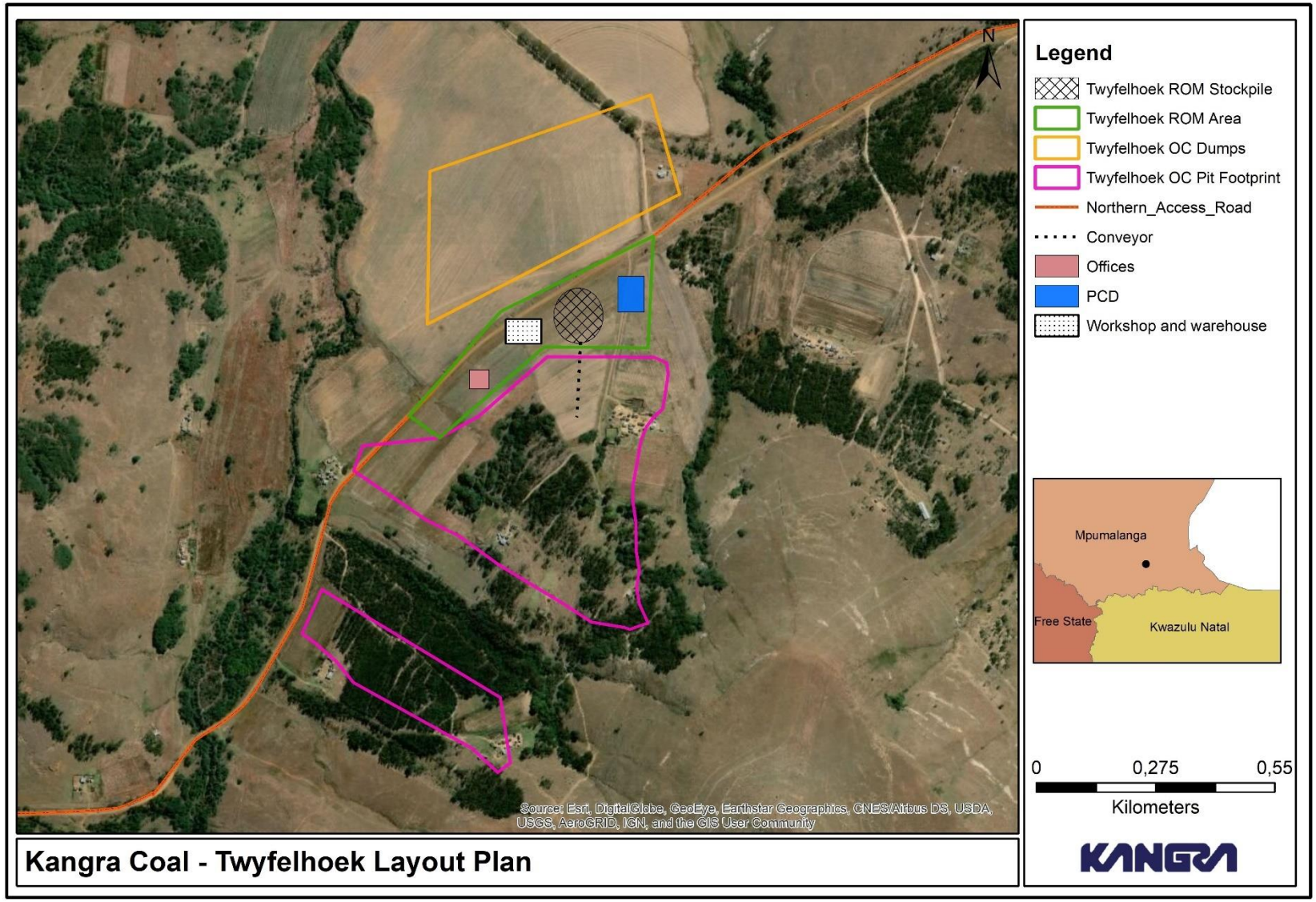


FIGURE 7-6: TWYFELHOEK CONCEPTUAL LAYOUT PLAN FOR ALTERNATIVE B

7.2 Details of the development footprint alternatives considered

7.2.1 The type of activity to be undertaken

Opencast and underground mining is proposed at Kusipongo. Opencast mining is proposed where the coal resources are shallow, while underground mining is proposed for the deeper resources. The alternatives were limited to either undertaking opencast mining or underground mining. These alternatives are based on the economics of coal mining. The footprints of the opencast mining were evaluated from the footprints of the total resource towards the Alternative B with a reduced footprint while maintaining and balancing the need for opencast mining due to employment succession from the neighbouring Maquasa operation.

7.2.2 The technology to be used

There are two mining methods available for opencast mining of shallow coal seams. These are pit and strip mining. Pit mining results in the opening of the entire resource by a dragline. Strip mining is undertaken by conventional truck and shovel. Strip mining also allows for concurrent rehabilitation due to backfilling of mined out strips.

Strip mining with concurrent rehabilitation is preferred for the proposed opencast pits.

There are also two primary methods for underground mining. These are bord-and-pillar and longwall mining. Bord-and pillar, as detailed in Section 4.3.1.2, involves leaving pillars of coal to support the roof of the mine. Longwall mining removes all of the coal, while supports temporarily hold the roof up. Once coal has been extracted the roof is then allowed to collapse.

Board-and-pillar is the preferred underground mining method to ensure that the roof stability is maintained during mining and more accurate investigations can then determine if the pillars are safe to remove.

7.2.3 Operational aspects of the activity

Alternative options related to operational aspects of the mine include the type of explosives and methods employed during blasting, dust suppression options, and control of impacts relating to air quality and noise aspects. These have been considered in the impact assessment and environmental management programme, based on the findings of the relevant specialist study. These alternatives are included as mitigation options in this assessment. The operational activities were also based on the need to maintain the current work force. Operational activities were however maintained to the minimum required considering the use of the Maquasa operations as an integral part of this mine.

7.2.4 No-Go Alternative

In accordance with the NEMA Regulations, the no-go alternative is required to be investigated and assessed. The No-go alternative means that no mining will be undertaken at Kusipongo. The status quo of the area will remain and coal resources at the existing Maquasa operations will be depleted at the end of 2019. Should the No-go alternative be implemented, it would potentially result in the following socio-economic impacts:

- Loss of employment for 745 employees that are currently working at the Savmore Colliery and approximately 900 direct jobs (contractors);
- Additional construction related jobs would not be created, as would be the case if the project were approved;
- It would impact on the local community that indirectly rely on Kangra Coal; and
- It would negatively affect the supply of coal to both international and local markets.
- The Mining Right that has been issued for the Kusipongo resource would not be utilised in terms of the MPRDA.

The no-go alternative would mean that the potential negative impacts relating to biodiversity, wetlands and land capability as well as the issues and impacts raised by landowners and stakeholders would not materialise.

Due to the segregated nature of the proposed development eg. Twyfelhoek section, Balgarthen section and Donkerhoek section, and different impacts associated with each section the no-go cannot be applied and considered as a whole. The go or no-go was therefore a function of the impact on each mining area. This created the opportunity to consider the sustainability of the project by trying to maintain social and economic aspects such as employment and production but balancing the need to consider other land uses and environmental impacts.

8. DETAILS OF THE PUBLIC PARTICIPATION PROCESS FOLLOWED

Public participation is a process that is designed to enable all interested and affected parties (I&APs) to voice their opinion and / or concerns which enables the practitioner to evaluate all aspects of the proposed development, with the objective of improving the project by maximising its benefits while minimising its adverse effects.

The public participation process must adhere to the requirements of Regulations 41 and 42 (GNR 982) under the NEMA (as amended).

8.1.1 Identification of Interested and Affected Parties

Existing databases held by Kangra Coal were used and updated for the purposes of this project. Potential Interested and Affected Parties (IAPs) were identified based on the definition of IAPs in the EIA regulations. This includes:

- Landowners or tenants adjacent to or within 100 m from the proposed study area.
- Any organisation of ratepayers that represent the community in the area (if applicable).
- Representatives of the local municipality/ward councillor with jurisdiction in the area.

This definition was expanded for the purposes of the assessment to include the mayor, councillors of the local council as well as members of the district municipality. This therefore included representatives of:

- Gert Sibande District Municipality;
- Mkhondo Local Municipality; and
- Pixley Ka Isaka Seme Local Municipality
- Authority or organs of state having jurisdiction in respect of any aspect of the activity, including. The following organs of state have been notified:
    - Mpumalanga Department of Mineral Resources (DMR)
    - Mpumalanga Department of Water and Sanitation (DWS);
    - Mpumalanga Department of Agriculture, Rural Development, Land and Environmental Affairs;
    - Mpumalanga Department of Economic Development and Tourism;
    - Mpumalanga Provincial Heritage Resources Authority;
    - Department of Roads and Transport;
    - Mpumalanga Tourism and Parks Agency; and
    - Mpumalanga Wetland Forum.

The IAP database has been updated with persons who responded to the Background Information Document (BID), press advertisements and site posters as well as persons who attended the public meetings during the scoping phase.

A list of all parties that have been identified thus far is included in **Appendix B.**

8.1.2 Notifications

In accordance with Section 41(2)(b) of Chapter 6 of the EIA Regulations (GNR 982 as amended), written notification (including BID document by email, facsimile or hand delivery) has been given to all persons on the IAP database.

IAP correspondence is included in **Appendix B.**

8.1.3 Media Advertisements and Site Notices

Press advertisements for the project were placed in the Excelsior newspaper in English and isiZulu. The adverts were published on 19 July 2019.

We appreciate you

Municipal workers do their job with a smile

Kate-Merie Ferreira

We as mortals are inclined to focus on the negative side of things, often forgetting the good that people do.

Mkhondo Local Municipality workers are always ready to fix and repair any damaged pipes, sidewalks, roads and electrical lines around town. This was no different when another burst water pipe was reported in Klopper Street on 16 July.

The first report of low water pressure was reported on a local forum at around 07:00, and by 08:00 the municipal workers were at the scene with their equipment, ready to repair the pipe.

Unfortunately the pipe was situated underneath a resident's driveway and in order to fix it, they had to lift the bricks of the driveway.

It was hard work but, they did it with professionalism and a smile. It was fixed within the hour and water pressure was restored.

Thank you for the swift manner in which you handle these situations!

Firefighters hard at work

A group of firefighters will not stop before a fire is properly extinguished

The Department of Environment, Forestry and Fisheries (DEFF) Working on Fire (WOF) firefighters have had a busy fire season so far, battling runaway veld and forest fires.

The week of Monday, 1 June, through to Sunday, 7 June, was the busiest, with various teams reporting for duty on the fireline.

The Highveld teams have been hard at work, with most of the teams called out to the fireline.

The Warburton team has been hit hardest, battling an ongoing fire throughout the whole week in the Highveld areas and WOF aerial resources had to be dispatched to fight the blaze.

The Piet Retief, Dullstroom and Breyten teams have also been called to assist Fire Protection Associations in their areas.

A fire broke out in Nelshoogte and kept the Lowveld Escarpment Fire Protection Association, LEFPA, and various Working on Fire teams busy throughout Sunday till Monday morning, causing extensive damage.

A total of 43 fires were recorded in Mpumalanga in the month of June during this fire season with an estimate of 1539,8 hectares burnt. WOF dispatched 18 teams to suppress these fires.

In the month of July, a total of five (5) fires have been recorded so far, with many hectares destroyed after the recent fire at Nelshoogte.

Working on Fire has a total of 579 firefighters in the Mpumalanga province, who are ready and on hand to assist in fighting fires during this Fire Season.

"We urge the community at large to be more vigilant as the fire season is at its peak and not to start unnecessary fires particularly during dry days this winter," WOF Mpumalanga spokesperson, Amanda Mthembu, said.

Ms Mthembu appealed to landowners in the province, to get into contact with WOF so they can assist with the development of clear integrated fire management services, which includes amongst others, prescribed burning, fuel load reduction, community fire awareness, early detection and fire suppression plans.

"Always check the Fire Danger Index (FDI) before starting any fire," Ms Mthembu concluded.

Fires cause air pollution and millions of rands in damages

KANGRA COAL (PTY) LTD

NOTICE OF APPLICATION FOR ENVIRONMENTAL AUTHORISATION AND WATER USE LICENCE FOR THE AMENDMENT OF THE PROPOSED KUSIPONGO PROJECT

SCOPING AND ENVIRONMENTAL IMPACT ASSESSMENT PROCESS AND INTEGRATED WATER USE LICENCE APPLICATION FOR THE PROPOSED DEVELOPMENT OF UNDERGROUND MINING, FOUR (4) ADITS AND THREE (3) OPENCAST PITS FOR THE KUSIPONGO MINING PROJECT

Notice is hereby given in terms of the Environmental Impact Assessment (EIA) Regulations 2014 (as amended) in terms of Section 24(5) of the National Environmental Management Act (NEMA) (Act No. 107 of 1998) (as amended); the National Environmental Management Waste Act (NEMWA) (Act No. 59 of 2008); the National Water Act (Act No. 36 of 2008) and the Mineral and Petroleum Resources Development Act (MPRDA) (Act No. 28 of 2002) (as amended) of the proposed Kusipongo Mining Project located in Mpumalanga Province.

Kangra Coal (Pty) Ltd (Kangra) operates a coal mine in Driefontein (Maquasa Operation) located near Piet Retief, in the Mkhondo Local Municipality. The life of the existing operations is coming to an end and Kangra wishes to commence mining within the Kusipongo Mining Right area (10099MR) in 2020. The Kusipongo Project is located approximately 25 km west of the Maquasa Operations and has an existing Mining Right and an approved Environmental Management Programme (EMPr), which authorised underground mining. Kangra is investigating the development of a revised underground mining plan, three opencast coal mining pits within the mining right area and four adits to access underground mining operations. New surface infrastructure will be required which includes overburden dumps, pollution control dams and stormwater management systems.

You are hereby notified that Kangra intend to submit the following applications for authorisation of the proposed development:

- **Application for amendment** in terms of Section 102 of the Minerals and Petroleum Resources Development (Act No. 28 of 2002) (as amended);
- **Application for environmental authorization** in terms of Section 24 of the National Environmental Management Act (Act No. 107 of 1998) (as amended);
- **Application for a Waste Management Licence** in terms of the National Environmental Management Waste Act (Act No. 59 of 2008); and
- **Integrated Water Use Licence Application** in terms of the National Water Act (Act No. 36 of 1998).

Should you wish to register as an interested and/or affected party or to obtain further information regarding the project, kindly contact:

Zama Khumalo
EXM Advisory Services (Pty) Ltd
Tel.: 067 267 1238
Fax: 086 616 0443
Post: PO Box 1822, Rivonia, 2128
E-mail: zama@exm.co.za

EXM Advisory Services
SOLUTIONS | PROGRESS | PARTNERS

A busy sports weekend in England

Lewis Hamilton took victory in the British Grand Prix for a record sixth time (Photo credit: BBC)

Monique Potgieter

Three major sporting events took place in England over the weekend of 13 July 2019. The Cricket World Cup final, the Wimbledon men's final and the British Grand Prix all competed for the limelight.

The 2019 Cricket World Cup came to an exciting end with a nail-biting match on Sunday, 14 July, at the Lord's Cricket Grounds in London.

New Zealand and England came face to face on Sunday in the final and neither of the two teams backed down. At the end, the two teams were tied with 241 runs each and a super over was called. Once again the teams kept the score tied and the winner was decided by the counting of boundaries. England reigned victorious with six boundaries more than New Zealand.

This nerve-wrecking cricket match was not the only thing that made history - the spectators were also entertained by a woman dressed in a skimpy outfit who ran across the pitch and had to be removed by security. She apparently did this to promote a website, definitely a "creative" marketing strategy.

The Wimbledon men's finals also took place on Sunday, 14 July. Novak Djokovic and Roger Federer played an excruciating match that lasted for 4 hours and 57 minutes, making it the longest Wimbledon final in history.

Djokovic became the first man in the Open Era to save match points en route to the Wimbledon title. He came through three tie-breaks to win with a score line of 7-6, 1-6, 7-6, 4-6 and 13-12.

The British Grand Prix was going to struggle to get attention in the shadows of the Cricket World Cup and Wimbledon. Fortunately the Formula 1's leading drivers delivered just as much exiting entertainment at Silverstone as that at Lord's and the All England Club.

Lewis Hamilton took a record sixth British Grand Prix victory, after a brief scrap with Mercedes teammate Valtteri Bottas. Ferrari's Charles Leclerc and Red Bull's Max Verstappen provided a big show when they staged a man-to-man duel for nearly half the race. It was a piece of racing that would not be forgotten.

After a staggering 4 hours and 57 minutes Djokovic came out on top (Photo Credit: Getty Images)

England, the 2019 Cricket World Cup winners (Photo Credit: Getty images)

Photo 1: Proof of English Advert in Excelsior Newspaper

LPR Nuus - Sport tydens skoolvakansie

Stefan Moolman gaan eersdaags die Pieties se naam hoog hou in Middelburg

Monique Potgieter

Die leerders van Laerskool Piet Retief het omtrent nie 'n kans gehad vir vakansie hou met al die sportbyeenkomste tydens die Junie/Julle skoolvakansie nie.

Krieket:

Die eerste krieketspan het op 11 Junie vertrek op 'n kriekettoer na Warmbad om voor te berei vir die komende krieketseisoen. Hulle het tydens hulle eerste wedstryd te staan gekom teen Laerskool Eugene Marais (van Naboomspruit). Die Pieties het hierdie span beperk tot 'n telling van 144/9 in die toegelate 30 beurte. Hulle het ook gesorg dat hulle self teen die verlangde tempo kolf en steek die opponente se telling verby in net 28 beurte vir die verlies van ses paaltjies.

Op dag twee was Laerskool Setlaarspark (van Port Elizabeth) aan die beurt teen Piet Retief en dié span kon net 'n telling van 71/9 behaal, in die toegelate 25 beurte. Elke Piet Retief speler het 'n kans gekry om te kolf, en die wenteiken word met slegs 14 beurte behaal.

Die laaste wedstryd teen Laerskool Warmbad, was 'n naelbytwedstryd. Piet Retief kolf eerste en behaal 'n telling van 128 lopies vir die verlies van vyf paaltjies in 30 beurte. Warmbad slaan baie balle in die lug en die goeie vangskote deur die Pieties sorg vinnig vir die val van vyf paaltjies. Die laaste paaltjie val in die 26ste beurt met net 119 lopies op die bord.

Alhoewel die eerstespan al drie hulle wedstryde gewen het, lê daar nog baie werk voor. Gelukkig was dit nie die hele tyd net sport nie, die kinders het ook heerlik geswem, geëet en gespeel. Hierdie toer is al vir 15 jaar lank 'n tradisie by die skool en word deur die seuns as 'n hoogtepunt van hulle laerskoolloopbaan beskou.

Die O/11 krieketspan het ook die voorreg gehad om van 11-14 Junie, op 'n onvergeetlike kriekettoer in die warmer, noordelike deel van ons land te gaan. Hier het hulle wedstryde gespeel teen Laerskool Eugene Marais (van Naboomspruit) en Laerskool Warmbad. Albei dié wedstryde is deur Piet Retief gewen en in die tweede wedstryd teken Ruan Pretorius 'n merkwaardige 98 lopies aan; so amper of hy het sy honderdtal gehaal. Almal is vreeslik trots op hierdie span se mooi spel maar veral op hulle onberispelike gedrag.

Hokkie:

Wanneer teëspoed oor jou pad kom, het jy een van twee keuses, of jy draai om en hardloop weg, of jy kyk dit vierkantig in die oë, skep moed en gee jou beste! Dit is hoe die eerste hokkiespan hulle terugslag hanteer het, nadat hulle gehoor het dat Zelandi Bouwer, Celesteé Rautenbach en Stefanie Maritz nie hulle laaste wedstryde vir die laerskool kan speel nie.

So met twee "huursoldate", Lerika Botha en Tanya Roelofse het hulle die koue Volksrusttoernooi gaan trotseer. Dit was vir almal lekker om te sien hoe die meisies saamstaan en mekaar motiveer en groot was die geluk toe hulle die eerste doel aanteken.

Baie geluk aan die spelers van die wedstryde: Zama Nhlabathi, Mpilonhle Mnisi, Andile Nkosi en Luané Groblers!

Hoëveld Tennis:

Hokkie en krieket is nie al waarmee die skool kan spog nie. Stefan Moolman is ingesluit by die O/13 Hoëveld tennisspan. Hy gaan van 23-25 Augustus deelneem aan die interdistrikte toernooi wat in Middelburg sal plaasvind.

Baie geluk aan almal wat deelgeneem het die vakansie, en sterkte met die kwartaal wat voorlê.

Die laaste jaar van Laerskool krieket vir sommige spelers van die eerstespan

Geen teëspoed kon die opwinding vir die hokkietoernooi demp nie

Goeie gedrag maak die beste sportmanne

The SANBS helps to save lives

Monique Potgieter

SANBS aims to collect 3 000 units of blood per day to ensure a safe and sufficient blood supply in the health care system.

On Tuesday, 16 July, the South Africa National Blood Service (SANBS) once again did their rounds in Piet Retief.

They visit Piet Retief once a month on a Tuesday, to give residents the opportunity to donate blood. They either set up at the Spar Centre or at the Dutch Reformed Church hall in Piet Retief.

To be able to donate you need to be over the age of 16, weigh above 50 kilograms and maintain a save sex life. You also need to make sure that you are healthy when donating.

Unfortunately the only way that the SANBS can let people know that they are heading in our direction is through the existing registered donors list. They either send an e-mail or SMS to the donors, so if you would like to be part of this communication group make sure that you go and donate some much needed blood the next time they are in town.

Your blood can save a life!

The SANBS hard at work setting up their station

Photo 2: Proof of IsiZulu Advert in Excelsior Newspaper

Site Notices which are A2 and A3 in size, have been placed at the following locations:

- Entrance to the Maquasa East Colliery;
- Mkhondo Municipality satellite office;
- At various locations along the roads to the proposed opencast pits and outside the boundary of the mining right area.

The notices were placed in English and isiZulu at these locations.

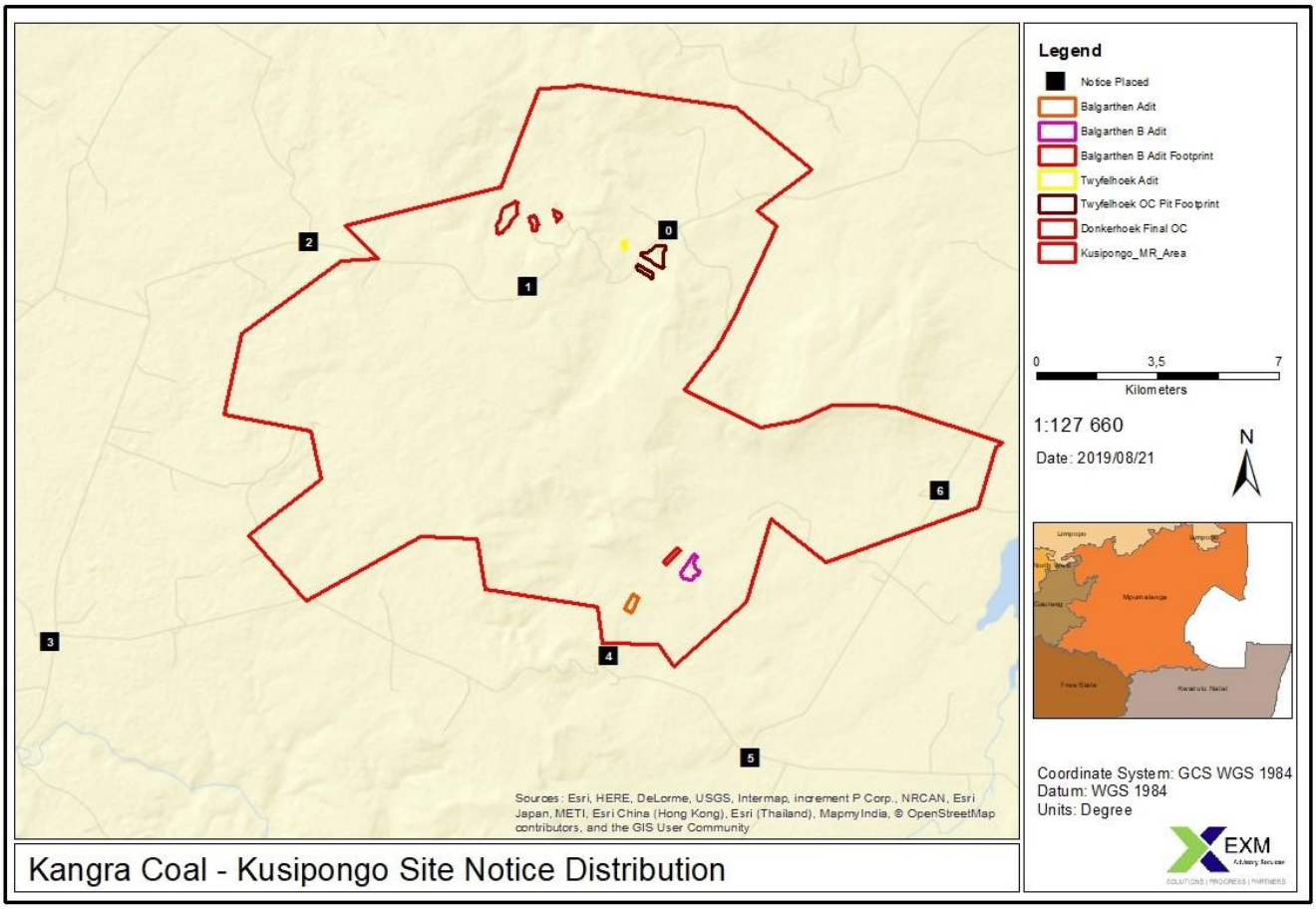


FIGURE 8-1: MAP SHOWING WHERE SITE NOTICES WERE PLACED IN PROXIMITY TO THE MINING RIGHT AREA

Site Notice 0

Site Notice 0

Site Notice 2

Site Notice 2

Site Notice 4

Site Notice 4

Site Notice 5

Site Notice 5

Site Notice 6

SITE NOTICE NEAR THE ENTRANCE TO THE SAVMORE COLLIERY

	
MKHONDO LOCAL MUNICIPALITY SATELLITE OFFICE	**MKHONDO LOCAL MUNICIPALITY SATELLITE OFFICE**

8.1.4 Public meetings during Scoping Phase

Public information-sharing meetings have been held with the following communities on 02 and 03 August 2019:

- Thuthukani Communal Property Association;
- Ekaluka Communal Property Association; and
- Yende Farmers Trust.

The Public information sharing meetings were held with the communities in proximity to the proposed opencast mining areas.

Minutes of the meetings are attached in **Appendix B**.

A meeting was held on 01 July 2019 with Mr Corneels Greyling, who owns a significant portion of the land within the mining right area.

A second meeting was held with Mr Kerneels Greyling and Mr Werner Potgieter, who also owns land within the mining right area.

8.1.5 Public and authority review of draft scoping report

The draft Scoping Report was made available for the legislated 30-day review period by IAPs (both commenting authorities and the public) from 20 July 2019 to 20 August 2019 in accordance with Section 40 of the 2014 EIA regulations 2014 (as amended).

Comments received during the 30 day review period have been included in Section 8.2.

8.1.6 EIA Phase PPP

8.1.6.1 Advertisements and meetings

In compliance with the EIA Regulations (2014) as amended, notification of the EIA Phase feedback meetings and availability of the draft EIA report will be advertised in the Excelsior newspaper.

Feedback meetings with the communities and landowners will be held during the draft EIA report 30-day review period.

8.1.6.2 Public and authority review of the draft EIA Report

The draft EIA Report will be made available for the legislated 30-day review period by IAPs (both commenting authorities and the public) from 30 October 2019 to 30 November 2019 in accordance with Section 40 of the EIA Regulations 2014 (as amended).

The draft EIA will be made available as follows:

- A hard copy will be available at the Savmore Colliery;
- Electronic copies will be sent to stakeholders registered on the IAP database;
- The executive summary will be translated into isiZulu and distributed during the community feedback meetings.

8.1.6.3 Environmental Authorisation

On receipt of environmental authorisation (positive or negative) from the DMR, I&APs registered on the project database will be informed of this authorisation and its associated terms and conditions by correspondence and advertisement.

8.2 Summary of issues raised by IAPs

Please refer to Appendix B, for full comments in minutes of meetings and correspondence with IAPs and authorities. Correspondence received to date is also included in Appendix B.

DATE	NAME	CORRESPONDENCE RECEIVED	EAPs RESPONSE TO ISSUES AS MANDATED BY THE APPLICANT	CONSULTATION STATUS (consensus, dispute, ongoing, etc.)
AFFECTED PARTIES				
Landowners/Lawful Occupiers of Adjacent Properties				
13 August 2019	Prinloo Inc on behalf of Mr Corneels Greyling	An objection letter to the proposed Kusipongo project was sent to Kangra Coal and the EAP on behalf of Mr Corneels Greyling. His objections relate to the following: • Loss of land and livelihood if certain portions of his farms are utilised for opencast mining operations. • Loss of income due to mining operations • Loss of income of employees who are employed on his farms; • Water security due to the potential impacts on ground and surface water	**Loss of land and income due to loss of grazing land:** The property affected by surface infrastructure is portion 1 of the farm Kikvorschfontein where the Balgarthen B adit will be developed. The entire property is ~147ha with the development footprint for the adit area being approximately 35ha (adit, dump, roads, ROM stockpile). The land is currently utilised for livestock grazing with a long-term grazing capacity of 4ha per large stock unit (LSU). Considering the grazing capacity, it can be estimated a profit loss of nine LSU can be expected. The mine needs to either compensate Mr, Greyling for the annual losses incurred based on his average profit per head of cattle/ sheep. The alternative is to negotiate the sale or lease of the property should it not affect the viability of the farming unit (additional farms) owned by Mr Greyling. Rehabilitation should plan to repair the disturbed sections to grazing at similar capacity post closure.	Consultation is ongoing. Feedback on specialist studies will be provide during the review period of the EIA and consultation meetings.

DATE	NAME	CORRESPONDENCE RECEIVED	EAPs RESPONSE TO ISSUES AS MANDATED BY THE APPLICANT	CONSULTATION STATUS (consensus, dispute, ongoing, etc.)
			Monitoring of fallout dust (near key grazing area), water supply and quality need to be implemented to identify if and when the impacts extend beyond the surface disturbance. These impacts need to be compensated for or mitigated. **Loss of employment due to reduced farming extent:** It is not anticipated that a loss of employment will occur due to the small section lost to farming. The loss of employment will however become evident if the impacts extend beyond the surface disturbance and affect a greater area. It is proposed the areas not used for mining continue to be used for farming. This can include utilisation of land owned by Kanga. Monitoring of fallout dust (near key grazing areas), water supply and quality needs to be implemented to identify if and when the impacts extend beyond the surface disturbance. These impacts need to be compensated for or mitigated. **Impacts on water availability and quality:**	

DATE	NAME	CORRESPONDENCE RECEIVED	EAPs RESPONSE TO ISSUES AS MANDATED BY THE APPLICANT	CONSULTATION STATUS (consensus, dispute, ongoing, etc.)
			The dewatering of the underground working will result in a drawdown of the local water table (See section 10.2.1). This drawdown is very isolated and will not extend beyond the local area. The water levels have been measured prior to mining and pump tests have assessed the pre-mining yields. A monitoring programme to measure water levels and quality will be commissioned based on the WUL requirements. Should a lowering of the water level or quality concerns be identified, and the user not believe it is due to climatic conditions or use of water the impact should form part of an investigation by an independent geohydrologist to confirm the impact. Should an impact be realised the investigation should provide mitigation measures that need to be implemented by Kangra.	
02 August 2019	Issues raised at the Thuthukani Community Meeting	The following were the main issues raised: • Blasting impacts; • Graves which may be affected by mining operations; • Water pollution; and • Unrehabilitated open pits due to previous mining operations in the area	The blasting assessment indicated that consideration should be given to relocate houses within a 500 m radius from mining operations and particularly those within 250 m. An assessment on the structural integrity and existing damage to surrounding structures within a 500 m radius must be undertaken prior to blasting commencing. Graves and potential graves that have been identified within the development footprint must either be preserved in situ, or a grave relocation process must be undertaken. Ground and surface water monitoring is to be undertaken in order to assess changes to water levels and water quality.	Consultation is ongoing. Feedback on specialist studies will be given in the EIA.

DATE	NAME	CORRESPONDENCE RECEIVED	EAPs RESPONSE TO ISSUES AS MANDATED BY THE APPLICANT	CONSULTATION STATUS (consensus, dispute, ongoing, etc.)
02 August 2019	Issues raised at the eKaluka Community meeting	The following were the main issues raised: • The community does not trust the mine; • Blasting impacts; • Lack of consultation with the community from the mine.	The blasting assessment indicated that consideration should be given to relocate houses within a 500 m radius from mining operations and particularly those within 250 m. An assessment on the structural integrity and existing damage to surrounding structures within a 500 m radius must be undertaken prior to blasting commencing. The issues relating to the mine communication were noted, but these do not form part of the current EIA being undertaken. These concerns have been escalated to the Mine.	Consultation is ongoing. Feedback on specialist studies will be given in the EIA. The mine has established a relationship with the community and opened communication channels.
	Andries and Schalk Pienaar	Concerned about traffic impacts on the haul road in proximity to their farms.	The road assessment concluded that none of the proposed roads were currently suitable for hauling coal and upgrades to these roads will be required. The traffic impact assessment concluded that the traffic due to the Kusipongo proposed mining operations will not have a significant impact on traffic volumes in the area. The use of trucks on the road may however result in the following potential impacts: 1. Degradation of roads 2. Safety on roads due to dust and speeding The roads must be upgraded and maintained. Where public roads are affected, this must be done in conjunction with the roads authority. Road safety must be enforced through inspections and control of vehicle speed by Kangra. Use consideration must be made when farmers utilise the roads for farming implements.	Consultation is ongoing. Feedback on specialist studies will be given in the EIA.

DATE	NAME	CORRESPONDENCE RECEIVED	EAPs RESPONSE TO ISSUES AS MANDATED BY THE APPLICANT	CONSULTATION STATUS (consensus, dispute, ongoing, etc.)
28 August 2019	Werner Potgieter	The following issues were raised as concerns: • traffic impacts on the roads adjacent to his farm; • socio-economic impacts on 168 employees on his farm; • coal dust on his sheep and financial impacts due to the wool being contaminated with coal dust; • Loss of land used for sheep grazing in winter due to the Balgarthen adits and pit; • Impacts on the Mpundu River, which feeds into the Heyshope dam. Mr Potgieter indicated that if the mine were to proceed, they would require financial compensation for loss of income due to mining operations.	Traffic |Impacts: The traffic impact assessment concluded that the traffic due to the Kusipongo proposed mining operations will not have a significant impact on traffic volumes in the area. The use of trucks on the road may however result in the following potential impacts: 1. Degradation of roads 2. Safety on roads due to dust and speeding The roads must be upgraded and maintained. Where public roads are affected, this must be done in conjunction with the roads authority. Road safety must be enforced through inspections and control of vehicle speed by Kangra. Use consideration must be made when farmers utilise the roads for farming implements. The road assessment concluded that none of the proposed roads were currently suitable for hauling coal and upgrades to these roads will be required. **Loss of employment due to reduced farming extent:** It is not anticipated that a loss of employment will occur due to the small section lost to farming. The loss of employment will however become evident if the impacts extend beyond the surface disturbance and affect a greater area. It is proposed the areas not used for mining continue to be used for farming. This can include utilisation of land owned by Kanga.	Consultation is ongoing. Feedback on specialist studies will be given in the EIA.

			Dust Impacts: Dust suppression measures must be undertaken on all haul routes in order to mitigate the potential impacts due to dust and coal dust. Dust monitoring (fallout) at Mr Potgieter's farm must be undertaken to confirm impacts. Mitigation should then be improved on road or at mine. Should loss of wool quality be identified by the farmer a complaint needs to be lodged and investigated with mitigation identified. **Loss of land and income due to loss of grazing land**: The property affected by surface infrastructure is the Remainder of the farm Kikvorschfontein where the Balgarthen B opencast pit and associated infrastructure will be developed. The development footprint for the pit and associated infrastructure approximately 170ha (adit, dump, roads, ROM stockpile). The land is currently utilised for livestock grazing with a long-term grazing capacity of 4ha per large stock unit (LSU). Considering the grazing capacity, it can be estimated a profit loss of nine LSU can be expected. The mine needs to either compensate Mr, Greyling/Potgieter for the annual losses incurred based on his average profit per head of cattle/ sheep. The alternative is to negotiate the sale or lease of the property. Rehabilitation should plan to repair the disturbed sections to grazing at similar capacity post closure. Impacts on Rivers and Heyshope Dam: Infrastructure will be located >100m away from any watercourses and dirty water will be	

DATE	NAME	CORRESPONDENCE RECEIVED	EAPs RESPONSE TO ISSUES AS MANDATED BY THE APPLICANT	CONSULTATION STATUS (consensus, dispute, ongoing, etc.)
			contained within pollution control dams. A monitoring programme is to be implemented and issues must be addressed if identified. Groundwater and surface water monitoring is to be undertaken in order to assess changes to water levels and water quality.	
26 August 2019	Webber Wentzel Attorneys on behalf of Donkerhoek Trust and TR Mabuza Contractors CC	A Letter was received from Manus Booysen of Webber Wentzel attorneys on behalf Donkerhoek Trust and TR Mabuza Contractors CC. The landowner of the Donkerhoek Trust has sold the land to TR Mabuza Contractors CC. The letter requested further details of the project and EIA process being undertaken.	All information requested has been sent to Webber Wentzel Attorneys. A surface agreement is to be negotiated with the landowner prior to the development of any mining operations.	Consultation is ongoing
Local Authorities				
24 July 2019	Mpumalanga Tourism and Parks Agency (MTPA)	A hard copy of the draft Scoping Report was requested. MTPA submitted comments on the proposed development raising various objections based on the sensitivity of the natural environment	A hard copy was sent to the MTPA. The objection form MTPA contains significant detailed questions and concerns. These are related to the sensitivity and importance of the natural environment based on the Mpumalanga conservation plan and targets. The impact assessment quantified the concerns raised by MTPA. A more detailed response is provided below in the Competent Authorities Affected section.	Consultation is ongoing
Organs of state (Responsible for infrastructure that may be affected Roads Department, Eskom, Telkom, DWA etc.) No comments received as yet.				
Traditional Leaders No comments received as yet				
Competent Authorities affected				
22 August 2019	Mpumalanga Tourism and Parks Agency (MTPA)	MTPA submitted comments on the draft Scoping Report which state that they do not support the application to mine opencast pits in the sensitive ecological area.	**Ecological sensitivity analysis:**	Ongoing

DATE	NAME	CORRESPONDENCE RECEIVED	EAPs RESPONSE TO ISSUES AS MANDATED BY THE APPLICANT	CONSULTATION STATUS (consensus, dispute, ongoing, etc.)
		MTPA requested the following: An ecological sensitivity analysis; • Avoidance of any mining activities in the sensitive areas described by the MBSP; • The PES and EIS of the wetland catchment affected by Kangra Coal must be included in the EIA; • A comparative analysis of other sustainable land uses; • The study must indicate the suitability of the post mining habitat to biodiversity and the loss of soil potential for food production; • The quality of water recycled into the environment over a long term of 50 years and longer; • The suitability of rehabilitated land for housing projects; • The accumulative effect of all the mining activities in this area and the cost to downstream users; • Risk Assessment for the effect of AMD decanting, dewatering of sensitive habitats and subsidence; • The desirability study of the proposed opencast mining method in a sensitive terrestrial biodiversity and freshwater biodiversity sub catchment area; • A cost benefit analysis for mining coal in such a sensitive environment including the costs of a 100-year water purification plant; • Cost estimation of the ecological services that will be lost; • The rehabilitation plan which includes long term water treatment plan.	This was undertaken as part of the floral and faunal assessments. See Section 9.6.4. **Avoidance of any mining activities in the sensitive area described by the MBSP:** The initial opencast pit layouts were revised, and Alternative B consists of six mini pits which avoid sensitive areas where possible and remain outside of the 100 m buffer of watercourses. **The PES and EIS of the wetland catchment affected by Kangra Coal must be included in the EIA:** This has been undertaken as part of the Aquatic Assessment. See Section 9.7.2. **A comparative analysis of other sustainable land uses:** Should the mining operations not be undertaken, land uses will remain as they currently are within each of the focus areas which include wilderness, grazing and farming activities. The rehabilitation plan aims at ensuring there is an economical land use post mining. Majority of the mining footprint will be underground. **The study must indicate the suitability of the post mining habitat to biodiversity and the loss of soil potential for food production:** A rehabilitation plan was compiled where final land uses was identified. The final land uses need to comply with the pre-mining uses. Where the development footprints could not avoid, mitigate or rehabilitate to the pre-mining land use offsets are proposed in accordance with the impact hierarchy.	

DATE	NAME	CORRESPONDENCE RECEIVED	EAPs RESPONSE TO ISSUES AS MANDATED BY THE APPLICANT	CONSULTATION STATUS (consensus, dispute, ongoing, etc.)
			The quality of water recycled into the environment over a long term of 50 years and longer: Ground and surface water monitoring will be undertaken and the geohydrological model will be updated to more accurately assess the potential for AMD and water quality impacts. An AMD and decant management plan has been developed quantifying the volumes of AMD, decant points with timeframes) and qualities expected. Treatment and discharge of clean water back to the catchment is recommended. **The suitability of rehabilitated land for housing projects:** Refer to Rehabilitation and Closure Report. Land will be rehabilitated as close to its pre-mining land use as possible. It is optimal to utilise the land for the use pre-mining. The footprints are small and mostly located far outside major settlements. **The accumulative effect of all the mining activities in this area and the cost to downstream users:**	

DATE	NAME	CORRESPONDENCE RECEIVED	EAPs RESPONSE TO ISSUES AS MANDATED BY THE APPLICANT	CONSULTATION STATUS (consensus, dispute, ongoing, etc.)
			The cumulative effect assessed as part of this study considered the development of acid mine drainage water, loss of land use, and loss of employment. The cumulative effect is addressed through concurrent rehabilitation to reduce the cumulative effect over the life of mine. The cumulative effect of AMD generation post mining is addressed as part of a combined AMD strategy and management plan. The cost of implementing the above is also quantified in the financial provision reporting. **Risk Assessment for the effect of AMD decanting, dewatering of sensitive habitats and subsidence**: A Waste assessment, a Geohydrological assessment and an Aquatic assessment have been undertaken which have identified the potential for and impacts associated with AMD and dewatering od sensitive habitats. An AMD and decant management strategy in conjunction with a rehabilitation plan and latent risk plan is focused on addressing the effects. **The desirability study of the proposed opencast mining method in a sensitive terrestrial biodiversity and freshwater biodiversity sub catchment area**: The Floral and Faunal assessment as well as the Aquatic assessment have identified and assessed potential impacts associated with the proposed mining operations. See Section 10.2. **A cost benefit analysis for mining coal in such a sensitive environment including the costs of a 100 year water purification plant**:	

DATE	NAME	CORRESPONDENCE RECEIVED	EAPs RESPONSE TO ISSUES AS MANDATED BY THE APPLICANT	CONSULTATION STATUS (consensus, dispute, ongoing, etc.)
			The cost to rehabilitate the negative effects of the proposed development is quantified in the financial provision. This provision must be provided for and is not accessible for any other commitments than rehabilitation and management of latent risks. The applicant will need to consider the cost implications against its benefit. **Cost estimation of the ecological services that will be lost:** The ecological services lost will either be mitigated, rehabilitated or offset where not possible. The mine will need to develop an offset strategy with the aim of calculating this cost as a function of its replacement value or residual loss. It is unlikely a no net loss of biodiversity services will be achieved locally but a regional objective as part of the offset can consider this benefit. **The rehabilitation plan which includes long term water treatment plan:** Please refer to Rehabilitation and Closure Report. A separate strategy for the management of decant and AMD has also been developed.	
INTERESTED PARTIES				

DATE	NAME	CORRESPONDENCE RECEIVED	EAPs RESPONSE TO ISSUES AS MANDATED BY THE APPLICANT	CONSULTATION STATUS (consensus, dispute, ongoing, etc.)
September 2019	EAP	It has been noted in the Blasting Impact Assessment that there is a primary school located within the proposed footprint of the Twyfelhoek opencast pit area.	This school will need to be relocated prior to opencast mining operations being undertaken and this must be done in conjunction with the community and parents of the learners who attend the school. Should the new location for the school by further away from learners' homes, Kangra should commit to suitable transport vehicle and learners should be transported to and from the new school location. The road will be used for transport of coal from the Donkerhoek opencast prior to the development of the Twyfelhoek opencast. Kangra will need to provide safety officers at the school during peak times to manage its truck movement while maintain safety for learners and parents taking and collecting learners from school.	Ongoing consultation

9. THE ENVIRONMENTAL ATTRIBUTES ASSOCIATED WITH THE DEVELOPMENT FOOTPRINT ALTERNATIVES

The baseline environmental data associated with the study area has been obtained using Geographic Information Systems (GIS) and mapping as well as information from the approved EIA and EMPr for the Kusipongo mining right undertaken by Environmental Resources Management (ERM) and baseline information of relevant specialist studies undertaken for the project at hand.

9.1 Climate

The proposed Project is located on the border of two climatic zones, based on the Köppen-Geiger classification for South Africa (Van Dyk and Kumirai 2012), namely the 'Warm Temperate Hot Summer Dry Winter' (Cwa) to the east and the 'Warm Temperate Warm Summer Dry Winter' (Cwb) to the west. The higher elevation to the west towards the Vaal River catchment area leads to cooler temperatures. During the warm summer months of December and January the average daily temperature is between 20 and 26°C, while the minimum temperatures in winter drop as low as 4°C.

9.1.1 Rainfall

The mining area is within a summer rainfall region, with more than 80% of the rainfall falling between the months of October and March. Annual rainfall varied between 573mm and 1,314 mm over a 30-year record period. The annual average rainfall over the record period is 877mm, however, rainfall is highly variable, particularly during the summer months,

9.1.2 Wind

The predominant wind direction is from the north-east with a frequency of occurrence of 16%. Winds from the northern sector are also predominant, occurring 10% of the total period. During day-time, strong winds from the north and north-easterly sectors occur frequently (9% and 10% of the time, respectively). There is an increase in north easterly flow with a decrease in westerly and north-westerly air flow during the night-time.

9.1.3 Topography

The Project lies within a mountainous area characterised by gentle to steep slopes in the central, northern and southern parts and a high plateau in the western part of the site. The topographically lowest area of the site is located in the south-western part on the farm Langverwacht close to the Heyshope Dam at 1,320 metres above mean sea level (mamsl). The highest area is located in the south-western part on the farm De Paarl at 1,880 mamsl.

The eastern sector of the Project Area is characterised by relatively gentle topography, with heights varying between 1,350 mamsl and 1,450 mamsl. Towards the north, the topography rises above 1,500 mamsl and the west (the escarpment), above 1,650mamsl.

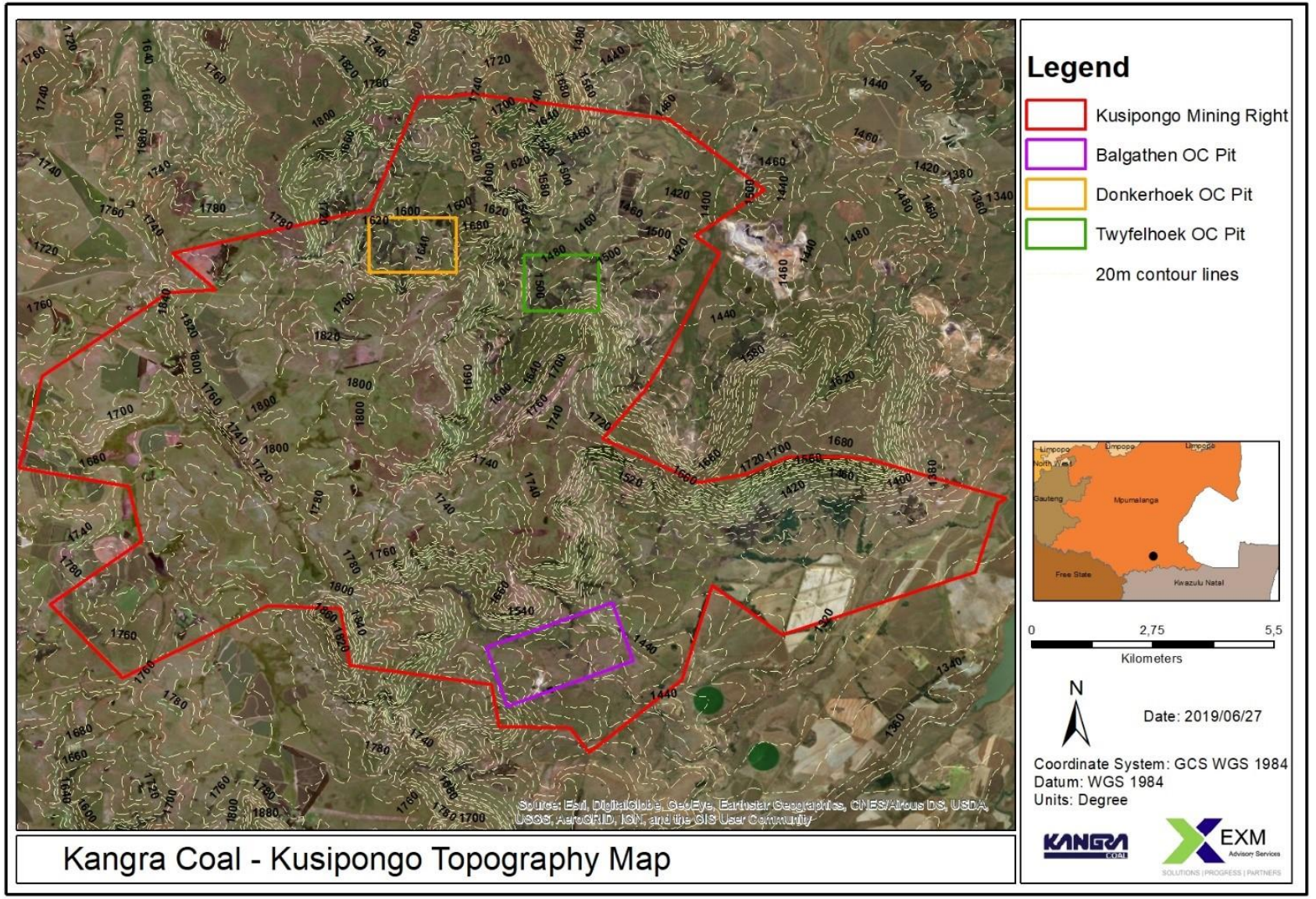


FIGURE 9-1: LOCAL TOPOGRAPHY

9.2 Geology

The Project Area is underlain by the sedimentary rocks of the Madzaringwe Formation of the Ecca Group, which forms part of a segment of the north eastern margin of the Karoo basin, filled with sediments belonging to the Karoo Supergroup. The sedimentary rocks were deposited discordantly on the basement, defined by the Undifferentiated Onverwacht Group, consisting of lava, tuff, schists and chert. The former forms part of the Barberton Sequence.

During the deposition of sediments in the Karoo basin, tension in the crust due to continuing loading lead to failure and subsequently intrusion of Post-Karoo dolerite sills and dykes along weak zones such as fractures, fissures and faults. Consequently, dykes and sills varying between a few centimetres to a couple of metres in thickness intruded the Project Area. Most dolerite dykes have a vertical or near-vertical dip.

9.3 Soils, Land Use and Land capability

Information was sourced from the Soil, Land Use and Land Capability Assessment (Scientific Terrestrial Services CC, September 2019).

Due to the extent of the mining right area (MRA), the study was limited to the envisaged opencast, adit areas as well as other related infrastructure and are referred to as the "focus areas".

9.3.1 Land Use

Based on observation during the site assessment, the dominant land uses within the focus areas are wilderness, wetlands, plantations, small-scale farming, commercial and residential areas within a rural setting. Large scale commercial agriculture activities were observed to be occurring within a 3km radius of the focus areas. Please refer to Figures below for maps depicting land uses.

PLATE 9-1: PHOTOGRAPHIC REPRESENTATION OF DOMINANT LAND USES

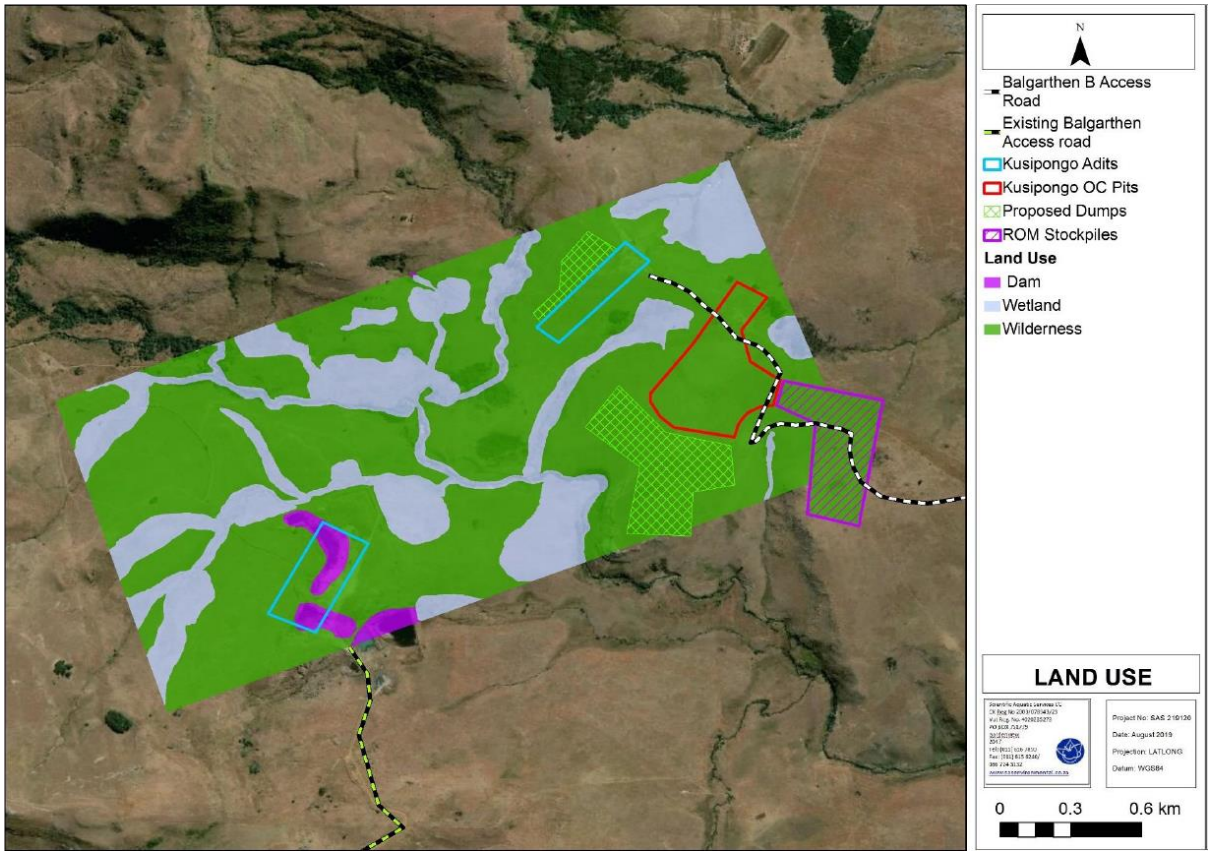


FIGURE 9-2: LAND-USE WITHIN THE BALGARTHEN FOCUS AREA

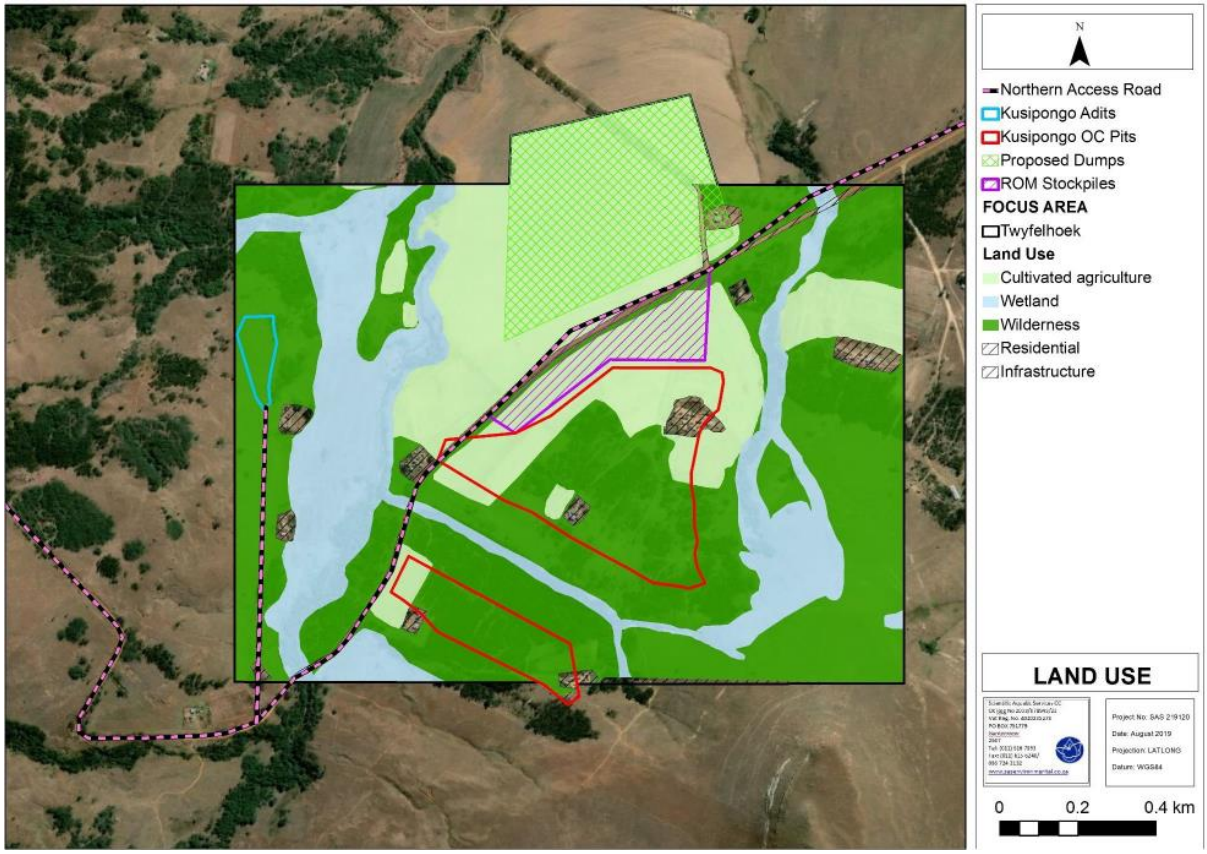


FIGURE 9-3: LAND-USE WITHIN THE TWYFELHOEK FOCUS AREA

FIGURE 9-4: LAND-USE WITHIN THE DONKERHOEK FOCUS AREA

9.3.2 Soils

The focus areas resemble a Plinthic, Oxidic, Lithic and Anthropic catena. Plinthic soils are comprised of an underlying plinthite material, which is a strong pigmentation effect of iron (Fe) oxides cemented together as hard nodules. The plinthite material provides an indication of periodic saturation of soils with water. The depth and thickness of the Plinthite within the soil profile restrict root development and water movement to varying degrees depending on the depth of the plinthite layer. These soils constitute approximately 57.05% of the total focus area. The soil forms identified within the focus areas which form part of the Plinthic soil group include Avalon, Glencoe, Eland, Bainslvei, Longlands, Wasbank, Westleigh, Dresden and Umvoti.

Oxidic soils are characterised by the strong pigmenting effects of iron (Fe) in the form of hematite. These soils are generally considered freely drained and well aerated. These attributes make these soils ideal for tillage. Oxidic soils constitute of approximately 18.68% of the total focus area and includes the following soil forms:

- Ermelo;
- Clovelly/Carolina; and
- Vaalbos/Nkonkoni

Lithic soils are generally associated with convex slope positions, highly erodible. Lithic soils include Mispah/Glenrosa soil forms which constitute of approximately 17.74% of the total focus area. According to literature, Lithic soils are typically characterised by a continuous hard layer of rock occurring immediately beneath the A horizon and offers extreme resistance to root and water penetration and it is mainly a feature of shallow soils. It should be noted however that this may vary depending on the rock types, as some rock types are easily penetrable.

The remainder of the focus areas comprises Cumulic soils and Gleyic soils, which occupy approximately 3.16% and 2.65% respectively. The spatial distribution of all identified soil forms within the focus areas are presented in soil maps in **Figure 9-5**, **Figure 9-6** and **Figure 9-7** below.

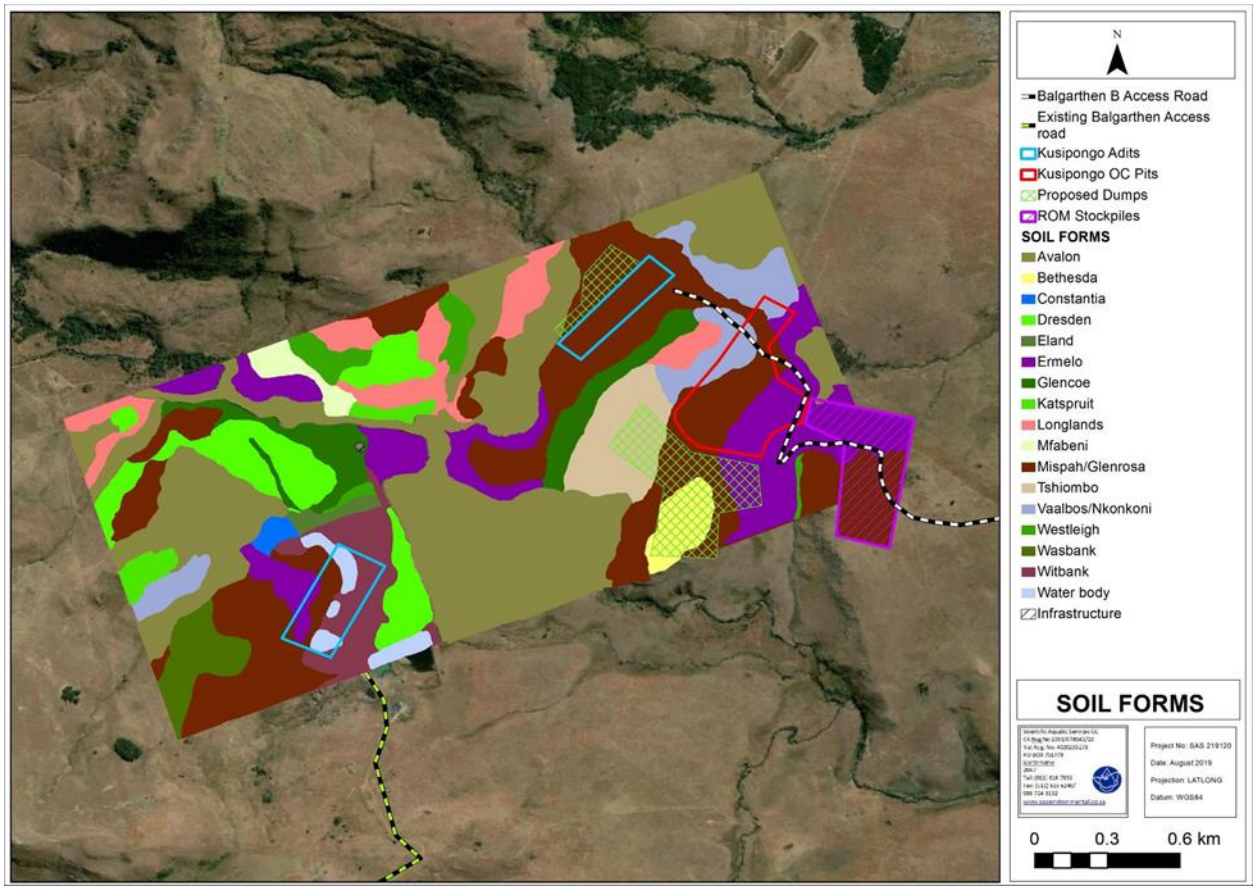


FIGURE 9-5: SOIL MAP DEPICTING IDENTIFIED SOIL FORMS WITHIN THE BALGARTHEN FOCUS AREA

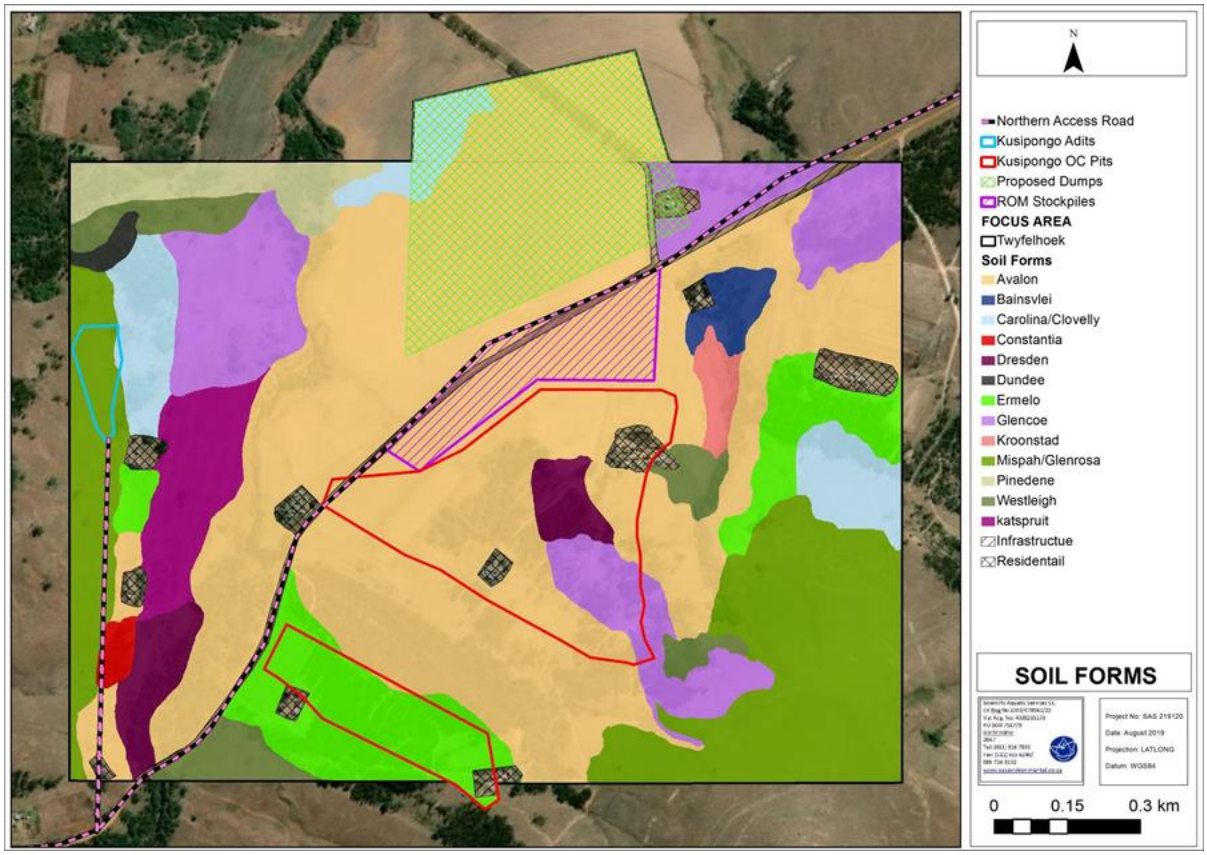


FIGURE 9-6: SOIL MAP DEPICTING IDENTIFIED SOIL FORMS WITHIN THE TWYFELHOEK FOCUS AREA

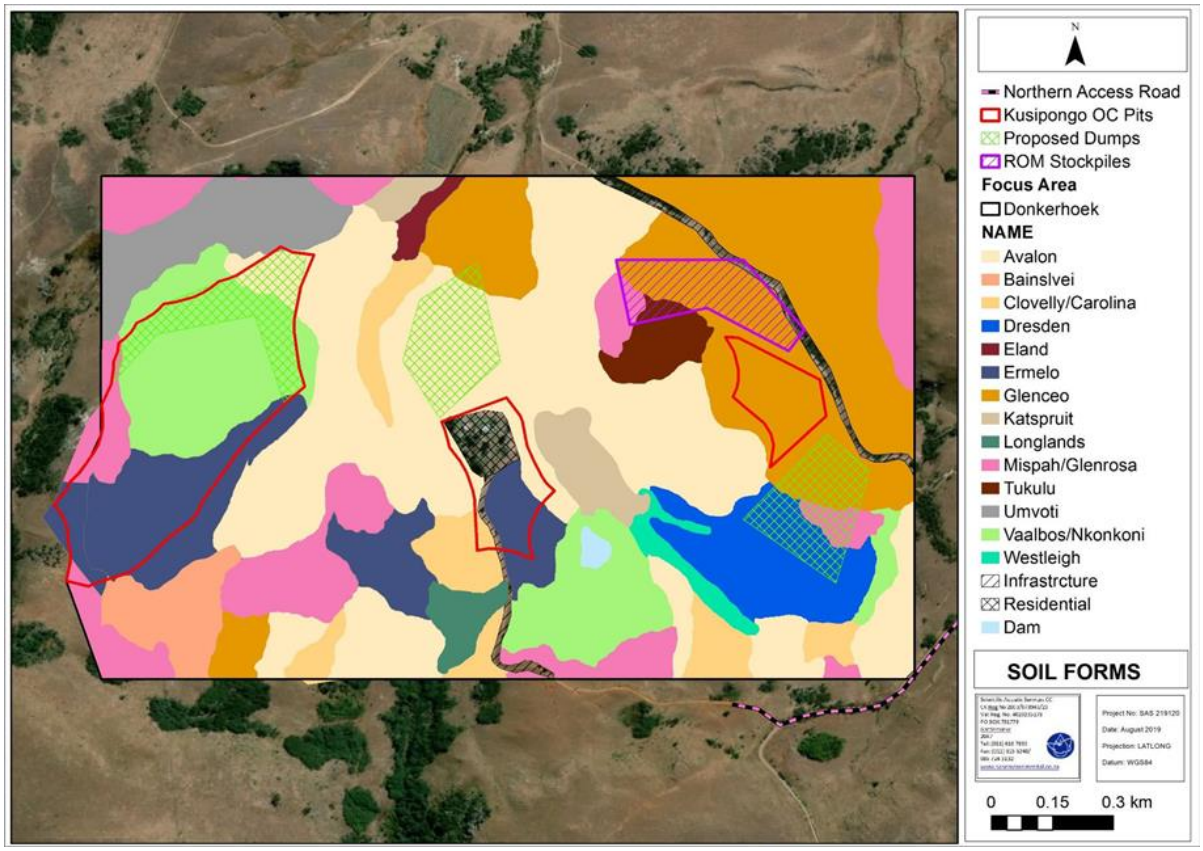


FIGURE 9-7: SOIL MAP DEPICTING IDENTIFIED SOIL FORMS WITHIN THE DONKERHOEK FOCUS AREA

9.3.3 Land capability classification

For this assessment, land capability was inferred in consideration of observed limitations to land use due to physical soil properties and prevailing climatic conditions. Climate Capability (measured on a scale of 1 to 8) was therefore considered in the agricultural potential classification.

THE FOCUS AREAS FALL INTO CLIMATE CAPABILITY CLASS 1, WITH LOCAL CLIMATE THAT IS FAVOURABLE FOR GOOD YIELD FOR A WIDE RANGE OF ADAPTED CROPS THROUGHOUT THE YEAR. THE IDENTIFIED SOILS WERE CLASSIFIED INTO LAND CAPABILITY CLASSES USING THE SCOTNEY *ET. AL.* LAND CAPABILITY CLASSIFICATION SYSTEM. A SUMMARY OF THE LAND CAPABILITY ASSESSMENT OF THE SOIL TYPES IS PROVIDED IN THE TABLE BELOW AND INDICATED IN FIGURE 9-8, FIGURE 9-9 AND FIGURE 9-10: MAP DEPICTING LAND CAPABILITY CLASSES OF SOILS ASSOCIATED WITH DONKERHOEK AREA

.

TABLE 9.1: SUMMARY DISCUSSION LAND CAPABILITY CLASSES

Soil forms	Land capability	Area Extent
Land Capability: Arable (Class I, II, and III)		
Ermelo, Vaalbos/ Nkonkoni, Bethesda, Tshiombo.	These soil forms are considered high potential agricultural soils with high (Class I to III) land capability, suitable for arable agricultural land use with minimal management interventions. Therefore, these soils are considered to contribute significantly to the provincial and/or national agricultural production grid if used for crop cultivation, and are also well-suited for other less intensive land uses such as grazing, forestry, etc. However, emphasis is directed to their agricultural crop productivity due to the scarcity of such soil resources on a national scale and food security concerns.	147.73 ha which constitutes 18.68% of the total focus area.
Land Capability: Arable (Class IV)		
Eland, Avalon, Glencoe Area Extent	The identified Eland, Avalon and Glencoe soil forms are considered to be of moderate (Class IV) land capability and are marginally suitable for arable agricultural land use. Therefore, these soils are considered to make a moderate contribution to agricultural production grid on a regional and national scale. These soils are suited for relatively shallow-rooted crops and cultivated pastures.	360.31ha which constitutes 45.56% of the total focus area.
Land Capability: Grazing (Class V)		

Constantia, Katspruit Longlands, Mfabeni, Wasbank, Westleigh, Dundee, Kroonstad	The identified soils are considered to be of poor (class V) land capability and are not suitable for arable agricultural land use. Theses soils are, at best, suited for natural pastures for light grazing or to be retained as wilderness areas. Therefore, these soils are considered to make a substantial contribution to extensive subsistence farming on a local scale.	67.44 ha which constitutes 8.53% of the total focus area.
Land Capability: Grazing (Class VI)		
Mispah/Glenrosa, Dresden	The identified Mispah/Glenrosa and Dresden soil forms are considered to be of poor (Class VII) land capability and are not suitable for arable agricultural land use. Theses soils are, at best, suitable for natural pastures for light grazing. Therefore, these soils are not considered to make a substantial contribution to extensive subsistence farming on a local scale.	174.28 ha which constitutes 22.4% of the total focus area.
Land Capability: Arable (Class VIII)		
Witbank (Anthrosols)	These identified Witbank soils have very poor (class VIII) land capability attributed to forestry and mining activities. In addition, some of these soils have been subjected to long term compaction and erosion. This land capability class also includes areas where the original soil has been buried and/or extensively modified by anthropogenic activities. These soils are not considered to make a t contribution to agricultural productivity even on a local scale.	13.42 ha; which constitutes 1.70% of the total focus area.

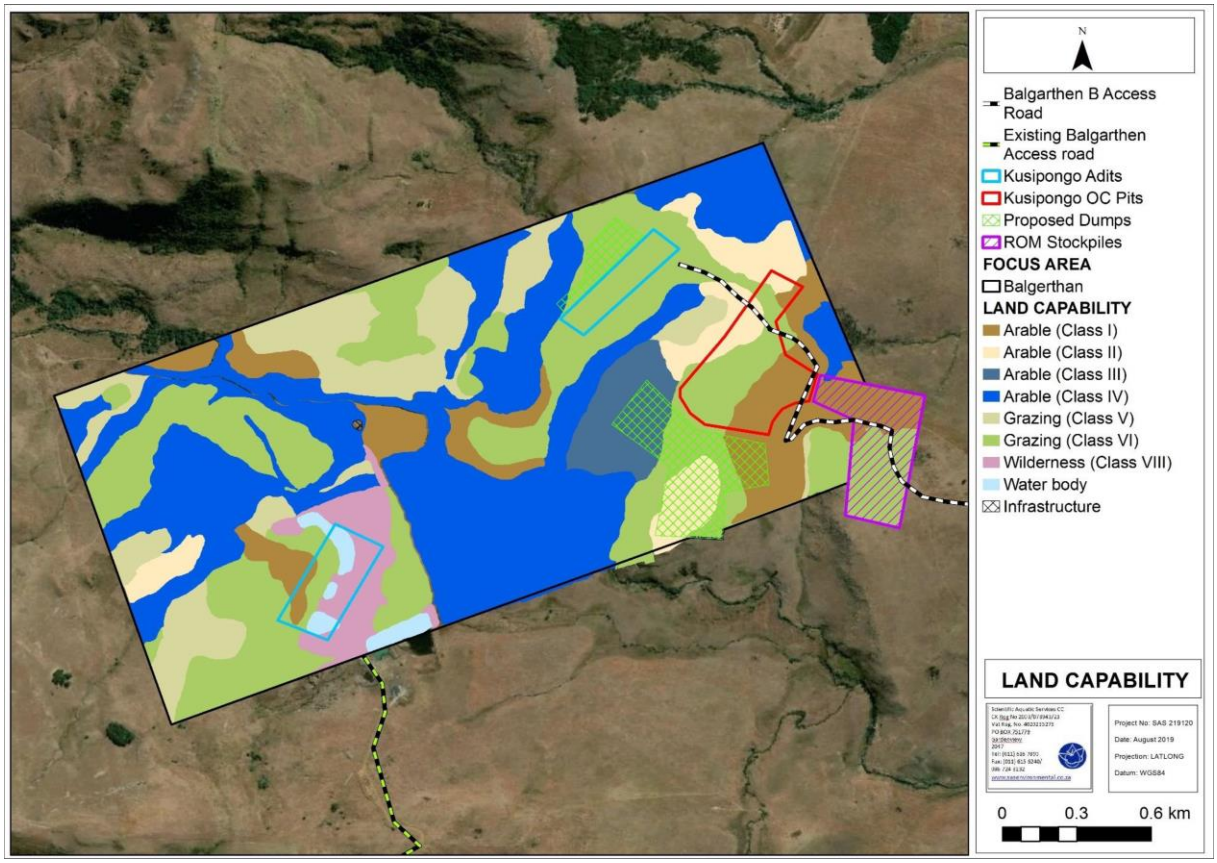


FIGURE 9-8: MAP DEPICTING LAND CAPABILITY CLASSES OF SOILS ASSOCIATED WITH THE MINING INFRASTRUCTURE WITHIN THE BALGARTHEN AREA.

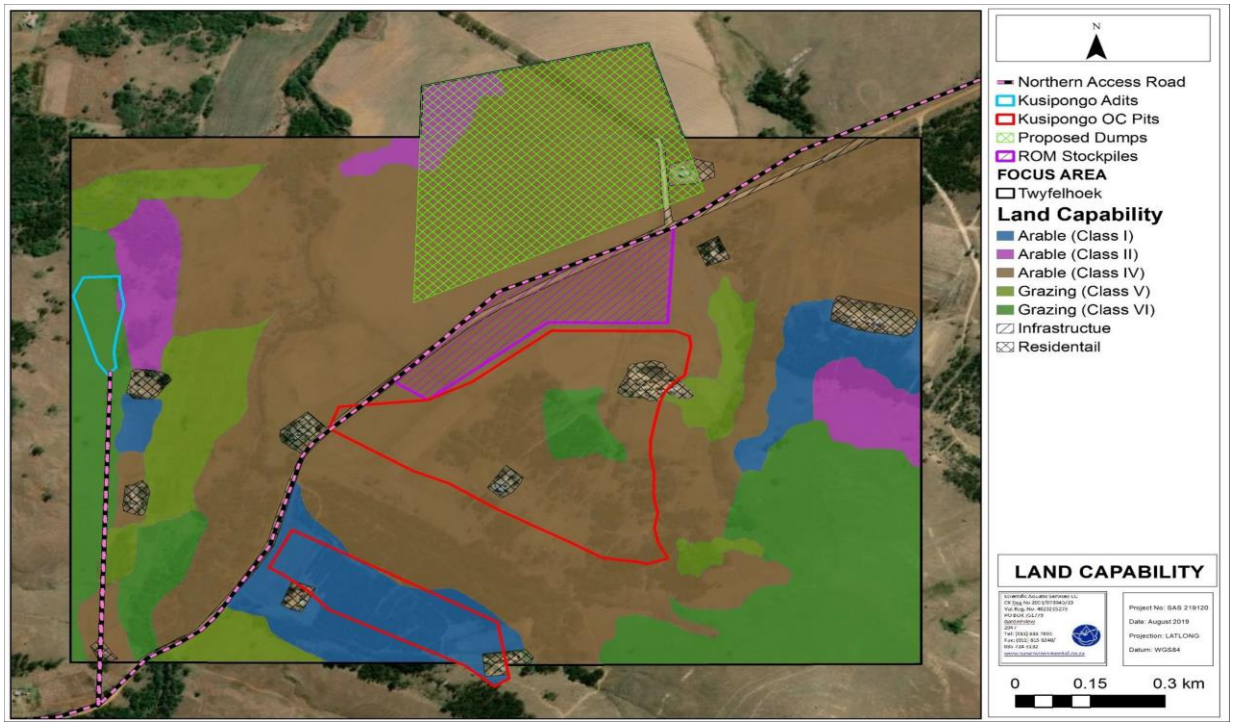


FIGURE 9-9: MAP DEPICTING LAND CAPABILITY CLASSES OF SOILS ASSOCIATED WITH THE MINING INFRASTRUCTURE WITHIN THE TWYFELHOEK AREA.

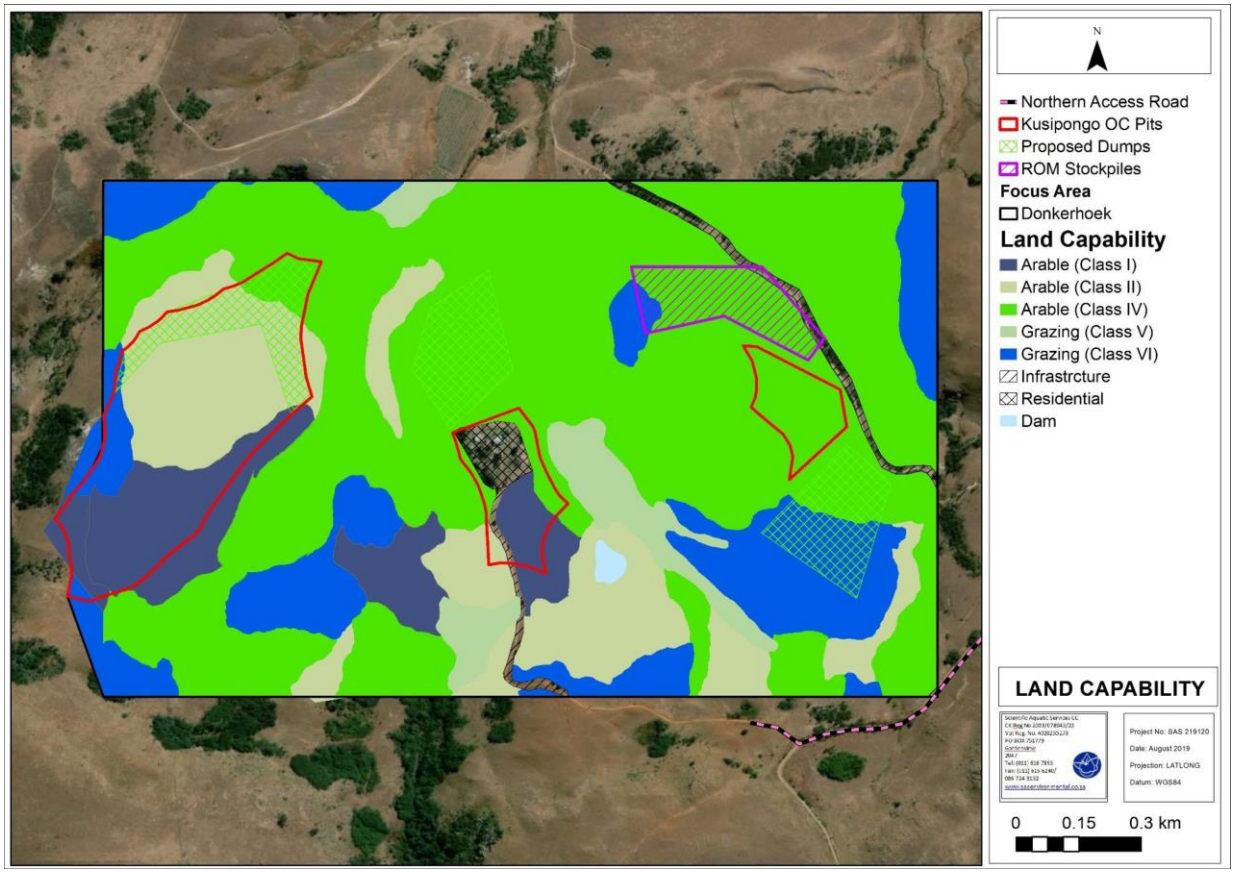


FIGURE 9-10: MAP DEPICTING LAND CAPABILITY CLASSES OF SOILS ASSOCIATED WITH DONKERHOEK AREA

9.4 Air Quality

The description of the existing air quality has been sourced from work undertaken as part of the Air Quality Impact Assessment (Rayten Engineering Solutions, September 2019)

The existing air quality situation is usually evaluated using available monitoring data from permanent ambient air quality monitoring stations and dust-fall networks operated near the project site. There was no air quality monitoring data from the South African Air Quality Information System (SAAQIS) (that could be determined) to present background concentrations for PM_{10} and $PM_{2.5}$ concentrations at the project site. Furthermore, there is no ambient air quality monitoring or dust fallout monitoring undertaken at the site. However, there was background data available for dust-fall rates near Maquasa East and West Operations, which is located east of the Kusipongo mining right area.

9.4.1 Baseline Dust Fall Rates

Kangra Coal undertakes dust fallout monitoring at 11 sites located near Maquasa East and West Operations. Dust-fall rates for the period January 2018 to May 2019 are presented **Figure 9-11** below. Dust-fall rates range from 39.11 – 786.74 mg/m^2/day for the period. Higher dust-fall rates were recorded at sites MQ4, MQ5 and MQ13. The higher dust-fall rates recorded at site MQ13 are most likely due to background sources as this site is located approximately 12km east of Maquasa East Operations. Out of 120 dust-fall rates recorded for the period, there were 4 exceedances of the residential limit of 600 mg/m^2/day and no exceedances of the non-residential limit of 1 200 mg/m^2/day.

A total of 2 exceedances of the dust fallout limits are permissible in a year (no 2 sequential months). No exceedances of the non-residential limit of 1 200 mg/m^2/day were recorded between January 2018 to May 2019 for the dust bucket sites that are classified as non-residential. In terms of the dust bucket sites that are classified as residential, no exceedances of the residential limit of 600 mg/m^2/day are observed for the period January 2018 to May 2019.

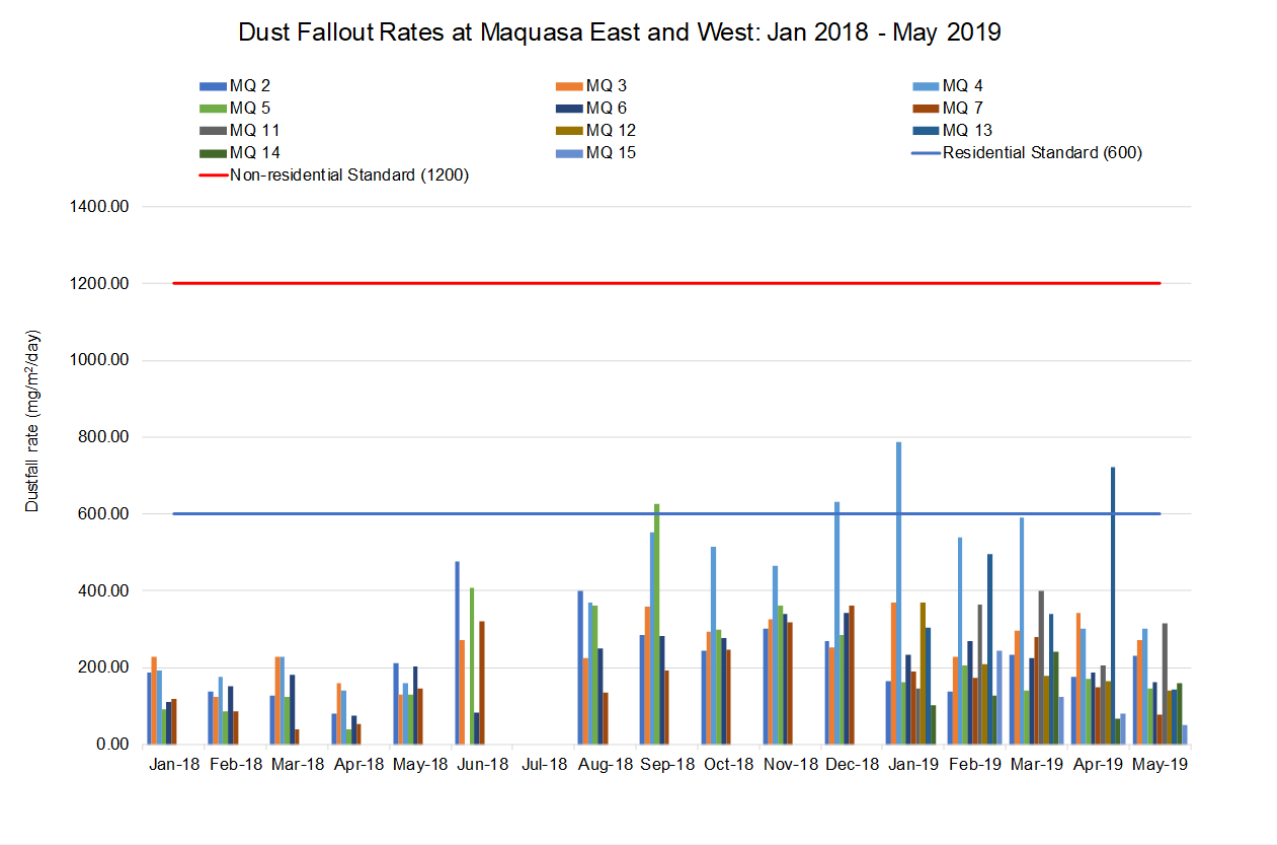


FIGURE 9-11: DUST-FALL RATES AT MAQUASA EAST AND WEST OPERATIONS (JAN 2018 – MAY 2019)

9.4.2 Surrounding Sources of Air Pollution

Existing key sources of air pollution surrounding Kusipongo Operations were identified during a desktop exercise and include (**Figure 9-12**):

- Mining activity (east of Kusipongo mining right area);
- Vehicle dust entrainment on unpaved roads (surrounding areas);
- Commercial agricultural activities (surrounding areas);
- Forestry/plantation activities (north-east, east and south-east of the Kusipongo mining right area).

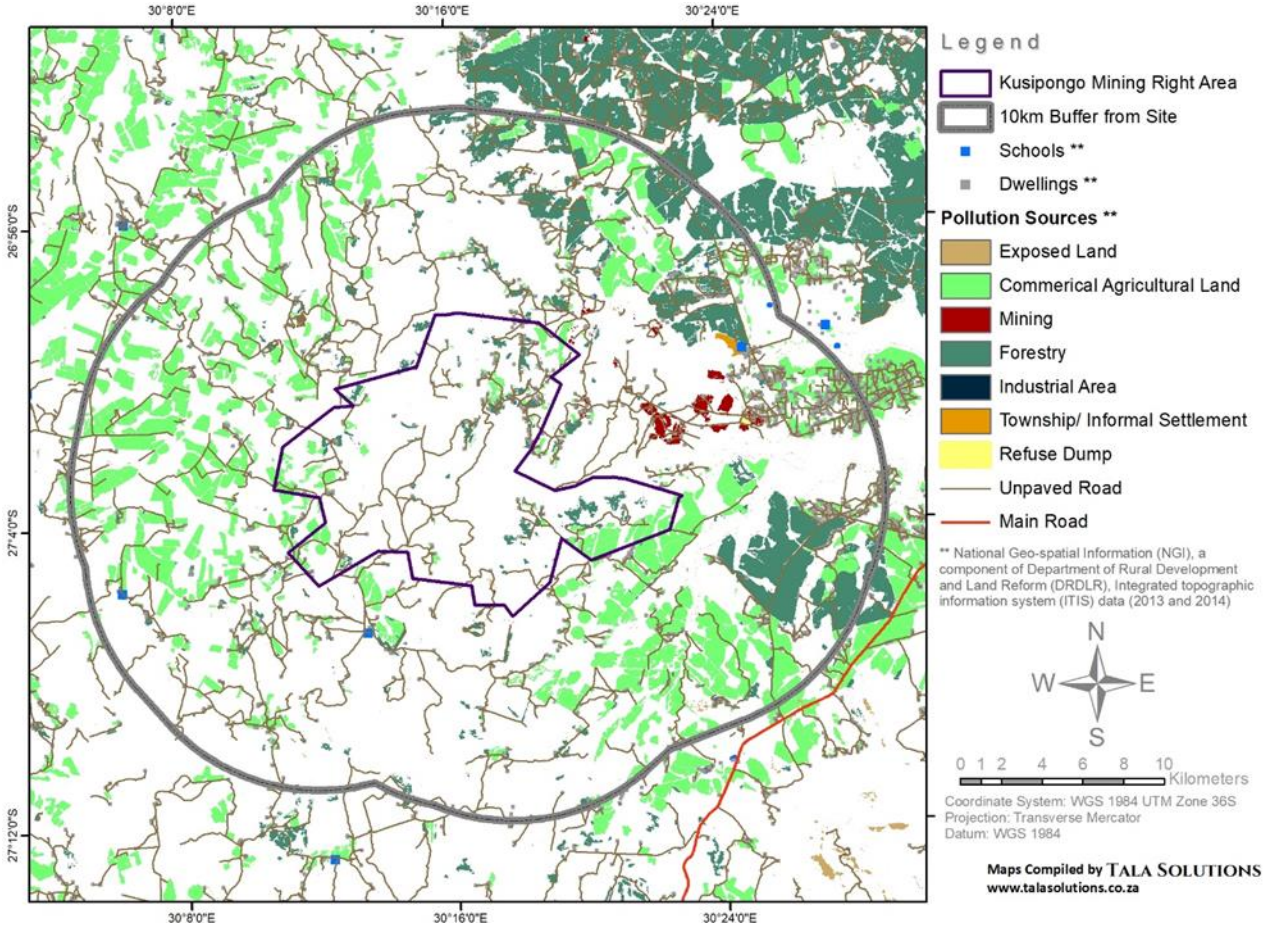


FIGURE 9-12: IDENTIFIED SURROUNDING EMISSIONS SOURCES WITHIN 10KM OF KUSIPONGO

9.4.3 Vehicle Dust Entrainment on Unpaved Roads

The area is rural and there are many unpaved dirt roads surrounding the Kusipongo mining right area. Vehicle-entrained dust emissions from the surrounding unpaved roads in the area potentially represent a key source of fugitive dust. When a vehicle or truck travels on an unpaved road, the force of the wheels on the road surface causes the pulverisation of surface material. Particles are lifted and dropped from the rolling wheels, and the road surface is exposed to strong air currents in turbulent shear with the surface. The turbulent wake behind the vehicle continues to act on the road surface after the vehicle has passed.

9.4.4 Commercial Agricultural Activities

There are agricultural areas surrounding the project site. Emissions from agricultural activities are difficult to control due to the seasonality of emissions and the large surface area producing emissions. Expected emissions resulting from agricultural activities include particulates associated with wind erosion and burning of crop residue, chemicals associated with crop spraying and odiferous emissions resulting from manure, fertilizer and crop residue. Dust associated with agricultural practices may contain seeds, pollen and plant tissue, as well as agrochemicals, such as pesticides. The application of pesticides during temperature inversions increases the drift of the spray and the area of impact.

Dust entrainment from farming vehicles travelling on gravel roads may also cause increased particulates in an area. Dust from traffic on gravel roads increases with higher vehicle speeds, more vehicles and lower moisture conditions. The seasonal burning of the veld from July to September for field clearing in preparation for planting is also a source of smoke. The nature of the activity has a potential impact on air quality in the area.

9.4.5 Forestry and Plantations

There are plantations located north, east and south-east of the Kusipongo Operations. The effects of plantations on ambient air quality are dependent on the type of plantations. Oil tree plantations, for example, are associated with production of high levels of VOCs, particularly isoprene. In general, plantations result in an increase in ambient NOx concentrations due to the frequent and heavier use of fertiliser (https://nerc.ukri.org/planetearth/stories/561).

Plantations generally have sawmills. Air pollutants generated from sawmill operations are mainly associated with combustion processes such as wood recycling and disposal, as well as boilers.

9.5 Noise

The description of the existing noise environment was sourced from work undertaken as part of the Noise Impact Assessment (Enviro Acoustic Research, September 2019).

9.5.1 Baseline noise characteristics

Long term noise monitoring was conducted at two locations in the study area as part of the Noise Impact Assessment. Additionally, short term noise monitoring was conducted at 10 locations to augment the long-term monitoring and in order to determine the current noise levels in the study area. The baseline noise level was used in the model to predict changes in the noise levels as a result of the proposed mining activities.

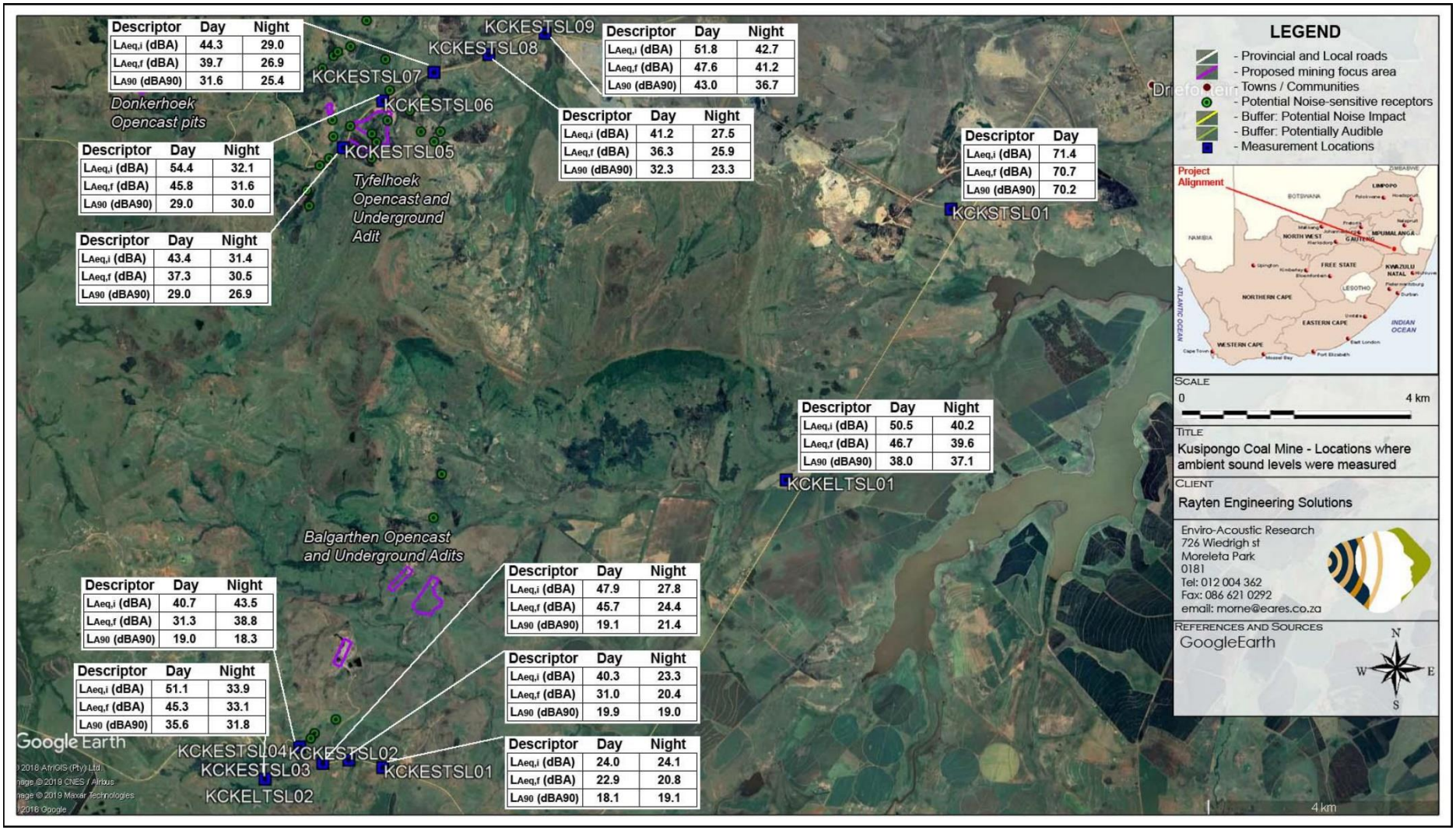
Refer to **Figure 9-13** for the noise monitoring locations in relation to the identified noise sensitive receptors. The noise monitoring locations are detailed below:

- KCKSTSL01 relates to a conveyor belt at the current Maquasa mining operations.
- KCKESTSL01, KCKESTSL02, KCKESTSL03 and KCKESTSL04 relate to noise receptors closest to the proposed Balgarthen operations.
- KCKESTSL05, KCKESTSL06, KCKESTSL07, KCKESTSL08 and KCKESTSL09 relate to noise receptors closest to the proposed Dokerhoek and Twyfelhoek operations.

Table 9.2 provides a summary of the noise levels during the day and **Error! Reference source not found.** for noise levels measured during night-time.

Considering the character of the area, sounds heard as well as the average and equivalent LAeq,f values, daytime ambient sound levels illustrate sound levels typical of a rural noise district, with night-time ambient sound levels illustrating sound levels typical of a sub-urban noise district. Considering the developmental nature of the area, the ideal rating level would be typical of a sub-urban noise district, set as:

- A daytime rating level of 45 dBA (LReq,d); and
- A night-time rating level of 35 dBA (LReq,n).



Descriptor	Day	Night
$L_{Aeq,i}$ (dBA)	44.3	29.0
$L_{Aeq,f}$ (dBA)	39.7	26.9
L_{A90} (dBA90)	31.6	25.4

Descriptor	Day	Night
$L_{Aeq,i}$ (dBA)	51.8	42.7
$L_{Aeq,f}$ (dBA)	47.6	41.2
L_{A90} (dBA90)	43.0	36.7

Descriptor	Day	Night
$L_{Aeq,i}$ (dBA)	41.2	27.5
$L_{Aeq,f}$ (dBA)	36.3	25.9
L_{A90} (dBA90)	32.3	23.3

Descriptor	Day	Night
$L_{Aeq,i}$ (dBA)	54.4	32.1
$L_{Aeq,f}$ (dBA)	45.8	31.6
L_{A90} (dBA90)	29.0	30.0

Descriptor	Day	Night
$L_{Aeq,i}$ (dBA)	43.4	31.4
$L_{Aeq,f}$ (dBA)	37.3	30.5
L_{A90} (dBA90)	29.0	26.9

Descriptor	Day
$L_{Aeq,i}$ (dBA)	71.4
$L_{Aeq,f}$ (dBA)	70.7
L_{A90} (dBA90)	70.2

Descriptor	Day	Night
$L_{Aeq,i}$ (dBA)	50.5	40.2
$L_{Aeq,f}$ (dBA)	46.7	39.6
L_{A90} (dBA90)	38.0	37.1

Descriptor	Day	Night
$L_{Aeq,i}$ (dBA)	40.7	43.5
$L_{Aeq,f}$ (dBA)	31.3	38.8
L_{A90} (dBA90)	19.0	18.3

Descriptor	Day	Night
$L_{Aeq,i}$ (dBA)	47.9	27.8
$L_{Aeq,f}$ (dBA)	45.7	24.4
L_{A90} (dBA90)	19.1	21.4

Descriptor	Day	Night
$L_{Aeq,i}$ (dBA)	51.1	33.9
$L_{Aeq,f}$ (dBA)	45.3	33.1
L_{A90} (dBA90)	35.6	31.8

Descriptor	Day	Night
$L_{Aeq,i}$ (dBA)	40.3	23.3
$L_{Aeq,f}$ (dBA)	31.0	20.4
L_{A90} (dBA90)	19.9	19.0

Descriptor	Day	Night
$L_{Aeq,i}$ (dBA)	24.0	24.1
$L_{Aeq,f}$ (dBA)	22.9	20.8
L_{A90} (dBA90)	18.1	19.1

FIGURE 9-13: LOCATION OF MONITORING POINTS

TABLE 9.2: SUMMARY OF MONITORING RESULTS FOR THE DAY TIME

Measurement location name	LAmax,i	LAeq,f	LAeq,f	LAF90	LAmin.f	Comments
	dBA	dBA	dBA	dBA90	dBA	
Day (Clear sky with light winds. Air temperature 16 to 34oC, humidity 41 to 15%)						
Current mining operations at Maquasa						
KCKSTSL01	73.2	71.4	68.4	70.7	70.2	10m from approximate centre of the conveyor belt, with noise from conveyor belt dominant.
Monitoring locations related to Balgarthen						
KCKESTSL01	37.2	24.0	16.4	22.9	18.1	Very quiet location. Birds and wind-induced noises dominate the soundscape.
KCKESTSL02	59.3	40.3	17.5	31.0	19.9	Birds and wind-induced noises audible. Cows moo-ing in area. Voices of kids playing in distance. Voices of people waiting in area.
KCKESTSL03	68.5	47.9	17.0	45.7	19.1	Wind-induced noises dominate with birds clearly audible. Cricket in grass clearly audible.
KCKESTSL04	58.5	40.7	16.7	31.3	19.0	Birds and wind-induced noises dominate. Voices from house in area.
Monitoring locations related to Donkerhoek and Twyfelhoek						
KCKESTSL05	53.2	43.4	25.8	37.3	22.0	Birds significant and wind-induced noises dominate. Voices from passers-by. Music audible in area.
KCKESTSL06	62.3	54.4	24.8	45.8	23.1	Birds dominant. Passing vehicle impacting on measurement. Voices from passers- by.

Measurement location name	LAmax,i	LAeq,f	LAeq,f	LAF90	LAmin.f	Comments
	dBA	dBA	dBA	dBA90	dBA	
KCKESTSL07	52.7	44.3	27.6	39.7	29.6	Mine activities just audible during quiet periods. People cutting wood in area with voices audible. Birds at times.
KCKESTSL08	52.2	41.2	28.6	36.3	32.3	Mine activities audible. People cutting wood in area. Birds at times. Goat at times.
KCKESTSL09	64.5	51.8	39.7	47.6	43.0	Noises from mine dominating. Birds audible. Wind induced noises audible. Drilling at mining pit ±53 dBA during drilling event.

TABLE 9.3: SUMMARY OF MONITORING RESULTS FOR NIGHT TIME

Measurement location name	LAmax,i	LAeq,f	LAeq,f	LAF90	LAmin.f	Comments
	dBA	dBA	dBA	dBA90	dBA	
Night (Clear sky with light winds). Air temperature 1 to 6oC, humidity 78 to 89%)						
Current mining operations at Maquasa						
KCKESTSL01	31.6	24.1	17.3	20.8	19.1	Grazer eating grass in area. One or more grazer moving around in grass. Cow audible in distance. Water flowing just audible.
Monitoring locations related to Balgarthen						
KCKESTSL02	32.3	23.3	17.4	20.4	19.0	Sound of water flowing audible. Insects just audible. Rooster in far distance. Cow mooing clearly audible. Car in far distance.
KCKESTSL03	36.8	27.8	19.7	24.4	21.4	Water flowing in distance. Cattle audible at times. Slight wind induced noises. Car or some unidentifiable noise in far distance. Sheep at times.
KCKESTSL04	57.7	43.5	16.7	38.8	18.3	Cattle mooing every few seconds close by. Sheep clearly audible. Crickets. Light but constant winds but no wind induced noises.
KCKESTSL05	41.1	31.4	24.9	30.5	26.9	Horses moving around in area and grazing. Crickets audible. Sound like water flowing. Slight wind induced noises.
Monitoring locations related to Donkerhoek and Twyfelhoek						
KCKESTSL06	36.5	32.1	28.3	31.6	30.0	Wind induced noises dominant. Broadband noise from far just audible. Wind speeds increasing above 5 m/s

Measurement location name	LAmax,i	LAeq,f	LAeq,f	LAF90	LAmin.f	Comments
	dBA	dBA	dBA	dBA90	dBA	
KCKESTSL07	36.5	29.0	23.4	26.9	25.4	Quiet environment with various unidentifiable sounds. Wind induced noises from bush in distance possible. Animals in area and hoof steps just audible.
KCKESTSL08	34.7	27.5	21.1	25.9	23.3	Quiet environment. Possible wind induced noises from trees in far distance, sounds cannot be identified. (Sounds like traffic in far distance). Broadband noise from mining operation audible with mobile equipment and reverse alarms audible.
KCKESTSL09	55.4	42.7	33.1	41.2	36.7	Mining noises clearly audible and dominant.

9.5.2 Summary of monitoring results

9.5.2.1 KCKELTSL01 - Measurement representing sound levels typical dwelling:

- Considering the average LAeq,f daytime data, sound levels are typical of a rural noise district (average daytime levels of 47 dBA, mean of the three daytime periods of the equivalent level is 52 dBA). Considering the developmental character of the area, daytime ambient sound levels should be typical of a rural noise district;
- Considering the average LAeq,f night-time data, sound levels are typical of a sub- urban noise district (average night-time levels of 40 dBA, mean of the two night- time periods of the equivalent level is 40 dBA). Considering the developmental character of the area, night-time ambient sound levels should be typical of a rural noise district;
- The freezer did influence the ambient sound levels which would have been quieter without the freezer.

9.5.2.2 KCKELTSL02 - Measurement representing sound levels typical dwelling:

- Considering the average LAeq,f daytime data, sound levels are typical of a rural noise district (average daytime levels of 45 dBA, mean of the three daytime periods of the equivalent level is 54 dBA). Considering the developmental character of the area, daytime ambient sound levels should be typical of a rural noise district;
- Considering the average LAeq,f night-time data, sound levels are typical of a rural noise district (average night-time levels of 33 dBA, mean of the two night-time periods of the equivalent level is 34 dBA). Considering the developmental character of the area, night-time ambient sound levels should be typical of a rural noise district;
- The sound from water flowing did raise the ambient sound levels.

9.5.2.3 Short-term measurements in vicinity of project area:

- Considering the average LAeq,f daytime data, sound levels are variable, ranging from sound levels typical of a rural to urban noise district. Excluding the measurement location within 1,000m from the mine, faunal noises were a significant noise source influencing the ambient sound levels. Average daytime sound levels (first 8 measurement locations) are 36 dBA. Considering the developmental character of the area, daytime ambient sound levels should be typical of a rural to suburban noise district
- Excluding the measurement locations close to the mine, considering the average LAeq,f night-time data, sound levels are typical of a rural noise district (average night-time levels of 27 dBA, first 8 measurement locations). Considering the developmental character of the area, night-time ambient sound levels should be typical of a rural to suburban noise district.

- Daytime ambient sound levels were similar as measurements collected in other areas with a rural sound character as can be observed from Figure 5-18. Night-time ambient sound levels (both LAeq,f and LA90) were slightly higher to measurements collected in other, similar rural areas as can be observed from Figure 5-19

9.6 Biodiversity (Flora and Fauna)

The description of the terrestrial biodiversity has been sourced from work undertaken as part of the Faunal and Floral Assessment (Scientific Terrestrial Services CC, September 2019)

9.6.1 Baseline Biodiversity Environment

The following provides an overview of the general biodiversity environment for the study area:

- The study area is located within the Drakensberg Afromontane Region of Phyto (plant) Endemism and within the Grasslands Important Bird and Biodiversity Area;
- The focus area is situated within the Grassland Biome and the Mesic Highveld Grassland Bioregion;
- The Balgarthen focus area falls within the Paulpietersburg Moist Grassland (VU) (Gm 15), while the Donkerhoek focus area as well as the western boundary and south-eastern corner of the Twyfelhoek focus area are located within the Wakkerstroom Montane Grassland (LT) (Gm 14). The majority of the Twyfelhoek focus area falls within the Eastern Highveld Grassland (EN) (Gm12) vegetation type;
- According to the National Threatened Ecosystems (2011) database, the focus area crosses two threatened ecosystems, i.e. the remaining extent of the Endangered (EN) Wakkerstroom/Luneburg Grassland (Balgarthen, Donkerhoek and Twyfelhoek) and the remaining extent of the Vulnerable (VU) Eastern Highveld Grassland (Twyfelhoek);
- The NPAES (2009) database indicate that the Balgarthen focus area, as well as the majority of the Donkerhoek focus area, falls within the Moist Escarpment Grasslands NPAES Focus Area;

- According to the Mpumalanga Biodiversity Sector Plan (2014) terrestrial dataset, the western portion of the Donkerhoek focus area, as well as the majority of the Twyfelhoek focus area is considered as Irreplaceable Critical Biodiversity Areas (CBA). Two small portions of the Balgarthen focus area are also classified as Irreplaceable CBA. An Ecological Support Area (ESA) Landscape Corridor is associated with the Donkerhoek focus area, while the Donkerhoek focus area as well as the majority of the Balgarthen focus area is classified as ESA Local Corridors. Various scattered portions of the Donkerhoek and Balgarthen focus area are classified as Other Natural Areas or are considered as Moderately Modified Old Lands. Small sections of the Donkerhoek and the Balgarthen focus areas, and most of the central portion of the Twyfelhoek focus area are considered to be Heavily Modified; and
- The Mining and Biodiversity Guidelines (2013) database indicates that the focus area falls within an area considered to be of Highest Biodiversity Importance, i.e. high risk for mining (especially new mining projects).

9.6.2 Faunal Habitat Units

The focus areas comprised of five faunal habitat units as described below and illustrated in **Figure 9-14, Figure 9-15** and **Figure 9-16.**

9.6.2.1 Grassland

The overarching vegetation type for the focus areas is grassland. The three sites, Balgarthen, Donkerhoek and Twyfelhoek, fall within three grassland vegetation types according to Mucina and Rutherford (2018), i.e. Paulpietersburg Moist Grassland (Vulnerable, VU), Wakkerstroom Montane Grassland (LT) and the Eastern Highveld Grassland (EN). The grassland habitat units associated with the focus areas fall part of an Important Bird Area for grassland species (IBA, 2015) which promotes the occurrence of avifaunal SCC.

9.6.2.2 Rocky Habitat:

This habitat unit is characterized by rock outcrops and rock sheet formations. Within the focus areas, the Rocky Habitat Unit comprises both rocky ridges and the more apparent mountain outcrops. The mountain outcrops were found at all three sites within the focus areas and comprised stretches of rock sheet protruding along mountain edges. The rocky ridges were found at the Balgarthen and Donkerhoek focus areas and are characterised by smaller rock boulders scattered along the ridges. This habitat unit provides good foraging grounds for mammals and avifaunal species and forms refuge for arachnid and reptile species.

9.6.2.3 Freshwater Habitat:

Within the focus areas several different freshwater systems were identified by the Freshwater Specialist (SAS, 2019), including Channelled Valley Bottom (CVB) wetlands, Unchannelled Valley Bottom (UCVB) wetlands, Seep wetlands, Peat wetlands etc. For the sake of this assessment, all freshwater characteristics have been referred to as freshwater habitat. This habitat unit promotes the occurrence of amphibian, avifaunal, insect and mammal species.

9.6.2.4 Wooden Ravine Habitat

Areas where woody plants formed the dominant cover were included in this habitat unit. These areas of increased woody species were restricted to rivers and include riparian vegetation and the riverine forest found at Balgarthen and Donkerhoek.

9.6.2.5 Modified Habitat Unit:

All three focus areas had areas where either historic or current disturbances resulted in the modification of the grasslands, thus contributing to vegetation that is considered degraded or, in some cases, associated with very limited vegetation.

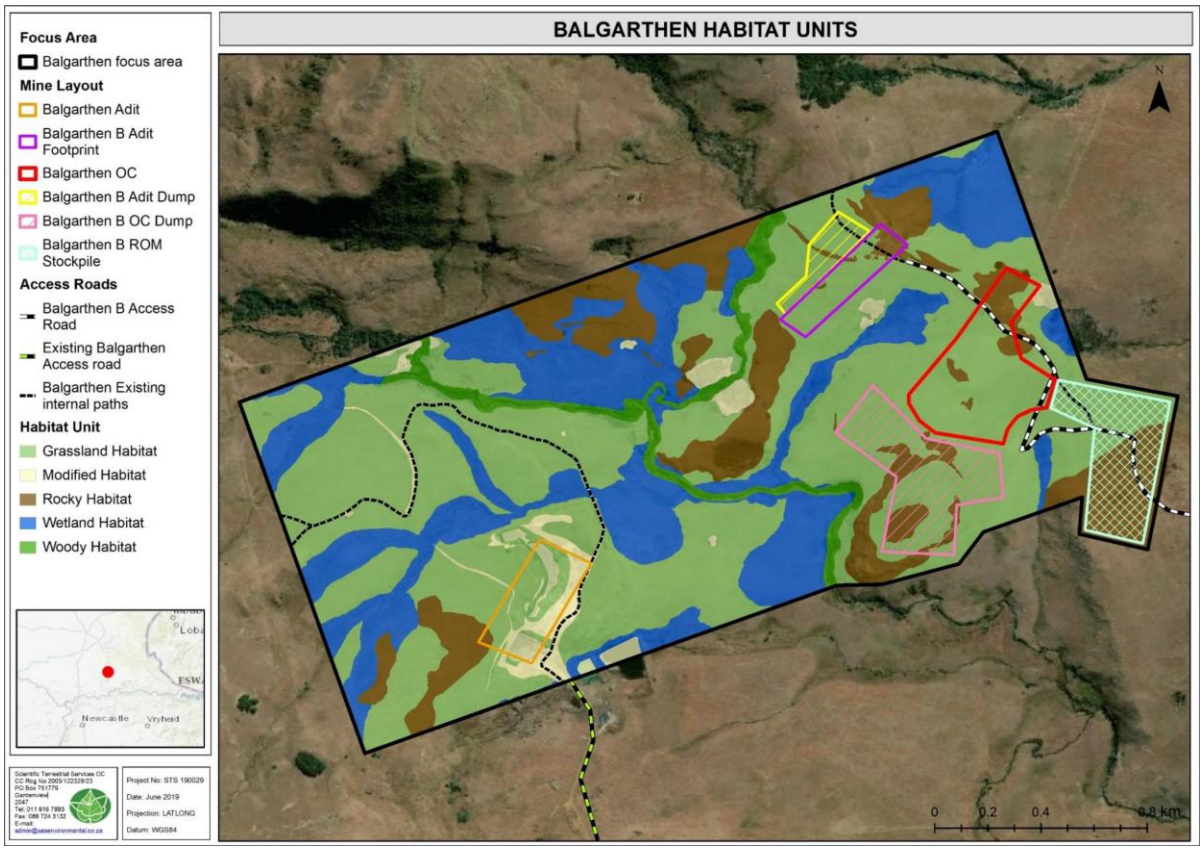


FIGURE 9-14: HABITAT UNITS FOR THE BALGARTHEN AREA

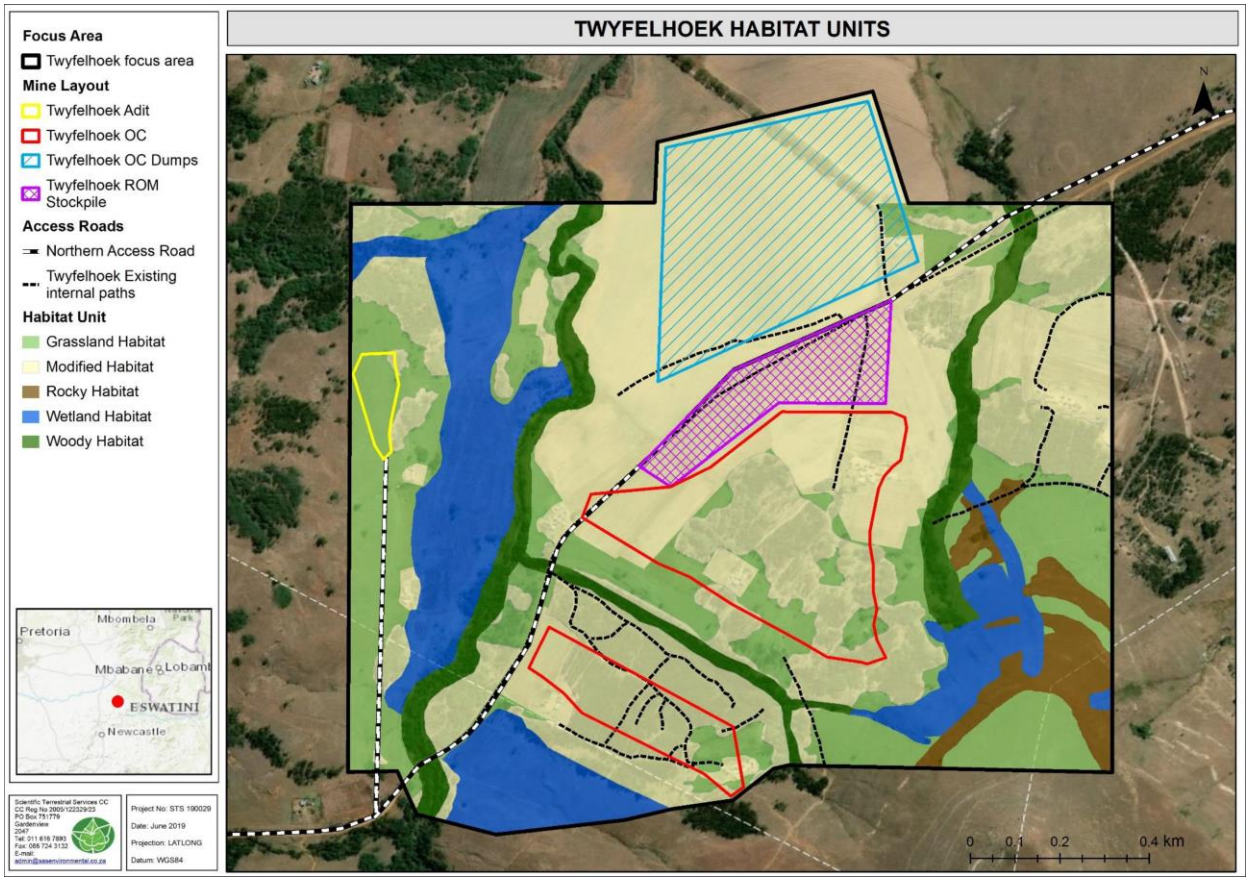


FIGURE 9-15: HABITAT UNITS FOR THE TWYFELHOEK AREA

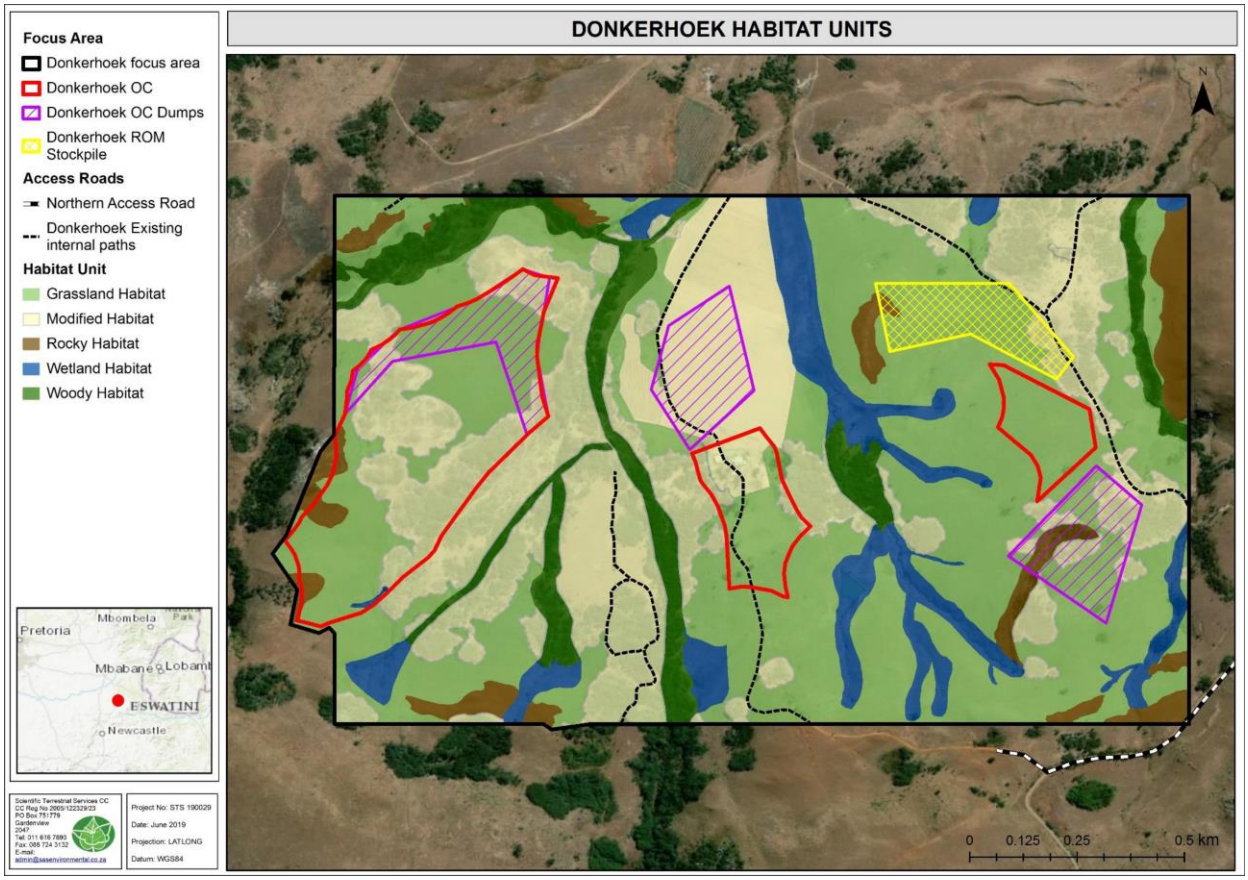


FIGURE 9-16: HABITAT UNITS FOR THE DONERHOEK AREA

9.6.3 Faunal Species of Conservation Concern

Table 9.4 provides a summary of the faunal SCC observed and likely to occur in the study area:

TABLE 9.4: SPECIES OF CONSERVATION CONCERN

Mammals	**Observed**	*Redunca fulvorufula* (Mountain Reedbuck, EN)
	Expected occurrence	*Georychus capensis* (Cape Mole Rat, EN), *Amblysomus hottentotus meesteri* (Meester's Golden Mole, VU), *Myotis welwitschii* (Welwitsch's Hairy Bat, EN), *Cloeotis percivali australis* (Short-eared Trident Bat, EN), *Proteles cristatus* (Aardwolf, NE) and *Hydrictis maculicollis* (Spotted Necked Otter, NT).
Birds (Avifauna)	**Observed**	*Geronticus calvus* (Southern Bald Ibis, VU), *Sagittarius serpentarius* (Secretary Bird) and *Balearica regulorum* (Grey Crowned Crane).
	Expected occurrence	*Balearica reguloru* (Blue Crane, VU), *Bucorvus leadbeateri* (Southern Ground Hornbill, VU); *Eupodotis caerulescens* (Blue Korhaan, VU), *Neotis denhami* (Stanleys Bustard, VU), *Circus ranivorus* (African Marsh Harrier, VU), *Hemimacronyx chloris* (Yellowbreasted Pipit, VU), *Eupodotis senegalensis* (White Bellied Bustard, VU), *Tyto capensis* (African Grass Owl, VU), *Eupodotis senegalensis* (White-bellied Korhaan, VU) and *Terathopius ecaudatus* (Bateleur, VU).

Amphibians	**Observed**	None, likely due to the time of year the survey
	Expected occurrence	*Heleophryne natalensis* (Natal Ghost Frog, VU), *Hyperolius semidiscus* (Yellow striped Reed Frog, VU). These species are generally restricted to freshwater habitats with good marginal vegetation and therefore are expected to occur in the tributaries of the Hlelo River situated within the Donkerhoek and Twyfelhoek focus areas. *Pyxicephalus adspersus* (African Bullfrog, VU).
Reptiles	**Observed**	None, likely due to the time of year the survey
	Expected occurrence	*Scelotes mirus* (Montane Burrowing Skink, LC).
Insects	**Observed**	None
	Expected occurrence	*Pseudagrion newtoni* (Newton's Sprite, VU) within the freshwater habitat of the Balgarthen and Donkerhoek focus areas and along with the tributary of the Hlelo River associated with the Twyfelhoek focus area.

9.6.4 Sensitivity Mapping

The figure below conceptually illustrates the areas considered to be of increased faunal ecological sensitivity. The areas are depicted according to their sensitivity in terms of the presence or potential for faunal SCC, habitat integrity, levels of disturbance and overall levels of diversity. The figure below presents the sensitivity of each area along with an associated conservation objective and implications for development.

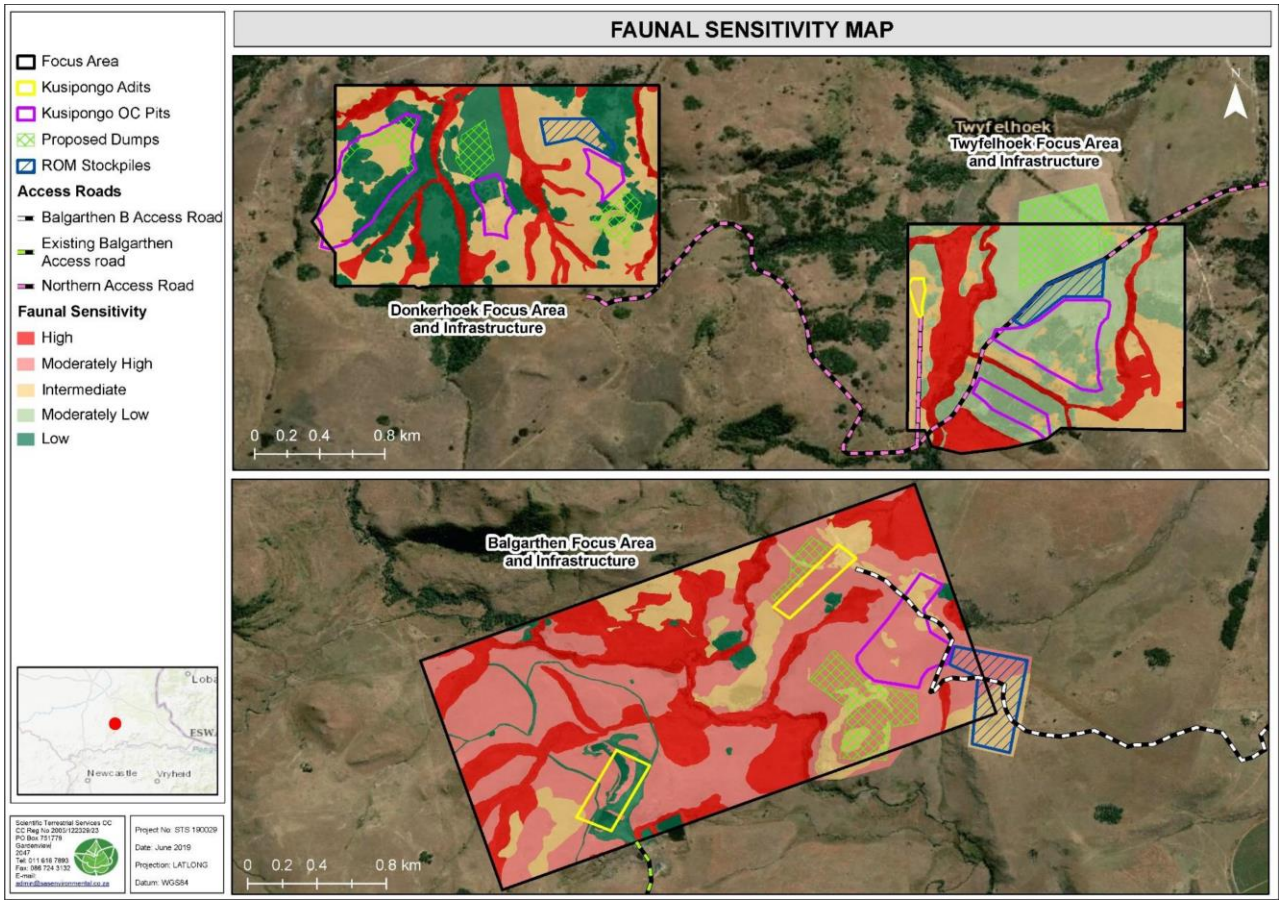


FIGURE 9-17: COMBINED FAUNAL SENSITIVITY MAP

9.6.5 Overview of Floral Habitat

The vegetation communities distinguished during the field assessment are described under five broad habitat units, namely:

9.6.5.1 Grassland Habitat Unit:

Paulpietersburg Moist Grassland: Primary grasslands were present within the Balgarthen focus area. Tall closed grassland rich in forbs and characteristically dominated by Hyparrhenia hirta and Tristachya leucothrix were dominant.

Wakkerstroom Montane Grassland: Primary grassland within the Donkerhoek and Twyfelhoek focus areas. Characteristically comprising short montane grassland with a diversity of graminoid and forb species.

Secondary Grassland: Including grasslands that have been disturbed in the past but have recovered to an ecologically functioning state, albeit different from the original state. This includes the Eastern Highveld Grassland vegetation type that is no longer represented within the focus area due to the floral communities being significantly altered.

9.6.5.2 Rocky Habitat Unit:

Mountain Outcrops and Rocky Ridges: This habitat unit was subdivided based more on the physical environment than floral species composition and is characterised by rock outcrops, rock sheet formations and lower lying ridges with scattered smaller rocks and larger boulders.

9.6.5.3 Wetland Habitat Unit:

Wetlands: Within the focus area several different wetlands were identified by the Freshwater Specialist (SAS 219118, 2019), including channelled valley bottom (CVB) wetlands, CVBs with riparian vegetation, unchannelled valley bottom (UCVB) wetlands, peat wetlands and seep wetlands. Riparian vegetation, including CVBs with riparian characteristics, were present in the focus areas but are discussed under a separate category. In terms of floral composition, the wetlands have been grouped together (but excludes CVBs with riparian characteristics which are dealt with in the woody habitat unit); distinct floral communities could not be distinguished.

9.6.5.4 Woody Habitat Unit:

Riparian vegetation and CVB with Riparian Characteristics: Balgarthen had a well-developed riparian habitat, albeit encroached by wattle trees, whereas true riparian vegetation could not be distinguished at the Donkerhoek and Twyfelhoek focus areas (SAS 219118, 2019). Instead, these are referred to as CVBs with riparian characteristics due to woody vegetation forming the dominant floral component.

Wooded Ravine: Woody vegetation layer that is sustained by the river but has also developed as a result of the cliff face along which the river runs – comprising a diversity of indigenous floral species adapted to both moisture-rich and rocky habitat; with a clear distinction between canopy and understory (shade-tolerant) vegetation.

9.6.5.5 Modified Habitat Unit:

Anthropogenically transformed areas: Modified grasslands as a result of current or historic anthropogenic activities, including historic mining, grazing pressures and currently cultivated maize fields.

Wattle stands: Small to extensive stands of wattle (*Acacia delbata*, *A. decurrens* and *A. mearnsii*) that have encroached along rivers and into grasslands, displacing indigenous vegetation.

These habitat units are depicted in **Figure 9-14**, **Figure 9-15** and **Figure 9-16**

TABLE 9.5: QUICK GUIDE TO FLORAL COMMUNITIES WITHIN THE KUSIPONGO AREAS

Habitat Unit	Habitat units subdivided	Balgarthen	Donkerhoek	Twyfelhoek
Grassland Habitat	Paulpietersburg Moist Grassland	✔		
	Wakkerstroom Montane Grassland		✔	✔
	Secondary Grassland	✔		✔
Rocky Habitat	Mountain Outcrops	✔	✔	✔
	Rocky Ridges	✔	✔	
Wetland Habitat	Wetland Habitat	✔	✔	✔
Woody Habitat	Riparian vegetation	✔		
	Wooded Ravine	✔	✔	
	CVB with Riparian Characteristics		✔	✔
Modified Habitat	Anthropogenically transformed Areas	✔	✔	✔
	Wattle stands	✔	✔	✔

9.6.6 Floral SCC and Medicinally Important Species

The Balgarthen and Donkerhoek focus areas are associated with larger, more continuous stretches of intact habitat and provided more suitable conditions for floral SCC. Twyfelhoek was not devoid of SCC but a smaller area was considered to still provide suitable growing conditions. Due to the assessment taking place outside of the flowering season for many floral species, including the turnover of flowering species over time in grasslands, the SCC recorded are not considered a full representation of what is likely to occur. For example, the primary grasslands provide favourable conditions to support floral SCC protected under the Mpumalanga Nature Conservation Act, 1998 (Act 10 of 1998) (MNCA) such as *gladiolii*, *Boophone*, orchids and lilies, which were not encountered during the winter assessment.

Endemic and threatened SCC are also likely to occur within the areas where habitat remains intact. A summer assessment is required to get a better representation of the floral SCC associated with the focus areas, preferably in both late November and early February.

Only one SANBI Red Data Listed (RDL) species was encountered during the field assessment, i.e. *Merwilla plumbea* (NT). Several floral SCC listed in the MNCA were recorded in all three focus areas.

TABLE 9.6: LIST OF SPECIES PROTECTED UNDER THE MNCA THAT WERE RECORDED WITHIN THE FOCUS AREAS

Species falling within specific families	
Proteaceae	***Protea roupelliae* subsp. *roupelliae*** (Donkerhoek – Rocky Habitat). ***Protea simplex*** (Donkerhoek – Grassland and Rocky Habitat).
Species falling within the specific genera	
Aloes	***Aloe ecklonis*** (Balgarthen – riparian zone and river habitat). ***Aloe maculata*** (Balgarthen and Donkerhoek – Grassland and Rocky Habitat).
Arum lilies	***Zantedeschia sp.*** (Balgarthen – wooded ravine).
Brunsvigia	***Brunsvigia*** sp. (Balgarthen, Donkerhoek and Twyfelhoek – Grassland and Rocky Habitat mainly).
Fire lilies	***Cyrtanthus contractus*** (Balgarthen – Grassland Habitat but expected to occur in Wetland Habitat as well).
Red hot pokers	***Kniphofia*** *sp.* (Balgarthen – Wetland Habitat).
Tree ferns	***Alsophila dregei*** (abundant in Wetland Habitat of Balgarthen and Donkerhoek).
Yellow woods	***Podocarpus latifolius*** (Balgarthen and Donkerhoek – wooded ravine).
All species within the groups	

Paint brush species	***Haemanthus sp***. (Balgarthen – Rocky Habitat. Likely to occur in Rocky Habitat of Donkerhoek and Twyfelhoek focus areas).

A high abundance of medicinal plant species was encountered during the field assessment, most of which being woody species. With the highest numbers of medicinal plant species occurring in South Africa's Grassland, Forest and Savanna biomes, the focus areas were anticipated to harbour several medicinal forb species; some of which will be more readily detectible and identifiable during a summer assessment. Most of the medicinal species recorded within the focus areas are not currently under threat; however, *Merwilla plumbea* is listed as near threatened on the SANBI RD List, and *Aloe greatheadii* var. *davyana* is protected under the MNCA.

The high demand for medicinal plant use and trade within the Mpumalanga province can place additional pressure on floral communities within the focus areas if the proposed Kusipongo coal mine is approved, as it will result in increased human populations in the area.

9.6.7 Alien and Invasive Plant Species

Woody AIPs, particularly the *Acacia* species, were the dominant invaders within all three focus areas. The woody AIPs recorded during the field assessment include six species listed as Category 1b invaders and four as Category 2 invaders. Several AIP forbs were recorded for the focus areas with only two AIP grass species. The forb and grass AIPs were rarely abundant and did not appear to aggressively displace indigenous species. The woody AIPs such as *Acacia dealbata, Acacia decurrens, Pyracantha angustifolia* and *Solanum sisymbriifolium* have encroached significantly into the Modified Habitat, Wetland Habitat and Woody habitat units, where indigenous vegetation have been displaced or their diversity greatly reduced.

Alien species located within the proposed development areas need to be removed regularly as part of maintenance activities - according to the NEMBA: Alien and Invasive Species Regulations, GN R864 of 2016.

9.6.8 Floral Habitat Sensitivity

The ecological sensitivity of the identified floral habitat units ranged from low (Wattle Stands) to high (Grassland Habitat and Rocky Habitat). **Table 9**.7 below indicates the sensitivity of the habitat units along with an associated conservation objective and implications for development. Sensitivity Maps are illustrated in **Figure 9-18, Figure 9-19** and **Figure 9-20**

TABLE 9.7: A SUMMARY OF SENSITIVITY OF EACH HABITAT UNIT AND IMPLICATIONS FOR DEVELOPMENT

Habitat Sensitivity	Habitat Unit	Floral Communities	Impacting Infrastructure	Development Implications
High Sensitivity <u>Conservation Objective</u>**:** Preserve and enhance the biodiversity of the habitat unit; a no-go alternative must be considered	**Grassland Habitat**	Paulpietersburg Moist Grassland & Wakkerstroom Montane Grassland	Balgarthen OC Balgarthen OC Dump Balgarthen B Adit Balgarthen B Adit Dump Balgarthen B ROM Stockpile Donkerhoek OC Donkerhoek OC Dump Donkerhoek ROM Stockpile	Areas of high sensitivity include the floral communities where the habitat integrity is still intact and where an overall high ecological functionality is associated with the floral communities. All highly sensitive habitat is associated with the presence, or potential presence, of floral SCC. Anthropogenic disturbance within areas of high floral sensitivity was low at the time of the field assessment, with very little activities in the surrounding area contributing to edge effect impacts (Twyfelhoek excluded).
	Rocky Habitat	Mountain Outcrops & Rocky Ridges	Balgarthen OC Balgarthen OC Dump Balgarthen B Adit Balgarthen B Adit Dump	

Habitat Sensitivity	Habitat Unit	Floral Communities	Impacting Infrastructure	Development Implications
			Donkerhoek OC (west) Donkerhoek Dump (west) Donkerhoek ROM Stockpile	
	Woody Habitat	Wooded Ravine	None	
Moderately High Sensitivity <u>Conservation Objective</u>**:** Preserve and enhance the biodiversity of the habitat unit, limit development and disturbance	**Wetland Habitat**	Intact wetlands	None	These areas are of moderately high sensitivity from a floral perspective. Generally high ecological function is attributed to floral communities in this group; however, the presence of some disturbances such as AIP encroachment or edge effect impacts on floral communities have resulted in decreased habitat integrity. Floral SCC are also well-represented within these areas, with suitable habitat for additional SCC also provided. This habitat unit is important for floral communities with the wetland habitat further serving as an important corridor along which ecological processes occur (including plant dispersal).
	Woody Habitat	Riparian vegetation	None	

Habitat Sensitivity	Habitat Unit	Floral Communities	Impacting Infrastructure	Development Implications
Intermediate Sensitivity <u>Conservation Objective</u>**:** Preserve and enhance the biodiversity of the habitat unit and the surrounds while optimising development potential	**Grassland Habitat**	Secondary Grassland	Balgarthen Adit A Donkerhoek OC and OC Dump (center) Twyfelhoek OC	Areas of intermediate sensitivity include those that have been impacted by AIP encroachment, overgrazing / trampling or anthropogenic disturbances so that the floral communities are no longer fully representative of the reference vegetation types that they occur in. With floral habitat integrity and diversity decreased as a result of the various pressures on floral communities, the conditions to support a diversity of floral SCC is sub-optimal. Floral SCC are still expected to establish within these areas, albeit at lower abundances e.g. at the Balgarthen focus area the secondary grasslands have suitable habitat for hardier floral SCC such as *Aloe ecklonis*.
	Wetland Habitat	Seep wetlands	None	
	Woody Habitat	CVB with riparian characteristics	None	
Moderately Low Sensitivity <u>Conservation Objective</u>**:**	**Modified Habitat**	Anthropogenically transformed	Balgarthen Adit A Donkerhoek OC and OC Dump (center) Twyfelhoek OC and OC Dump (center)	The anthropogenically transformed areas floral communities are of moderately low importance and significance from a floral perspective. The modification of the vegetation to maize fields, built-up areas and historically mined sites have resulted in floral communities that are no longer representative of the reference vegetation type in which each occur. Decreased habitat integrity and the presence of AIPs have resulted in low potential for SCC to be present.

Habitat Sensitivity	Habitat Unit	Floral Communities	Impacting Infrastructure	Development Implications
Optimise the development potential while improving the biodiversity integrity of the surrounding natural habitat and managing edge effects			Twyfelhoek ROM Stockpile	In its current modified state, these areas are not deemed important to support indigenous floral communities. Development within the anthropogenically transformed areas can be optimized but edge effects should be well managed.
Low Sensitivity <u>Conservation Objective</u>**:** Optimise the development potential	**Modified Habitat**	Wattle stands	Donkerhoek OCs Donkerhoek Dumps Donkerhoek ROM Stockpile Twyfelhoek OCs	Areas where wattle species (*Acacia dealbata, A. decurrens* and *A. mearnsii*) form dense and far stretching stands where little to no indigenous vegetation are present, are of low sensitivity. Ecological functioning and habitat integrity are significantly compromised, and these areas should be optimized for development. Edge effect impacts on the surrounding natural vegetation should be well managed.

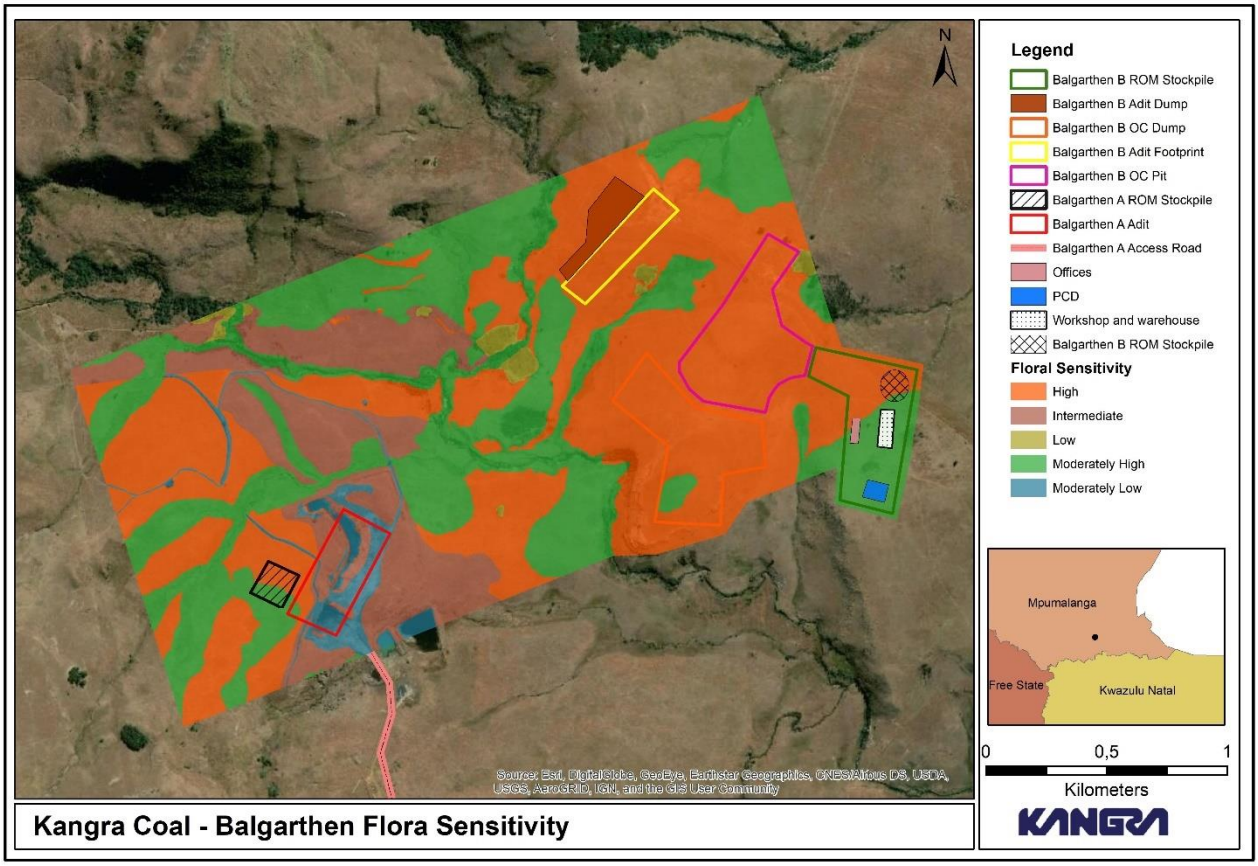


FIGURE 9-18: SENSITIVITY MAP FOR THE BALGARTHEN FOCUS AREA

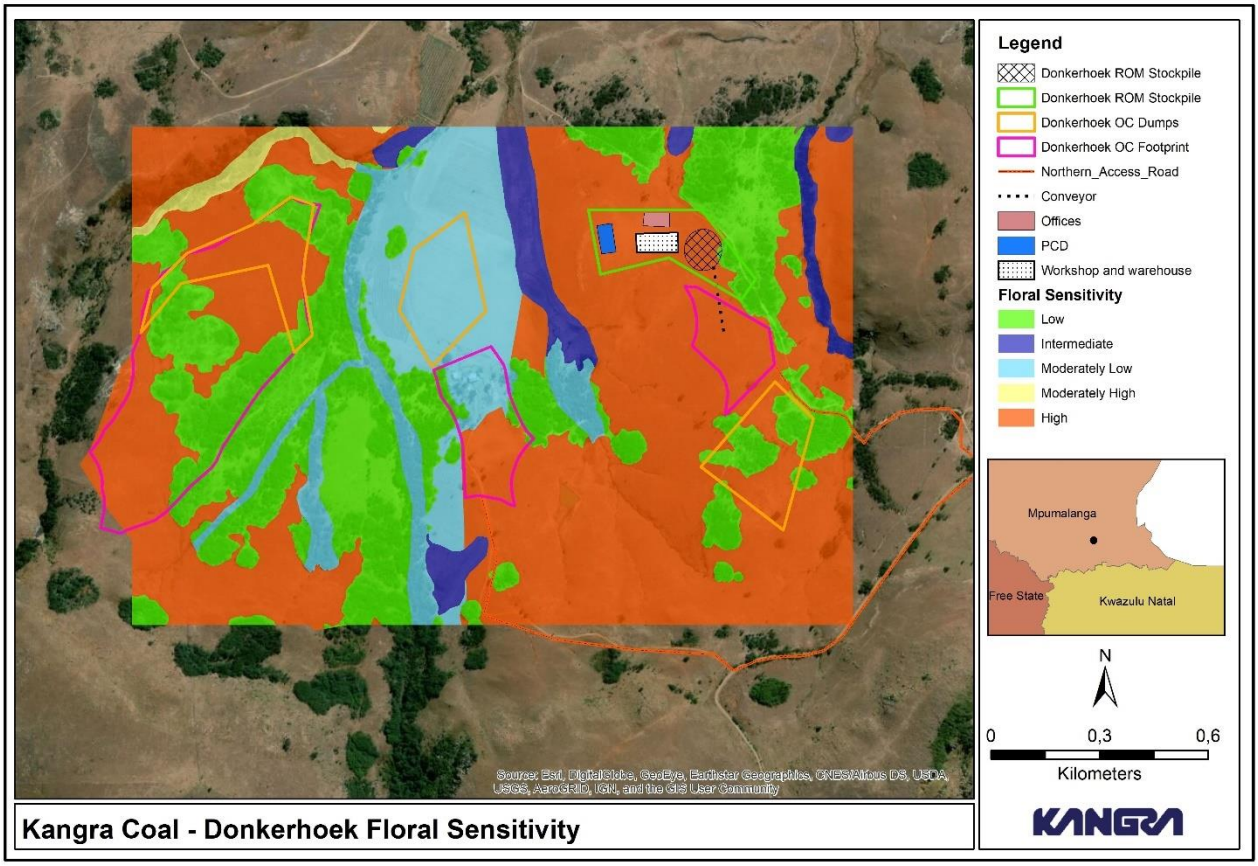


FIGURE 9-19: SENSITIVITY MAP FOR DONKERHOEK FOCUS AREA

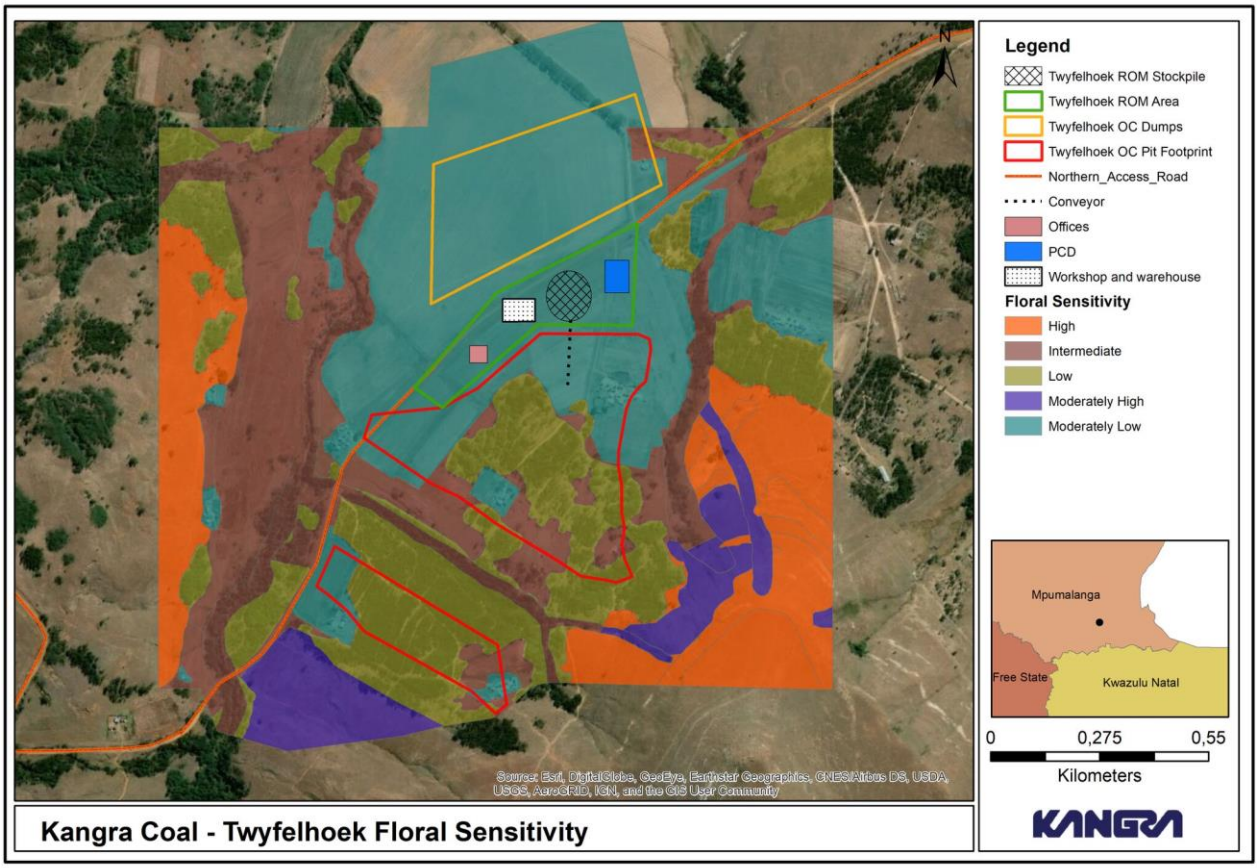


FIGURE 9-20: SENSITIVITY MAP FOR THE TWYFELHOEK FOCUS AREA

9.7 Surface Water Resources

The description of the surface water resources has been sourced from work undertaken as part of the Watercourse and Aquatic Ecological Assessment (Scientific Aquatic Services CC, September 2019).

9.7.1 Watercourse verification

For the purposes of this investigation, the definitions of a watercourse, wetland and riparian habitat were taken as per that in the National Water Act, 1998 (Act No. 36 of 1998). The definitions are as follows:

A watercourse means:

(a) a river or spring;

(b) a natural channel in which water flows regularly or intermittently;

(c) a wetland, lake or dam into which, or from which, water flows; and

(d) any collection of water which the Minister may, by notice in the Gazette, declare a watercourse.

Wetland habitat is "land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil."

9.7.2 Freshwater Resource System Classification

Three Hydrogeomorphic (HGM) types and 33 HGM units were identified within the focus areas of the Kusipongo mining rights area between the three focus areas (Twyfelhoek, Donkerhoek and Balgarthen). These include the following:

Twyfelhoek:

- Three channelled valley bottom wetlands;
- Two unchannelled valley bottom wetlands; and
- Two seep wetlands.

Donkerhoek:

- Three channelled valley bottom wetland;s
- Three unchannelled valley bottom wetlands; and
- One seep wetland.

Balgarthen:

- Twelve seep wetlands;
- Four unchannelled valley bottom wetlands (one was assessed to possess peat wetland characteristics).

9.7.2.1 Twyfelhoek Watercourse Assessment

The wetlands located within the Twyfelhoek focus area form part of the Hlelo River system. Wetlands forming part of headwater catchments are generally known to provide important ecological and hydrological services such as providing a source of water and streamflow regulation services. In addition, they are also known to play an important role in the characterisation of water quality before it enters other watercourses further down in the catchment. The Twyfelhoek focus area is generally an undeveloped rural area where the wetlands within the area provide a source of water and harvestable resources such as blue thatching grass (i.e *Hyparrhenia Tamba*) for local communities.

The wetlands within the focus area have been impacted upon largely as a result of the significant reliance on them by the local communities for whom limited alternatives to the goods and services provided by the wetlands are available. Impacts on the wetlands include subsistence cultivation activities which have encroached wetland boundaries, this activity has limited the natural and functional extent of wetlands and in addition limited the persistence of indigenous vegetation within the focus area. A major impact on the hydrology within the wetland in the establishment of wattle species within the channel valley-bottom (CVB) wetlands and this has further resulted in the disturbance of riparian areas. (**Figure 9-21**)

As a result of the homogeneous wetland characteristics and noting that the impacts on the wetlands are highly localized, the wetlands have been grouped and are discussed at a systems level (**Table 9**.8). The Present Ecological State (PES) of the wetlands is discussed for each HGM unit within a wetland system while the Ecological Importance and Sensitivity (EIS) and Ecoservices are presented on a system level.

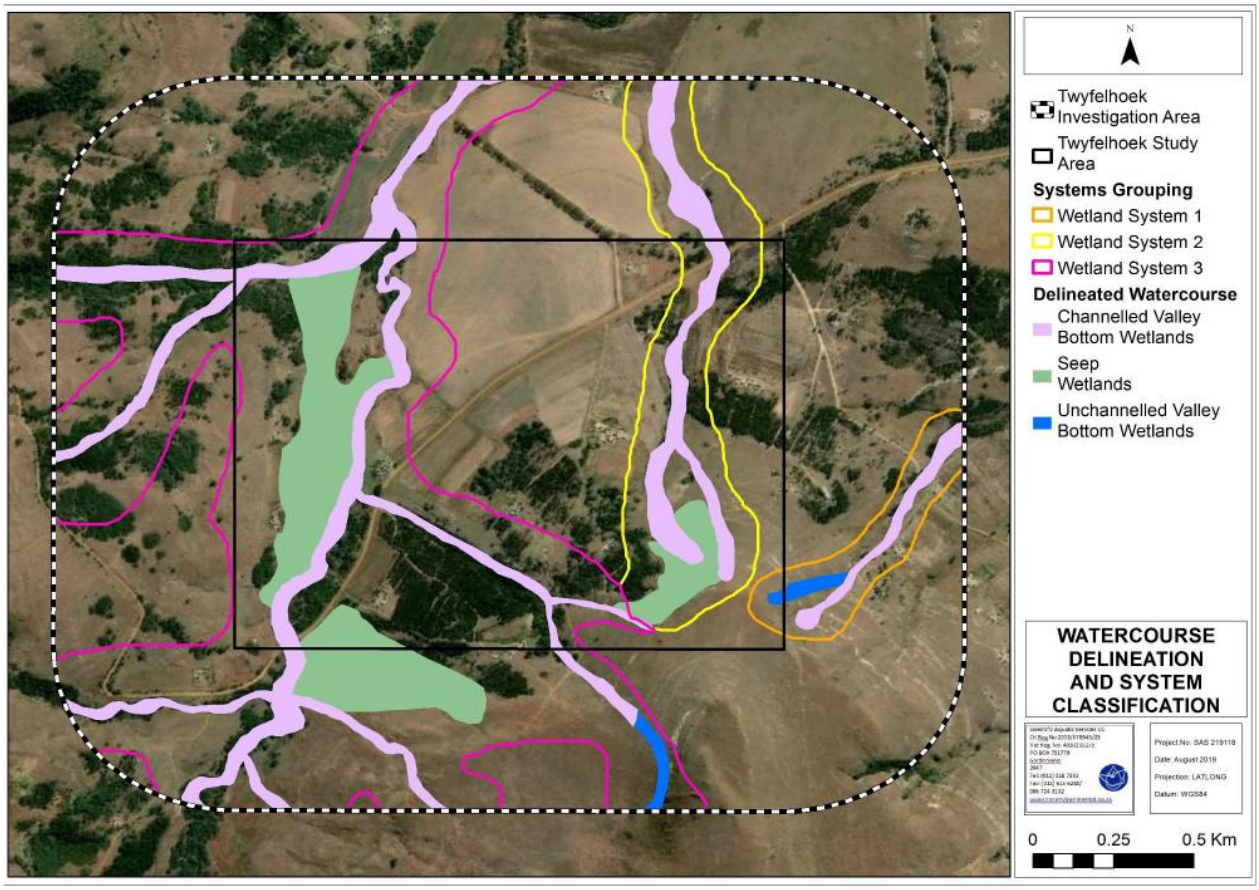


FIGURE 9-21: DELINEATED WATERCOURSES WITHIN THE TWYFELHOEK FOCUS AREA

TABLE 9.8: TWYFELHOEK WETLAND GROUPING

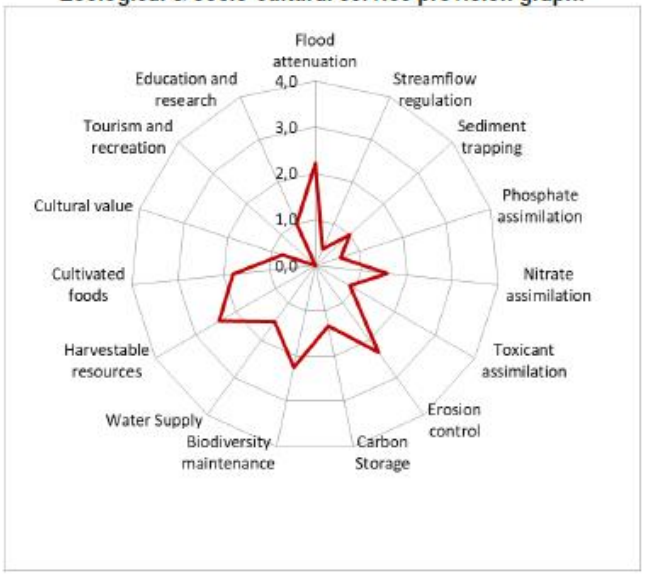
Wetland System	Represented HGM Units
Wetland System 1	Channelled valley bottom
	Unchanneled valley bottom
Wetland System 1	Channelled valley bottom
	Seep
Wetland System 1	Seep
	Channelled valley bottom
	Unchanneled valley bottom

TABLE 9.9: SUMMARY OF THE ASSESSMENT OF WETLAND SYSTEM 1 AT TWYFELHOEK



Representative photographs of wetland system 1 located within the eastern portion of the Twyfelhoek Focus area. The wetland system comprises of an CVB and UCVB wetland. Erosional features within the landscape located higher up the mountains were observed (centre).

Ecological & socio-cultural service provision graph:



PES discussion	**PES Category:** **CVB Wetland: C (Moderately modified)** **UCVB Wetland: A (Unmodified)** Slight ecological modifications occur on within the wetland system. Observed modifications include artificial trenches and informal roads utilized by local communities which have altered natural hydrology of the wetland. In addition, alien riparian forests consisting of wattle and cultivation activities have also altered the ecological integrity of the wetland system.
Ecoservice provision	**Moderate** The overall ecoservices provision of the wetland system is considered to be moderately low. Important ecoservices provided by the wetland system include flood attenuation, erosion control and provision of harvestable resources. Ecological services such as education, research tourism and recreation were not assessed to be important for the wetland system.
EIS discussion	**EIS Category: C (Moderate)** The biodiversity of these wetlands is not considered sensitive to flow and habitat modifications. The wetland systems moderate importance is largely based on its hydro-functional importance and management of geomorphological processes (flood attenuation and sediment trapping) and not on its ecological sensitivity.

<table>
<tr><td></td><td>REC Category</td><td>
REC Category: RMO:
CVB Wetland: C (Largely natural) CVB Wetland: C (Maintain)
UCVB Wetland: A (Unmodified) UCVB Wetland: A (Maintain)

The HGM units within the wetland systems are considered of moderate ecological importance and sensitivity, therefore, the recommended management objective (RMO) for the CVB wetland is to main the category B while the RMO for the UCVB wetland is also to maintain category A and not allow any degradation to occur within the wetland system. Should there be any mining activities occurring within the wetland system, mitigation measures be implemented during all phases of the proposed mining activities to avoid further degradation and offset of the residual impacts is considered important. Considering the impacts on the CVB wetland such as cultivation and alien tree invasion, the Best Attainable State (BAS) for the wetland is class B (largely natural).
</td></tr>
<tr><td colspan="3">Watercourse drivers:</td></tr>
<tr><td colspan="2">a) Hydrology

The CVB and UCVB wetlands within the system are largely driven by hillslope processes where presence of an impending horizon limits infiltration of water into the soil. Hydrological processes within the wetland, particularly within the CVB wetland have been modified by wattle trees growing within channel.</td><td>c) Topography: Geomorphology and sediment balance

Modification of the wetland geomorphology is currently is currently minimal. Presence of narrow drainage lines high up the mountains have resulted in minor modifications of sediment balance. Furthermore, the presence of informal roads used by local communities has also increased sediment reporting to the wetland system in the lower lying areas.</td></tr>
<tr><td colspan="2">b) Water quality

The water quality is most likely within the wetland system is impacted by informal road runoff and agricultural runoff subsistence farmers within the vicinity. However, not impacts on the water quality occur further up the mountain.</td><td>d) Habitat and biota

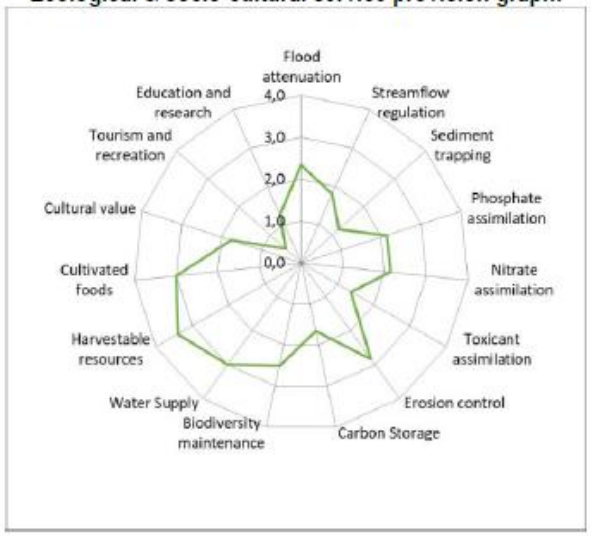
The vegetation community has been altered a result of encroachment by wattle trees and this has resulted in the loss of wetland vegetation particularly within the CVB wetlands. Clearing of natural vegetation within the wetland system for cultivation has also reduced diversity of habitat types.</td></tr>
<tr><td colspan="3">Possible significant impacts, Business case, Conclusion and Mitigation Requirements:</td></tr>
<tr><td colspan="3">The proposed Alternative B (Four Adits and Minor Opencast Mining) poses no quantum risk to the ecological integrity of the of the wetlands (CVB and UCVB) within the wetland system. This is due to the position of these wetlands in relation to the alternative proposed where these wetlands are located in positions making impact of them impossible as defined below:
1. Mining occurring in a different catchment to the wetland;
2. Mining occurring downgradient of the wetlands which is unlikely to be impacted by cone of depression impacts; and
3. Mining occurring on the other side of an intervening watercourse which forms the boundary of potential impact.
Since the northern access road in the proposed alternative also does not intersect these wetland systems, no impacts on these wetlands are envisaged.</td></tr>
</table>

TABLE 9.10: SUMMARY OF THE ASSESSMENT OF WETLAND SYSTEM 2 AT TWYFELHOEK



Representative photographs of wetland system 2 located within the central portion of Twyfelhoek (left). The wetland system is formed by a seep and CVB wetland. The seep wetland was considered important for provision of water for communities located downstream and as a result it has been protected from cattle (centre). Modification within the wetland system include wattle proliferation along the channels of the CVB wetlands (right).

Ecological & socio-cultural service provision graph:



PES discussion	**PES Category:** **CVB Wetland: D (Largely modified)** **Seep Wetland: A (Unmodified)** Ecological modifications to the wetland system are mostly attributable to the surrounding agricultural activities, which have encroached the boundary of the wetland, as well as wattle trees which occur along the channels of the CVB wetland. Seeps occurring higher up on the mountains were found to currently have no ecological modifications.
Ecoservice provision	**Moderately high** The functioning of the wetland in terms of provision of ecoservices is considered to be at a moderately high level, this is due to provision of services such as sediment trapping, provision of water supply and harvestable resources to local communities. However, due to the nature of the surrounding areas, the system is not considered to have significant value in terms of tourism, recreation, education and research.
EIS discussion	**EIS Category: C (Moderate)** The EIS of the wetland system falls within the C category, and the wetland is considered not to be sensitive to flow and habitat modifications. The wetland is considered moderately important based largely on its direct benefits for humans such as provision of water supply. Protected community water sources were observed within the seep wetland during the site assessment.

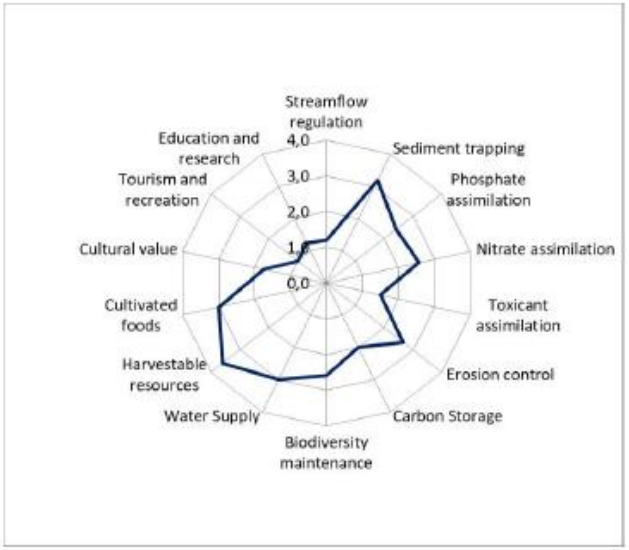
	REC Category	**REC Category:** **RMO:** **CVB Wetland: C (Largely natural)** **CVB Wetland: D (Maintain)** **Seep Wetland: A (Unmodified)** **Seep Wetland: A (Maintain)** Despite degradation of the wetland system largely as a result of alien wattle within the CVB wetland, and the wetland systems ecological importance and sensitivity is considered to be moderate. Therefore, the Recommended Management Objective (RMO) for the seep wetland and the CVB wetland based on the PES and EIS scores is to maintain the current ecological categories and not allow any degradation of the wetlands to take place. No further degradation of the CVB wetland which is already modified should be permitted. Considering the impacts on the CVB wetland, the Best Attainable State (BAS) of the wetland is a Category C (moderately modified).
Watercourse drivers:		
a) **Hydrology** Wetland hydrological processes have been altered mainly by increase wattle species growing within the channel of the CVB wetland. Cultivation adjacent to the wetland has also impacted wetland hydrological processes due to the increase in surface water input and sediment runoff reporting to the wetland system.		b) **Topography: Geomorphology and sediment balance** Geomorphology within the wetland system, particularly in the CVB wetland has been altered significantly by the wattle trees growing within the channels which have resulted in desiccation of channel banks and subsequently made the soil very prone to erosion. In addition to this sedimentation is anticipated due to the proximity of agricultural activities, specifically crop cultivation, which causes ongoing disturbances to surrounding soils. Within the seep wetland, minor modifications have taken place, and these include impacts from cattle which has resulted in alterations to the vegetation composition and geomorphological processes due to trampling.
c) **Water quality** The water quality within the wetland system is most likely to be impacted by agricultural activities from the surrounding areas and informal road runoff. Within the seep wetland, water quality is most likely unmodified and of increased importance for supply for communities.		d) **Habitat and biota** The vegetation community has been altered within the wetland system as a result of impacts such as overgrazing, proliferation of alien and invasive species and cultivation activities occurring adjacent to the wetlands.
Possible significant impacts, Business case, Conclusion and Mitigation Requirements:		
The proposed Alternative B (Four Adits and Minor Opencast Mining) does not directly encroach on the wetland system associated with a CVB and seep wetland. Envisaged impacts on these wetland systems include sedimentation and runoff from the mining activities which could be mitigated if appropriate measures are employed. The highest risk to the proposed mining activities is the risk they will pose on the ecoservice provision of the wetlands, particularly from a direct human benefit perspective. The seep wetlands are currently the sole source of water for the communities in the area and should any impacts on these systems occur then methods to substitute water provision by these sources must be provided.		

TABLE 9.11: SUMMARY OF THE ASSESSMENT OF WETLAND SYSTEM 3 AT TWYFELHOEK



Representative photographs of wetland system 3 located within the central to western portion of Twyfelhoek. The wetland system is formed by a multiple UCVB wetlands, seeps and CVB wetland. Vegetation within the seep wetland was dominantly *miscanthus junceus* (left) *and* Hyperenia grasses which are collected by local communities for thatching purposes (right).

Ecological & socio-cultural service provision graph:



PES discussion	**PES Category:** **CVB Wetland: D (Largely modified)** **Seep Wetland: C (Moderately modified)** **UCVB Wetland: A (Unmodified)** Agricultural activities, proliferation of wattle trees within wetland channel and overgrazing are the most notable ecological modifications to the wetland system which consists of seeps, CVB and UCVB wetlands. In addition to this, the presence of informal roads which traverse the some historically connected wetlands contributes to the ecological modifications within the wetland.
Ecoservice provision	**Intermediate** Despite the overall reduced ecological integrity of the wetland, functioning remains at an intermediate level in terms of the provision of ecological services such as sediment trapping, water supply for local communities and provision of harvestable resources. Other services such as tourism, recreation, education and research were not considered significant
EIS discussion	**EIS Category: C (Moderate)** The EIS of the wetland system falls within category C, which are wetlands considered to be of moderate ecological importance and sensitivity. The system is not considered to be sensitive to flow and habitat modifications. The wetland is considered moderately important as a result of its hydro-functional importance for streamflow regulation, and direct human benefits.

<table>
<tr><td></td><td>REC Category</td><td>REC Category:
CVB Wetland: C (Moderately modified)
Seep Wetland: B (Largely natural)
UCVB Wetland: A (Unmodified)

RMO:
CVB Wetland: D (Maintain)
Seep Wetland: C (Maintain)
CVB Wetland: A (Maintain)

Despite portion of the wetland system having minor ecological modifications, it is still considered to be of moderate ecological importance and sensitivity. As a result, the recommended management objective (RMO) for the wetlands is as follows: CVB – Maintain (D), Seep – Maintain (C) and UCVB – Maintain (A). Considering the impacts on the wetlands, the Best Attainable State (BAS) is considered to be an improvement in the ecological state of the CVB (Category C) and seep (Category B) wetlands.</td></tr>
<tr><td colspan="3">Watercourse drivers:</td></tr>
<tr><td colspan="2">a) Hydrology
The hydrological processes within the wetland system have been modified by cultivation activities occurring adjacent to the wetland system, these have increased sediment load into the wetland. Furthermore, dominance of wattle trees within wetland has significantly reduced water flowing within channels.</td><td>b) Topography: Geomorphology and sediment balance
Sediment balance within the wetland system has been altered by cultivation which has resulted in sediment deposition in the wetland due to disturbances in the soil.</td></tr>
<tr><td colspan="2">c) Water quality
Sediment deposition within the wetland systems has likely impacted the water quality within the CVB wetland. Water quality within the UCVB wetlands at higher elevations are likely not modified due since there are fewer human activities occurring.</td><td>d) Habitat and biota
Cultivation activities have limited establishment of natural vegetation within most parts of the wetland system, in addition to this wattle trees within channels have also limited establishment of establishment of riparian vegetation. However, the portions of the CVB wetland are dominated by species such as Cyperus macranthus and Imperata cylindrica which can also be considered to be a disturbance indicator species.</td></tr>
<tr><td colspan="3">Possible significant impacts, Business case, Conclusion and Mitigation Requirements:</td></tr>
<tr><td colspan="3">The proposed Alternative B (Four Adits and Minor Opencast Mining) does not directly intersect the wetland system associated with a CVB, Seep and UCVB wetlands. Envisaged impacts on these wetland systems include sedimentation and runoff from the mining activities which could be mitigated if appropriate measures are employed. The highest risk to the proposed mining activities is the risk they will pose on the ecoservice provision of the wetlands, particularly from a direct human benefit perspective. The wetland in the system provide a source of water and area for grazing for cattle in the area, therefore, should any impacts on these systems occur then methods to substitute such ecoservices provided by the wetlands should be put into place. In addition, the UCVB wetlands within the wetland system were also found to currently be in a good ecological condition with no impacts occurring within the wetland, therefore any mining activities pose a risk to ecological integrity of the wetlands and a subsequent loss of biodiversity.</td></tr>
</table>

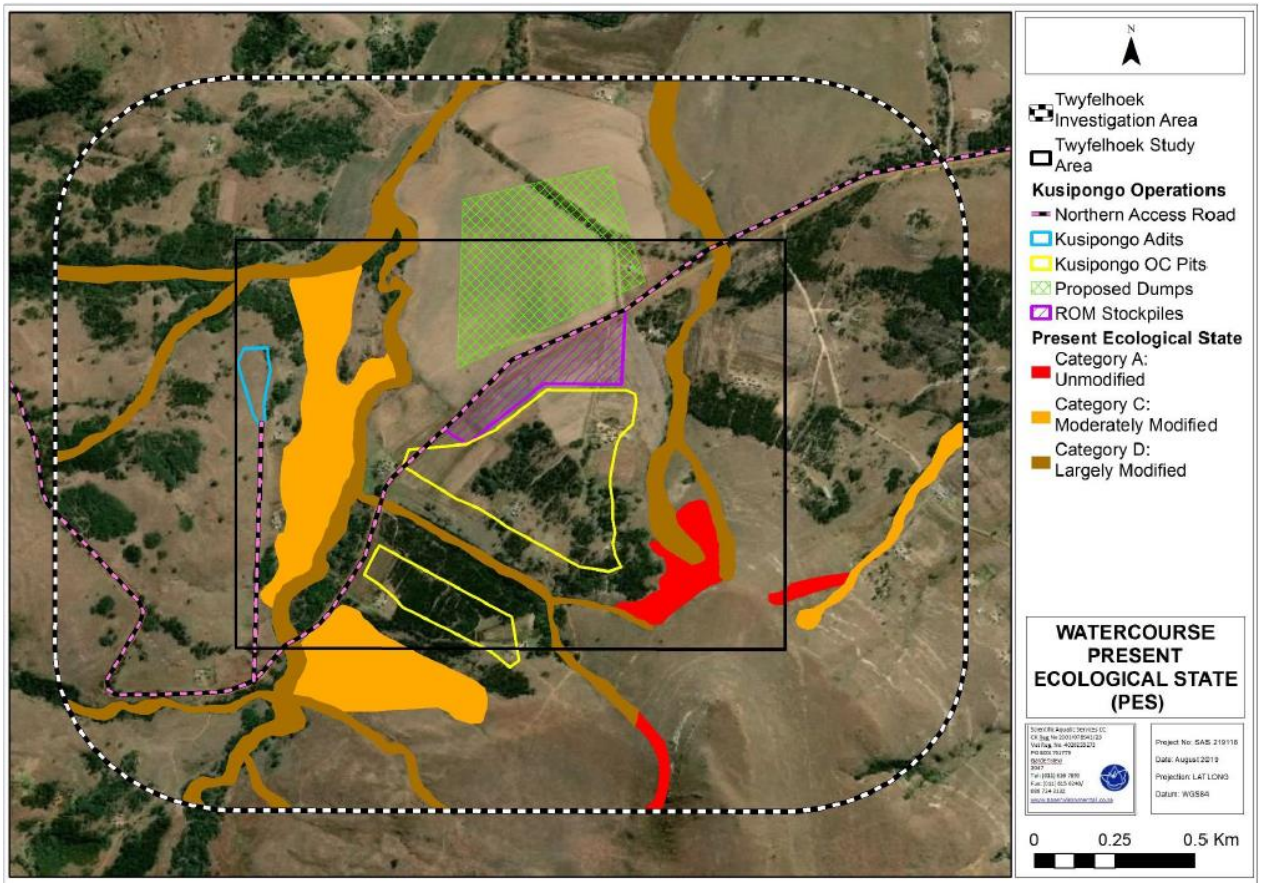


FIGURE 9-22: CONCEPTUAL ILLUSTRATION OF THE PES AT TWYFELHOEK

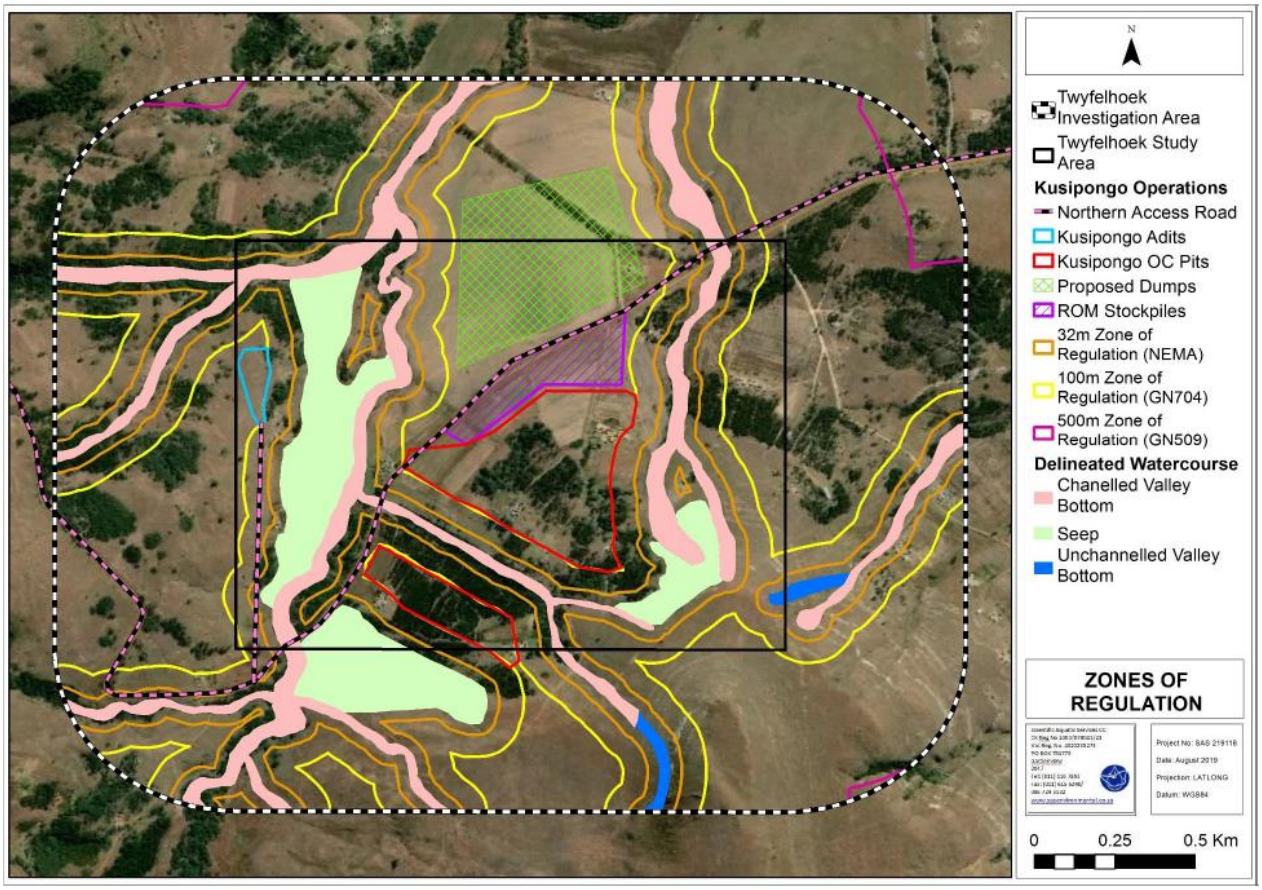


FIGURE 9-23: TWYFELHOEK CONCEPTUAL PRESENTATION OF THE ZONES OF REGULATION

9.7.2.2 Donkerhoek Watercourse Assessment

The wetlands within the Donkerhoek focus area were found to have minimal modifiers mainly because the footprint local communities or anthropogenic activities within the focus area are currently minor. Observed impacts within the study include wattle trees established within wetland systems where increased moisture is available and this has, as mentioned above altered the hydrological balance of the wetlands significantly. Despite occurring within a small area in relation to the focus area, crop cultivation activities have altered sediment balance within the central part of the focus area. (**Figure 9-24**)

As a result of the homogeneous wetland characteristics but noting that the impacts on the wetlands are highly localized (**Table 9**.12), the wetlands have been grouped and are discussed at a system level. The PES of the wetlands is discussed for each HGM unit within a wetland system while the EIS and Ecoservices are presented on a system level.

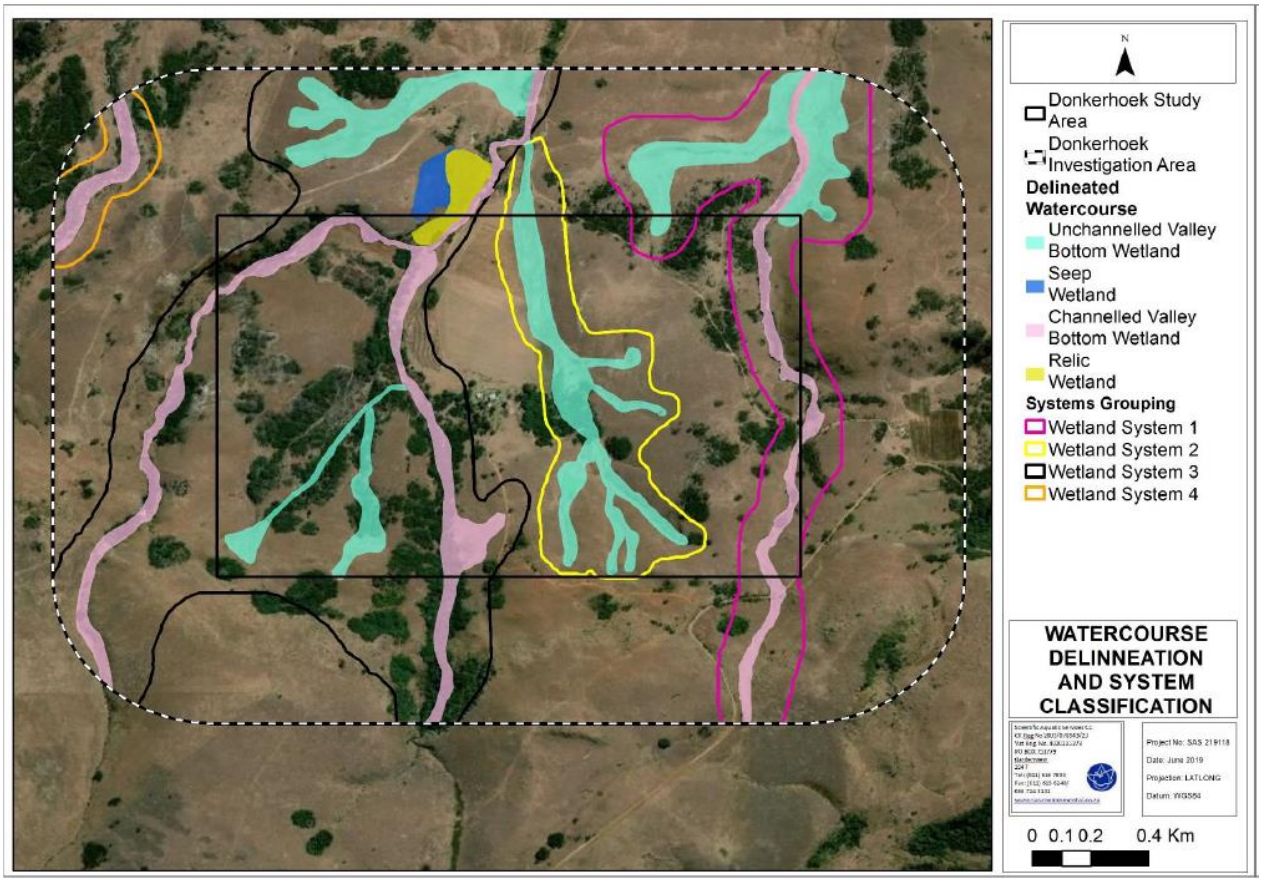


FIGURE 9-24: DONKERHOEK DELINEATED WATERCOURSES

TABLE 9.12: DONKERHOEK WETLAND GROUPING

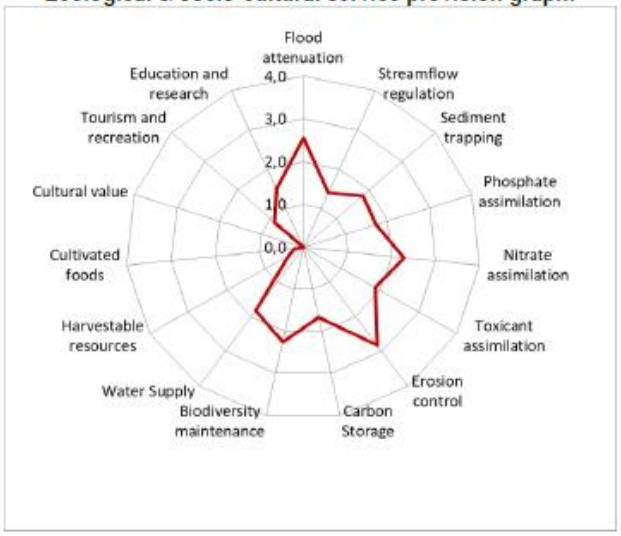
Wetland System	Represented HGM Units
Wetland System 1	Channelled valley bottom
	Unchanneled valley bottom
Wetland System 3	Unchanneled valley bottom
Wetland System 3	Seep
	Channelled valley bottom
	Unchanneled valley bottom
Wetland System 4	Channelled valley bottom

TABLE 9.13: SUMMARY OF THE ASSESSMENT OF WETLAND 1 AT DONKERHOEK



Representative photographs of wetland system 1 located on the eastern portion of the Donkerhoek study area. The wetland system is associated with a CVB and UVCB, furthermore these occur in a relatively undisturbed area with observed disturbances generally including wattle trees planted along channels associated with the CVB wetlands (centre).

Ecological & socio-cultural service provision graph:



PES discussion	**PES Category:** **UCVB Wetland: A (Unmodified)** **CVB Wetland: C (Moderately modified)** The ecological integrity of the UCVB wetlands within the wetland system was found to be largely unmodified while the CVB wetland has been moderately modified as a result of alien riparian forests within the CVB wetlands. Further disturbances such as erosion gullies were observed within the wetland system.
Ecoservice provision	**Intermediate** Despite the compromised ecological condition of the wetland system, particularly the CVB wetland with altered channels, the ecoservice provision is still considered to be at an intermediate level. This is largely as a result of services such as flood attenuation, erosion control and to a lesser extent the assimilation of nitrates.
EIS discussion	**EIS Category: C (Moderate)** The ecological importance and sensitivity (EIS) is considered to be moderate (Category C), and these type of systems have biodiversity is not usually sensitive to flow and habitat modifications. The ecological importance of the wetland is based on hydro-ecological function such as regulation of streamflow.

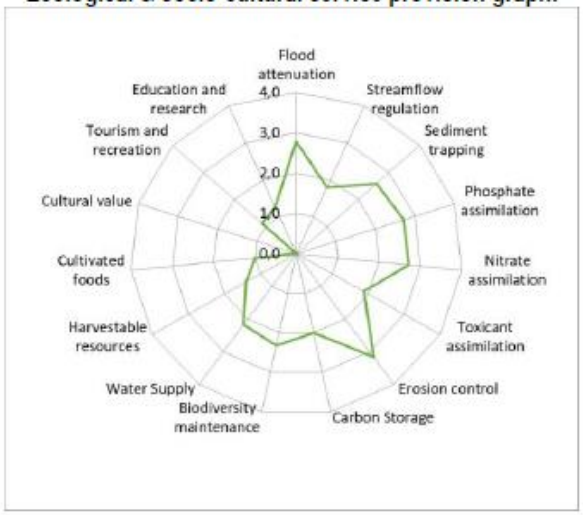
	REC Category	**REC Category:** **RMO:** **UCVB Wetland: A (Unmodified)** **UCVB Wetland: A (Maintain)** **CVB Wetland: C (Moderately modified)** **CVB Wetland: C (Maintain)** Based on the ecological condition of the wetland systems and their ecological importance and sensitivity which was assessed to be moderate. The Recommended Management Objective (RMO) for both the wetlands to maintain their respective ecological categories (UCVB – A, unmodified and CVB – C, moderately modified). Should the proposed mining activities be approved, mitigation measures to ensure no further degradation of the modified CVB wetland should be implemented at all phases of the proposed activities. Considering the ecological conditions of the wetlands, the Best Attainable State (BAS) for the wetland is their current ecological condition.
Watercourse drivers:		
a) Hydrology The hydrology of the wetlands is currently minimally modified, the main observed modification includes proliferation of wattle of trees which has limited the flow within the CVB wetlands. The hydrology within the UCVB wetland remains relatively unmodified.		**b) Topography: Geomorphology and sediment balance** Disturbances resulting in gully erosion has altered geomorphology within the wetland system. Gravel roads used traversing portions of the wetland system are likely to result in input of sediment within the wetlands, particularly during periods of increased rainfall.
c) Water quality The water quality within the wetland system is relatively unmodified due to the nonexistence of direct impacts within the wetlands. Observed minor impacts on the water quality result from sedimentation of wetlands due to informal roads.		**d) Habitat and biota** Wattle trees within channels of the UCVB wetland have limited the establishment of vegetation commonly associated with these types of habitats, where wattle had not established presence of facultative wetland species was observed. Since the assessment was conducted in the winter season, numerous species which die-back in the winter season were not observed.
Possible significant impacts, Business case, Conclusion and Mitigation Requirements:		
The proposed Alternative B does not directly encroach on the wetland system associated with a CVB and UCVB wetland s, however, the proposed infrastructure components (RMO stockpile) is located on interflow soils which are considered important from a hydropedological perspective since these soils are known to be significant hydrological drivers of wetlands. The location of the proposed dumps within the eastern portion of the focus area is also considered to pose high risk due to runoff from the stockpiles, especially given the topography of the landscape. The strict implementation of mitigation measures to minimise the impacts associated with areas which might encroach the wetlands or have a residual impact on the wetlands is critically important.		

TABLE 9.14: SUMMARY OF THE ASSESSMENT OF WATLAND 2 AT DONKERHOEK



Representative photographs of wetland system 2 located on the central portion of the Donkerhoek study area. The wetland system is associated with an UCVB wetland. Cultivation practices (left) adjacent to the wetland have resulted in sediment loading within the wetland (centre).

Ecological & socio-cultural service provision graph:



PES discussion	**PES Category: C (Moderately modified)** Ecological modifications to the wetland have occurred as a result of cultivation activities occurring adjacent to the UCVB wetland. Part of the HGM unit can be observed to have previously been characteristically CVB, however as a result of increased sediment load reporting to the wetland from the adjacent disturbed soil, the flow has become strongly diffused.
Ecoservice provision	**Intermediate** The wetland ecoservice provision is currently considered to be intermediate. This is due to the provision of important ecological services such as controlling erosion, attenuating floods and to a lesser extent trapping sediment. The wetland occurs in an area where no communities have established, as a result it is not considered important for direct provision services such as provision water supplies, harvestable resources and cultivated foods.
EIS discussion	**EIS Category: C (Moderate)** The wetland system associated with an UCVB wetland is considered to have moderate ecological importance and sensitivity. According to the EIS category, these wetlands are not considered sensitive to changes in flow and habitat modifications. The wetland was found important due to its hydro-functional importance and direct human-based services are considered be minimal.

<table>
<tr><td></td><td>REC Category</td><td>REC Category: C (Moderately modified)
RMO: C (Maintain)

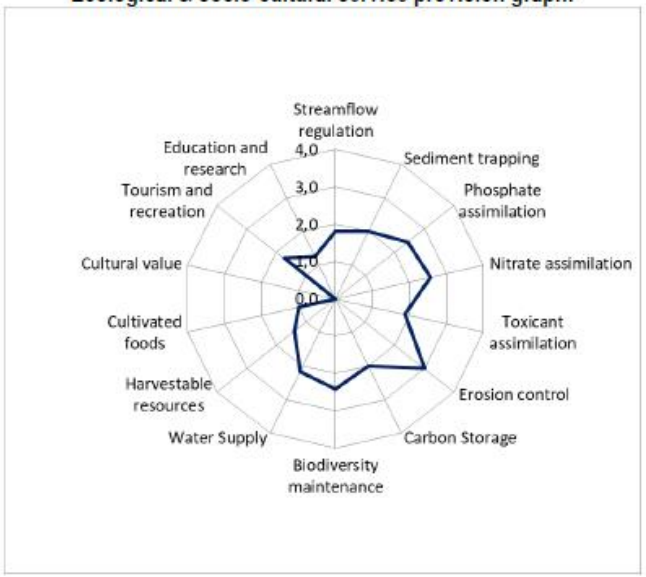
Considering the wetland PES and EIS scores as assessed, the recommended management objective (RMO) of the wetland is to maintain the ecological category of C. No further degradation should be permitted, and mitigation measures should be implemented during all phases of the proposed mining activities to minimise the risk of further negative impacts to the wetlands. The Best Attainable State (BAS) for the wetland considering the impacts occurring is an improvement in the ecological integrity to a Category B (largely natural).</td></tr>
<tr><td colspan="3">Watercourse drivers:</td></tr>
<tr><td colspan="2">a) Hydrology
Sediment from adjacent cultivation activities has altered the hydrology of the wetland. This has resulted in diffusion of water flow within the wetland. In addition, agricultural drainage lines have also altered hydrological patterns within the wetland.</td><td>b) Topography: Geomorphology and sediment balance
Soil disturbance from adjacent cultivated areas has altered the sediment balance within the wetland and given that the slope is conducive for sediment to move towards the wetland, it can be deduced that increased sediments report to the wetland during high rainfall events.</td></tr>
<tr><td colspan="2">c) Water quality
The water quality from higher up the mountains likely occurs in a good condition and this is due to the absence of impacts which could significantly alter the water quality. Within the lower areas of the wetland the water quality is considered slightly impacted as a result of sediment from cultivation activities adjacent to the wetland.</td><td>d) Habitat and biota
The intermittent streams forming part of the UCVB wetland were found to possess high abundance of the protected Alsophila dregei (tree fern) and obligate sedges such as Cyperus macranthus were distributed across wetland. Where impacts such as wattle tree establishment and maize cultivation occurred the habitat and biota were found to be compromised.</td></tr>
<tr><td colspan="3">Possible significant impacts, Business case, Conclusion and Mitigation Requirements:</td></tr>
<tr><td colspan="3">The proposed Alternative B is likely to pose indirect impacts on the UCVB wetland since the footprint of the mine does not intersect the wetland, according to the layout provided by the proponent. It is however envisaged that impacts from runoff and sedimentation from the disturbed soils will have an impact on the wetland ecological integrity. Strict implementation of mitigation measures which could include using berms to minimise sediment reporting to the wetland is critically important. Given the topography of the focus area, managing runoff and sedimentation of lower potions of the wetland is likely to be challenging to control and therefore, impacts should be managed in line with the mitigation hierarchy.</td></tr>
</table>

TABLE 9.15: SUMMARY OF THE ASSESSMENT OF WETLAND 3 AT DONKERHOEK



Representative photographs of wetland system 3 located on the central to western portion of the Donkerhoek focus area. The wetland system is associated with a seep (left), UCVB and a CVB wetlands. Cultivation practices have resulted in some historical wetlands being considered to currently occur as relict wetlands (centre) and this is because the soil from the cultivated area shows signs of mottling which is considered to be a wetland indicator (right).

Ecological & socio-cultural service provision graph:



PES discussion	**PES Category:** **Seep: A (Unmodified)** **UCVB: C (Moderately modified)** **CVB: C (Moderately modified)** Ecological modifications to the wetland system are mostly attributable to alien riparian forests which have significantly altered the ecological state of the CVB and UCVB wetlands. In addition to this, cultivation activities within and adjacent to these wetlands has reduced the natural extent of the wetland system. The seep wetland however within the system remains relatively unmodified with its edges slowly being encroached by cultivation activities.
Ecoservice provision	**Intermediate** Despite reduced ecological integrity within portions of the wetland system, at large the system is considered to provide ecological services at an intermediate level. Ecological services of particular importance include erosion control, biodiversity maintenance and nitrate assimilation. Other services such as tourism, recreation, education and research are considered of least importance.
EIS discussion	**EIS Category: C (Moderate)** The wetland system is considered of moderate ecological importance and sensitivity and such wetlands are considered not to be usually sensitive to flow and habitat modifications. The wetland is considered ecologically important more so as a result of the biodiversity support and its sensitivity.

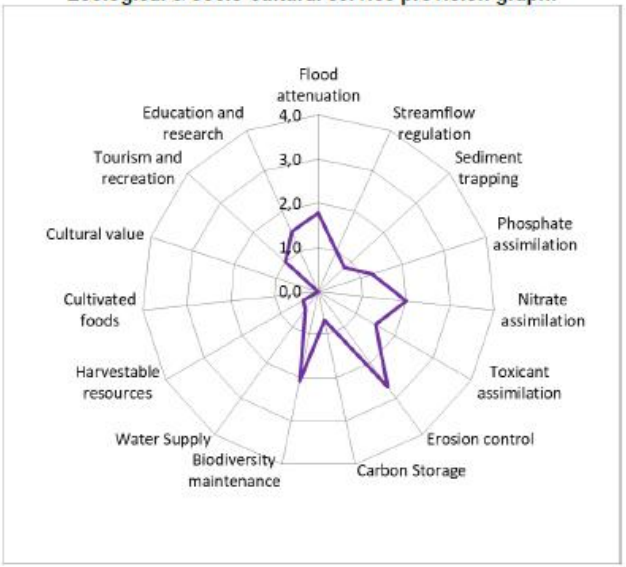
	REC Category	**REC Category:** **RMO:** **Seep Wetland: A (Unmodified)** **Seep Wetland: A (Maintain)** **UCVB Wetland: C (Moderately modified)** **UCVB Wetland: C (Maintain)** **CVB Wetland: C (Moderately modified)** **CVB Wetland: C (Maintain)** The ecological integrity of the CVB and UCVB wetland with the wetland system has been degraded to an extent, however, the system is still considered of ecological importance and sensitivity and the seep on the other hand remains unmodified. Based on the PES and the EIS of these wetlands, the recommended management objective (RMO) are as follows: Seep wetland – maintain (A), UCVB - maintain - (C) and CVB – maintain (C). Cultivation activities and alien riparian forests within wetlands channels are considered to be the drivers of ecological changes within the wetland systems, it can therefore be considered that the Best Attainable State (BAS) for the already impacted wetlands is higher than the current ecological condition as follows UCVB (B, largely natural) and CVB (B, largely natural).
Watercourse drivers:		
a) Hydrology The wetland system forms part of a larger headwater catchment, and since these catchments are generally comprised of small or intermittent streams surface water is present in limited amounts. With the presence of wattle tress within channels in the wetland system, the volume of water present has been reduced further. Further modifications within the system are observed by the presence of wet cultivated lands which are known as relic wetlands.		**b) Topography: Geomorphology and sediment balance** Soil erosion within dry channels has altered sediment balance within the wetland system. Absence of riparian vegetation as a result of wattle trees dominance has also resulted in the banks of the channels being largely unstable.
c) Water quality The water quality within the wetland system remains relatively unmodified particularly within the mountainous areas. Further below the mountainous areas there is an increase in sedimentation of the wetlands as a result of cultivation activities.		**d) Habitat and biota** The floral community within the wetland system is considered to be relatively high where no wattle trees have been planted. Within seeps and UCVB wetlands where intermittent streams occur, a high abundance of *Alsophila dregei* (tree fern) was observed.
Possible significant impacts, Business case, Conclusion and Mitigation Requirements:		
The proposed Alternative B is likely to pose indirect impacts to the wetland system due to edge effects since the footprint of the mine does not intersect the wetland, according to the layout provided by the proponent. It is however envisaged that impacts from runoff and sedimentation from the disturbed soils will have an impact on the wetland ecological integrity. Strict implementation of mitigation measures which could include using berms to minimise sediment reporting to the wetland is critically important. Given the topography of the focus area, managing runoff and sedimentation of lower potions of the wetland is likely to be challenging to control and therefore, impacts should be managed in line with the mitigation hierarchy.		

TABLE 9.16: SUMMARY OF THE ASSESSMENT OF WETLAND 4 AT DONKERHOEK



Representative photographs of wetland system 4 located on the western portion of the Donkerhoek focus area. The wetland system is associated with a CVB wetland. Wattle trees occurring along the channels have disturbed soils and vegetative cover within the wetland (left).

Ecological & socio-cultural service provision graph:



PES discussion	**PES Category: C (Moderately modified)** Ecological modifications to the wetland are attributable to mostly the unstable channel banks which have been disturbed as a result of wattle trees planted which have disturbed flow of water along the channels.
Ecoservice provision	**Moderately low** The wetland system ecoservice provision was considered to be moderately low. Although very minimal, ecoservices considered to be important for the wetland system include erosion control, nitrate assimilation and to a lesser extent flood attenuation.
EIS discussion	**EIS Category: D (Low/marginal)** The EIS of the wetland falls within category D and therefore known to be of low/marginal importance and sensitivity. Furthermore, these wetlands are considered to have biodiversity that is ubiquitous and is not sensitive to flow and habitat modifications.
REC Category	**REC Category: C (Moderately modified)** **RMO: C (Maintain)** The wetland was assessed to be moderately modified and considered to be of low/margin ecological importance and sensitivity. Thus, the recommended management objective (RMO) for the wetland based on the PES and EIS scores is to maintain the ecological category of C. Any impacts occurring on the wetland should be mitigated during

		all phases of the mining activities. In addition, the Best Attainable State (BAS) for the wetland system given the impacts is an improvement on the wetland to a Category B (largely natural).
Watercourse drivers:		
a) Hydrology Hydrological processes within the CVB wetland have been altered by wattle trees which have significantly reduced the volume of water flowing within wetland channels. Desiccation of soils within the channels has also altered the wetland hydrology due to increase in sediment reporting to the wetland.		**b) Topography: Geomorphology and sediment balance** Geomorphology within the wetland system has been altered by disturbed banks within the channels. The disturbance in these channels has resulted in the increase in sediment inputs.
c) Water quality The water quality within the wetland system remains largely unmodified as there are no agricultural activities occurring within or adjacent to the CVB wetland. However, sedimentation of the wetland as a result of soil erosion is likely		**d) Habitat and biota** Disturbances occurring on the channel banks have limited the establishment of riparian vegetation, and in addition establishment of wattle within the wetland channels has also significantly reduced habitat availability for other vegetation.
Possible significant impacts, Business case, Conclusion and Mitigation Requirements:		
The proposed Alternative B (Four Adits and Minor Opencast Mining) poses no quantum risk to the ecological integrity of the of the CVB wetland. This is due to the proximity of these wetland in relation to the alternative proposed. No access roads nor mining features (i.e. stockpile areas) traverse the delineated wetland. Therefore, provided that all relevant environmental authorizations are obtained, the proposed development may proceed.		

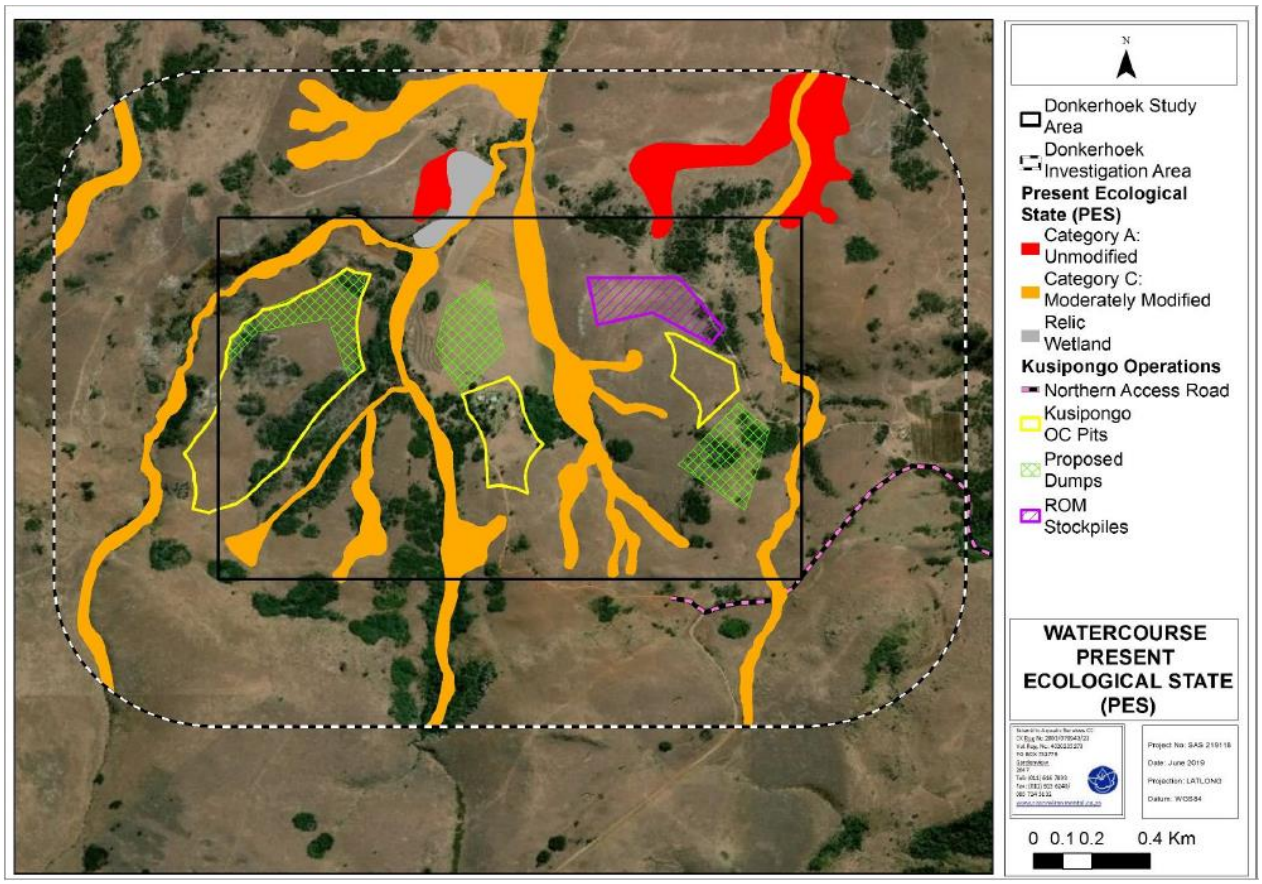


FIGURE 9-25: CONCEPTUAL ILLUSTRATION OF THE PES AT DONKERHOEK

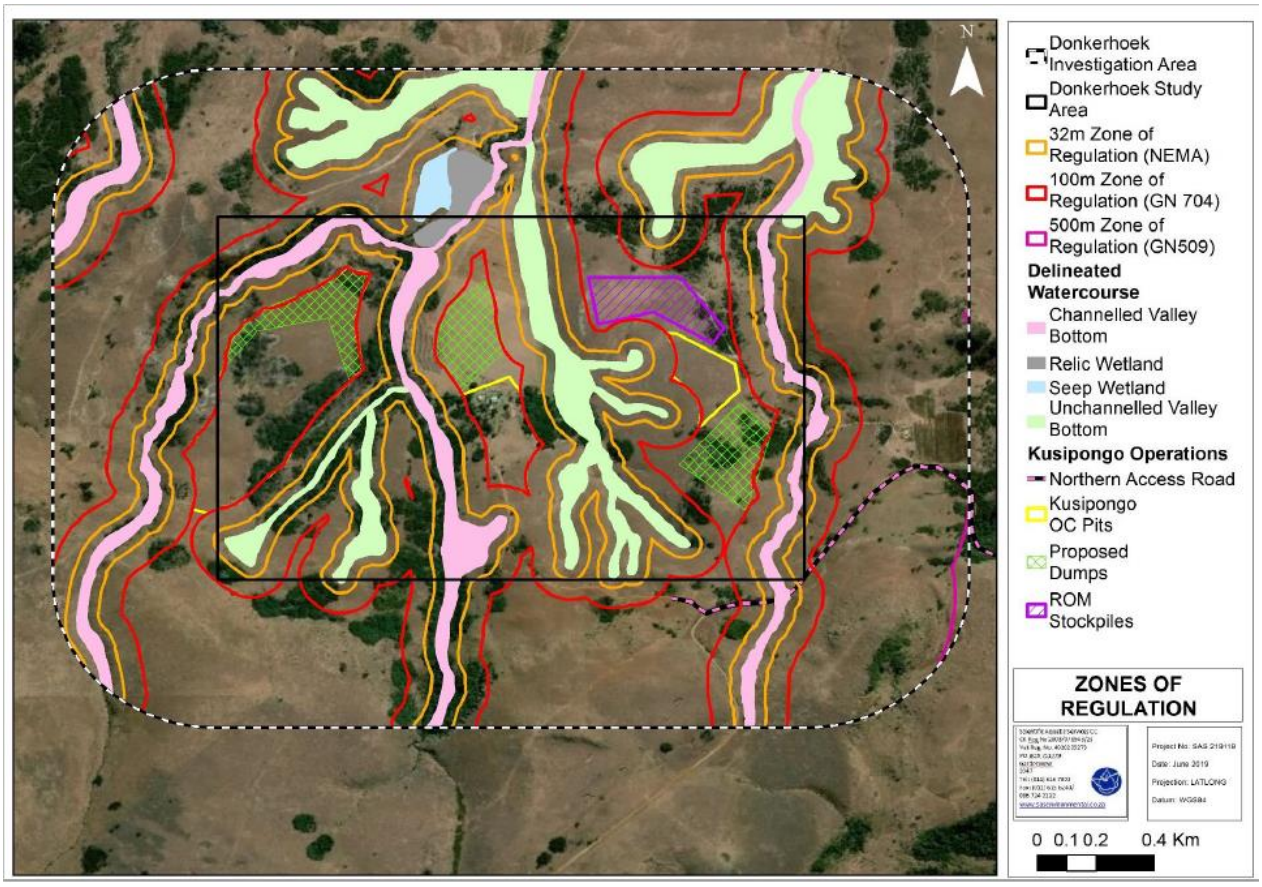


FIGURE 9-26: DONKERHOEK CONCEPTUAL PRESENTATION OF THE ZONES OF REGULATION

9.7.2.3 Balgarthen Watercourse Assessment

The Balgarthen focus area is located in a relatively isolated area where no significant impact on the majority of the wetlands has occurred. However, historical mining impacts within the focus area have resulted in the development of artificial dams, either for storage or to contain decant from the box cuts and pollution control dams (PCD) and as a result altering the hydrological processes within the wetlands. In addition, decant from the box cuts above the pollution control dams impacting on the hydrological regime and water quality of the system. Other impacts within the focus area include trampling by cattle which has resulted in the vegetation composition alteration, and possible proliferation of alien invasive species. The proliferation of wattle trees along the riparian zones of the active channels of the valley bottom wetlands was considered particularly severe. (**Figure 9-27**)

As a result of the connectivity of the wetlands within the Balgarthen focus area, including the similarity of impacts occurring within the wetlands, qualitative assessment of these wetlands is reported with some grouping of the wetland HGM units by HGM unit type. The PES, EIS and Ecoservices of the wetland was therefore reported based on wetland characteristics and degree of modification on each wetland HGM unit.

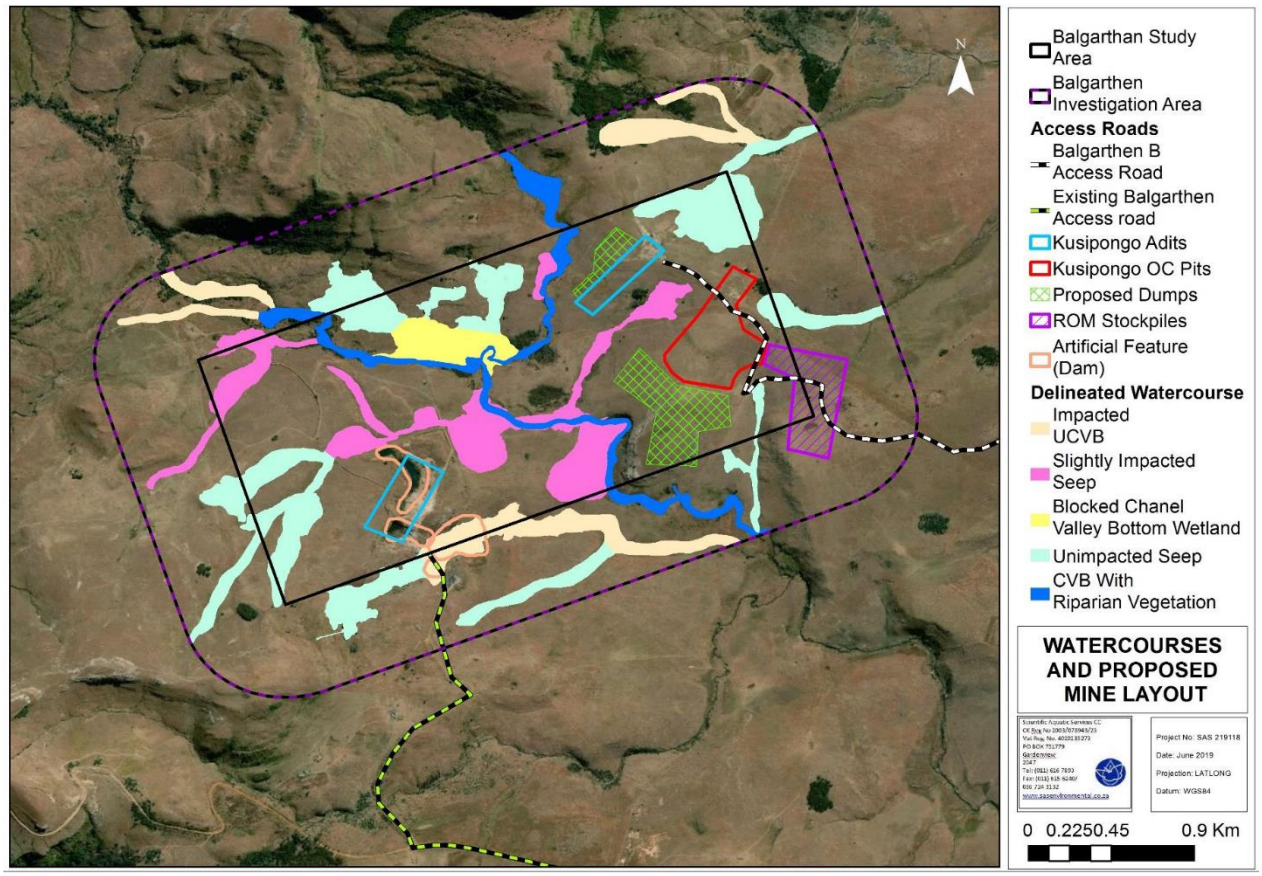
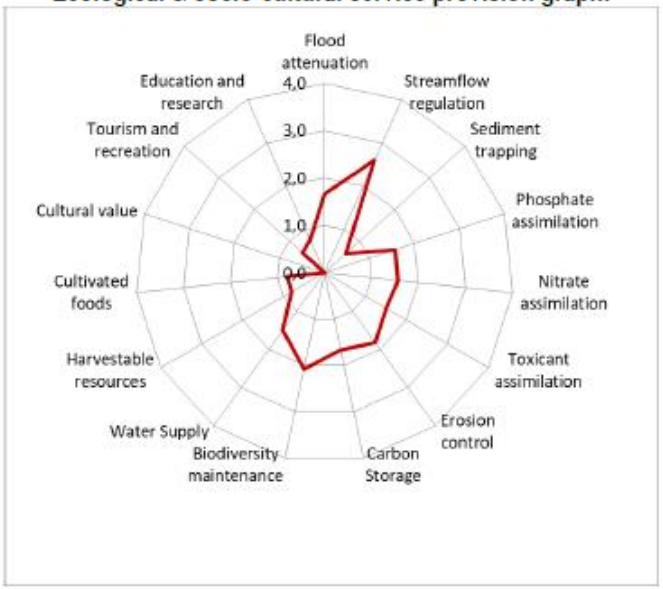


FIGURE 9-27: DELINEATED WATERCOURSES ASSOCIATED WITH THE BALGARTHEN FOCUS AREA

TABLE 9.17: SUMMARY OF THE ASSESSMENT OF HGM UNIT 1 (CVB WITH RIPARIAN VEGETATION) IN BALGARTHEN

Ecological & socio-cultural service provision graph:



PES discussion	**PES Category: Largely natural** The CVB wetland associated with riparian was found to be largely natural. Identified modifiers within the wetland include encroachment of alien riparian forests (wattle) which has resulted loss of soil stability and therefore erosion of soil within channel banks as well as changes to the structure of the vegetation along the active channel of the systems on site.
Ecoservice provision	**Intermediate** Despite the minor alterations to the CVB wetland, the extent to which the wetland provides ecoservices was found to be intermediate. Important ecoservices provided by the wetland include streamflow regulation, and to a lesser extent, biodiversity maintenance and carbon storage.

Photograph notes	Representative photographs of the channelled valley bottom wetland with riparian vegetation within the Balgarthen focus area.

Watercourse drivers:

a) Hydrology

The hydrology of the wetland has been slightly modified as a result of sediment loading within the wetland channel as a result of soil erosion from the disturbed channel banks. Flow within the wetland channel has also been disturbed by dense invasion of alien invasive species.

b) Water quality

Water quality within the wetland is likely to be unimpacted, minor impacts on the water quality occur as a result of trampling by cattle in areas adjacent to the wetland channel which has the potential to increase sediment reporting to the wetland.

c) Topography: Geomorphology and sediment balance

Desiccation of the soil as a result of increased alien vegetation increases soil erosion within the wetland and this further results in the loss of wetland geomorphic integrity.

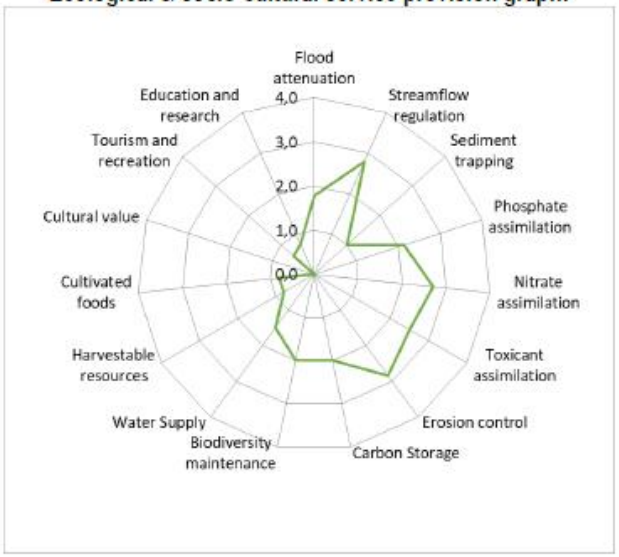
<table>
<tr><td rowspan="2">EIS discussion</td><td rowspan="2">EIS Category: Very high
The wetland EIS category was assessed to be Category A which are wetlands considered very sensitive to flow and habitat modifications. The wetland is considered to be of high importance due to its sensitivity to changing hydrological flows.</td><td colspan="2">d) Habitat and biota
Linked to the above, the loss of wetland geomorphic integrity as a result of soil desiccation and subsequent erosion limits the ability of the wetland to provide heterogenous habitat and limits establishment of diverse biota that are associated with wetlands. Dense patches of alien invasive species within the wetland channels further limit the establishment of indigenous vegetation.</td></tr>
<tr><td>REC Category</td><td>REC Category: B (Largely natural)
RMO: A/B (Improve)

The wetland was assessed to be largely natural and considered to be of high ecological importance and sensitivity, as a result these findings the recommended management objective (RMO) for the wetland is to improve the ecological class to A. Possible interventions to improve the ecological category would possibly include removal of alien and invasive species which have significantly encroached the wetland and therefore the Best Attainable State (BAS) for the wetland is an improvement of the wetland ecological state to a Category A (unmodified).</td></tr>
<tr><td colspan="4">Possible significant impacts, Business case, Conclusion and Mitigation Requirements:

The proposed alternative B does not intersect any portions of the CVB wetland associated with riparian vegetation. However, there is moderate risk of runoff and sedimentation of the CVB wetland due to the elevation of the eastern mine dumps in relation to the wetland. Given the ecological category of the wetland (Category B) and the very high ecological importance and sensitivity, maintenance of the ecological integrity of the wetland is considered critical for the HGM unit. Furthermore, it is deemed essential to manage any possible impacts in line with the mitigation hierarchy as defined in the mining and biodiversity guidelines.</td></tr>
</table>

TABLE 9.18: SUMMARY OF THE ASSESSMENT OF HGM UNIT 2 (IMPACTED UCVB WETLANDS) IN BALGARTHEN

Ecological & socio-cultural service provision graph:



PES discussion	**PES Category: B (Largely natural)** The UCVB wetland was defined as being in a largely natural ecological state with however discernible impacts from historical and on-going mining activities located within proximity of the wetland. Remaining box cut features from historical mining activities within the southern UCVB wetlands have filled with water and resulted in the formation of artificial dams which have altered instream flow and recharge patterns within the wetland. Dense alien vegetation encroachment was observed in the UCVB wetlands located within the northern-eastern and north-western part of the focus area.
Ecoservice provision	**Intermediate** Despite current modifications on the UCVB wetland as a result of historical mining activities, the extent to which the wetland supplies ecoservices was found to be intermediate. Important ecoservices provided by the wetland include streamflow regulation, nitrate assimilation and erosion.

Photograph notes	Representative photographs of the impacted unchannelled valley bottom wetland within the Balgarthen focus area. Three dams exist (left) within the wetland and these were formed as a result of historical mining activities.

Watercourse drivers:

a) Hydrology

The hydrology of the wetland has been modified extensively due to the presence of dams which are remnants of historical mining activities along with the impacts of decant from the existing box cuts.

b) Water quality

The water quality within the wetland is likely impacted as a result of decant from historical mining activities which has flown into the wetland. Measured water quality results were as following: EC – 105.8mS/m; TDS - 687mg/L and pH - 07.17.

c) Topography: Geomorphology and sediment balance

Evident disturbances of topography were observed within the wetland, these alterations have occurred due to the presence of informal access roads and largely as a result of the historical mining activities which disturbed the natural topography in the focus area.

d) Habitat and biota

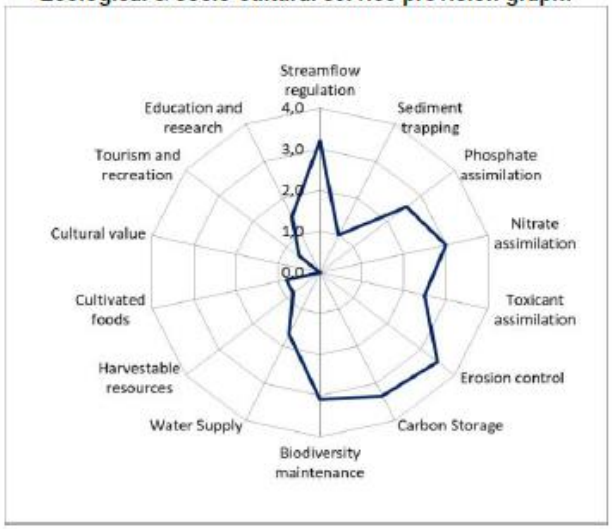
<table>
<tr><td rowspan="2">EIS discussion</td><td rowspan="2">EIS Category: High
The EIS of the wetland was found to be with Category B and these wetlands may be sensitive to flow and habitat modifications. The wetlands were found to be of high ecological importance and sensitivity due to their biodiversity support function.</td><td colspan="2">Habitat diversity within the UCVB wetland has been limited by the establishment of dense alien vegetation in parts of the wetland. Disturbance of soil due to historical mining activities within the wetland have in addition resulted in the loss of indigenous vegetation. The presence of the dams in addition limits the ability for emergent vegetation to grow.</td></tr>
<tr><td>REC Category</td><td>REC Category: B (Largely natural)
RMO: A/B (Improve)

The wetland was defined as being in a largely natural state and it was found be of high ecological importance and sensitivity. Based on these findings, the recommended management objective (RMO) for the UCVB wetland is to improve the wetland ecological class. However, considering the nature of the impacts being mostly permanent dams and impacts associated with the deterioration of water quality within the wetlands, the Best Attainable State is the current ecological state (Category B, largely natural).</td></tr>
<tr><td colspan="4">Possible significant impacts, Business case, Conclusion and Mitigation Requirements:

The UCVB wetland was found to be slightly impacted as a result of historical mining activities which have left portions of the HGM unit impacted by artificial dams. Whilst the significance of impact at the impact site is deemed to be significant, the cumulative impact of the proposed activities on a local or regional scale is currently considered to be of acceptably low levels. Furthermore, it is deemed essential to manage any possible future impacts in line with the mitigation hierarchy.</td></tr>
</table>

TABLE 9.19: SUMMARY OF THE ASSESSMENT OF HGM UNIT 3 (UNIMPACTED SEEPS) IN BALGARTHEN

Ecological & socio-cultural service provision graph:



PES discussion	**PES Category: Unmodified** The unimpacted / natural seep wetlands within the focus area were found to only have negligible impacts form livestock trampling have not altered the overall integrity of the wetland. Minor impacts on the wetland include alien invasive vegetation establishment.
Ecoservice provision	**Intermediate** The extent to which the unimpacted seep wetlands provide ecoservices was assessed to be medium. Within this wetland important ecoservices provided include erosion control, biodiversity maintenance and the assimilation of nitrates.
EIS discussion	**EIS Category: High** The EIS of the wetland was assessed to be within B which are wetlands with biodiversity that may be sensitive to flow and habitat modifications. Presence of rare and endangered species within the wetland and general biodiversity support of the wetland resulted in the wetland being considered of high ecological importance and sensitive.

Photograph notes	Representative photographs of the unimpacted seep wetlands within the Balgarthen focus area. Numerous areas where water seeps from fractured bedrock were observed within the wetland (right).

Watercourse drivers:

a) Hydrology

Seep wetlands are generally driven by vadose zone and groundwater daylighting on surface due to impermeable layers of sandstone that outcrop at various levels in the landscape. Some recharge rain derived water flowing downslope also occurs after rainfall events. The hydrology of the unimpacted seep wetland was observed to have no significant alterations. It is considered imperative that the hydrogeological processes and groundwater processes driving these wetlands are fully understood and to ensure to ensure that adequate planning of the mine layouts occur to ensure the levels of impact are acceptable.

b) Water quality

Water quality within the unimpacted seep wetland was observed to have not been modified.

c) Topography: Geomorphology and sediment balance

The topography within the seep was observed to be have no current impacts.

d) Habitat and biota

The vegetation within the seep wetland was found to be largely intact. Floral diversity within the wetland was considered to be high, comprising of species restricted to moisture-rich habitats such as areas within the landscape where water seeps. Minor alterations from alien vegetation establishment were also observed, but these were not considered highly significant at the time of assessment.

		REC Category	**REC Category: A (Unmodified)** **RMO: A (Maintain)** The Recommended Management Objective (RMO) for the wetland based on the PES and the EIS scores is to maintain the current wetland ecological category (A, unmodified). There should strictly be no mining activities within the wetland or the applicable zones of regulation of the wetland in order to maintain the current ecological category which is also considered the Best Attainable State (BAS) of the wetland.

Possible significant impacts, Business case, Conclusion and Mitigation Requirements:

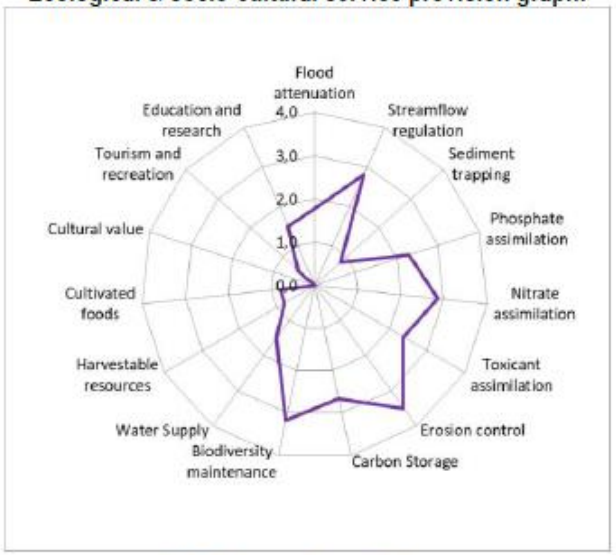
The proposed alternative B does not intercept any portions of the unimpacted seep wetlands. However, there is moderate risk of runoff and sedimentation of some seep wetlands due to the elevation of the eastern mine dumps in relation to the wetland. Most of the unimpacted seep wetlands are unlikely to be impacted by the proposed mining activities since:

1. Mining occurring in a different catchment to the wetland;
2. Mining occurring downgradient of the wetlands which is unlikely to be impacted by cone of depression impacts; and
3. Mining occurring on the other side of an intervening watercourse which forms the boundary of potential impact.

Given the ecological category of the wetland (Category A, unmodified) and the high ecological importance and sensitivity, maintenance of the ecological integrity of the wetland is considered critical for the HGM unit. It is therefore deemed critical that no mining activities takes place within these wetlands or within the associated zones of regulation.

TABLE 9.20: SUMMARY OF THE ASSESSMENT OF HGM UNIT 4 (SLIGHTLY IMPACTED SEEPS) IN BALGARTHEN

Ecological & socio-cultural service provision graph:



PES discussion	**PES Category: Unmodified** The seep wetland was assessed to occur in an unmodified ecological state, although there were identified impacts occurring within the wetland, these were found not to be significant to alter the ecological integrity of the wetland due to the extent of each identified impact in relation to the entire wetland.	**Photograph notes**	Representative photographs of the slightly impacted seep wetlands within the Balgarthen focus area.
Ecoservice provision	**Intermediate** Despite the wetland being assessed to be in an unmodified ecological state, the extent of ecoservice provision by the wetland was assessed to be intermediate. Important ecoservices provided by the wetland include nitrate assimilation, streamflow regulation and carbon storage.	**Watercourse drivers:** **a) Hydrology** Minor hydrological impacts were identified within the seep wetland, these include the presence of very small dams, from historical mining activities adjacent to the seep wetland and in addition the historical mining activities adjacent to parts of the wetland have also resulted in the creation of artificial channels which alter the wetland hydrological regime slightly. **b) Water quality** No significant impacts on the water quality of the seep wetland were identified, minor potential impacts from the adjacent historical mining activities are considered to possibly alter the water quality within the wetland. **c) Topography: Geomorphology and sediment balance** Erosion from informal access roads traversing within the wetland are considered to have had an impact on increasing the erosion potential of the soil within the wetland. Furthermore, compaction of soil for access roads increases sediment runoff and loss of organic matter within the soil. **d) Habitat and biota**		

<table>
<tr><td rowspan="2">EIS discussion</td><td rowspan="2">EIS Category: High

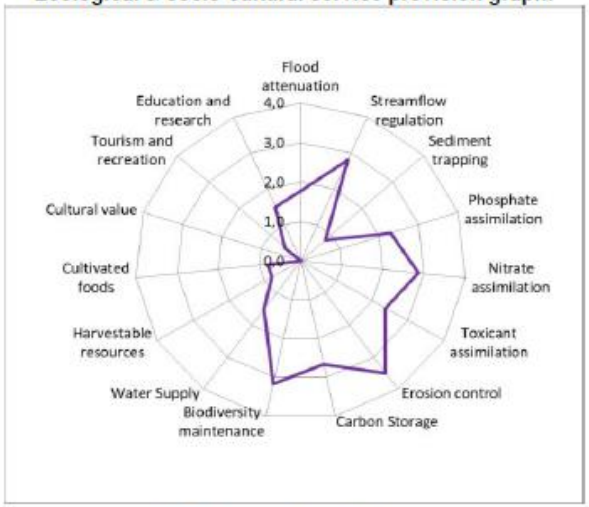
The EIS of the slightly impacted seep wetland was assessed to be within Category B which are wetlands which may be considered to be sensitive to flow and habitat modifications. These wetlands are considered to be of high ecological importance and sensitivity due to its ecological role for biodiversity support.</td><td colspan="2">Minor impacts on the wetland habitat have occurred as a result of informal access roads and soil erosion which have limited the areas in which vegetation could establish. However, in parts of the wetland where such impacts were not observed, floral diversity within these portions of the wetland was considered to be intact.</td></tr>
<tr><td>REC Category</td><td>REC Category: A (Unmodified)
RMO: A (Maintain)

The Recommended Management Objective (RMO) for the wetland based on the PES and the EIS scores is to maintain the ecological integrity of seep wetland (A, unmodified). No degradation of the wetland should be permitted and the Best Attainable State (BAS) which is the current ecological category must be maintained. Thus, mitigation measures should be implemented during all phases of the proposed development.</td></tr>
<tr><td colspan="4">Possible significant impacts, Business case, Conclusion and Mitigation Requirements:

These seep wetlands were found to be slightly impacted therefore given the sensitivity of these systems and the overall ecological category considered to be unmodified (Category A), maintaining wetland integrity is considered critical for the system. Furthermore, it is deemed essential to manage impacts in line with the mitigation hierarchy as defined in the mining and biodiversity guidelines by, in order, avoiding, minimising, rehabilitating and, as a last resort, offsetting latent impacts on the ecological integrity of the wetland.</td></tr>
</table>

TABLE 9.21: SUMMARY OF THE ASSESSMENT OF HGM UNIT 5 (BLOCKED CHANNEL UCVB PEAT WETLAND) IN BALGARTHEN

Ecological & socio-cultural service provision graph:



PES discussion	**PES Category: Unmodified** The ecological condition of the floodplain (peat) wetland was assessed to be unmodified and the ecological integrity considered to be intact. Identified impacts occurring within the wetland include impacts from cattle such as grazing and trampling.
Ecoservice provision	**Intermediate** The floodplain wetland was likelihood to provide ecoservices was assessed to be intermediate, however within the focus area this HGM unit was considered to provide highest ecoservices. Ecoservice provision considered most important within the wetland include carbon storage, erosion control and streamflow regulation.
EIS discussion	**EIS Category: Very High** The EIS of the slightly impacted seep wetland was assessed to be within Category A which are wetlands considered to be very sensitive to flow and habitat modification. The wetland ecological

Photograph notes	Representative photographs of the floodplain (peat) wetlands within the Balgarthen focus area.

Watercourse drivers:

a) Hydrology

The hydrology of the floodplain wetland was observed to be driven largely by the unimpacted wetland. Within the blocked UCVB peat wetland no significant impacts were observed.

b) Water quality

The water quality within the floodplain wetland is likely to be slightly modified by presence of cattle within the wetland and associated impacts such as trampling. However, since the hydrological driver is mainly the unimpacted seep wetland, the water quality of the floodplain can also be considered good.

c) Topography: Geomorphology and sediment balance

Trampling by cattle has impacts on the sediment balance within the floodplain wetland although these impacts are likely not to have a significant impact on the ecological integrity.

d) Habitat and biota

The trampling and grazing by livestock has resulted in the removal of natural wetland vegetation. Habitat provision is therefore considered to be altered (especially due to the invasion of some alien vegetation species), resulting in a lowered species diversity. For more information on habitat and biota, please refer to the Fauna and Flora Assessment conducted by SAS (SAS, 2019).

	importance and sensitivity is a function of its ecological sensitivity and to a limited extent on the hydro-functional importance.	**REC Category**	**REC Category: A (Unmodified)** **BAS: Category A (Unmodified)** **RMO: A (Maintain)** The Recommended Management Objective (RMO) for the wetland based on the PES and the EIS scores is to maintain the ecological integrity of floodplain wetland (Category A, unmodified). No degradation of the floodplain wetland ecological integrity should be allowed to take place.

Possible significant impacts, Business case, Conclusion and Mitigation Requirements:

The UCVB peat wetland is considered to be a very important wetland from a wetland conservation point of view because of their important roles such as provision of good quality water and storage of carbon due to the presence of some peat. Within the Donkerhoek focus area, this wetland was also found to be unmodified and identified to be of high ecological importance and sensitivity. Since peat wetlands are rare, they have a particularly important conservation value and support a particularly unique biological community. Therefore, mining activities which are likely to pose a threat to this wetland can be considered of critical risk significance.

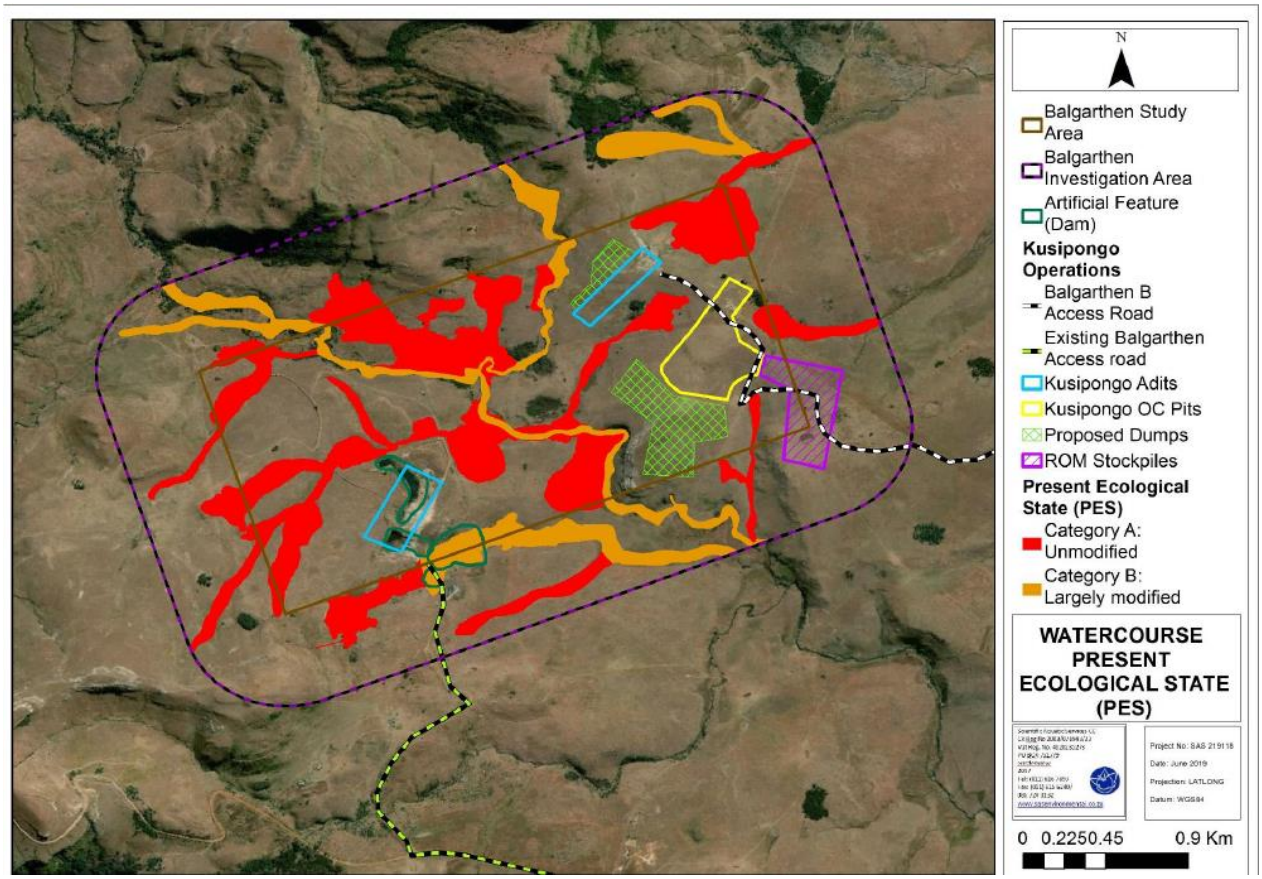


FIGURE 9-28: CONCEPTUAL ILLUSTRATION OF THE PES AT BALGARTHEN

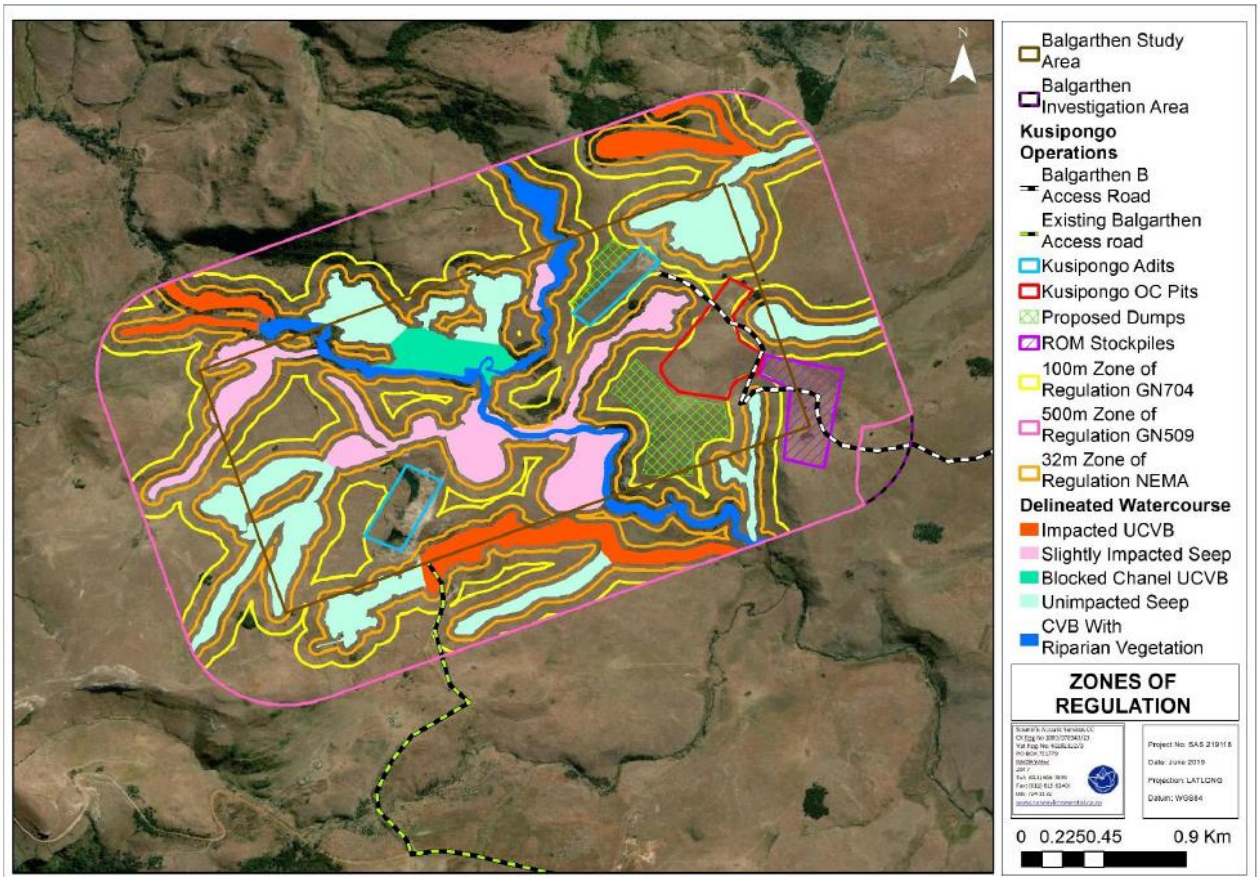


FIGURE 9-29: BALGARTHEN CONCEPTUAL PRESENTATION OF THE ZONES OF REGULATION

9.7.3 Aquatic Ecology

Best practice methodologies were used to assess the aquatic ecological integrity of the various sites based on water quality, instream and riparian habitat condition and biological impacts and integrity.

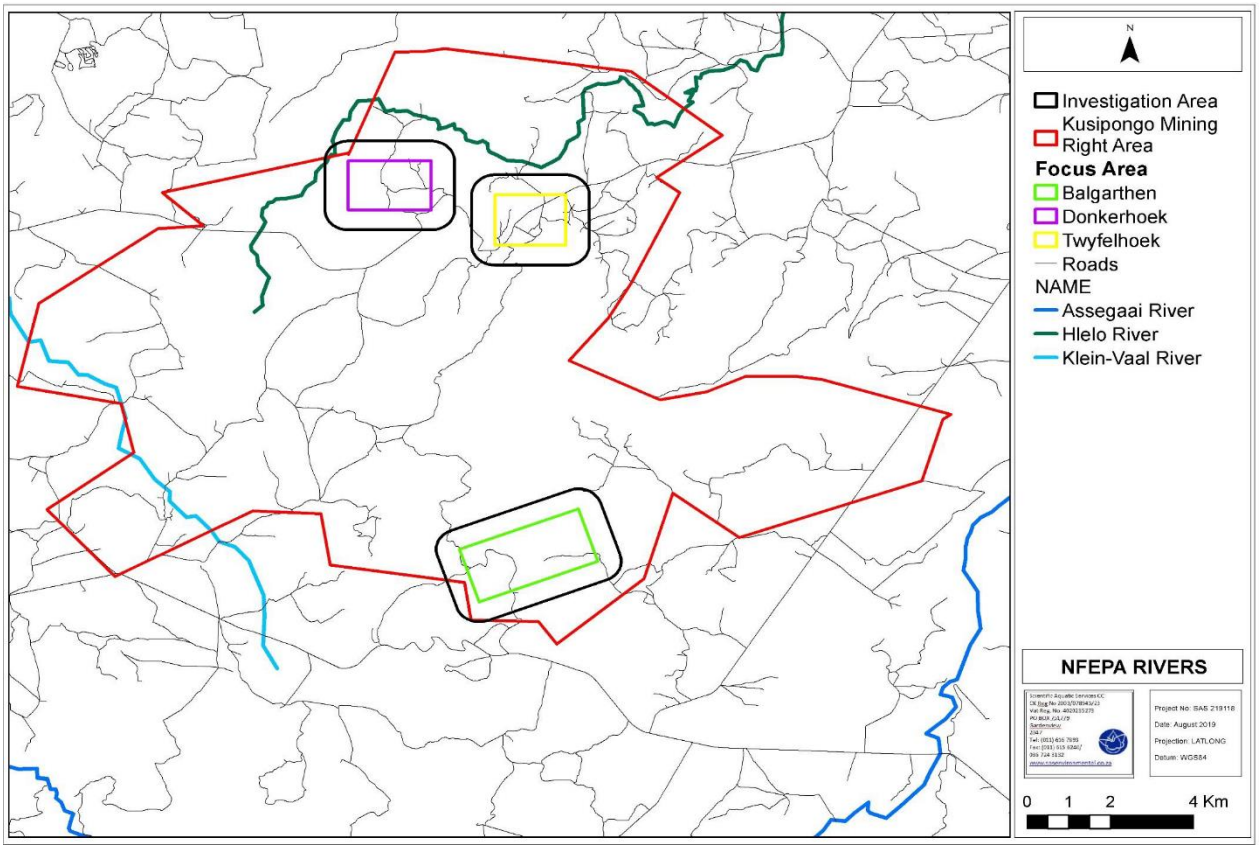


FIGURE 9-30: RIVERS ASSOCIATED WITH THE FOCUS AREAS ACCORDING TO THE NFEPA DATABASE

The PES/EIS database, as developed by the DWS RQIS department, was utilised to obtain additional background information on the project area. The information from this database is based on information at a sub-quaternary catchment reach (SQR) level, with the descriptions of the aquatic ecology based on the information collated by the DWS RQIS department from all reliable sources of reliable information such as SA RHP sites, EWR sites and Hydro WMS sites.

In this regard, information for sub-quaternary catchment reach (SQR) for the Hlelo River (W52A – 01983) and the Assegaai River (W51A – 02082) are applicable as the sites are located on tributaries of these rivers (See **Figure 9-30**). The summary of the ecological status of the relevant sub-quaternary catchment area is tabulated in **Table 9**.22 and **Table 9**.23**.**

TABLE 9.22: SUMMARY OF THE ECOLOGICAL STATUS OF THE SUB-QUATERNARY CATCHMENT REACH E51A 02082 (ASSEGAAI RIVER) BASED ON THE DWS PES/EIA DATABASE

Synopsis (SQ reach W51A - 02082 (Assegaai River))					
PES[1] category median	**Mean EI[2] class**	**Mean ES[3] class**	**Length**	**Stream order**	**Default EC[4]**
C (Moderately Modified)	High	Very High	84,87	1	Very High (A)
PES details					
Instream habitat continuity MOD		Small	**Riparian/wetland zone MOD**		Moderate
RIP/wetland zone continuity MOD		Moderate	**Potential flow MOD activities**		Moderate
Potential instream habitat MOD activities		Small	**Potential physico-chemical MOD activities**		Moderate
EI details					
Fish spp/SQ		11.00	**Fish average confidence**		4.82
Fish representivity per secondary class		Low	**Fish rarity per secondary class**		Very Low
Invertebrate taxa/SQ		61.00	**Invertebrate average confidence**		3.33
Invertebrate representivity per secondary class		Very High	**Invertebrate rarity per secondary class**		Very High
EI importance: riparian-wetland-instream vertebrates (excluding fish) rating		Low	**Habitat diversity class**		Very High
Habitat size (length) class		Very High	**Instream migration link class**		Very High
Riparian-wetland zone migration link		High	**Riparian-wetland zone habitat integrity class**		High
Instream habitat integrity class		Very High	**Riparian-wetland natural vegetation rating based on percentage natural vegetation in 500m**		High
Riparian-wetland natural vegetation rating based on expert rating					High
ES details					
Fish physical-chemical sensitivity description		Very High	**Fish no-flow sensitivity**		Very High
Invertebrates physical-chemical sensitivity description		Very High	**Invertebrates velocity sensitivity**		Very High
Riparian-wetland-instream vertebrates (excluding fish) intolerance water level/flow changes description					Very High
Stream size sensitivity to modified flow/water level changes description					Very High
Riparian-wetland vegetation intolerance to water level changes description					High

TABLE 9.23: SUMMARY OF THE ECOLOGICAL STATUS OF THE SUB-QUATERNARY CATCHMENT REACH W52A 01983 (HLELO RIVER) BASED ON THE DWS RQS PES/EIS DATABASE

Synopsis (SQ reach W52A – 01983 Hlelo River)					
PES[1] category median	Mean EI[2] class	Mean ES[3] class	Length	Stream order	Default EC[4]
B (Largely Natural)	High	Very High	2,93	1	Very High (A)
PES details					
Instream habitat continuity MOD		Small	Riparian/wetland zone MOD		Moderate
RIP/wetland zone continuity MOD		Moderate	Potential flow MOD activities		Small
Potential instream habitat MOD activities		Small	Potential physico-chemical MOD activities		Small
EI details					
Fish spp/SQ		12	Fish average confidence		3.67
Fish representivity per secondary class		Low	Fish rarity per secondary class		Moderate
Invertebrate taxa/SQ		56	Invertebrate average confidence		2.36
Invertebrate representivity per secondary class		Very High	Invertebrate rarity per secondary class		Very High
EI importance: riparian-wetland-instream vertebrates (excluding fish) rating		Low	Habitat diversity class		Moderate
Habitat size (length) class		Moderate	Instream migration link class		Very High
Riparian-wetland zone migration link		High	Riparian-wetland zone habitat integrity class		High
Instream habitat integrity class		Very High	Riparian-wetland natural vegetation rating based on percentage natural vegetation in 500m		Very High
Riparian-wetland natural vegetation rating based on expert rating					High
ES details					
Fish physical-chemical sensitivity description		Very High	Fish no-flow sensitivity		Very High
Invertebrates physical-chemical sensitivity description		Very High	Invertebrates velocity sensitivity		Very High
Riparian-wetland-instream vertebrates (excluding fish) intolerance water level/flow changes description					Very High
Stream size sensitivity to modified flow/water level changes description					High
Riparian-wetland vegetation intolerance to water level changes description					High

9.7.4 Aquatic Ecological Assessment

To avoid repetition, the following was applied to each of the aquatic dashboards detailed in Sections 9.7.4.1, 9.7.4.2 and 9.7.4.3;

- For pH "deterioration"/"improvement" significant changes were indicated using red text, as conditions at either end of the spectrum (either too acidic or too alkaline) pose a risk to aquatic systems;

- For Dissolved Oxygen (DO) percentage change is calculated using concentration values as measured in mg/L and not expressed in percentage saturation values. Classification of "deterioration"/ improvement" was thus not evaluated in terms of the guideline, but a change exceeding 15% was considered significant;
- For Electrical Conductivity (EC) percentage change is calculated using concentration values as measured in mg/L and classification of "deterioration"/ improvement" was evaluated in terms of the guideline (DWAF, 1996), which advocates that seasonal and temporal changes should not exceed 15%;
- Bold text = significant change (compared to guideline – DWAF, 1996), red text = significant deterioration and blue text = significant improvement;
- For the PT, ET, D1 and T2 sites, the following is applicable with regards to the FRAI scores: although no fish species were sampled at the time of the assessment, the reach was evaluated based on specialist experience and river characteristics, where species which are likely to occur from the expected species list were used in the FRAI model to establish a possible FRAI score. It should be noted that the FRAI score for the assessment point is of low confidence at this stage, with future monitoring the fish communities will be described accurately; and
- Abbreviations pertaining to the dashboards are as follows: NA = Not Applicable, Var = variation and ref = reference.

9.7.4.1 Balgarthen Focus Area

TABLE 9.24: RESULTS OF THE AQUATIC ECOLOGICAL ASSESSMENT AT SITE B1 (LOCATED IN THE NORTH-WESTERN CORNER OF THE BALGARTHEN FOCUS AREA ON A TRIBUTARY OF THE ASSEGAAI RIVER

Site B1

Algal proliferation	Isolated to rocks.
Depth profiles	The site is dominated by a slow shallow run over stones with scattered sections of Gravel Sand and Mud (GSM).
Flow condition	Under the present flow conditions, the flow can generally be considered as slow flowing runs.
Riparian zone characteristics	The riparian zone is dominated by grasses, shrubs and alien trees. Both banks well covered albeit with alien vegetation with limited areas of severe erosion.
Water clarity and odour	Water was clear under the current flow conditions. No odours evident.

SITE ECOSTATUS CATEGORY

Dallas (2007)	**Category B**
MIRAI	**Category C**
Instream IHI	**Category B/C**
Riparian IHI	**Category C/D**
VEGRAI	**Category B**
FRAI	**Category A**
Integrated Ecological Category	**79.5% (Category B/C)**

***In situ* physico-chemical water quality**

Parameter		RWQO (DWA, 2011)	
pH	7.55	**pH**	> 6.5 - < 8.4
EC (mS/m)	5.6	**EC (mS/m)**	< 30
DO (mg/ℓ)	6.78		
DO (% sat)	80.8		
Temp (℃)	15.8		

Index of Habitat Integrity

Instream IHI	79.9 (Category B/C)
Riparian IHI	58.1 (Category C/D)

Riparian Vegetation Response Assessment Index

VEGRAI score	83.4 (Category B)

Comment:

- The pH value complies with the recommended range as defined by the DWA, (2011). No adverse effects on the aquatic ecology are anticipated at the time of the assessment;
- Electrical Conductivity (EC) complies with the DWA (2011) recommendation (< 30 mS/m) and no adverse effects on the aquatic ecology is anticipated at the time of assessment;
- Dissolved oxygen (DO) saturation complies with the DWAF (1996) recommendation and no negative impact on the aquatic ecology was evident at the time of assessment. This observation is further substantiated by the flow of water which is likely to increase the DO saturation;
- Overall, any adverse effects on the biota specific water quality of the site is considered limited and the sensitivity of this system needs to be continually monitored to manage any potential adverse effects to the water quality if authorisation is approved.

Aquatic macro-invertebrate community integrity

Invertebrate community assessment (SASS5 and IHAS)		% Var. from ref. ecoregion data
SASS5 score	150	**-19.8**
ASPT score	6.3	-10.0
IHAS score	53 (Poor)	
Number of Taxa	24	

Fish Community Assessment

FRAI score	99.1 (Category A)
Species Present: *Chiloglanis emarginatus*	

Macro-invertebrate Response Assessment Index

MIRAI score	64.4 (Category C)

Comment:

- The site can be considered to be in a Category C condition according to the MIRAI EcoStatus tool, and in a Category B condition according to the SASS5 index;
- The macro-invertebrate habitat suitability can be regarded as poor at the time of the assessment, with a lack of diverse biotopes (specifically the presence of aquatic vegetation) at this point;
- The instream and riparian zones can be regarded as moderately natural to largely modified at the time of the assessment. Limited erosion is present at this assessment point, although signs of livestock trampling was observed upstream. Limited sedimentation was observed instream, although algae was isolated to the stone biotope;
- The fish community integrity (FRAI) at the site can be regarded as unmodified with a classification of Category A assigned at the time of the assessment. *Chiloglanis emarginatus* (the Phongolo Suckermouth), a vulnerable (VU) species according to the IUCN, 2018 due to declining habitat and system modifications such as dams and weirs, was sampled at the time of assessment.

Overall, the EcoStatus Category for the IHI, MIRAI, Dallas, VEGRAI and FRAI classifications comply with the RQIS PES (DWS, 2014) classification of Category C conditions for this tributary of the Assegaai River. The overall Integrated EcoStatus Category for the B1 site complies with the RQIS PES (DWS, 2014) classification and due to the sensitivity of the system, any further impact must be avoided.

TABLE 9.25: RESULTS OF THE AQUATIC ECOLOGICAL ASSESSMENT AT SITE B2 (LOCATED DOWNSTREAM OF THE B1 SITE, ON A TRIBUTARY OF THE ASSEGAAI RIVER)

Site B2

Algal proliferation	Isolated and associated with rocky substrate.
Depth profiles	The depth profile of the assessment point was limited to shallow runs over stones and cobbles. The low water crossing has affected depth profiles and habitat on a local scale.
Flow condition	Under the present flow conditions, shallow runs are present and flow can generally be considered as low. A low water crossing has had a critical impact on the continuity of the system and will affect fish migration.
Riparian zone characteristics	The riparian zone is dominated by grasses and scattered trees. Both banks well covered with limited indication of erosion.
Water clarity and odour	Water was very clear under the current flow conditions. No odours were present at the time of the assessment.

***In situ* physico-chemical water quality**

Parameter		**Spatial var. from site B1**	**RWQO (DWA, 2011)**	
pH	8.08	**+7.0**	**pH**	> 6.5 - < 8.4
EC (mS/m)	10.0	**+78.6**	**EC (mS/m)**	< 30
DO (mg/ℓ)	6.45	-4.9		
DO (% sat)	77.0	-4.7		
Temp (C)	16.70	+5.7		

Index of Habitat Integrity

Instream	79.9 (Category B/C)
IHI Riparian	58.1 (Category C/D)
IHI	

Riparian Vegetation Response Assessment Index

VEGRAI score	81.1 (Category B/C)

Comment:

- The pH value complies with the recommended range as defined by the DWA, (2011). No adverse effects on the aquatic ecology are anticipated at the time of assessment;
- The EC complies with the DWA (2011) recommendation (< 30 mS/m) and no adverse effects on the aquatic ecology are anticipated at the time of assessment. It is notable that a significant increase in EC took place, considering percentages, although the absolute value of the variation is limited. It unknown what is driving this variation;
- The saturation of DO can be considered as inadequate in supporting a diverse and sensitive aquatic community as it falls below the recommended 80% saturation range stipulated by DWAF (1996), however, at 77.0% saturation, it is unlikely that significant adverse effects on the aquatic community will occur as a result ofDO;
- Overall, any adverse effects on the biota specific water quality of the site is considered limited and the sensitivity of this system needs to be regularly monitored throughout the life of mine (especially the DO concentration) to manage any potential adverse effects to the water quality.

Aquatic macro-invertebrate community integrity

Invertebrate community assessment (SASS5 and IHAS)		**% Var. from ref. ecoregion data**	**Spatial var. from site B1**
SASS5 score	88	**-28.5**	**-41.3**
ASPT score	6.3	+12.5	0.0
IHAS score	50 (Poor)		-5.7
Number of Taxa	14		

Fish Community Assessment

FRAI score	99.0 (Category A)
Species Present: *Chiloglanis emarginatus, Enteromius argenteus, Pseudocrenilabrus philander* and *Tilapia sparrmanii.*	

Macro-invertebrate Response Assessment Index

MIRAI score	62.5 (Category C)

Comment:

- The site can be considered to be in a Category C condition according to the MIRAI EcoStatus tool, and in a Category A condition according to the SASS5 index;
- The macro-invertebrate habitat suitability can be regarded as poor at the time of the assessment, with the presence of relatively slow flowing water but limited aquatic vegetation at this point. The latter will likely limit the diversity and sensitivity of the vegetation-specific aquatic community expected at this site;
- The instream and riparian zones can be regarded as moderately natural to largely modified at the time of the assessment. The riparian zone is unimpacted by erosion and sedimentation in the instream zone;
- The fish community integrity (FRAI) at the site can be regarded as unmodified with a classification of Category A assigned at the time of the assessment. *Chiloglanis emarginatus* [VU species (IUCN, 2018)], *Enteromius argenteus, Pseudocrenilabrus philander* and *Tilapia sparrmanii* were sampled at the time of assessment.

SITE ECOSTATUS CATEGORY

Dallas (2007) MIRAI Instream	**Category A Category C Category B/C**
IHI Riparian	**Category C/D**

Overall, the EcoStatus Category for the IHI, MIRAI, Dallas, VEGRAI and FRAI classifications comply with the RQIS PES (DWS, 2014) classification of Category C conditions for this tributary of the Assegaai River. The overall Integrated EcoStatus Category for the B2 site complies with the RQIS PES (DWS, 2014) classification and due to the sensitivity of the system, any further impact must be avoided.

IHI **VEGRAI** **FRAI**	**Category** **B/C** **Category A**	
Integrated Ecological Category	**77.8% (Category C)**	

TABLE 9.26: RESULTS OF THE AQUATIC ECOLOGICAL ASSESSMENT AT SITE PT (LOCATED OUTSIDE OF THE BALGARTHEN FOCUS AREA ON THE EXISTING BALGARTHEN ACCESS ROAD)

Site PT

Algal proliferation	Limited in extent to the rocky substrate.
Depth profiles	The site is dominated by a deep run. Depth is generally > ½ m.
Flow condition	Under the present flow conditions, flow can generally be considered as slow to still. A degree of inundation is present upstream due to the established pipe culverts.
Riparian zone characteristics	The riparian zone is primarily dominated by grasses, with scattered shrubs and trees. Both banks are generally well covered with some indication of erosion as a result of livestock trampling.
Water clarity and odour	Water was clear under the current flow conditions but blanketing of benthos was noted. No odours evident.

SITE ECOSTATUS CATEGORY

Dallas (2007)	**Category A**
MIRAI	**Category C**
Instream IHI	**Category B/C**
Riparian IHI	**Category C/D**
VEGRAI	**Category C**

***In situ* physico-chemical water quality**

Parameter		RWQO (DWA, 2011)	
pH	8.12	**pH**	> 6.5 - < 8.4
EC (mS/m)	12.4	**E C (mS/m)**	< 30
DO (mg/ℓ)	5.82		
DO (% sat)	68.5		
Temp (˚C)	17.10		

Index of Habitat Integrity

Instream IHI	79.9 (Category B/C)
Riparian IHI	58.1 (Category C/D)

Riparian Vegetation Response Assessment Index

VEGRAI score	75.6 (Category C)

Comment:

- The pH value complies with the recommended range as defined by the DWA, (2011). No adverse effects on the aquatic ecology are anticipated at the time of assessment;
- The EC complies with the DWA (2011) recommendation (< 30 mS/m) and no adverse effects on the aquatic ecology are anticipated at the time of assessment;
- The saturation of DO can be considered as low and inadequate in supporting a diverse and sensitive aquatic community as it falls below the recommended 80% saturation limit (DWAF, 1996) and some impact on sensitive biota is anticipated at the time of assessment. It is likely that the disturbance in flow (pipes seen in Figure 16) compounded by seasonality (low flow) has affected the DO concentration at the PT site;
- Overall, any significant adverse effects on the biota specific water quality of the site as a result of catchment activities is considered to be limited at the time of assessment, however, special attention needs to be paid to the DO concentration and saturation in future assessments.

Aquatic macro-invertebrate community integrity

Invertebrate community assessment (SASS5 and IHAS)		% Var. from ref. ecoregion data
SASS5 score	143	-23.5
ASPT score	7.5	+7.1
IHAS score	55 (Adequate)	
Number of Taxa	19	

Fish Community Assessment

FRAI score	41.2 (Category D/E)

Species Present: None (see bullet point in Section 4.1 regarding FRAI)

Macro-invertebrate Response Assessment Index

MIRAI score	66.1 (Category C)

Comment:

- The site can be considered to be in a Category C condition according to the MIRAI EcoStatus tool, and in a Category A condition according to the SASS5 index;
- The macro-invertebrate habitat suitability can be regarded as adequate at the time of the assessment, with adequate presence of aquatic vegetation at this point. However, lack of strong flowing water (likely due to the pipe observed in Figure 16) and blanketing of benthos with sediment is likely to limit the diversity and sensitivity of the vegetation-specific aquatic community expected at this site;
- The instream and riparian zones can be regarded as moderately natural to largely modified at the time of the assessment. The riparian zone has undergone slight clearing due to the established pipe culvert and trampling has also caused a degree of erosion. A degree of sedimentation and blanketing of benthos was observed instream at the time of the assessment;
- The fish community structure was classed Largely to Seriously Modified (Category D/E). The altered fish community structure is primarily due to the changes in natural flow regime as well as migrational barriers such as low-level crossings and weirs within the reach.

Overall, the EcoStatus Category for the IHI, MIRAI, Dallas and VEGRAI classifications comply with the RQIS PES (DWS, 2014) classification of Category C conditions for this tributary of the Assegaai River. The FRAI classification does not comply with RQIS PES (DWS, 2014) classification. The overall Integrated EcoStatus Category for the PT site complies with the RQIS PES (DWS, 2014) classification and due to the sensitivity of the system, any further impact must be avoided.

FRAI	**D/E**	
Integrated Ecological Category	**75.1% (Category C)**	

TABLE 9.27: RESULTS OF THE AQUATIC ECOLOGICAL ASSESSMENT AT SITE ET (LOCATED WITHIN THE BALGARTHEN FOCUS AREA, APPROXIMATELY 457 M SOUTH-WEST OF THE PROPOSED ADIT (2) ON A TRIBUTARY OF THE ASSEGAAI RIVER)

Site ET

Algal proliferation	Slight algal proliferation, limited to the rocky substrate.
Depth profiles	The assessment site was mainly characterised by slow flowing runs.
Flow condition	Under the present flow conditions, runs are present and flow can generally be considered as slow.
Riparian zone characteristics	The riparian zone is dominated by grasses, shrubs and trees. Both banks well covered with limited indication of erosion. Livestock watering was evident at the time of the assessment.
Water clarity and odour	Water was very clear. No odours evident.

SITE ECOSTATUS CATEGORY	
Dallas (2007)	**Category B**
MIRAI	**Category C**
Instream IHI	**Category B/C**
Riparian IHI	**Category C/D**
VEGRAI	**Category B/C**
FRAI	**Category A**
Integrated Ecological Category	**77.7% (Category C)**

In situ physico-chemical water quality

Parameter		**RWQO (DWA, 2011)**	
pH	8.30	**pH**	> 6.5 - < 8.4
EC (mS/m)	7.0	**EC (mS/m)**	< 30
DO (mg/ℓ)	7.07		
DO (% sat)	83.6		
Temp (℃)	16.40		

Index of Habitat Integrity

Instream IHI	79.9 (Category B/C)
Riparian IHI	58.1 (Category C/D)

Riparian Vegetation Response Assessment Index

VEGRAI score	77.7 (Category B/C)

Comment:

- The pH value complies with the recommended range as defined by the DWA, (2011). No adverse effects on the aquatic ecology are anticipated at the time of assessment;
- EC complies with the DWA (2011) recommendation (< 30 mS/m) and no adverse effects on the aquatic ecology are anticipated at the time of assessment;
- The DO saturation complies with the DWAF (1996) recommendation and no negative impact on the aquatic ecology was evident at the time of assessment.

Aquatic macro-invertebrate community integrity

Invertebrate community assessment (SASS5 and IHAS)		**% Var. from ref. ecoregion data**
SASS5 score	103	**-44.9**
ASPT score	6.4	-8.6
IHAS score	52 (Poor)	
Number of Taxa	16	

Fish Community Assessment

FRAI score	41.2 (Category D/E)

Species Present: None (see bullet point in Section 4.1 regarding FRAI)

Macro-invertebrate Response Assessment Index

MIRAI score	65.8 (Category C)

Comment:

- The site can be considered to be in a Category C condition according to the MIRAI EcoStatus tool, and in a Category B condition according to the SASS5 index;
- The macro-invertebrate habitat suitability can be regarded as poor at the time of the assessment, with a lack of relatively strong flowing water and limited aquatic vegetation at this point. The latter will likely limit the diversity and sensitivity of the vegetation-specific aquatic community expected at this site;
- The instream and riparian zones can be regarded as moderately natural to largely modified at the time of the assessment. The instream zone has undergone limited anthropogenic impacts, although slight algal proliferation isolated to stones was observed at the time of the assessment. *Acacia mearnsii* stands have significantly impacted on the riparian zone at present.
- The fish community structure was classed Largely to Seriously Modified (Category D/E).

Overall, the EcoStatus Category for the IHI, MIRAI, Dallas and VEGRAI classifications comply with the RQIS PES (DWS, 2014) classification of Category C conditions for this tributary of the Assegaai River. The FRAI classification does not comply with RQIS PES (DWS, 2014) classification. The overall Integrated EcoStatus Category for the ET site complies with the RQIS PES (DWS, 2014) classification and due to the sensitivity of the system, any further impact must be avoided.

TABLE 9.28: RESULTS OF THE ASSESSMENT AT SITE NT (LOCATED WITHIN THE BALGARTHEN FOCUS AREA, APPROXIMATELY 76 M WEST OF THE PROPOSED DUMP AND THE BD SITE (LOCATED IN THE BALGARTHEN FOCUS AREA, APPROXMATELY 302 M SOUTH-EAST OF THE PROPOSED ADIT)

Site NT

***In situ* physico-chemical water quality**

Parameter		Var. from reference site B1	RWQO (DWA, 2011)	
pH	8.11	**+7.4**	**pH**	> 6.5 - < 8.4
EC (mS/m)	8.0	**+42.9**	**EC (mS/m)**	< 30
DO (mg/L)	4.88	**-28.0**		
DO (% sat)	59.8	**-26.0**		
Temp (℃)	17.6	+11.4		

Comment:

- The pH value complies with the recommended range as defined by the DWA RWQO's (2011). No adverse effects on the aquatic ecology is anticipated at the time of assessment;
- EC complies with the DWA (2011) recommendation (< 30 mS/m) and no adverse effects on the aquatic ecology is anticipated at the time of assessment;
- The saturation of DO can be defined as low and inadequate in supporting a diverse and sensitive aquatic community as it falls below the recommended 80% saturation limit (DWAF, 1996) and some impact on sensitive biota is anticipated at the time of assessment. It is likely that seasonality (low flow) has affected the DO concentration at the NT site;
- When compared to the reference B1 site, there are indications that some impact is occurring in which pH, dissolved salts (EC) and DO are affected at the NT site. It is likely that should the proposed mining activities proceed, further impact on the NT site is possible.

Site BD

***In situ* physico-chemical water quality**

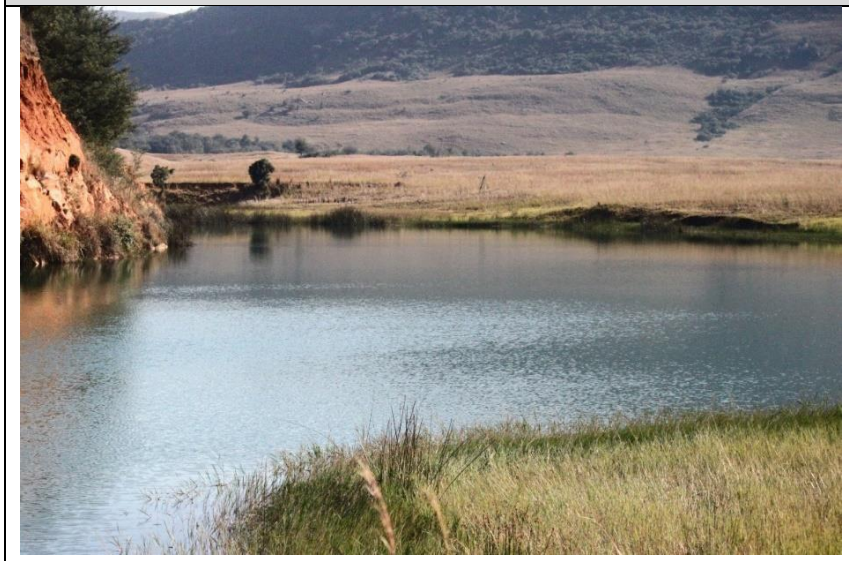
Parameter		Var. from reference site B1	RWQO (DWA, 2011)	
pH	7.72	+2.3	**pH**	> 6.5 - < 8.4
EC	19.2	**+242.9**	**EC (mS/m)**	< 30
(mS/m)	6.15	-9.3		
DO	74.4	-7.9		
(mg/L)	1.1	-93.0		
DO (% sat) Temp (℃)				

Comment:

- The pH value complies with the recommended range as defined by the DWA RWQO's (2011). No adverse effects on the aquatic ecology is anticipated at the time of assessment;
- EC complies with the DWA (2011) recommendation (< 30 mS/m) and no adverse effects on the aquatic ecology is anticipated at the time of assessment;
- The saturation of DO can be considered as low and inadequate in supporting a diverse and sensitive aquatic community as it falls below the recommended 80% saturation limit (DWAF, 1996) and some impact on sensitive biota is anticipated at the time of assessment. It is likely due to the lack of flow and stagnant conditions (as the site is a dam) compounded by seasonality (low flow) affecting the DO concentration at the BD site;
- When compared to the reference site B1, significant (> 15%) increase of 242.9% in EC is noted and should be monitored closely.

TABLE 9.29: RESULTS OF THE ASSESSMENT AT SITE BCD1 [LOCATED WITHIN THE BALGARTHEN FOCUS AREA, NORTH-WEST OF THE AREA FOR THE PROPOSED ADIT (1)] AND THE BCD2 SITE [LOCATED WITHIN THE BALGARTHEN FOCUS AREA, WITHIN THE AREA FOR THE PROPOSED ADIT (1)].

Site BCD1



***In situ* physico-chemical water quality**

Parameter		Var. from reference site B1	RWQO (DWA, 2011)	
pH	7.38	-2.3	pH	> 6.5 - < 8.4
EC (mS/m)	23.0	**+310.7**	EC (mS/m)	< 30
DO (mg/L)	5.22	**-23.0**		
DO (% sat)	64.6	**-20.0**		
Temp (°C)	18.1	+14.6		

Comment:

- The pH value complies with the recommended range as defined by the DWA RWQO's (2011). No adverse effects on the aquatic ecology is anticipated at the time of assessment;
- EC complies with the DWA (2011) recommendation (< 30 mS/m) and no adverse effects on the aquatic ecology is anticipated at the time of assessment;
- The saturation of DO can be considered as low and inadequate in supporting a diverse and sensitive aquatic community as it falls below the recommended 80% saturation limit (DWAF, 1996) and some impact on sensitive biota is anticipated at the time of assessment. It is likely due to the lack of flow and stagnant conditions (as the site is a dam) compounded by seasonality (low flow) affecting the DO concentration at the BD site.

Site BCD2

***In situ* physico-chemical water quality**

Parameter		Var. from reference site B1	Var. from site BCD1	RWQO (DWA, 2011)	
pH	7.17	**-5.0**	-2.8	pH	> 6.5 - < 8.4
EC (mS/m)	105.8	**+1789.3**	**+360.0**	EC (mS/m)	< 30
DO (mg/L)	12.97	**+91.3**	**+148.5**		
DO (% sat)	162.9	**+101.6**	**+152.2**		
Temp (°C)	18.7	+18.4	+3.3		

	**Comment:** ➢ The pH value complies with the recommended range as defined by the DWA RWQO's (2011). No adverse effects on the aquatic ecology is anticipated at the time of assessment; ➢ The EC can be regarded as significantly elevated from natural conditions (> 30 mS/m). Potential adverse effects on sensitive taxa in the aquatic community is deemed possible at the time of assessment. It is likely that historic mining activities have resulted in the elevated dissolved salt concentration at this site considering it is an old box cut; ➢ The DO saturation can be considered as adequate in supporting a diverse and sensitive aquatic community, as it complies with the 80% saturation recommendation (DWAF, 1996), and no impact on the aquatic ecology is anticipated at the time of assessment.

9.7.4.2 Donkerhoek Focus Area

TABLE 9.30: RESULTS OF THE AQUATIC ECOLOGICAL ASSESSMENT AT SITE D1 (LOCATED DIRECTLY NORTH OF THE DONKERHOEK FOCUS AREA, ON A TRIBUTARY OF THE HLELO RIVER)

Site D1

Algal proliferation	Limited to rocks.
Depth profiles	The depth varied from shallow runs over cobble and stones to deeper pools caused by the low-level bridge constructed from stones which has caused a degree of inundation.
Flow condition	Under the present flow conditions, pools and runs are present and flow can generally be considered as slow.
Riparian zone characteristics	The riparian zone is dominated by shrubs and trees. Both banks well covered with limited indication of erosion.
Water clarity and odour	Water was clear under the current flow conditions. Odours associated with defecating livestock was present at the time of the assessment

SITE ECOSTATUS CATEGORY

Dallas (2007)	**Category B**
MIRAI	**Category D**
Instream	**Category C**

***In situ* physico-chemical water quality**

Parameter		**RWQO (DWA, 2011)**	
pH	7.69	**pH**	> 6.5 - < 8.4
EC (mS/m)	13.8	**EC (mS/m)**	< 30
DO (mg/ℓ)	6.17		
DO (% sat)	70.0		
Temp (℃)	13.5		

Index of Habitat Integrity

Instream	76.2 (Category C)
IHI Riparian	71.4 (Category C)
IHI	

Riparian Vegetation Response Assessment Index

VEGRAI score	62.9 (Category C)

Comment:

- The pH value complies with the recommended range as defined by the DWA, (2011). No adverse effects on the aquatic ecology is anticipated at the time of assessment;
- EC complies with the DWA (2011) recommendation (< 30 mS/m) and no adverse effects on the aquatic ecology is anticipated at the time of assessment;
- The saturation of DO can be considered low and inadequate in supporting a diverse and sensitive aquatic community as it falls below the recommended 80% saturation limit (DWAF, 1996) and some impact on sensitive biota is anticipated at the time of assessment. It is likely that the disturbance in flow (rocks seen in Figure 23) compounded by livestock trampling and seasonality (low flow) has affected the DO concentration at the D1 site.

Aquatic macro-invertebrate community integrity

Invertebrate community assessment (SASS5 and IHAS)		**% Var. from ref. ecoregion data**
SASS5 score	61	**-50.4**
ASPT score	5.1	-8.9
IHAS score	47 (Poor)	
Number of Taxa	12	

Fish Community Assessment

FRAI score	44.7 (Category D)

Species Present: None (see bullet point in Section 4.1 regarding FRAI)

Macro-invertebrate Response Assessment Index

MIRAI score	55.8 (Category D)

Comment:

- The site can be considered to be in a Category D condition according to the MIRAI EcoStatus tool, and in a Category B condition according to the SASS5 index;
- The macro-invertebrate habitat suitability can be regarded as poor at the time of the assessment, with a lack of strong flowing water and limited aquatic vegetation at this point. The latter will likely limit the diversity and sensitivity of the vegetation-specific aquatic community expected at this site;
- The instream and riparian zones can be regarded as largely natural to moderately modified at the time of the assessment. Excessive trampling has caused a degree of erosion within the riparian zone which has caused sedimentation instream. A low-level bridge has also altered the natural flow regimes of which a caused inundation upstream. The informal road crossing constructed from rock fill have also affected the connectivity of the tributary of the Hlelo River which may be limiting the use of this tributary for potamodromous fish species;
- The fish community integrity (FRAI) at the site can be regarded as largely modified (Category D). The altered fish community structure is primarily due to the changes in natural flow regime as well as migrational barriers such as low-level crossings and weirs within the reach.

Overall, the EcoStatus Category for the Dallas classification complies with the RQIS PES (DWS, 2014) classification of Category B conditions for this tributary of the Hlelo River, however, Ecostatus categories for MIRAI, FRAI, VEGRAI and IHI do not comply with the RQIS PES classification. The overall Integrated EcoStatus Category for the D1 site does not comply with the RQIS PES (DWS, 2014) classification and this is indicative of some impact to the system prior to proposed Donkerhoek mining activities and thus any further impact must be avoided.

IHI Riparian **IHI VEGRAI** **FRAI**	**Category C** **Category C** **Category D**	
Integrated Ecological Category	**66.2% (Category C)**	

TABLE 9.31: RESULTS OF THE ASSESSMENT AT SITE DD (LOCATED WITHIN THE DONKERHOEK FOCUS AREA, APPROXIMATELY 118 M SOUTH EAST OF THE PROPOSED DONKERHOEK OPENCAST PIT)

Site DD

***In situ* physico-chemical water quality**

Parameter		Var. from reference site D1	RWQO (DWA, 2011)	
pH	8.54	+7.3	pH	> 6.5 - < 8.4
EC	7.9	-42.8	EC (mS/m)	< 30
(mS/m)	6.93	+12.3		
DO (mg/L)	82.7	+18.1		
DO (% sat) Temp (℃)	15.4	+14.1		

Comment:

- The pH value slightly exceeds the recommended range as defined by the DWA RWQO's (2011). Some adverse effects on the aquatic ecology is anticipated at the time of assessment;
- EC complies with the DWA (2011) recommendation (< 30 mS/m) and no adverse effects on the aquatic ecology are anticipated at the time of assessment;
- The DO saturation complies with the DWAF (1996) recommendation and no negative impact on the aquatic ecology was evident at the time of assessment.

TABLE 9.32: RESULTS OF THE ASSESSMENT AT THE DONKER SPRING SITES. SITE DSW (APPROXIMATELY 163 M WEST OF THE PROPOSED DONKERHOEK OPENCAST PIT) AND SITE DSE (APPROXIMATELY 137 M SOUTH OF THE PROPOSED DUMP AND NORTH OF THE NORTHERN ACCESS ROAD)

Donker Spring Sites (DSW and DSE)

***In situ* physico-chemical water quality**

Parameter	DSW	DSE	RWQO (DWA, 2011)	
pH	7.69	8.12	pH	> 6.5 - < 8.4
EC (mS/m)	7.0	10.5	EC (mS/m)	< 30
DO (mg/L)	6.65	7.85		
DO (% sat)	75.7	85.8		
Temp (℃)	13.3	11.4		

Comment:

- The pH value for both sites (DSW and DSE) comply with the recommended range as defined by the DWA RWQO's (2011). No adverse effects on the aquatic ecology are anticipated at either of the sites at the time of assessment;
- EC complies with the DWA (2011) recommendation (< 30 mS/m) for both sites and no adverse effects on the aquatic ecology are anticipated at the time of assessment;
- At the DSW site, the DO percentage saturation can be considered as inadequate in supporting a diverse and sensitive aquatic community as it falls below the recommended 80% saturation range stipulated by DWAF (1996), however, at 75.7% saturation, it is unlikely that significant adverse effects on the aquatic community will occur as a result of DO;
- The DO percentage saturation at site DSE is considered adequate in supporting diverse and sensitive aquatic communities and no adverse effect will occur as a result of DO;
- Overall, any significant adverse effects on the biota specific water quality of both the DSW and DSE sites as a result of catchment activities is considered to be limited at the time of assessment.

9.7.4.3 Twyfelhoek Focus Area

TABLE 9.33: RESULTS OF THE AQUATIC ECOLOGICAL ASSESSMENT AT SITE T1 (LOCATED ON A TRIBUTARY OF THE HLELO RIVER BELOW THE NORTHERN ACCESS ROAD WITHIN THE TWYFELHOEK FOCUS AREA AND SERVES AS A SPATIAL REFERENCE SITE FOR THE T2 SITE)

Site T1

Algal proliferation	None observed.
Depth profiles	The depth varied from shallow runs over cobble and stones to deeper pools. Shallow runs dominated the site.
Flow condition	Under the present flow conditions, pools and runs are present and flow can generally be considered as moderate.
Riparian zone characteristics	The riparian zone is dominated by grasses, shrubs and alien trees. Both banks well covered albeit with alien vegetation with limited areas of severe erosion.
Water clarity and odour	Water was discoloured under the current flow conditions. No odours was evident at the of the assessment.

SITE ECOSTATUS CATEGORY	
Dallas (2007)	**Category A**
MIRAI	**Category C**
Instream IHI	**Category C**
Riparian IHI	**Category C**
VEGRAI	**Category C**
FRAI	**Category A**
Integrated Ecological Category	**73.3% (Category C)**

***In situ* physico-chemical water quality**

Parameter		**RWQO (DWA, 2011)**	
pH	7.66	**pH**	> 6.5 - < 8.4
EC (mS/m)	11.9	**EC (mS/m)**	< 30
DO (mg/ℓ)	8.87		
DO (% sat)	89.2		
Temp (℃)	8.7		

Index of Habitat Integrity

Instream IHI	76.2 (Category C)
Riparian IHI	71.4 (Category C)

Riparian Vegetation Response Assessment Index

VEGRAI score	68.9 (Category C)

Comment:

- The pH value complies with the recommended range as defined by the DWA, (2011). No adverse effects on the aquatic ecology is anticipated at the time of assessment;
- The EC complies with the DWA (2011) recommendation (< 30 mS/m) and no adverse effects on the aquatic ecology is anticipated at the time of assessment;
- The DO saturation complies with the DWAF (1996) recommendation and no negative impact on the aquatic ecology was evident at the time of assessment;
- Overall, any adverse effects on the biota specific water quality of the site is considered limited and the sensitivity of this system needs to be continually monitored to manage any potential adverse effects to the water quality.

Aquatic macro-invertebrate community integrity

Invertebrate community assessment (SASS5 and IHAS)		**% Var. from ref. ecoregion data**
SASS5 score	108	-12.2
ASPT score	6.4	+14.3
IHAS score	48 (Poor)	
Number of Taxa	17	

Fish Community Assessment

FRAI score	99.3 (Category A)
Species Present: *Enteromius brevipinnis*	

Macro-invertebrate Response Assessment Index

MIRAI score	62.7 (Category C)

Comment:

- The site can be considered to be in a Category C condition according to the MIRAI EcoStatus tool and a Category A condition according to the SASS5 index;
- The macro-invertebrate habitat suitability can be regarded as poor at the time of the assessment, with a lack of strong flowing water and limited aquatic vegetation at this point. The latter will likely limit the diversity and sensitivity of the vegetation-specific aquatic community expected at this site;
- The instream and riparian zones can be regarded as largely natural to moderately modified at the time of the assessment. There are no signs of erosion and sedimentation in the instream and riparian zones;
- The fish community integrity (FRAI) at the site can be regarded as unmodified with a classification of Category A assigned at the time of the assessment. *Enteromius brevipinnis*, the Shortfin Barb, was captured at the time of assessment and this species is considered near threatened (NT). according to the IUCN (Engelbrecht *et al.,* 2017). Threats to this species include afforestation, the establishment of dams forming migrational barriers and introduced fish species, efforts to preserve this fish community should be priority if authorisation is approved.

Overall, the EcoStatus Category for the Dallas and FRAI classifications comply with the RQIS PES (DWS, 2014) classification of Category B conditions for this tributary of the Hlelo River, however, Ecostatus categories for MIRAI, VEGRAI and IHI do not comply with the RQIS PES classification. The overall Integrated EcoStatus Category for the T1 site does not comply with the RQIS PES (DWS, 2014) classification and this is indicative of some impact to the system prior to proposed Twyfelhoek mining activities and thus any further impact must be avoided.

TABLE 9.34: RESULTS OF THE AQUATIC ECOLOGICAL ASSESSMENT AT SITE T2 (LOCATED DIRECTLY NORTH OF THE TWYFELHOEK FOCUS AREA, DOWNSTREAM OF THE T1 SITE ON A TRIBUTARY OF THE HLELO RIVER)

Site T2

Figure 28: Upstream view of the T2 site at the time of the assessment.

Algal proliferation	Limited presence on rocky substrate.
Depth profiles	The site is dominated by a slow shallow run over cobble and stones. Faster riffles are present downstream.
Flow condition	Under the present flow conditions, the flow can generally be considered slow.
Riparian zone characteristics	The riparian zone is dominated by grasses, shrubs and trees. Both banks well covered with high levels of erosion due to livestock trampling.
Water clarity and odour	Water was very clear under the current flow conditions. No odours evident.

SITE ECOSTATUS CATEGORY	
Dallas (2007)	**Category A**
MIRAI	**Category C**
Instream IHI	**Category C**
Riparian IHI	**Category C**
VEGRAI	**Category C**
FRAI	**Category C**
Integrated Ecological Category	**70.6% (Category C)**

***In situ* physico-chemical water quality**

Parameter		**Spatial var. from site T1**	**RWQO (DWA, 2011)**	
pH	5.77	**-24.7**	**pH**	> 6.5 - < 8.4
EC (mS/m)	13.5	+13.4	**EC (mS/m)**	30
DO (mg/ℓ)	10.67	**+20.3**		
DO (% sat)	110.9	**+24.3**		
Temp (˚C)	10.1	+16.1		

Index of Habitat Integrity

Instream IHI	76.2 (Category C)
Riparian IHI	71.4 (Category C)

Riparian Vegetation Response Assessment Index

VEGRAI score	68.9 (Category C)

Comment:

- The pH value does not comply with the recommended range as defined by the DWA (2011) and is considered slightly acidic. Some adverse effects on the aquatic ecology is anticipated at the time of assessment;
- The EC complies with the DWA (2011) recommendation (< 30 mS/m) and no adverse effects on the aquatic ecology is anticipated at the time of assessment;
- The DO saturation complies with the DWAF (1996) recommendation and no negative impact on the aquatic ecology was evident at the time of assessment;
- Overall, any adverse effects on the biota specific water quality of the site are currently considered limited but it is essential that the pH of the T2 site be continually monitored to manage any potential adverse effects to the water quality.

Aquatic macro-invertebrate community integrity

Invertebrate community assessment (SASS5 and IHAS)		**% Var. from ref. ecoregion data**	**Spatial var. from site T1**
SASS5 score	78	**-36.6**	**-27.8**
ASPT score	6.5	**+16.1**	+1.6
IHAS score	53 (Poor)		+10.4
Number of Taxa	12		

Fish Community Assessment

FRAI score	67.6 (Category C)
Species Present: None (see bullet point in Section 4.1 regarding FRAI)	

Macro-invertebrate Response Assessment Index

MIRAI score	61.1 (Category C)

Comment:

- The site can be considered to be in a Category C condition according to the MIRAI EcoStatus tool, and in a Category A condition according to the SASS5 index;
- The macro-invertebrate habitat suitability can be regarded as poor at the time of the assessment, with a lack of strong flowing water and aquatic vegetation at this point;
- The instream and riparian zones can be regarded as largely natural to moderately modified at the time of the assessment. High levels of erosion was observed due to livestock trampling, which has caused sedimentation within the reach, rock stockpiling instream is associated with the low level bridge crossing which have caused a migrational barrier and inundation of the reach upstream;
- The fish community integrity (FRAI) at the site can be regarded as modified with a classification of Category C assigned at the time of the assessment.

Overall, the EcoStatus Category for the Dallas classification complies with the RQIS PES (DWS, 2014) classification of Category B conditions for this tributary of the Hlelo River, however, Ecostatus categories for MIRAI, FRAI, VEGRAI and IHI do not comply with the RQIS PES classification. The overall Integrated EcoStatus Category for the T2 site does not comply with the RQIS PES (DWS, 2014) classification and this is indicative of some impact to the system prior to proposed Twyfelhoek mining activities and thus any further impact must be avoided

9.7.5 Aquatic Ecological Importance and Sensitivity

The Ecological Importance and Sensitivity (EIS) method (DWAF, 1999) was applied to the tributaries of the Assegaai River (W51B) and tributaries of the Hlelo River (W52A) in order to ascertain the current Ecological Importance and Sensitivity of the systems. The results of the assessment of each proposed mine section are presented in the table below:

TABLE 9.35: RESULTS OF THE EIA ASSESSMENT OF THE FOCUS AREAS

Balgarthen Focus Area (Assegaai tributaries)	
Biotic Determinants	**Score**
Rare and endangered biota	4
Unique biota	3
Intolerant biota	4
Species/taxon richness	3
Aquatic Habitat Determinants	
Diversity of aquatic habitat types or features	4
Refuge value of habitat type	3
Sensitivity of habitat to flow changes	4
Sensitivity of flow-related water quality changes	4
Migration route/corridor for instream and riparian biota	3
Nature Reserves, Natural Heritage sites, Natural areas, PNEs	2
RATINGS	**3.4**
EIS CATEGORY	**Very High**
Donkerhoek Focus Area (Hlelo tributaries)	
Biotic Determinants	**Score**
Rare and endangered biota	3
Unique biota	2
Intolerant biota	2
Species/taxon richness	2
Aquatic Habitat Determinants	
Diversity of aquatic habitat types or features	2
Refuge value of habitat type	2
Sensitivity of habitat to flow changes	2
Sensitivity of flow-related water quality changes	2
Migration route/corridor for instream and riparian biota	2
Nature Reserves, Natural Heritage sites, Natural areas, PNEs	1
RATINGS	**2.0**
EIS CATEGORY	**High**
Twyfelhoek Focus Area (Hlelo tributaries)	
Biotic Determinants	**Score**
Rare and endangered biota	4
Unique biota	3
Intolerant biota	3
Species/taxon richness	3
Aquatic Habitat Determinants	
Diversity of aquatic habitat types or features	3
Refuge value of habitat type	3
Sensitivity of habitat to flow changes	3
Sensitivity of flow-related water quality changes	3
Migration route/corridor for instream and riparian biota	2
Nature Reserves, Natural Heritage sites, Natural areas, PNEs	1
RATINGS	**2.8**
EIS CATEGORY	**High**

The Ecological Importance and Sensitivity Assessment analysis of the tributaries of the Assegaai River provided a score of 3.4 which is regarded as **extremely important and sensitive**. The high importance and sensitivity of the stream is mainly as a result of the presence of intolerant biota and possible rare and endangered species in the region, namely, *Amphilius* sp. (Kleynhans, 1999) which was not collected during the current assessment despite sampling efforts, but *Chiloglanis emarginatus* (a vulnerable species according to the IUCN, 2018) was captured at the time of the assessment at the B1 and B2 sites. The diversity of aquatic habitat types as well as the sensitivity of the habitat to flow changes also added to the high importance and sensitivity rating. The biota in this system have a preference for rocky and gravely substrate in clear fast flowing water thus indicating that the system is sensitive to changes in the total suspended solids. In order for the sensitivity score to remain high, it is vital and of the utmost importance that sedimentation and sediment loading of this system when mining activities commence is prevented. The system is considered unique on a national scale based on its biodiversity and habitat diversity.

The Ecological Importance and Sensitivity Assessment analysis of the tributaries of the Hlelo within the Donkerhoek Focus Area provided a score of 2.0, which is regarded as **highly important and sensitive**. The high importance and sensitivity of the stream is mainly as a result of the possible presence of rare and endangered species in the region, namely, *Chiloglanis emarginatus* (a vulnerable species according to the IUCN, 2018) and *Opsaridium peringueyi* (Kleynhans, 1999) but were not collected during the current assessment despite sampling efforts. The diversity of aquatic habitats, sensitivity of biota to flow and water quality changes, as well as the possible presence of intolerant biota also contribute to the importance of the system. In order for the sensitivity score to remain high, it is vital and of the utmost importance that sedimentation and sediment loading of this system when mining activities commence is prevented.

The Ecological Importance and Sensitivity Assessment analysis the tributaries of the Hlelo within the Twyfelhoek Focus Area provided a score of 2.8, which is regarded as **highly important and sensitive**. The high importance and sensitivity of the stream is mainly as a result of the possible presence of rare and endangered species in the region, namely, *Chiloglanis emarginatus* (a vulnerable species according to the IUCN, 2018) and *Opsaridium peringueyi* (Kleynhans, 1999) but were not collected during the current assessment despite sampling efforts. The presence of *Enteromius brevipinnis*, the Shortfin Barb, was captured at the time of assessment and this species is considered near threatened (NT) according to the ICUN (Engelbrecht *et al.*, 2017) was considered to increase the sensitivity of this area. The system is sensitive to flow and water quality changes, as well as the possible presence of intolerant biota.

9.7.6 Hydropedology

The description of the Hydropedology has been sourced from the assessment undertaken by The Biodiversity Company (September 2019).

A hydropedological study was undertaken for the proposed Donkerhoek and Twyfelhoek areas, in which five transects were configured in Catchment Modelling Framework (CMF) and parameterised using measured data from the field and laboratory analysis. These were the transects where the largest impact associated with the open-cast pits were expected. The topography (surface elevations) was obtained from Google Earth and included to the configuration of the transects. The Van Genuchten-Maulem hydraulic model was used in the simulation of water flow through the soils. Relevant Van Genuchten parameters were derived from measured hydraulic properties in combination with PedoTransfer Functions in Rosetta (2003).

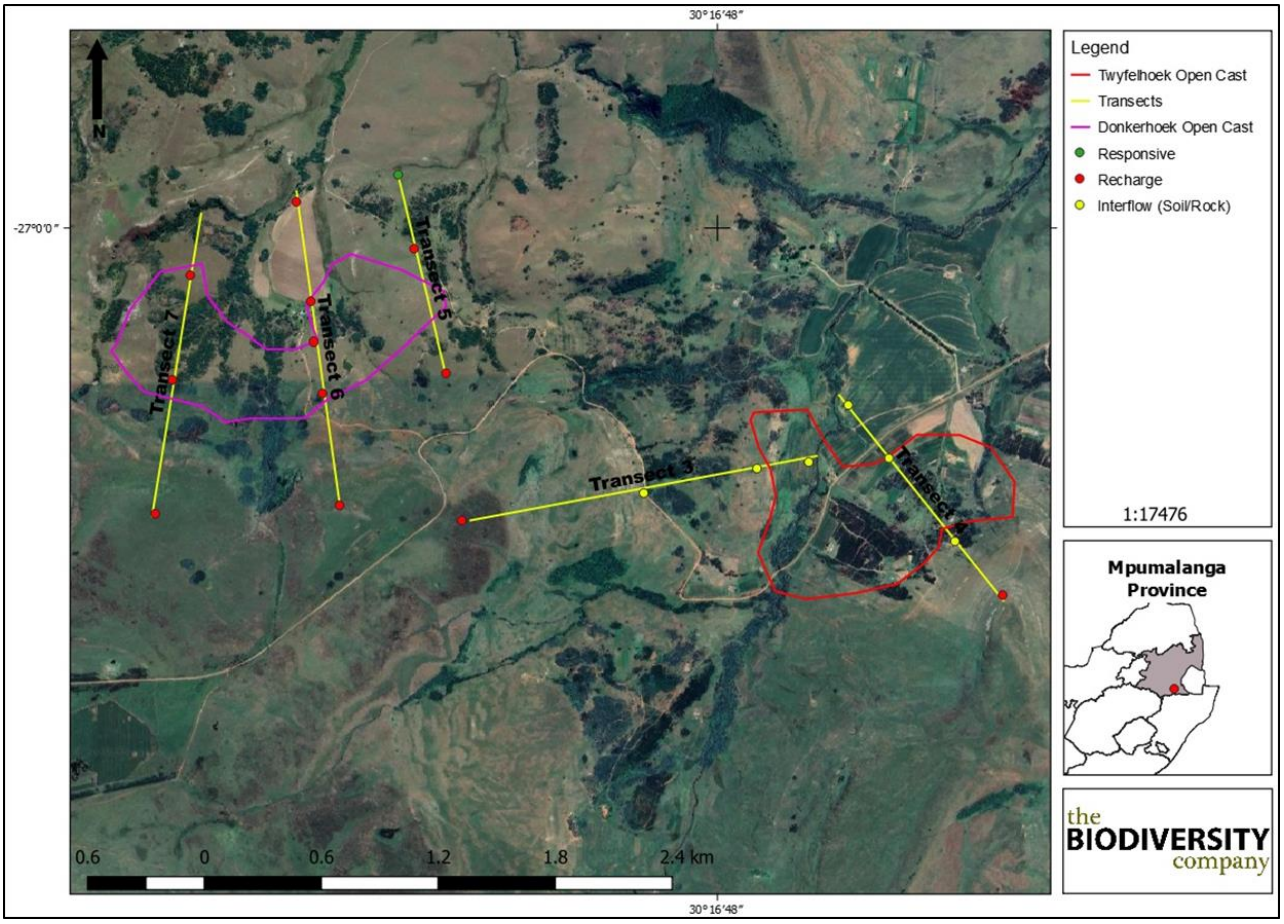


FIGURE 9-31: TRANSECTS 3 – 7 FOR DONKERHOEK AND TWYFELHOEK OPENCAST AREAS

9.7.6.1 Transect 3

The hydropedological behaviour of transect 3 is illustrated in a conceptual hydrological response model below. The processes involved within this slope are described according to the number assigned to the relevant hydrological response.

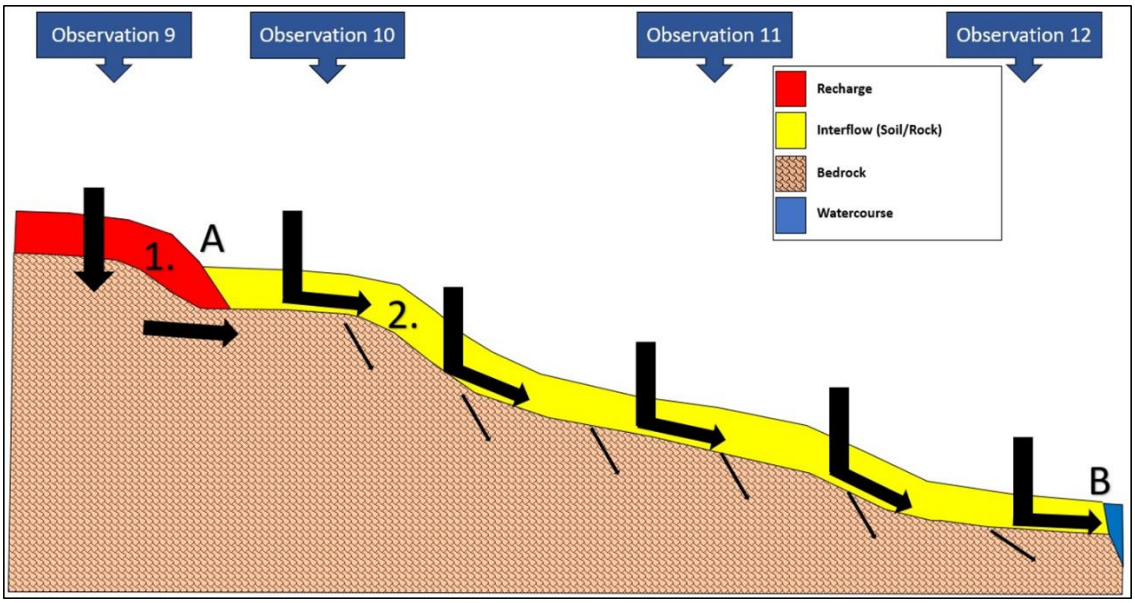


FIGURE 9-32: CONCEPTUAL HYDROPEDOLOGICAL RESPONSE MODEL FOR TRANSECT 3

Observation 9 is located in the crest position of Transect 3 and has been classified as a Glenrosa soil form. This soil form consists of an Orthic A-horizon on top of a Lithic B-horizon. This soil form has been determined to be a recharge hydropedological soil form, given the rapid infiltration of water into this profile (due to the high hydraulic conductivity of the Lithic B-horizon) and the lack of signs of wetness.

Observation 10 and 11 have been identified as a Bainsvlei soil form, which consists of an Orthic A-horizon on top of a Red Apedal B-horizon, which in turn is underlain by an unspecified material with signs of wetness. This soil form is distributed from the upper slopes of transect 3 towards the lower section of the slope and has been classified as an interflow soil form (between the soil and rock) due to the signs of wetness identified at the rock interface.

The toe of the slope relevant to transect 3 has been classified as an Avalon soil form, which consists of an Orthic A-horizon on top of a Yellow-Brown Apedal B-horizon, which in turn is underlain by an unspecified material with signs of wetness. This soil form also has been determined to be an interflow (soil/bedrock) hydropedological soil form due to the presence of signs of wetness at the bedrock interface. (**Figure 9-33**)

Given the fact that the proposed open cast mine is located at the toe of the slope and is intended to force the removal of the watercourse, all sub-surface flow (vertical and lateral) feeding the watercourse will be lost.

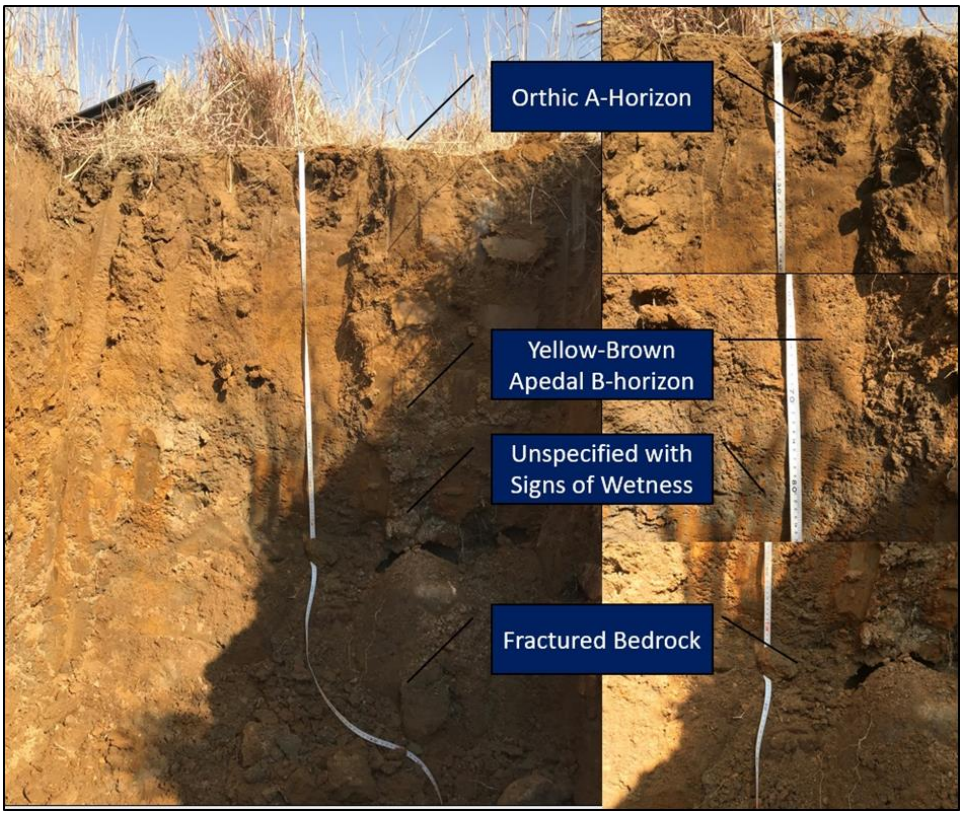


FIGURE 9-33: INTERFLOW HYDROPEDOLOGICAL SOIL TYPE IN OBSERVATION 12 TRANSECT 3

9.7.6.2 Transect 4

The hydropedological behaviour of transect 4 is illustrated in a conceptual hydrological response model (**Figure 9-34**). The processes involved within this slope is described according to the number assigned to the relevant hydrological response.

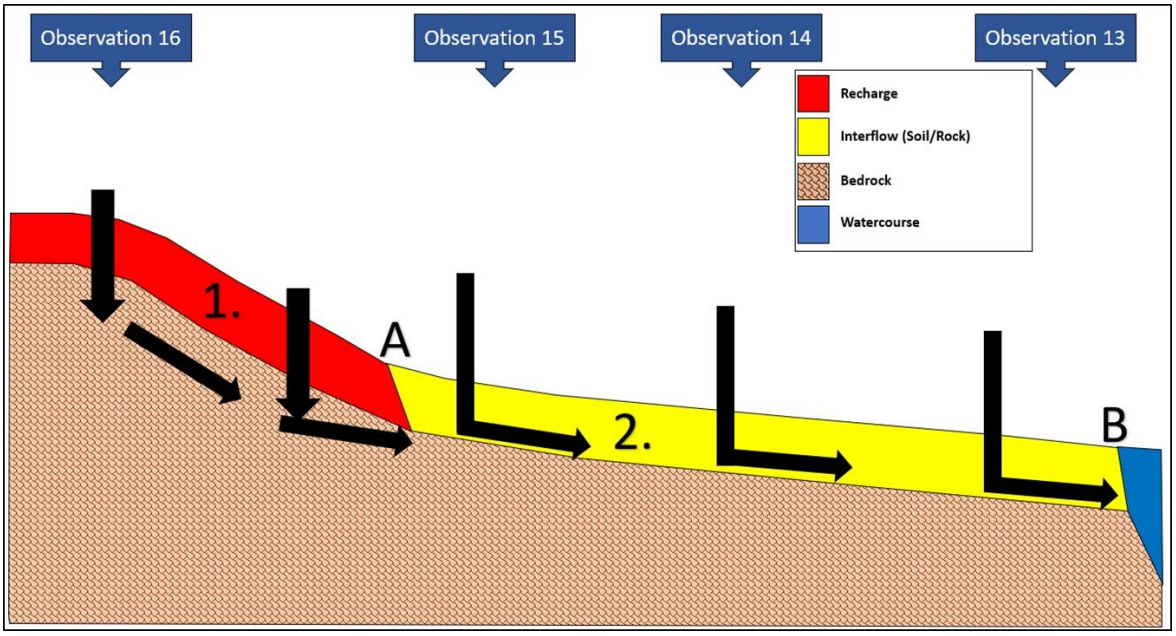


FIGURE 9-34: CONCEPTUAL HYDROPEDOLOGICAL RESPONSE MODEL OF TRANSECT 4

Transect 4's hillslope hydrology is similar to that of Transect 3 with the addition of a Dresden soil form at the toe of the slope. Water from the recharge hydropedological soil form recharges the interflow (soil/bedrock) hydropedological soil form and is channelled over the bedrock interface towards the watercourse at the toe of the slope.

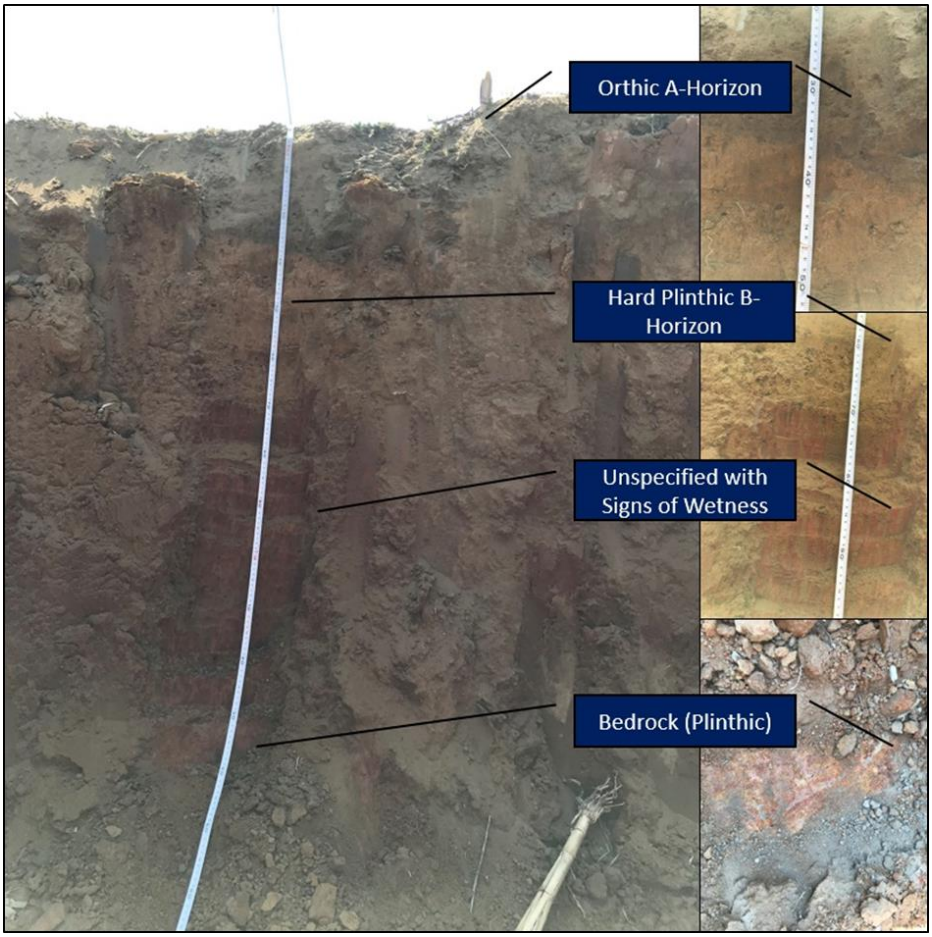


FIGURE 9-35: INTERFLOW HYDROPEDOLOGICAL SOIL TYPE IN OBSERVATION 13 TRANSECT 4

After the construction of the open cast pit, interflow from the mid-slope and up will be lost, ultimately rendering the only input to the hillslope a 450 m slope between the proposed open cast pit and the watercourse.

9.7.6.3 Transect 5

The hydropedological behaviour of transect 5 is illustrated in a conceptual hydrological response model (see **Figure 9-36**Figure 9-36). The processes involved within this slope is described according to the number assigned to the relevant hydrological response.

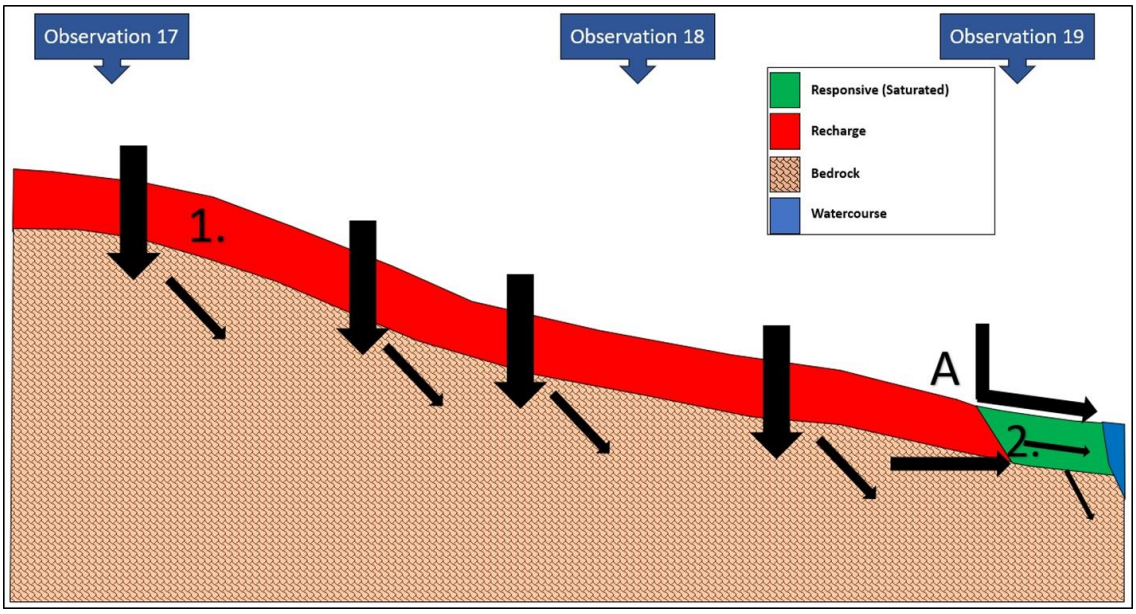


FIGURE 9-36: CONCEPTUAL HYDROPEDOLOGICAL RESPONSE MODEL OF TRANSECT 5

Observation 17 and 18 is located between the crest and mid-slope of the slope relevant to Transect 5. This hydropedological soil form has been classified as a recharge soil form given the lack of signs of wetness within the profiles. A Carolina and Clovelly soil form has been identified in Observation 17 and 16 respectively. The Carolina soil form consists of an Orthic A-horizon on top of a Yellow-Brown Apedal B-horizon which in turn is underlain by hard rock (see **Figure 9-37**). As for the Clovelly soil form, a similar profile is present with the presence of a Lithic B-horizon instead of a Hard Rock layer.

FIGURE 9-37: RECHARGE HYDROPEDOLOGICAL SOIL TYPE OBSERVATION 17 TRANSECT 5

Observation 19 has been classified as a Champagne soil form given the presence of an Organic O-horizon on top of a G-horizon. This soil form has been identified as a responsive (saturated) hydropedological soil form due to the presence of a G-horizon. It is apparent that the recharge soil forms throughout the slope seeps out below the Organic O-horizon given the concentration of organic material. Interflow through the topsoil would result in a grey matrix. And a loss of organic matter.

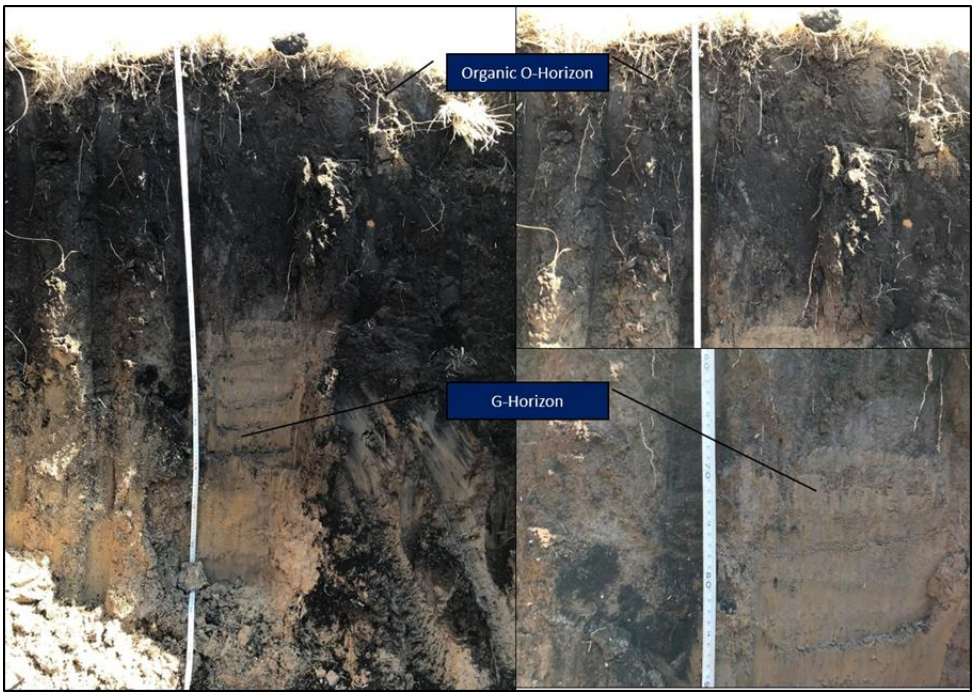


FIGURE 9-38: RESPONSIVE HYDROPEDOLOGICAL SOIL TYPE OBSERVATION 19 TRANSECT 5

The proposed open cast mine will result in approximately one third to a half of the recharge area within the hillslope being cut off, ultimately resulting in a reduction of interflow feeding the responsive area on the toe of the slope.

9.7.6.4 Transect 6

The hydropedological behaviour of transect 6 is illustrated in a conceptual hydrological response model (see **Figure 9-39**). The processes involved within this slope is described according to the number assigned to the relevant hydrological response.

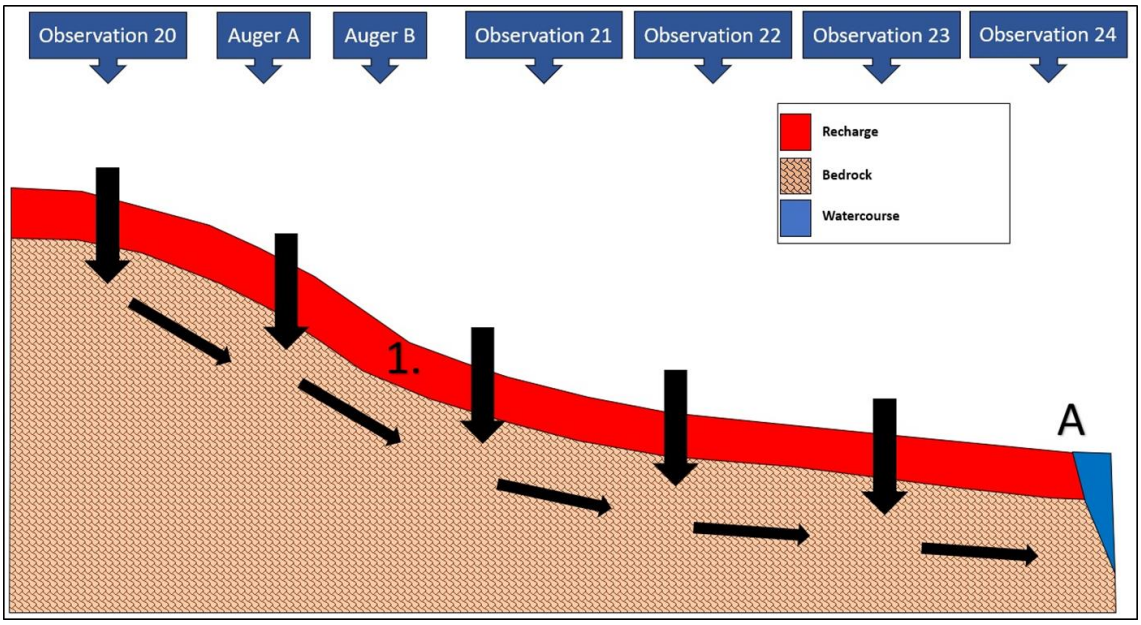


FIGURE 9-39: CONCEPTUAL HYDROPEDOLOGICAL RESPONSE MODEL OF TRANSECT 6

Observations 20 to 24 (including Auger observation A and B) has been classified as recharge hydropedological soil forms given the lack of signs of wetness throughout the profiles. Observation 20 has been identified as a Glenrosa soil form (Orthic A-horizon on top of a Lithic B-horizon). Observation 21 has been identified as a Vaalbos soil form, which consists of an Orthic A-horizon on top of a Red Apedal B-horizon which in turn is underlain by a hard rock layer (see **Figure 9-40**). Observation 22 is similar to observation 21, only with the inclusion of a Lithic B-horizon in place of the Hard Rock layer and has therefore been classified as a Nkonkoni soil form (Soil Classification Working Group, 2018).

Observation 23 and 24 has been identified as a Carolina soil form, which consists of an Orthic A-horizon on top of a Yellow-Brown Apedal B-horizon, which in turn is underlain by a Hard Rock layer.

FIGURE 9-40: RECHARGE HYDROPEDOLOGICAL SOIL TYPE OBSERVATION 21 TRANSECT 6

No interflow occurs throughout this slope, emphasising the fact that the watercourse is fed by seeps from groundwater and water channelled over the shallower granite layer. The section of the hillslope above the proposed mine's flows will be intercepted by the mining area, ultimately resulting in a loss of flow towards the watercourse.

9.7.6.5 Transect 7

The hydropedological behaviour of transect 7 is similar to that of Transect 6. A Glenrosa soil form has been identified in the crest and upper regions of the hillslope with a Carolina soil form identified from the mid-slope to the toe of the slope.

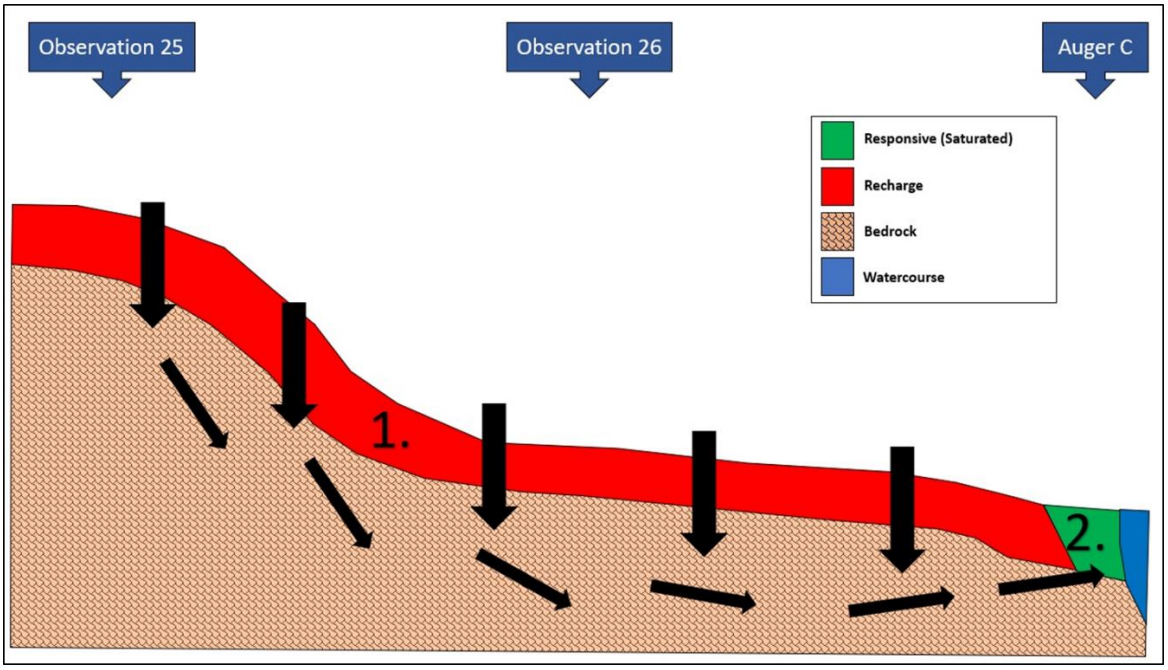


FIGURE 9-41: CONCEPTUAL HYDROPEDOLOGICAL RESPONSE MODEL TRANSECT 7

Observations 25 and 26 has been classified as a recharge hydropedological soil form given the lack of signs of wetness within the profiles. Observation 25 is characterised by a Glenrosa soil form (Orthic A-horizon on top of a Lithic B-horizon) with Observation 26 characterised by a Carolina soil form (Orthic A-horizon on top of a Yellow-Brown Apedal B-horizon, which is underlain by a Hard Rock layer). (**Figure 9-42**)

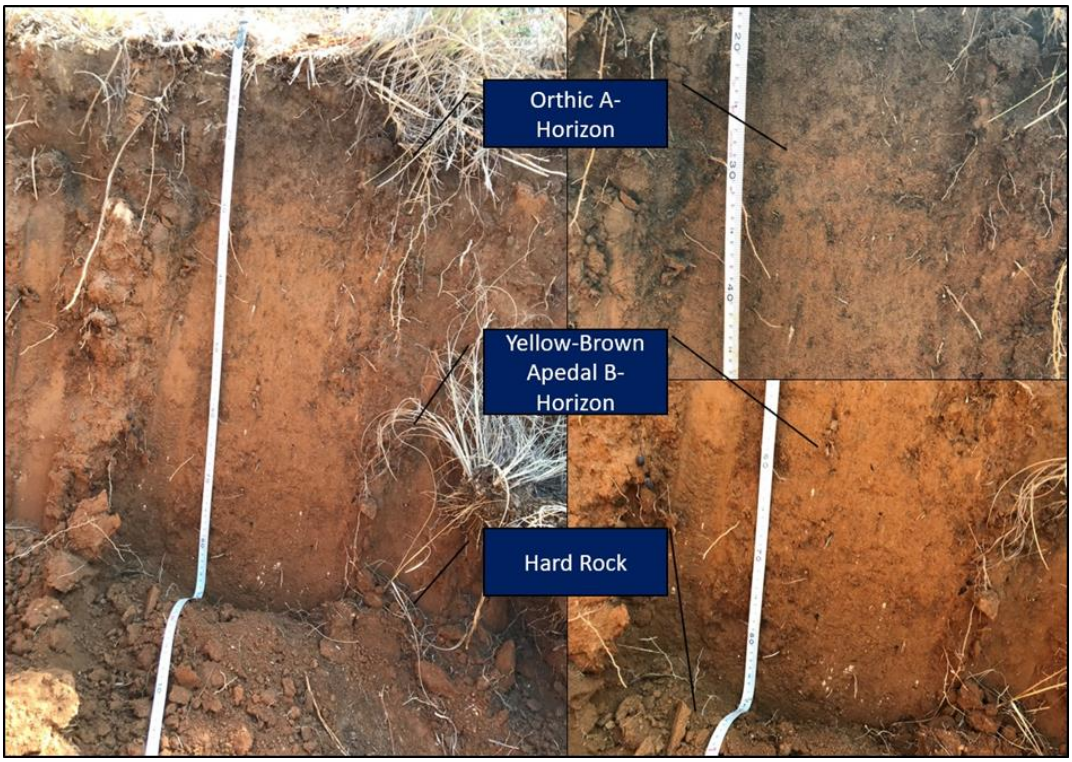


FIGURE 9-42: RECHARGE HYDROPEDOLOGICAL SOIL TYPE OBSERVATION 26 TRANSECT 7

The hydropedological behaviour of the slope relevant to Transect 7 is similar to that of Transect 5 due to the dominance of recharge throughout the slope and a responsive soil form at the toe of the slope. The entire watercourse will be removed together with the bottom half of the hillslope feeding the wetland and the proposed mining activities will therefore result in a complete loss of the watercourse.

9.7.6.6 Balgarthen Transects

The hydropedology survey for the Balgarthen area was conducted in August 2019 to obtain information regarding the soil morphology and hydropedological flow paths relevant to the hillslope by means of seven transects. The hydropedological soil types classified during the site assessment are illustrated in Error! Reference source not found.. Those most relevant to the proposed Balgarthen opencast pit, have been detailed below.

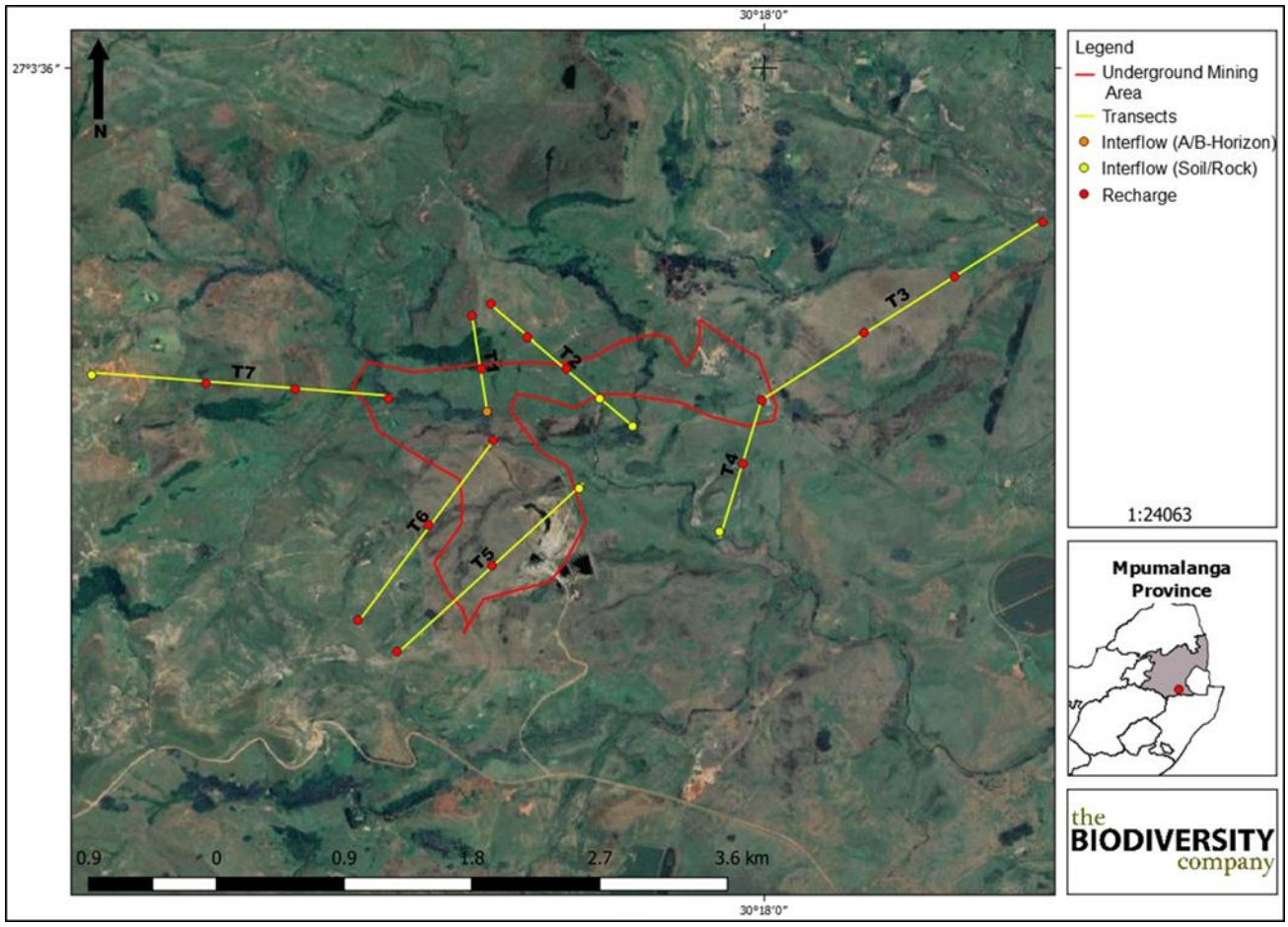


FIGURE 9-43: HYDROPEDOLOGICAL SOIL TYPES IDENTIFIED FOR THE BALGARTHEN AREA

9.7.6.7 Transect 3

The hydropedological behaviour of transect 3 is illustrated in a conceptual hydrological response model (see **Figure 9-44**). The processes involved within this slope is described according to the number assigned to the relevant hydrological response.

The entire slope consists of recharge hydropedological soil forms (Mispah, Hutton and Shortlands soil forms). These soils are characterised by red soils without any signs of wetness, ultimately rendering the entire slope as a recharge zone. Letter A indicates the transition from a recharge hydropedological soil form to a watercourse, which is dominated by seepage from shallow fractured rock beneath the soil profile as well as deeper aquifers.

Lateral sub-surface flows through the vadose zone will not be affected by the proposed mining activities. It is however evident that recharge is dominant throughout the slope, of which the vertical distance the recharged water travels is uncertain. The volume of groundwater drawn into the mining area's void will have to be determined by means of a groundwater or geochemical assessment. The proposed mining area is located on the upper parts of the slope, which emphasises the fact that if the mining area were to drain the recharged water, only a small fraction of the slope's hillslope will be affected.

After the construction of the mining area, the exact same conceptual impacts explained for Transect 1 and 2 can be expected for Transect 3 only with less significance given the position of the mining area underneath the crest position only (see Figure 28). The proposed mining area is located on the upper parts of the slope, which emphasises the fact that if the mining area were to drain the recharged water, only a small fraction of the slope's hillslope will be affected.

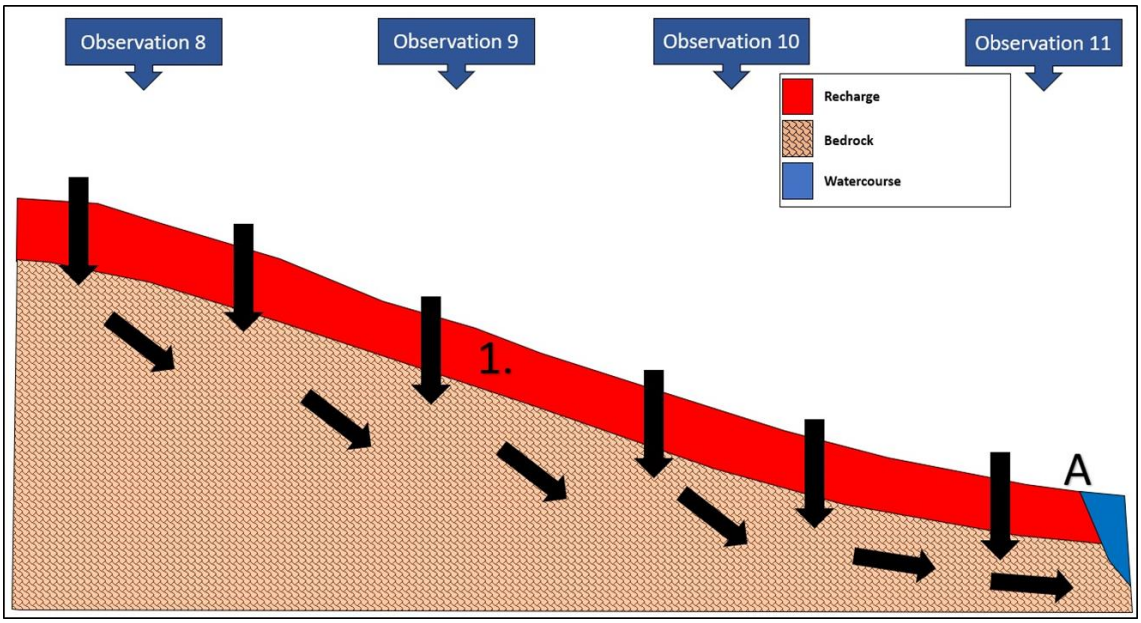


FIGURE 9-44: CONCEPTUAL HYDROLOGICAL RESPONSE MODEL OF TRANSECT 3

9.7.6.8 Transect 4

The hydropedological behaviour of transect 4 is illustrated in a conceptual hydrological response model (see **Figure 9-45**). The processes involved within this slope is described according to the number assigned to the relevant hydrological response.

The hillslope hydrology of Transect 4 is identical to that of Transect 2 only with the addition of an Avalon soil form at the toe of the slope, which represents an Interflow (between soil and bedrock) hydropedological soil form. The transitions from one hydropedological soil type to another also is identical to that of Transect 2.

After the construction of the mining area, the same conceptual impacts explained for Transect 3 can be expected for Transect 4 given the location of the mining area at the upper parts of the crest.

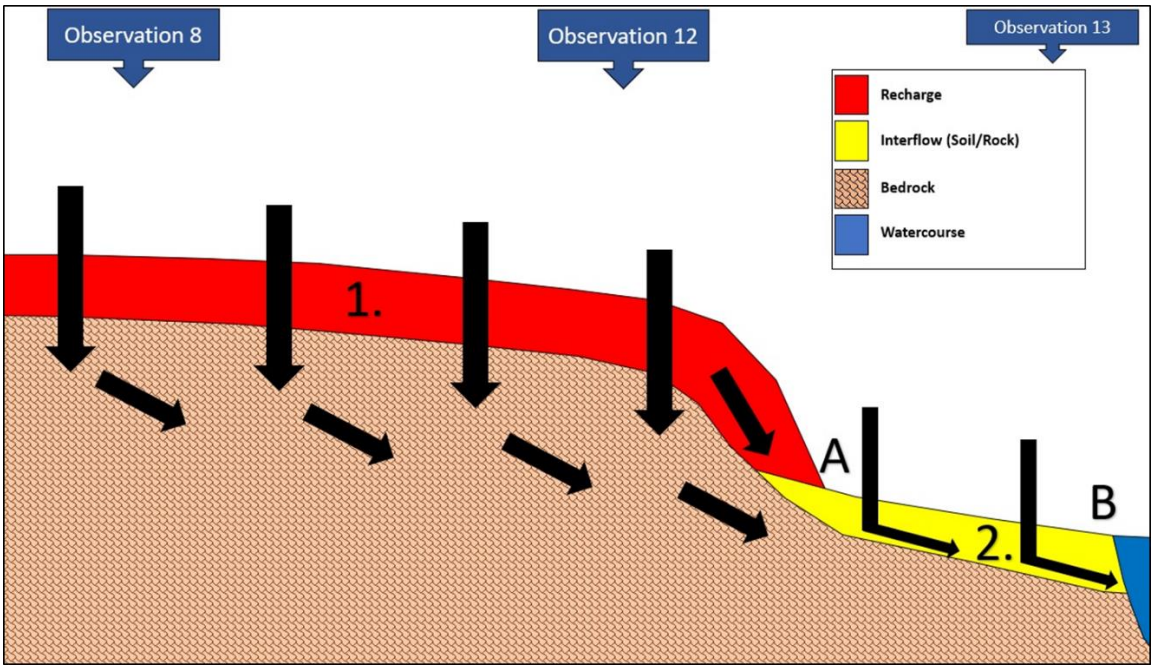


FIGURE 9-45: CONCEPTUAL HYDROPEDOLOGICAL RESPONSE MODEL OF TRANSECT 4

9.8 Groundwater

The groundwater description has been sourced from the assessment undertaken by Gradient Consulting (September 2019).

9.8.1 Hydrocensus

As part of this study, Gradient conducted a hydrocensus in May 2019. The newly identified boreholes, springs and other surface water sampling points are documented in **Table 9**.36 and illustrated in **Figure 9-46.**

TABLE 9.36: HYDROCENSUS POINTS

Site ID	Latitude (wgs84, lo31)	Longitude	Type	Water level (mbgl)	Borehole status	Equipment	Application	Monitoring
N04D	-27.085500	30.275300	Borehole	7.3	Static	In use	Not equipped	Monitoring
N04S	-27.085500	30.275300	Borehole	3.47	Static	In use	Not equipped	Monitoring
N05D	-27.085300	30.273020	Borehole	8.84	Static	In use	Not equipped	Monitoring
N05S	-27.085300	30.273020	Borehole	3.7	Static	In use	Not equipped	Monitoring
N06D	-27.086800	30.273730	Borehole	11.62	Static	In use	Not equipped	Monitoring
N06S	-27.086800	30.273730	Borehole	9.95	Static	In use	Not equipped	Monitoring
BSW01	-27.086745	30.284623	Drainage	N/A				
BSW02	-27.086875	30.277337	Drainage					
BSW03	-27.092875	30.284598	Mine void					
BSW04	-27.096219	30.285693	PCD					
BSW05	-27.09012	30.27451	Drainage					
BSW06	-27.09414	30.29832	Drainage					
BSW07	-27.084564	30.272472	Drainage					
TSW01	-27.0176	30.28316	Drainage					
TSW02	-27.003	30.28757	Drainage					
DSW01	-26.99735	30.25948	Drainage					
DSW02	-27.01047	30.26709	Drainage					
KT-HC01	-27.01638	30.27857	Borehole	Blocked	Blocked	Blocked	Not equipped	Monitoring
KT-HC02	-27.01704	30.28413	Borehole	2.71	Static	In use	Not equipped	Monitoring
KT-HC03	-27.01747	30.2837	Borehole	1.2	Static	In use	Not equipped	Monitoring

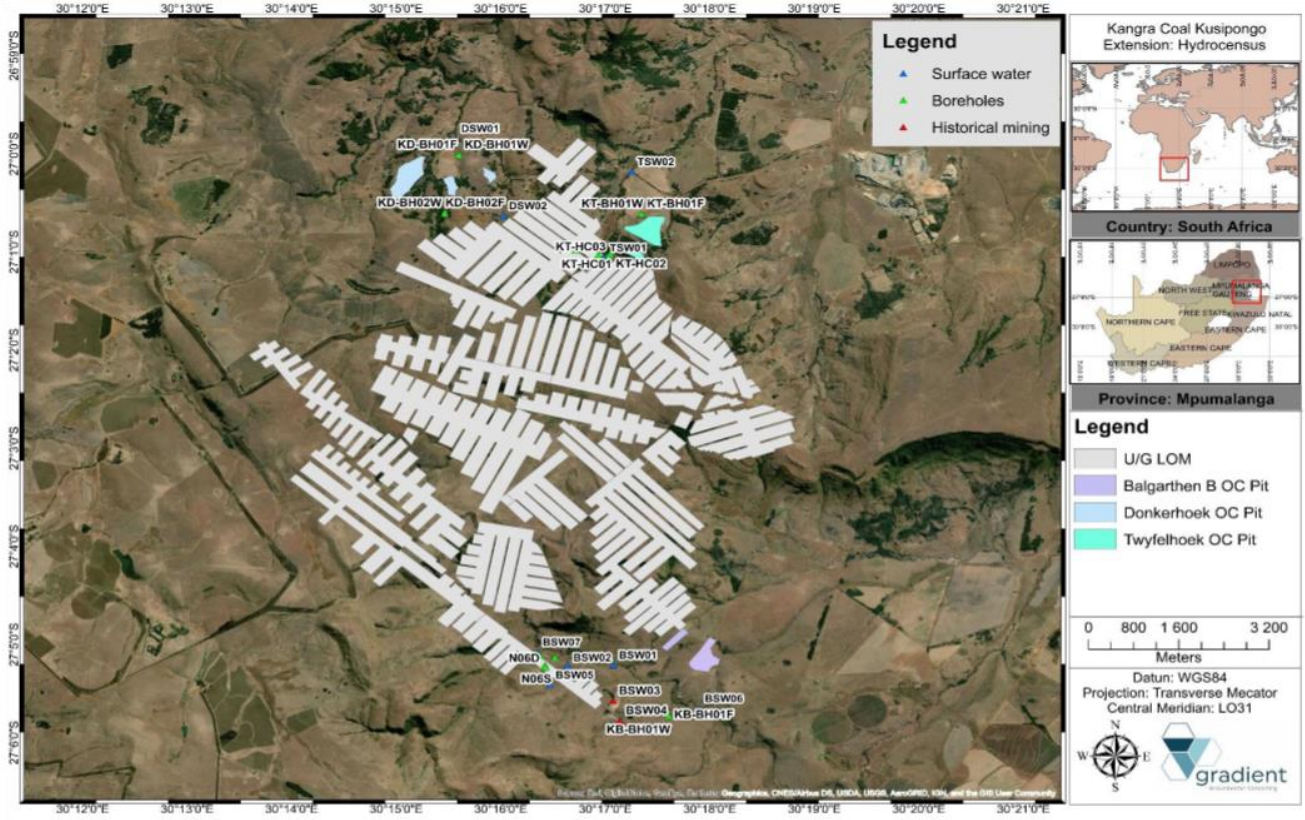


FIGURE 9-46: HYDROCENSUS POINTS

9.8.2 Monitoring Boreholes

16 groundwater monitoring boreholes were drilled, as listed in the table below. The boreholes were drilled in clusters or pairs. A borehole cluster comprises of a shallow perched aquifer borehole (I.e. KB-BH01P), a weathered aquifer borehole (i.e. KB-BH01W) and a deep fractured aquifer borehole (i.e. KB-BH01F). The borehole construction is such that the aquifers are isolated and monitored separately (**Figure 9-47**).

TABLE 9.37: NEWLY DRILLED MONITORING BOREHOLES

Borehole	LAT	LONG	Elevation (mamsl)	Depth	Aquifer	SWL (mbgl)	Weathering Depth (mbgl)	Borehole Placement
Balgarthen Boreholes								
KB-BH01F	-27.09539491	30.29342808	1410	30	Fractured	12.57	10 – 15	Upstream
KB-BH01W	-27.09539491	30.29342808	1410	10	Weathered	1.98	10	Upstream
KB-BH01P	-27.09539491	30.29342808	1410	3	Perched	0.8	N/A	Upstream
KB-BH02F	-27.08715194	30.273802	1482	30	Fractured	4.82	9 - 10	Downstream
KB-BH02W	-27.08715194	30.273802	1482	10	Weathered	2.7	9 - 10	Downstream
KB-BH02P	-27.08715194	30.273802	1482	4	Perched	Dry	N/A	Downstream
Donkerhoek Boreholes								
KD-BH01F	-27.00012794	30.26002705	1606	30	Fractured	0	15	Downstream
KD-BH01W	-27.00012794	30.26002705	1606	10	Weathered	1.96	10	Downstream
KD-BH02F	-27.010002	30.2577201	1663	30	Fractured	5.78	12	Upstream
KD-BH02W	-27.010002	30.2577201	1663	10	Weathered	2.72	12	Upstream
Twyfelhoek Boreholes								
KT-BH01F	-27.01018091	30.289077	1498	30	Fractured	5.11	10 - 15	Downstream
KT-BH01W	-27.01018091	30.289077	1498	10	Weathered	0	10	Downstream
KT-BH02F	-27.01713496	30.28222701	1515	30	Fractured	2.73	10 - 17	Upstream
KT-BH02W	-27.01713496	30.28222701	1515	10	Weathered	Dry	10	Upstream

FIGURE 9-47: NEWLY DRILLED BOREHOLES

9.8.3 Aquifer Testing

Hydraulic Testing was performed on the newly drilled boreholes to supplement the existing aquifer parameter data that was available for the site.

Important parameters that can be obtained from borehole test pumping include Hydraulic Conductivity (K), Transmissivity (T) and Storativity (S). These parameters are defined as follows (Krusemann and De Ridder, 1991):

- Hydraulic Conductivity (K): This is the volume of water that will move through a porous medium in unit time under a unit hydraulic gradient through a unit area measured at right angles to the direction of flow. It is normally expressed in metres per day (m/d).
- Transmissivity (T): This is the rate of flow under a unit hydraulic gradient through a cross-section of unit width over the full, saturated thickness of the aquifer. Transmissivity is the product of the average hydraulic conductivity and the saturated thickness of the aquifer. Transmissivity is expressed in metres squared per day (m^2/d).
- Storativity (S): The storativity of a saturated confined aquifer is the volume of water released from storage per unit surface area of the aquifer per unit decline in the component of hydraulic head normal to that surface. Storativity is a dimensionless quantity.

Constant rate tests of up to 4 hours, recovery tests and falling head tests were conducted on the newly drilled boreholes. The eventual pumping time would be determined by the pumping rate and yield of each borehole. The recovery period of these boreholes was also measured, as the recovery rate can yield accurate aquifer parameter results, specifically in terms of storativity.

9.8.3.1 Hydrogeological Setting

Three aquifers are typically present in the greater project area. These are:

- A shallow perched aquifer mainly consisting of alluvium and transported hill wash material on top of a pebble marker and ferricretes in the low-lying areas, valleys and paleo channels;
- A weathered aquifer, which extends to depths of approximately 12 mbgl, depending on the extent of weathering. In the project area, this aquifer has comparatively low aquifer parameters. This aquifer is therefore not considered to be a major aquifer, although it plays a role in recharge to the deeper hard-rock aquifers and baseflow to streams. It also feeds many springs in the study area; and
- A deeper fractured rock aquifer, which is characterised by fractures, faults and contact zones with dolerite intrusions which can serve as conduits for the movement of groundwater. These conduits can also serve as connections between the above-mentioned aquifers. This aquifer in the study area was also low yielding.

The average depths of the various aquifers within the study area, as based on the existing borehole database, is summarised in **Table 9**.38 below.

TABLE 9.38: AVERAGE AQUIFER DEPTHS

Aquifer	Depth (mbg)	Geology
Perched	0 - 3	Alluvium & transported hill wash underlain by ferricrete and a pebble marker in places
Weathered	6 - 12	Mostly comprising a highly to medium weathered, soft rock to medium hard rock Vryheid formations
Fractured	12+	Slightly weathered to unweathered sandstone, siltstone & shales

9.8.3.2 Aquifer Parameters

Aquifer parameters were obtained from field investigations undertaken during previous investigations as well as from aquifer tests conducted by Gradient in 2019. These results are summarised below.

TABLE 9.39: MEAN AQUIFER PARAMETERS

Estimated Mean Parameter	Transmissivity (T) (m^2/d)	Hydraulic Conductivity (K) (m/d)	Aquifer extent
Weathered Aquifer			
Calculated Mean	0.9	0.03	0 – 30m
Intermediate weathered/fractured Aquifer			
Calculated Mean	0.2	0.005	30 – 70m
Fractured Aquifer			
Calculated Mean	0.625	0.0025	70 – 250m

Mean transmissivity values of less than 1 m^2/d were calculated for both the weathered and fractured aquifers whereas hydraulic conductivity values of 0.03 m/day were calculated for the weathered aquifer and 0.003 m/day for the fractured aquifer. This data corresponds with the parameters obtained from previous investigations undertaken by GCS and Golder.

9.8.4 Hydrochemistry

Groundwater samples were collected from the pump tested boreholes as well as from the hydrocensus, which includes various surface water samples as well. A summary of the samples and analyses performed is included in **Table 9**.40.

The purpose of the sampling was to establish the background water qualities and to determine if historical mining or other activities may have impacted on the groundwater and surface water regimes. The current groundwater quality status is thus seen as the background water quality against which the impacts from the proposed project can be measured.

TABLE 9.40: SAMPLES TAKEN FOR HYDROCHEMICAL ANALYSIS

Sample	Major Parameters (inorganic analyses)
Newly drilled boreholes KB-BH01F, 01W & 01P KB-BH02F & 02W KD-BH01F & 01W KD-BH02F & 02W KT-BH01F & 01W KT-BH02F & 02W **Hydrocensus groundwater** KTBH02 **Hydrocensus surface water** BSW01 – BSW07 DWS01 & DSW02 TSW01 & TSW02	pH at 25°C EC in mS/m at 25°C TDS at 180°C Total Alkalinity in CaCO3 Chloride as Cl Sulphate as SO4 Nitrate as N Ammonium NH4 as N Orthosphosphate PO4 as P Fluoride as F Calcium as Ca Magnesium as Mg Sodium as Na Potasium as K Aluminium as Al Iron as Fe Manganese as Mn Chromium as Cr Copper as Cu Nickel Ni Zinc as Zn Cobalt as Co Cadmium as Cd Lead as Pb Total hardness

9.8.4.1 Sampling and Screening results

Groundwater samples were collected on neighbouring properties during the hydrocensus, as well as from the newly drilled boreholes which were purged before sampling. Results from groundwater and surface water sampling conducted by Gradient are included alongside the screening guidelines in **Table 9**.41 and **Table 9**.42.

TABLE 9.41: GROUNDWATER HYDROCHEMISTRY RESULTS FOR KUSIPONGO

Orange = exceeds 1, Red = exceeds both guidelines	SANS 241 2015	WUL 2017	KB-BH01F	KB-BH01W	KB-BH01P	KB-BH02F	KB-BH02W	KD-BH01F	KD-BH01W	KD-BH02F	KD-BH02W	KT-BH01F	KT-BH01W	KT-BH02F	KT-BH02W	KT-HC2
			Balgarthen					Donkerhoek				Twyfelhoek				
pH	5.0 to 9.7	6.5 – 8.0	8.1	7.14	6.94	7.98	6.98	8.46	7.5	7.83	6.78	7.63	6.99	7.55	7.0	8.82
EC (mS/m)	170	27	24.1	20	16.4	31.6	9.3	40	34.6	12.5	10.2	17.5	10	40.7	26.6	79.6
TDS	1200	177	159	111	86	203	45	252	217	64	53	100	52	245	150	475
Total Alkalinity	NG	100	150	94.3	58.7	184	37.5	230	170	58	48.6	89.4	42.2	229	90.5	357
Nitrate (NO_3 as N)	11	0.24	<0.2	<0.2	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.3	0.2	0.6
Chloride (Cl)	300	3.0	2.7	6.1	4.5	8.3	1.7	2.6	4.9	2.2	2.0	2.5	2.3	4.9	9.3	62.8
Sulphate (SO_4)	500	45	0.6	6.1	13.3	0.6	0.7	4.8	27.1	3.1	2.1	4.0	1.8	4.9	18.3	2.4
Ammonium (NH_4 as N)			0.2	0.2	0.06	0.3	0.06	0.05	0.1	0.06	0.1	0.08	0.07	0.05	0.2	0.2
Fluoride (F)	1.5	0.3	0.3	0.3	<0.26	0.4	0.3	0.5	0.3	<0.26	0.3	<0.26	<0.26	0.3	8.3	1.5
Calcium (Ca)	NG	29	7.0	20.8	13.8	12.5	5.6	3.5	32.5	11.5	8.3	22.4	8.9	34.5	16.4	4.3
Iron (Fe)	2.0	2.3	<0.004	<0.004	<0.004	<0.004	<0.004	0.06	0.03	<0.004	<0.004	0.4	<0.004	<0.004	0.8	<0.004
Magnesium (Mg)	NG	9.0	3.0	7.5	6.2	2.2	2.6	0.2	4.3	5.5	4.3	3.8	1.8	13.1	6.0	0.5
Potassium (K)	NG	3.0	1.1	1.7	0.9	2.1	3.7	2.3	3.9	1.0	1.6	3.0	1.9	2.5	10.8	1.9
Sodium (Na)	200	21	51.6	10.5	9.9	64	7.2	96.8	39.2	4.8	4.5	9.0	8.3	43.8	25	182
Manganese (Mn)	0.5	0.2	<0.001	0.7	0.3	0.02	0.2	0.04	0.9	0.3	0.08	0.2	0.09	0.5	0.5	0.02
Cadmium (Cd)	0.0030	0.01	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Cobalt (Co)	0.50		<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Chromium (Cr)	0.05		<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Copper (Cu)	2.0		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Lead (Pb)	0.010	0.01	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Nickel (Ni)	0.07		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Zinc (Zn)	5.0	0.02	0.005	0.03	0.03	0.01	0.007	0.002	0.03	0.02	0.01	0.03	0.008	0.04	0.02	<0.0002

TABLE 9.42: SURFACE WATER HYDROCHEMISTRY RESULTS FOR KUSIPONGO

Exceeds SANS guidelines	SANS 241 2015	BSW01	BSW02	BSW03	BSW04	BSW05	BSW06	BSW07	DSW01	DSW02	TSW01	TSW02
		Balgarthen							Donkerhoek		Twyfelhoek	
pH	5.0 to 9.7	8.54	8.87	7.4	8.35	7.5	7.92	7.54	7.01	7.67	7.59	7.63
Electrical Conductivity EC (mS/m)	170	10.1	8.1	18.1	87.8	8.3	9.2	8.7	4.4	5.9	9.5	8.2
Total Dissolved Solids (TDS)	1200	52		104	633	47	46	45	21	31	46	41
Total Alkalinity	NG	43.1		<2.0	119	38.2	3.9	34.3	8.84	24.1	36.7	34
Nitrate (NO_3 as N)	11	0.3		0.2	0.3	0.4	0.7	0.7	0.2	0.3	0.3	0.3
Chloride (Cl)	300	2.7		2.4	5.1	2.8	1.8	2.6	2.12	2.0	2.8	1.4
Sulphate (SO_4)	500	2.2		68.3	35	2.6	4.6	2.5	6.0	2.5	2.7	2.7
Ammonium (NH_4 as N)	NG	0.04		0.1	0.1	0.02	0.04	0.03	0.2	0.3	0.1	0.03
Fluoride (F)	1.5	<0.3		<0.3	0.3	<0.3	<0.3	<0.3	0.3	0.3	<0.3	<0.3
Calcium (Ca)	NG	7.8		12.5	127	6.3	6.4	5.7	1.3	4.7	6.5	6.5
Iron (Fe)	2.0	<0.004		<0.004	<0.004	<0.004	0.01	<0.004	0.2	<0.004	<0.004	0.1
Magnesium (Mg)	NG	5.2		6.8	43.9	3.5	3.7	2.7	0.9	1.9	3.7	3.7
Potassium (K)	NG	0.7		7.9	10.9	0.9	0.8	0.8	0.3	0.06	0.9	0.5
Sodium (Na)	200	5.9		4.2	16.9	6.3	5.0	6.0	4.0	3.7	5.3	4.2
Manganese (Mn)	0.5	<0.001		1.3	<0.001	<0.001	<0.001	<0.001	0.005	<0.001	<0.001	<0.001
Cadmium (Cd)	0.003	<0.002		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Cobalt (Co)	0.5	<0.003		0.02	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Chromium (Cr)	0.05	<0.003		<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Copper (Cu)	2.0	<0.002		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Lead (Pb)	0.010	<0.004		<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Nickel (Ni)	0.07	<0.002		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Zinc (Zn)	5.0	<0.002		0.02	<0.002	<0.002	<0.002	<0.002	0.003	0.008	<0.002	<0.002

Balgarthen - Groundwater

- Electrical conductivity values range from 9.3 mS/m in borehole KB-BH02W to 31.6 mS/m in KB-BH02F. The electrical conductivity levels are below both screening guidelines for all boreholes at Balgarthen which indicate good background water quality;
- Similarly, the sulphate concentrations range from 0.6 mg/ℓ in borehole KB-BH01F and KB-BH02F to 13.3 mg/ℓ in KB-BH01P. The sulphate concentrations are below both screening guidelines for all boreholes at Balgarthen which indicate good background water quality;
- The TDS concentrations range from 45 mg/ℓ in KB-BH02W to 203 mg/ℓ in KB-BH02F. The TDS concentration in the latter exceed the WUL screening guidelines;
- The only other constituent to exceed both the SANS and IWUL screening guidelines is manganese in KB-BH01W (0.7 mg/ℓ);
- In general, the fractured aquifer boreholes seem to have slightly higher concentrations of the above listed constituents, probably as a result of more saline conditions.

Balgarthen - Surface water

- Electrical conductivity values range from 8.3 mS/m in downstream drainage BSW05 to 87.1 mS/m in the old PCD (BSW04). The electrical conductivity levels are below the SANS screening guidelines for all surface water sampling points;
- The sulphate concentrations range from 2.2 mg/ℓ in drainage BSW01 to 68.3 mg/ℓ in the old void (BSW03). The sulphate concentrations are below the screening guidelines for all sampling points;
- The TDS concentrations range from 45 mg/ℓ in upstream drainage (BSW07) to 633 mg/ℓ in BSW04 with none of the sampling points exceeding the SANS screening guidelines;
- The only constituent to exceed the SANS screening guidelines is manganese in BSW03 (1.3 mg/ℓ).

Donkerhoek - Groundwater

- Electrical conductivity values range from 10.2 mS/m in borehole KD-BH02W to 40 mS/m in KD-BH01F. The electrical conductivity levels in borehole pair KD-BH01 in both aquifers exceed the WUL screening guidelines;
- The sulphate concentrations range from 2.1 mg/ℓ in borehole KD-BH02W to 27.1 mg/ℓ in KD-BH01W. The sulphate concentrations are below both screening guidelines for all boreholes at Donkerhoek which indicate good background water quality for the coal mining industry;
- The TDS concentrations range from 53 mg/ℓ in KD-BH02W to 252 mg/ℓ in KD-BH01F. The TDS concentration in the latter borehole pair exceed the WUL screening guidelines;
- The only constituent to exceed both the SANS and IWUL screening guidelines is manganese in KD-BH01W (0.9 mg/ℓ);
- In general, the downstream boreholes seem to have slightly higher concentrations of the above listed constituents.

Donkerhoek – Surface Water

- Electrical conductivity values for both the upstream and downstream sampling points are below 6.0 mS/m which is well within the SANS screening guidelines;
- The sulphate and TDS concentrations in both the upstream and downstream drainages are well below the SANS screening guidelines;
- None of the constituents exceed both the SANS screening guidelines for the Donkerhoek surface water samples.

Twyfelhoek – Groundwater

- Electrical conductivity values range from 10 mS/m in borehole KT-BH01W to 79.6 mS/m in hydrocensus borehole KT-HC2. The electrical conductivity levels in both KT-HC2 and KT-BH02F (40.7 mS/m) exceed the WUL screening guidelines but are below the SANS screening guidelines;

- The sulphate concentrations range from 1.8 mg/ℓ in borehole KT-BH01W to 18.3 mg/ℓ in KT-BH02W. The sulphate concentrations are well below both screening guidelines for all boreholes at Twyfelhoek;
- The TDS concentrations range from 52 mg/ℓ in KT-BH01W to 475 mg/ℓ in KT-HC2. The TDS concentration in the latter borehole and in KT-BH02F exceed the WUL screening guidelines;
- The only constituent to exceed both the SANS and IWUL screening guidelines is fluoride in KT-BH02W (8.3 mg/ℓ).

Twyfelhoek – Surface water

- Electrical conductivity values at both surface water sampling points (upstream and downstream) are below 10 mS/m and are well below both screening guidelines;
- The sulphate and TDS concentrations in both the upstream and downstream drainages are well below the SANS screening guidelines;
- None of the remaining constituents exceed the SANS screening guidelines for the Donkerhoek surface water samples.

9.8.5 Aquifer Classification and Vulnerability

Based on the fact that there is limited groundwater usage in the study area, as well as the insignificantly yielding potential of the aquifers (<1.0 L/s) both the weathered and fractured aquifers in the Donkerhoek and Twyfelhoek areas are classified as non-aquifer systems, according to Parsons and DWS. The weathered and fractured aquifers at Balgarthen yielded more water and thus classify as Minor Aquifer systems.

9.9 Land Tenure

The majority of the land which falls within the Kusipongo mining right area is owned by various Trusts **Figure 9-48** provides a list of the property owners, which are also listed below.

- Yende Farmers Trust;
- Baltrina Johanna Kemp;
- Carla Labuschagne;
- Elizabeth Wanliss;
- Corneels Greyling Trust;
- Mooibank Boerdery Trust;
- Ukuchuma Farming;
- Donkerhoek Trust;
- Kerneels Greyling Trust;
- Indabuko Agricultural Co-operative Ltd;
- Ekaluka Communal Property Association;
- B.Z Zelpy 1007 (Pty) Ltd;
- Dymastar (Pty) Ltd

- Republic of South Africa; and
- Kangra Coal (Pty) Ltd.

The land ownership where the proposed adits and opencast pits are to be located are detailed below:

Donkerhoek opencast pits	**Twyfelhoek opencast pits**	**Balgarthen A adit**	**Balgarthen B adit**
• Corneels Greyling Trust; • Dymastar (Pty) Ltd (owned by Corneels Greyling); and • Donkerhoek Trust	• Yende Farmers Trust	• Kangra Coal (Pty) Ltd	• Corneels Greyling Trust; • Kerneels Greyling Trust; and • Indabuko Agricultural Co-operative

The neighbouring land ownership surrounding the mining right area is shown in **Figure 9-49**.

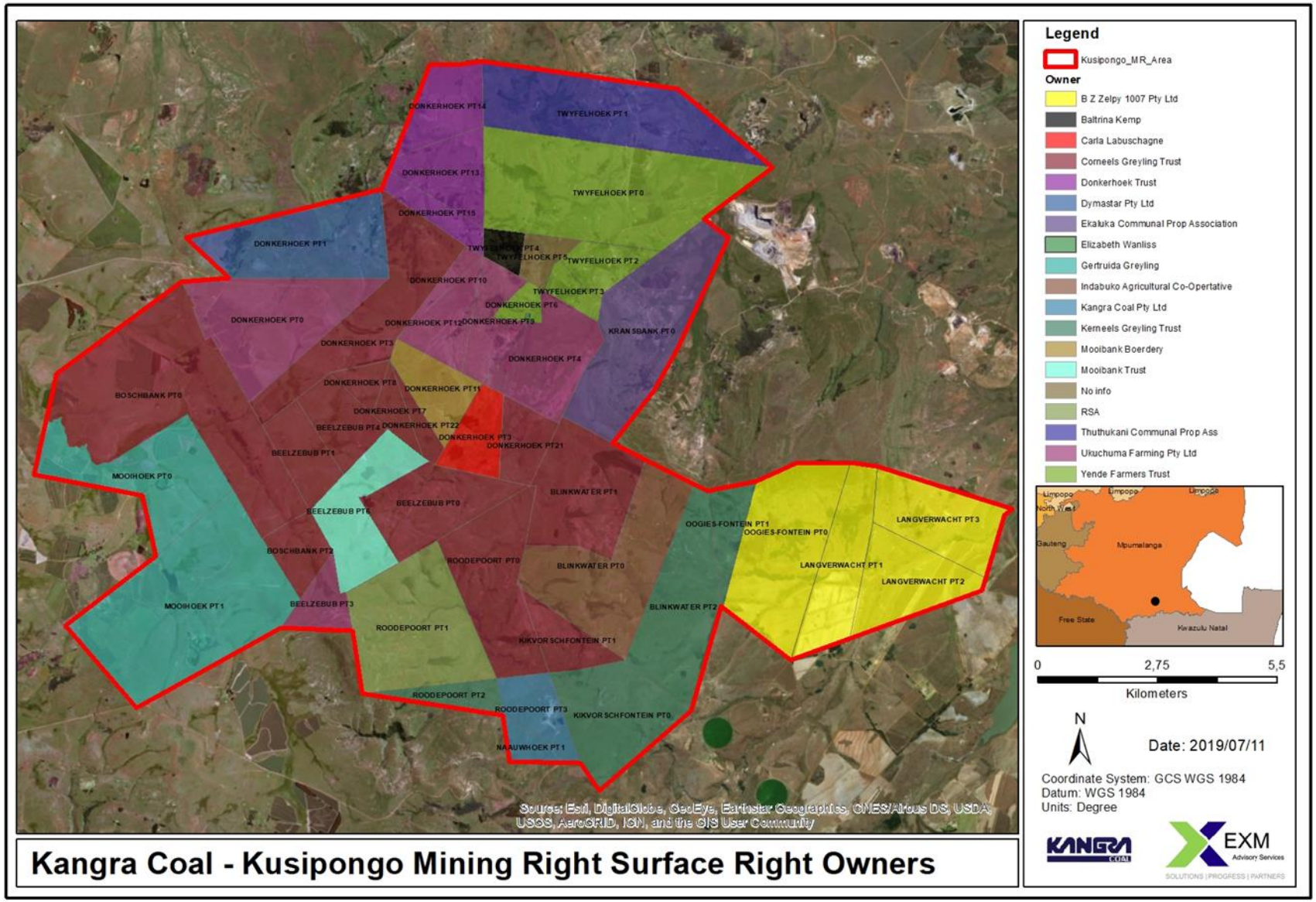


FIGURE 9-48: LAND OWNERSHIP WITHIN THE KUSIPONGO MINING RIGHT