Plan 1

Umcebo Mining Hendrina Underground Coal Mine EIA

Land Tenure

Legend

- Project Area
- R — Other Town
- Arterial/National Route
- Main Road
- Minor Road
- Railway Line
- Non-Perennial Stream
- Perennial Stream
- Dam Wall
- Dam/Lake
- Non-Perennial Pan
- Perennial Pan
- Wetland
- Farm Boundary
- Farm Portion

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Projection: Transverse Mercator	Ref #: kam.XST3791.201610.079
Datum: WGS 1984	Revision Number: 1
Central Meridian: 29°E	Date: 12/10/2016

0 1 2 4

Kilometres

1:80,000

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Plan 2

Umcebo Mining Hendrina Underground Coal Mine EIA

Regional Setting

Legend

- Project Area
- Major Town
- Secondary Town
- Other Town
- Settlement
- National Road
- Main Road
- Railway Line
- River
- Dam
- Local Municipality

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Projection: Transverse Mercator	Ref #: kam.XST3791.201610.080
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Central Meridian: 29°E	Date: 12/10/2016

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Kilometres

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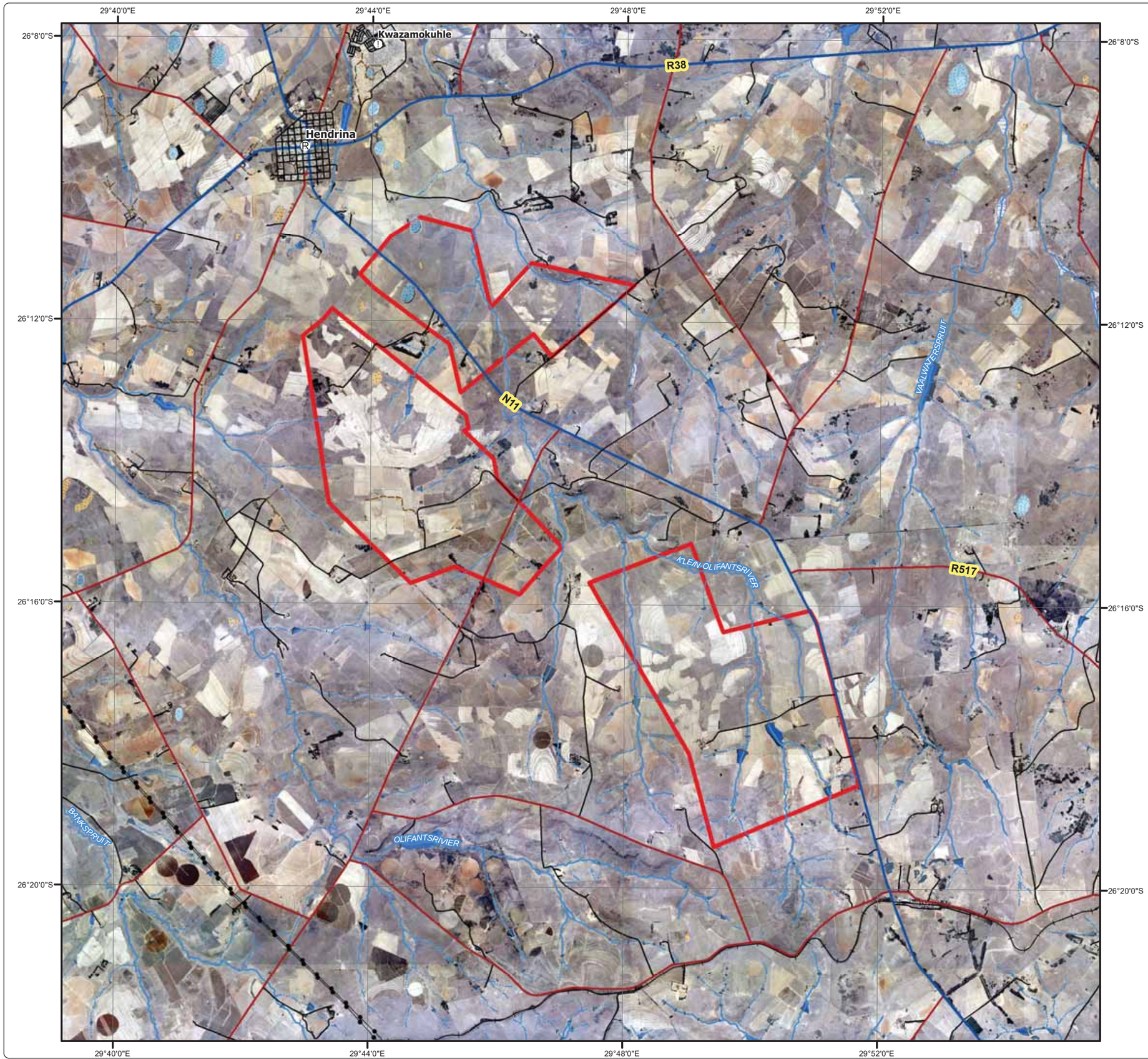
Plan 3

Umcebo Mining Hendrina Underground Coal Mine EIA

Local Setting



Legend

- Project Area
- R — Other Town
- ! — Settlement
- Power Line
- Arterial/National Route
- Main Road
- Minor Road
- Track
- Railway Line
- Non-Perennial Stream
- Perennial Stream
- Dam Wall
- Dam/Lake
- Non-Perennial Pan
- Perennial Pan
- Wetland

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Kilometres

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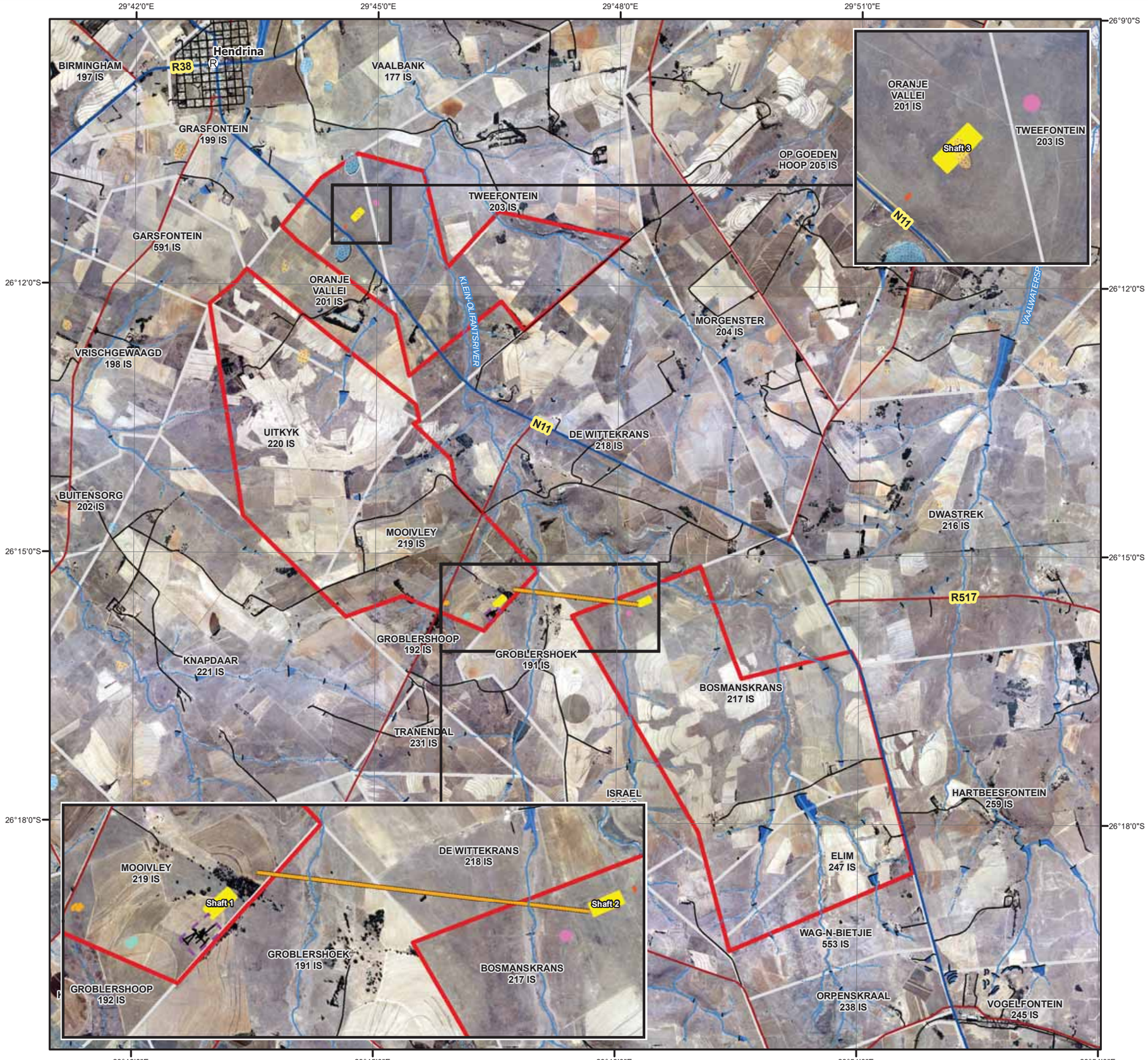
Plan 4

Umcebo Mining Hendrina Underground Coal Mine EIA

Preliminary Infrastructure



Legend

- Project Area
- R Other Town
- Arterial/National Route
- Main Road
- Minor Road
- Railway Line
- Non-Perennial Stream
- Perennial Stream
- Dam Wall
- Dam/Lake
- Non-Perennial Pan
- Perennial Pan
- Wetland
- Farm Boundary

Infrastructure

- Overland Conveyor
- Crushing and Screening Plant
- Offices, Change House and Workshop
- Plant Area
- PCD
- Shaft
- Shaft Site Office
- Silo Bin

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Projection: Transverse Mercator	Ref #: kam.XST3791.201610.082
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Kilometres

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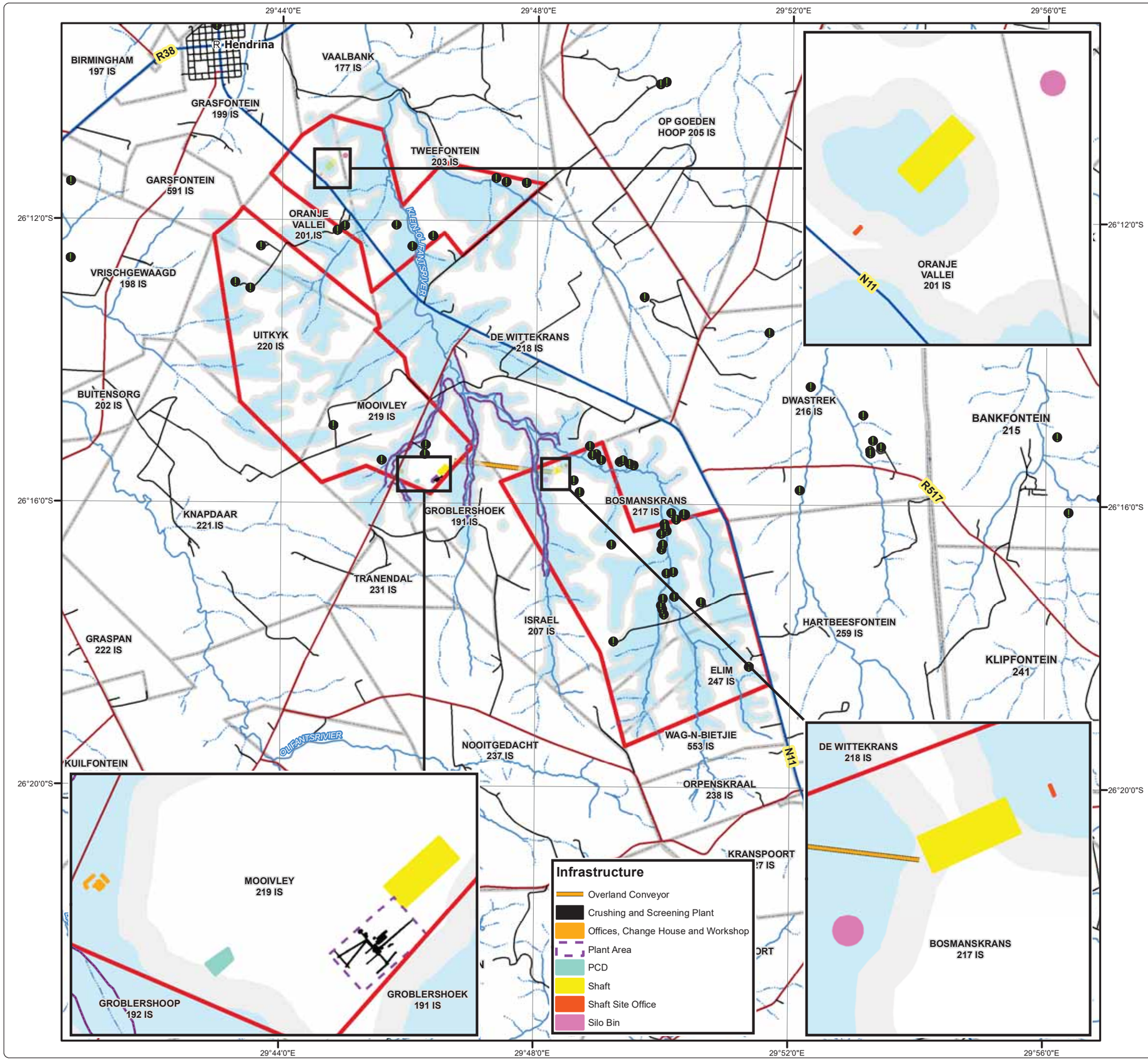
Plan 5

Umcebo Mining Hendrina Underground Coal Mine EIA

Sensitivity Map 1



Legend

- Project Area
- Identified Heritage Resources
- R Other Town
- Arterial/National Route
- Main Road
- Minor Road
- Non-Perennial Stream
- Perennial Stream
- 1:100 Year Floodlines
- 100m Wetlands Buffer
- Wetlands
- Farm Boundary

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Projection: Transverse Mercator
Datum: WGS 1984
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Kilometres
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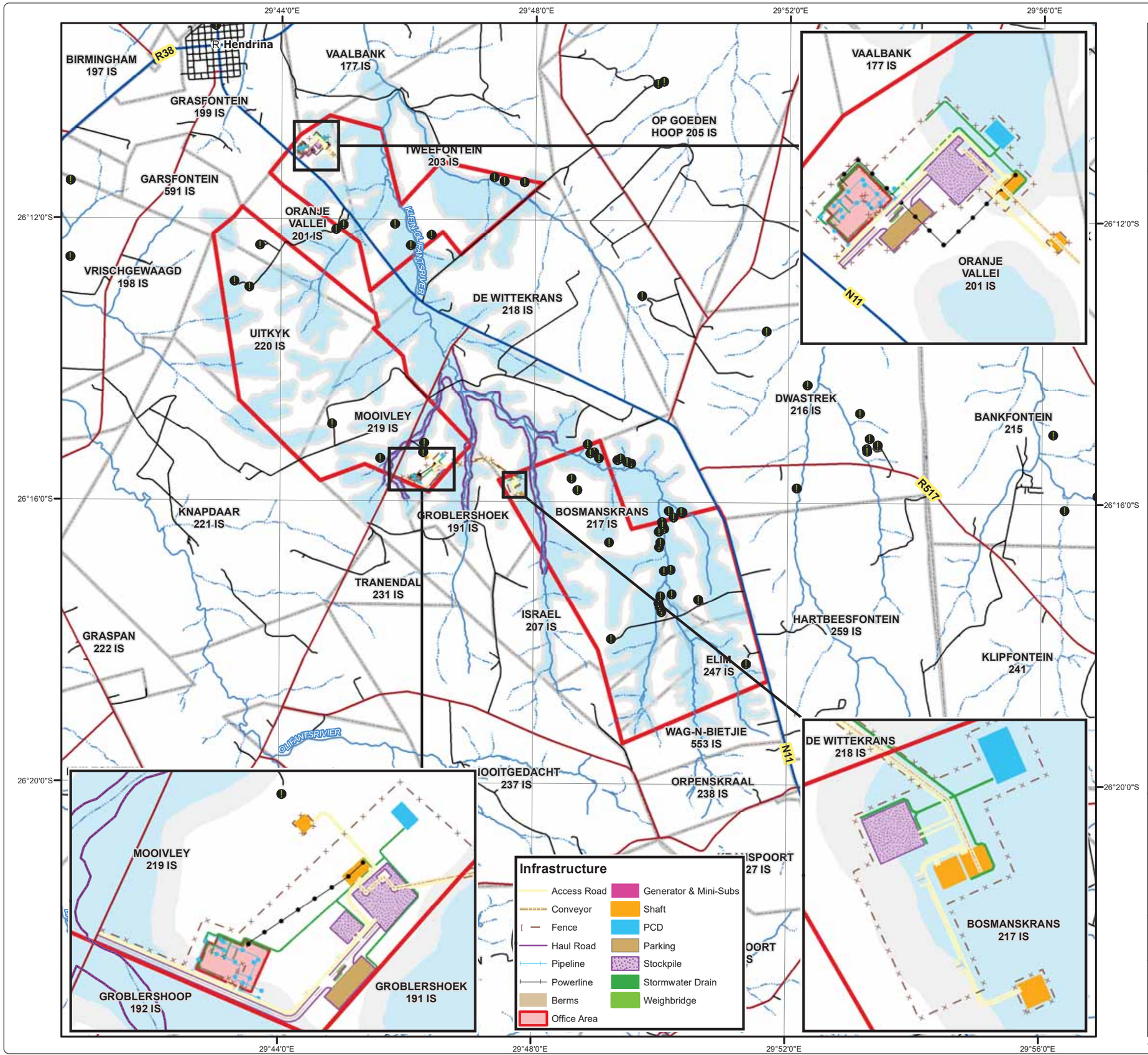
Plan 6

Umcebo Mining Hendrina Underground Coal Mine EIA

Sensitivity Map 2



Legend

- Project Area
- Identified Heritage Resources
- R Other Town
- Arterial/National Route
- Main Road
- Minor Road
- Non-Perennial Stream
- Perennial Stream
- 1:100 Year Floodlines
- 100m Wetlands Buffer
- Wetlands
- Farm Boundary

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Projection: Transverse Mercator	Ref #: kam,XST3791.201610.084
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Kilometres

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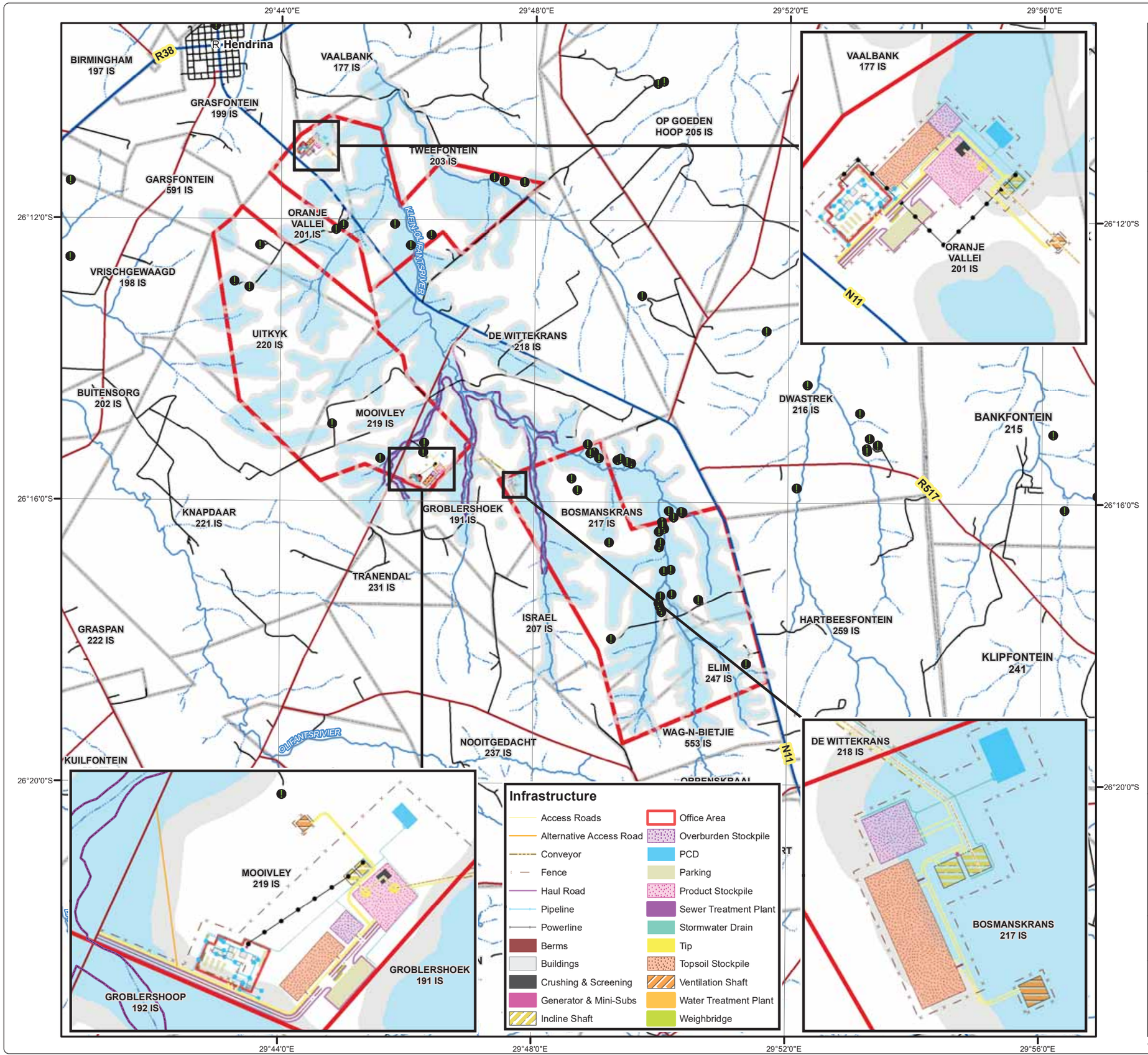
Plan 7

Umcebo Mining Hendrina Underground Coal Mine EIA

Sensitivity Map 3



Legend

- Project Area
- Identified Heritage Resources
- R Other Town
- Arterial/National Route
- Main Road
- Minor Road
- Non-Perennial Stream
- Perennial Stream
- 1:100 Year Floodlines
- 100m Wetlands Buffer
- Wetlands
- Farm Boundary

Infrastructure

- Access Roads
- Alternative Access Road
- Conveyor
- Fence
- Haul Road
- Pipeline
- Powerline
- Berms
- Buildings
- Crushing & Screening
- Generator & Mini-Subs
- Incline Shaft
- Office Area
- Overburden Stockpile
- PCD
- Parking
- Product Stockpile
- Sewer Treatment Plant
- Stormwater Drain
- Tip
- Topsoil Stockpile
- Ventilation Shaft
- Water Treatment Plant
- Weighbridge

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Revision Number: 1
Date: 24/10/2016

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Kilometres
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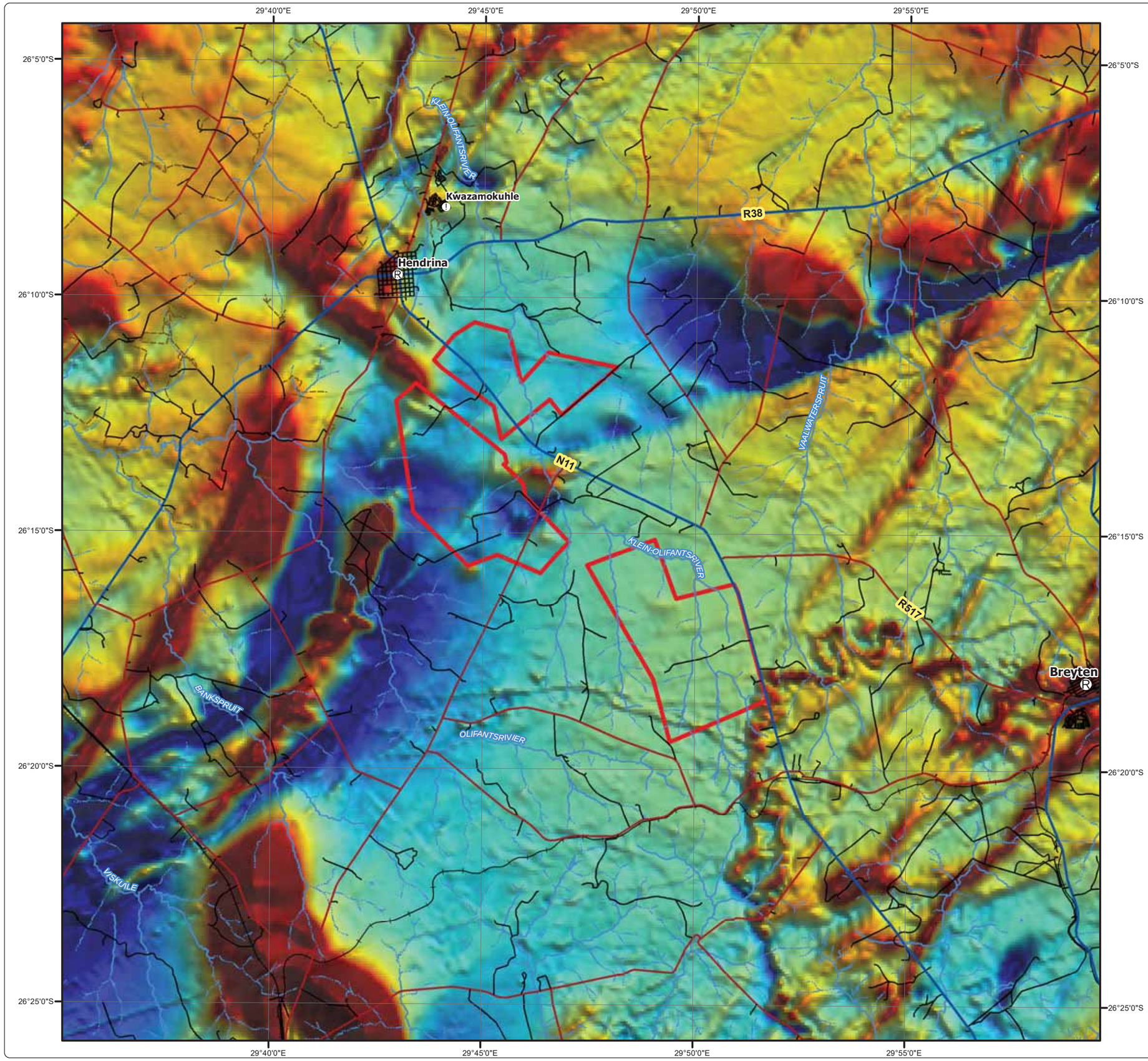
Plan 8

Umcebo Mining Hendrina Underground Coal Mine EIA

Aeromagnetics Model and Geological Anomalies



Legend

- Project Area
- R Secondary Town
- R Other Town
- ! Settlement
- Arterial/National Route
- Main Road
- Minor Road
- Track
- Railway Line
- Non-Perennial Stream
- Perennial Stream

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0 2 4 8

Kilometres

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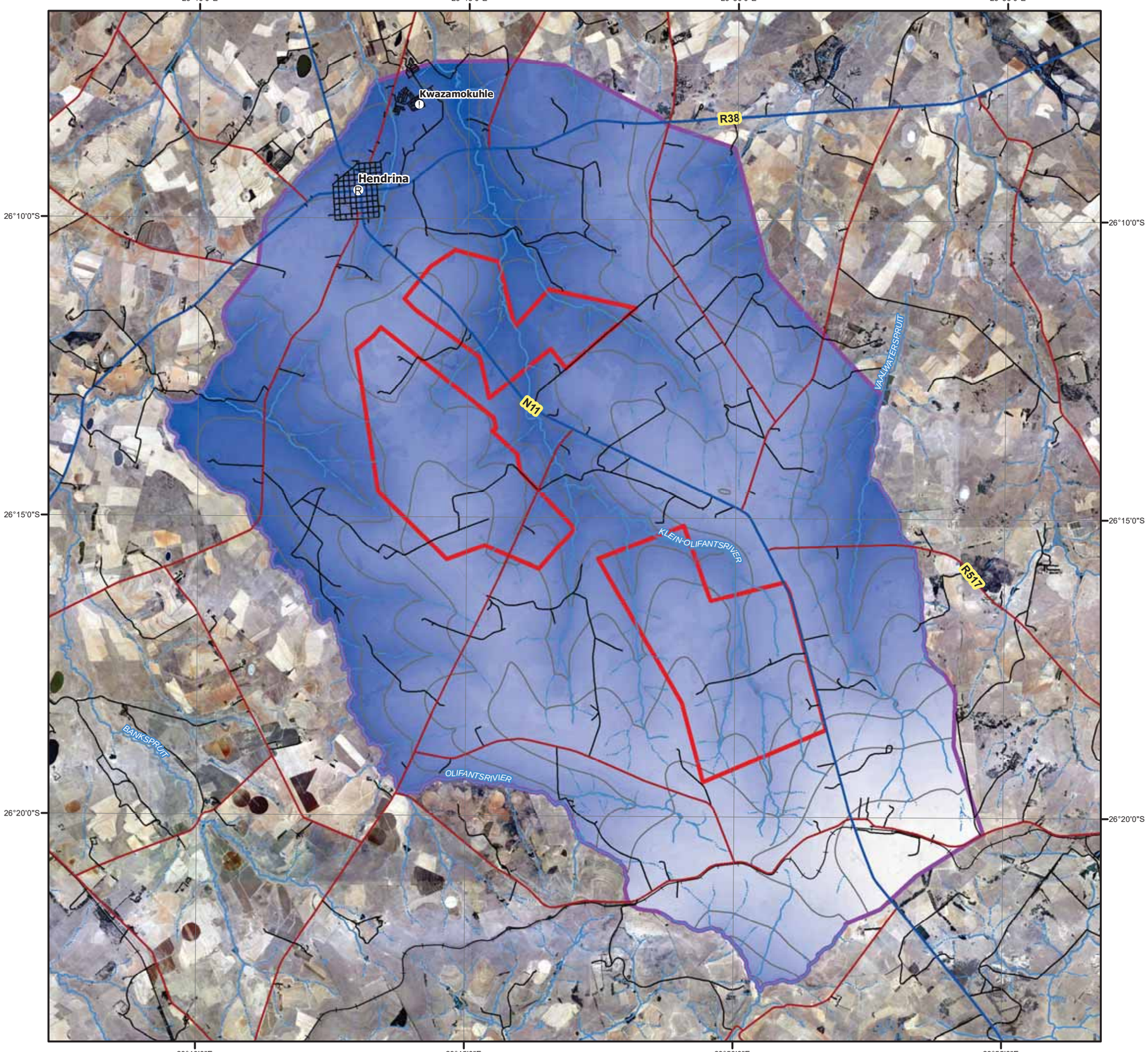
Plan 9

Umcebo Mining Hendrina Underground Coal Mine EIA

Simulated Water Level and Flow Direction



Legend

- Project Area
- Model Boundary
- R Other Town
- ! Settlement
- Arterial/National Route
- Main Road
- Minor Road
- Railway Line
- Non-Perennial Stream
- Perennial Stream

Hydraulic Head

Elevation (m.a.m.s.l)

High : 1796

Low : 1618

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Projection: Transverse Mercator	Ref #: kam.XST3791.201610.087
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Central Meridian: 29°E	Date: 13/10/2016

0 1 2 4 6

Kilometres

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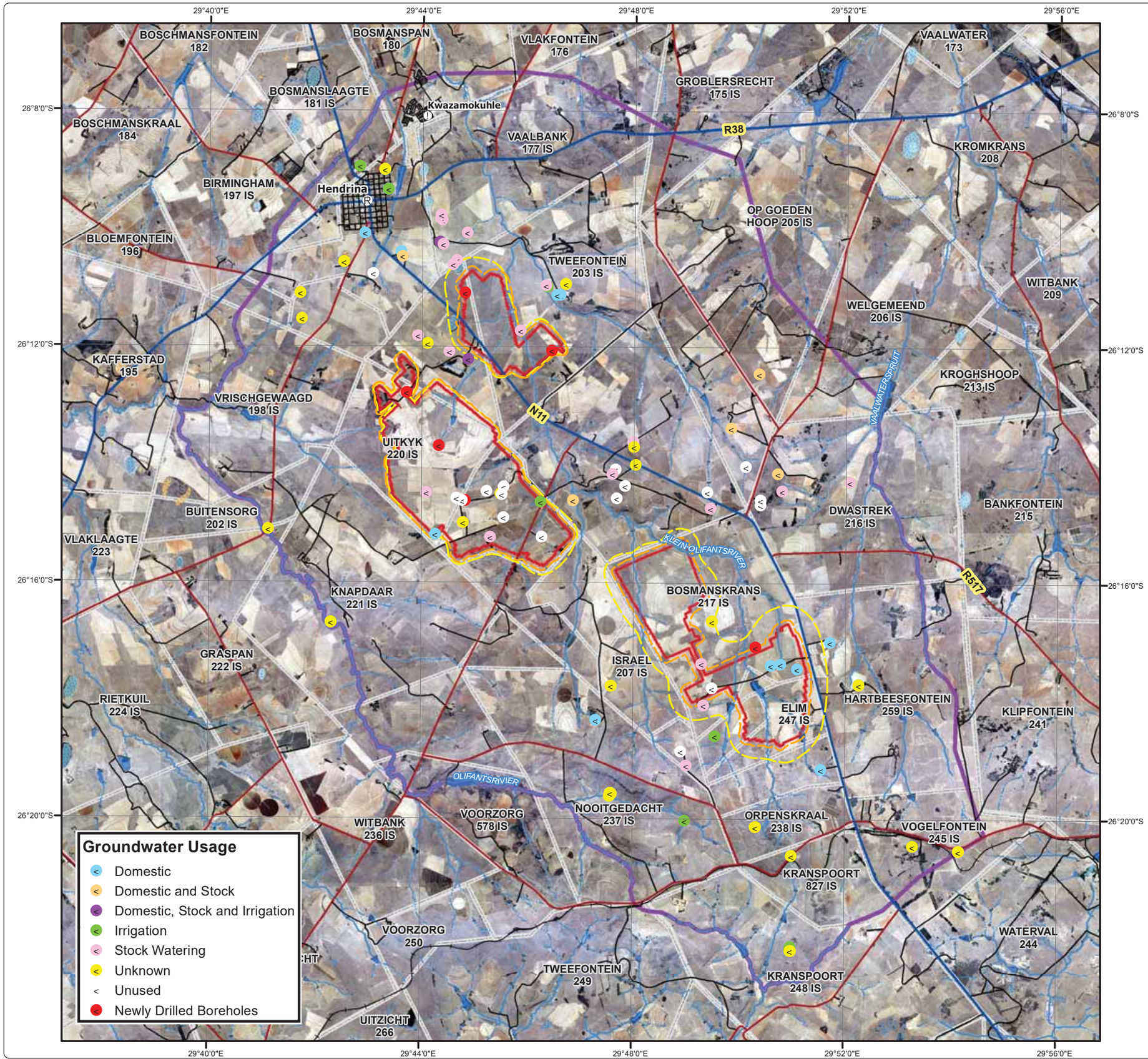
Plan 10

Umcebo Mining Hendrina Underground Coal Mine EIA

Groundwater Sensitivity Map



Groundwater Usage

- Domestic
- Domestic and Stock
- Domestic, Stock and Irrigation
- Irrigation
- Stock Watering
- Unknown
- Unused
- Newly Drilled Boreholes

Legend

- Life of Mine Boundary
- Model Boundary
- R — Other Town
- ! — Settlement
- Arterial/National Route
- Main Road
- Minor Road
- Railway Line
- Non-Perennial Stream
- Perennial Stream
- Dam Wall
- Dam/Lake
- Non-Perennial Pan
- Perennial Pan
- Wetland
- Farm Boundary

Sensitivity

- 0.1% Concentration Limit
- 5m Drawdown Limit

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Central Meridian: 29°E

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Revision Number: 1
Date: 13/10/2016

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Kilometres
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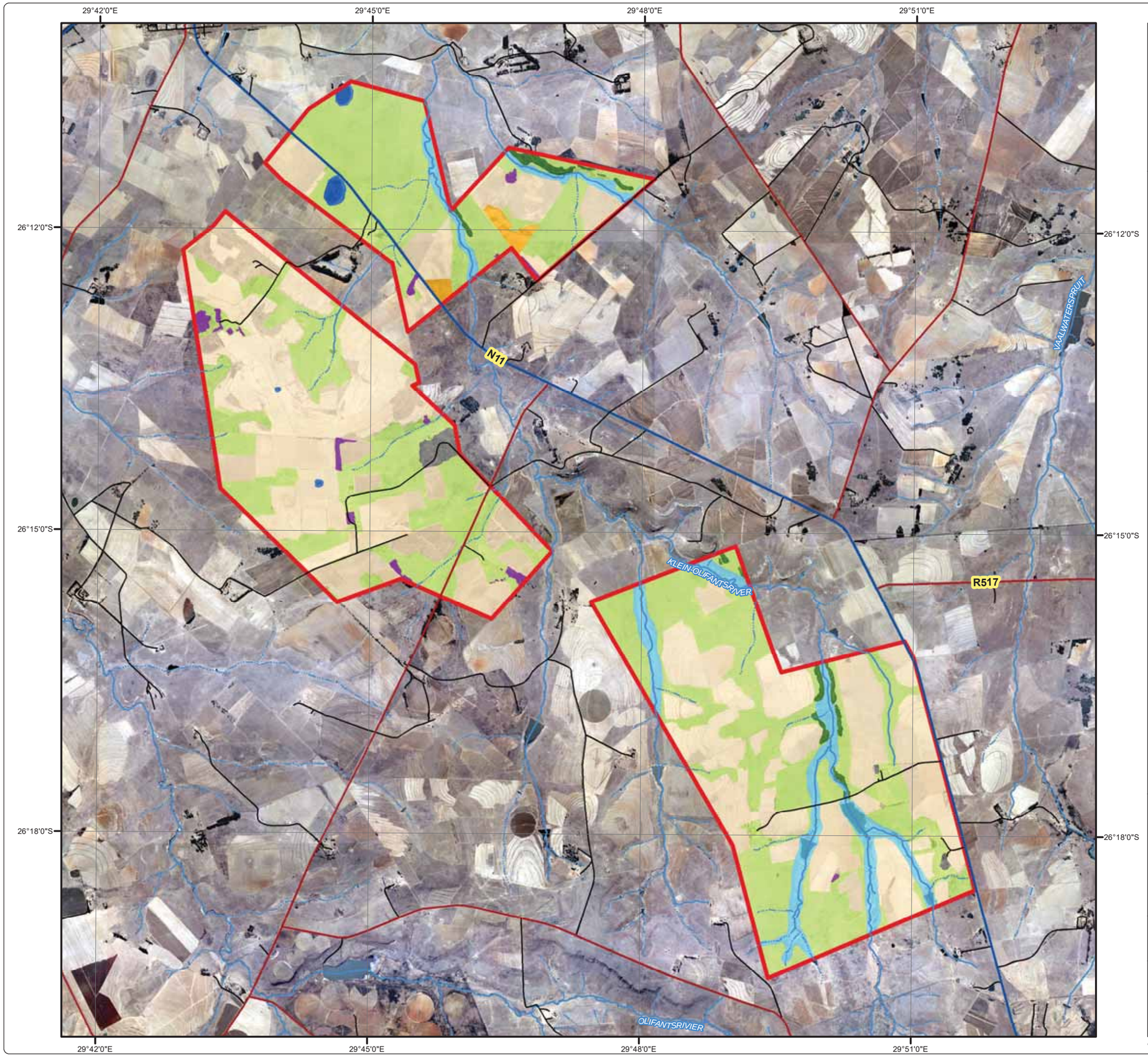
Plan 11

Umcebo Mining Hendrina Underground Coal Mine EIA

Vegetation Habitats



Legend

- Project Area
- Arterial/National Route
- Main Road
- Minor Road
- Non-Perennial Stream
- Perennial Stream

Vegetation Habitats

- Alien Bushclump
- Crinum - Arundinella Riparian Habitat
- Cultivation
- Disturbed Grassland
- Eragrostis Grassland
- Gnidia - Diospyros Rocky Grassland
- Infrastructure
- Pan

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Datum: WGS 1984	Revision Number: 1
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0 0.5 1 2 3

Kilometres

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Plan 12

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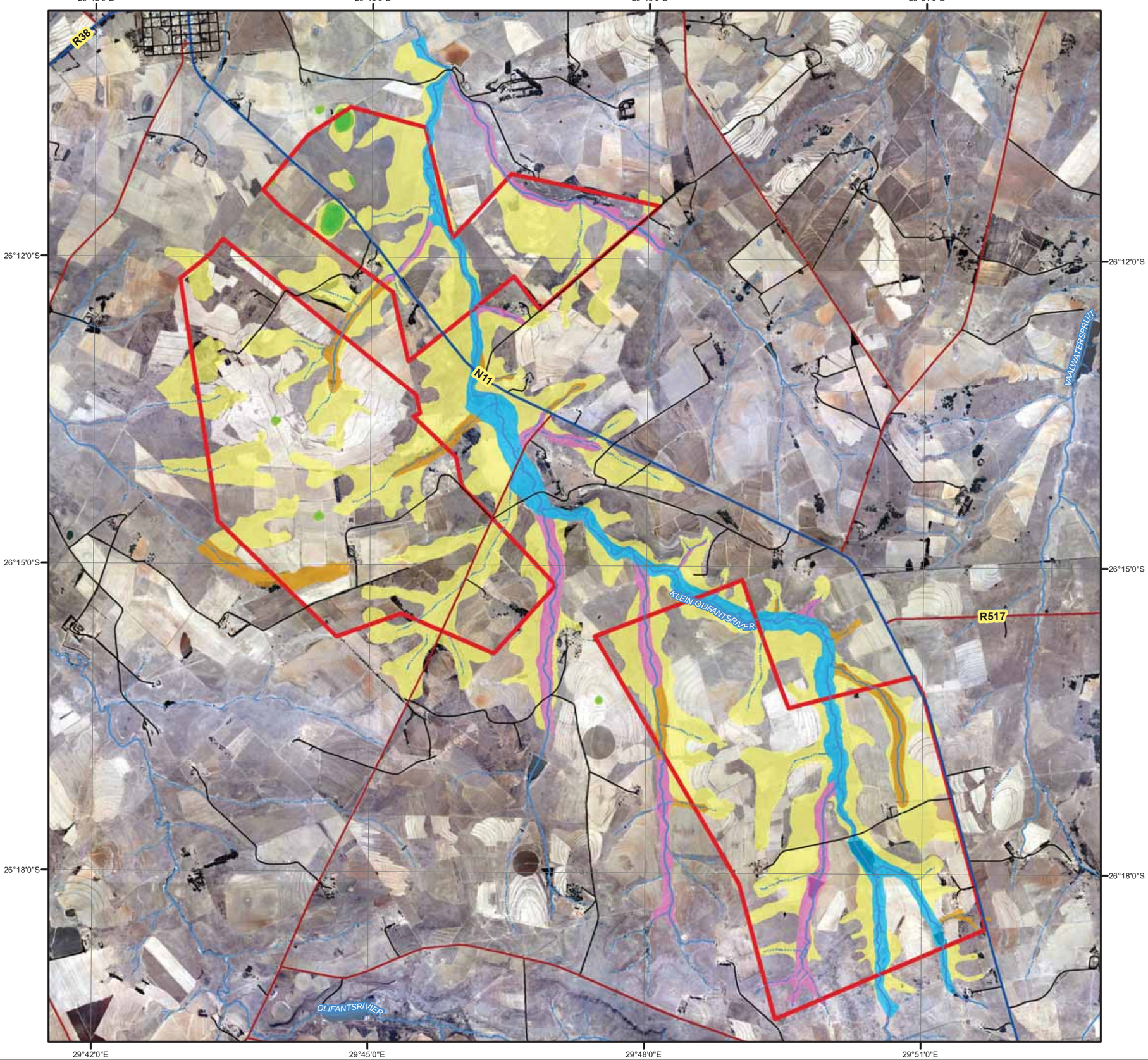
Wetland Delineation and Hydrogeomorphic Units



Legend

- Project Area
- Arterial/National Route
- Main Road
- Minor Road
- Non-Perennial Stream
- Perennial Stream

Wetland Delineation

- Channelled Valley Bottom
- Klein Olifants River
- Pan
- Seep
- Valley Bottom

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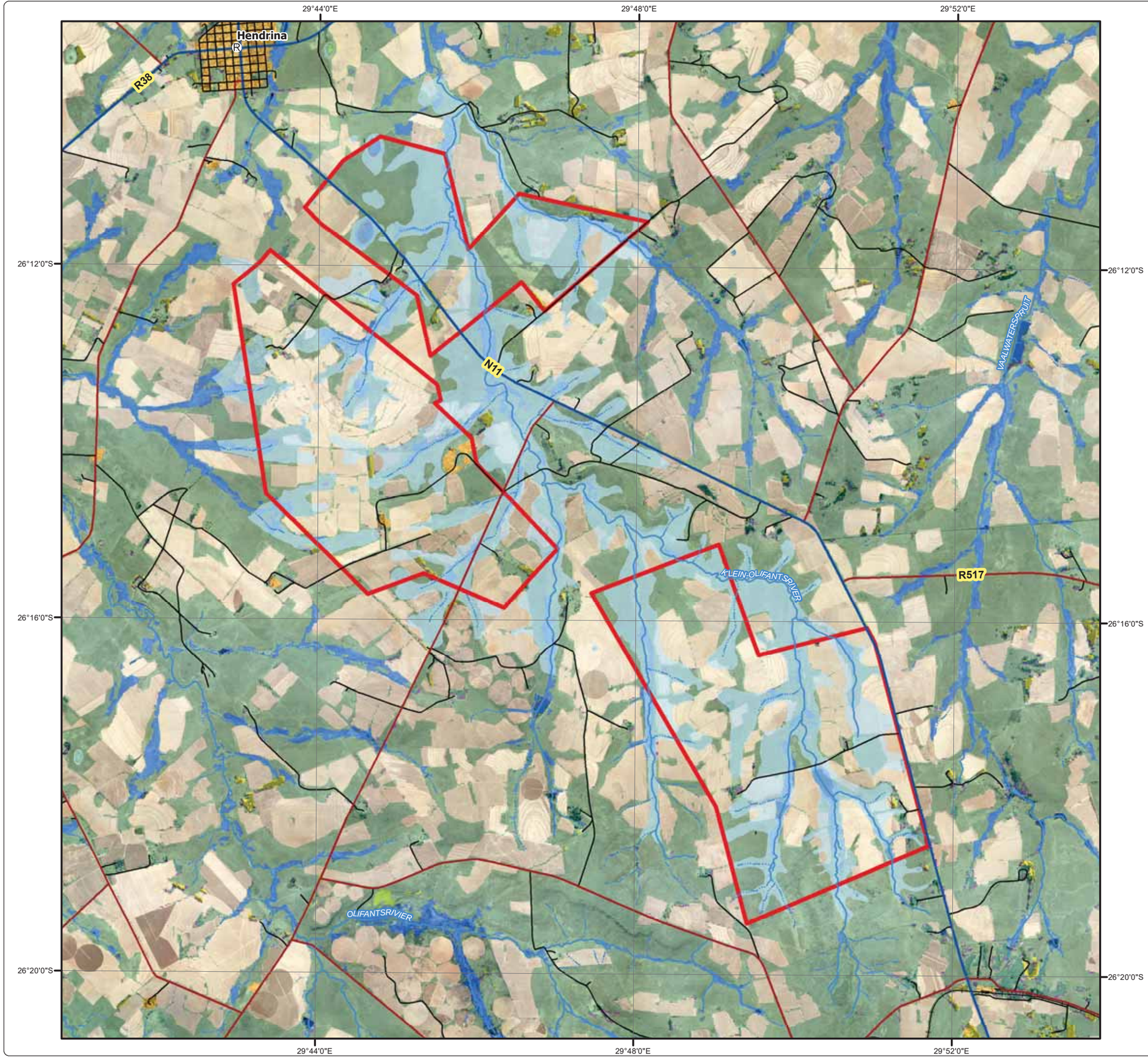
Plan 13

Umcebo Mining Hendrina Underground Coal Mine EIA

Wetlands and Land Use



Legend

- Project Area
- R — Other Town
- Arterial/National Route
- Main Road
- Minor Road
- Railway Line
- Non-Perennial Stream
- Perennial Stream
- Wetland Delineation

Land Use

NLC (2013/2014)

- Cultivated Area
- Grassland
- Low Shrubland
- Plantations/Woodlots
- Thicket/Dense Bush
- Urban Area
- Water Areas
- Woodlands/Open Bush

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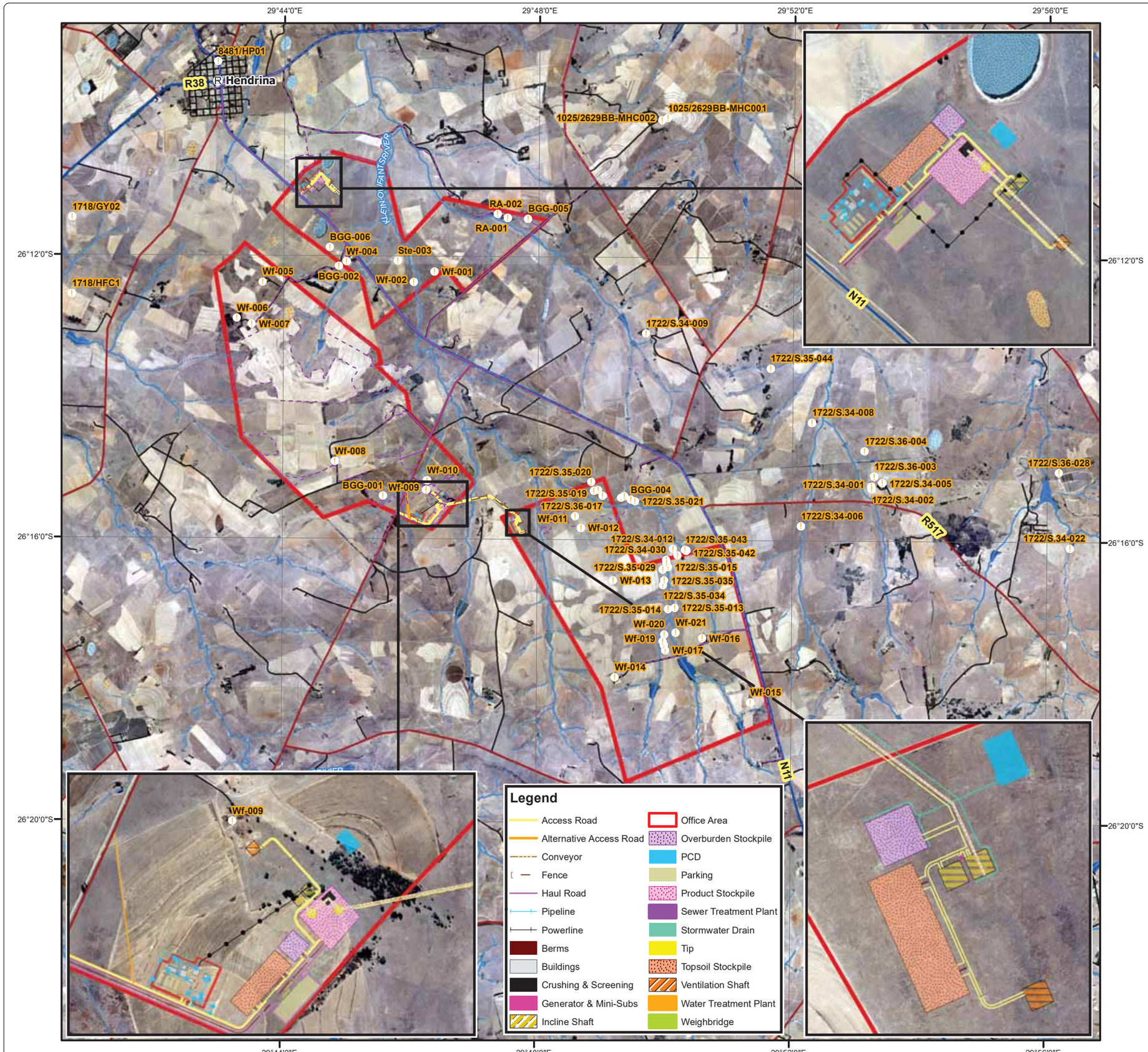
Plan 14

Umcebo Mining Hendrina Underground Coal Mine EIA

Identified Heritage Resources



Legend

- Project Area
- R — Other Town
- ! — Identified Heritage Resources
- Track Log
- Arterial/National Route
- Main Road
- Minor Road
- Non-Perennial Stream
- Perennial Stream
- Dam Wall
- Dam/Lake
- Non-Perennial Pan
- Perennial Pan
- Wetland

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Kilometres
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Plan 15

Umcebo Mining Hendrina Underground Coal Mine EIA

Land Use within Primary Study Area

29°44'0"E 29°48'0"E 29°52'0"E

26°12'0"S 26°16'0"S 26°20'0"S

N11

VAALWATERSPRUIT

KLEINOLIFANTSRIVER

Legend

- Project Area
- Borehole Locations
- Identified Heritage Resources
- Arterial/National Route
- Main Road
- Minor Road
- Non-Perennial Stream
- Perennial Stream

Field Visit Points

- Business/Commercial Structures/Assets
- Farm Dweller/Occupants
- Formal Residential
- Other Uses or Landmarks

Land Use

NLC (2013/2014)

- Cultivated Area
- Grassland
- Low Shrubland
- Plantations/Woodlots
- Thicket/Dense bush
- Urban Area
- Water Areas
- Woodlands/Open Bush

Infrastructure

- 100m Infrastructure Buffer
- 500m Shaft Buffer
- Access Road
- Alternative Access Road
- Conveyor
- Fence
- Haul Road
- Pipeline
- Powerline
- Seams
- Berms
- Buildings
- Crushing & Screening
- Generator & Mini-Subs
- Incline Shaft
- Office Area
- Overburden Stockpile
- PCD
- Parking
- Product Stockpile
- Sewer Treatment Plant
- Stormwater Drain
- Tip
- Topsoil Stockpile
- Ventilation Shaft
- Water Treatment Plant
- Weighbridge

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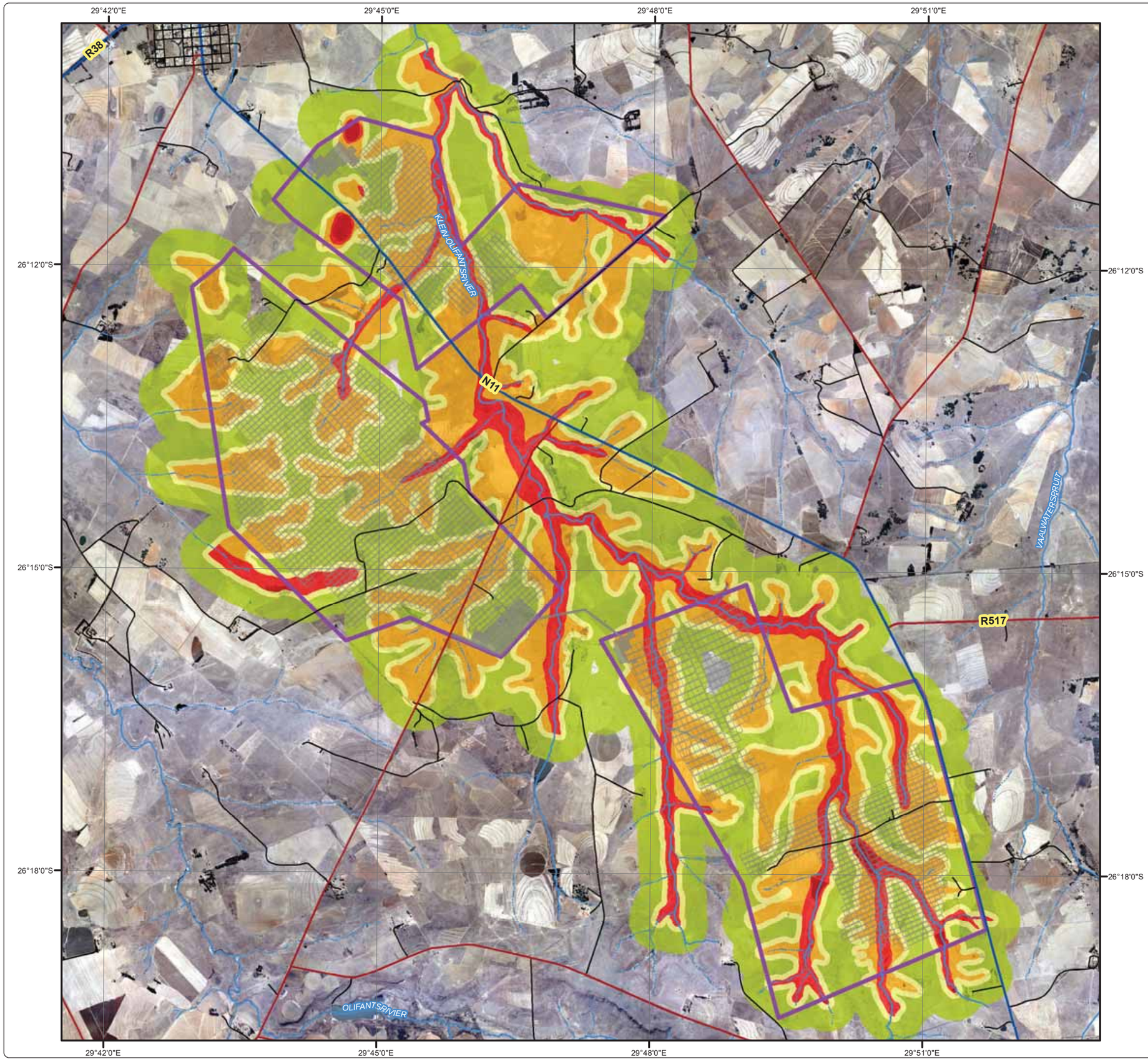
Plan 16

Umcebo Mining Hendrina Underground Coal Mine EIA

Wetlands Sensitivity Map



Legend

- Project Area
- Arterial/National Route
- Main Road
- Minor Road
- Non-Perennial Stream
- Perennial Stream
- Infrastructure

Sensitive Areas

- Very High - No-Go
- High
- Moderate - High
- Moderate - Low

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Kilometres

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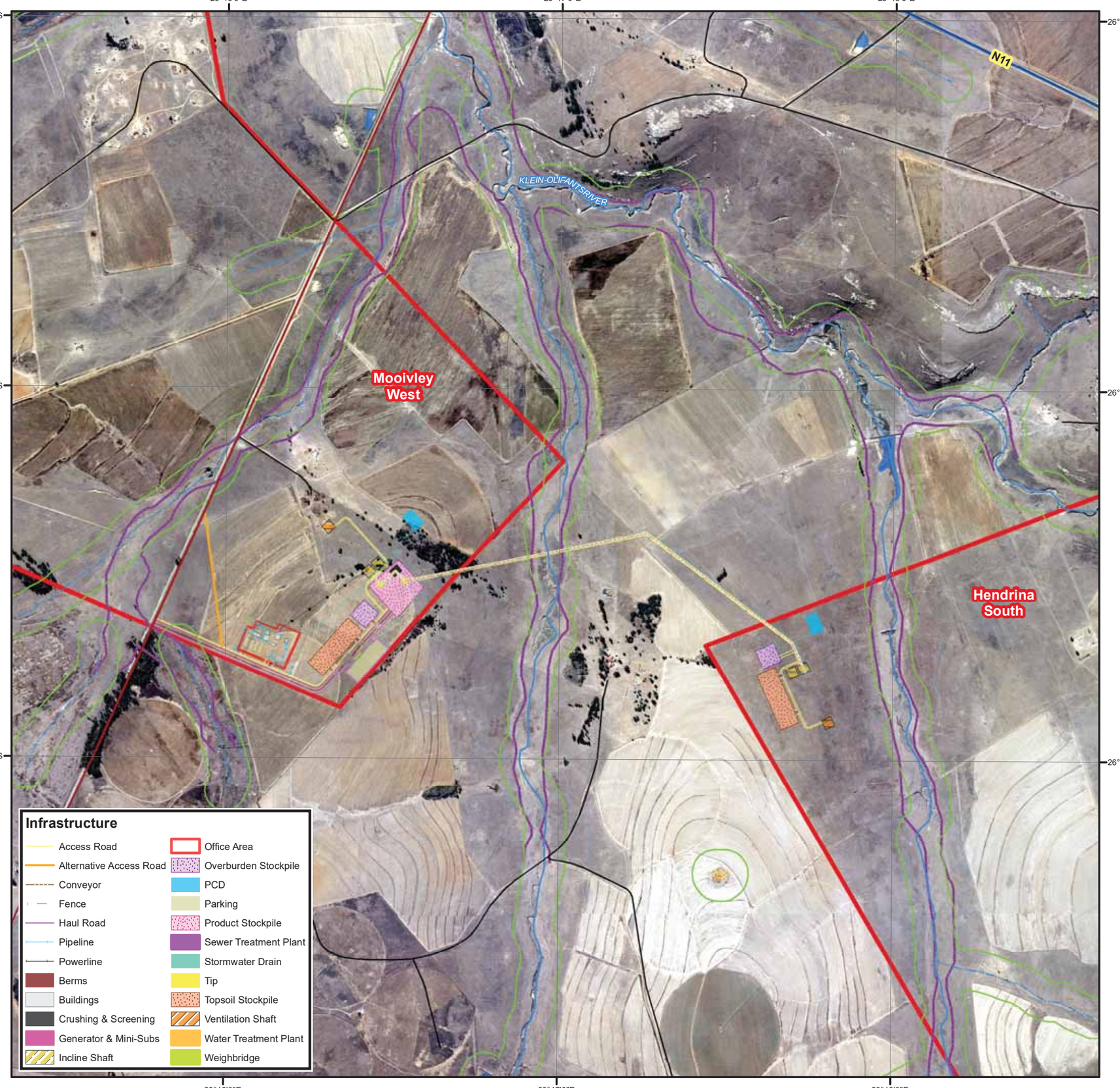
Plan 17

Umcebo Mining Hendrina Underground Coal Mine EIA

1:100 Year Floodline and 100m Buffer of Watercourses

29°46'0"E 29°47'0"E 29°48'0"E

26°14'0"S 26°15'0"S 26°16'0"S



Legend

- Project Area
- Arterial/National Route
- Main Road
- Minor Road
- Non-Perennial Stream
- Perennial Stream
- 1:100 Year Floodlines
- Dam Wall
- Dam/Lake
- Non-Perennial Pan
- 100m Buffer of Watercourses

Infrastructure

- Access Road
- Alternative Access Road
- Conveyor
- Fence
- Haul Road
- Pipeline
- Powerline
- Berms
- Buildings
- Crushing & Screening
- Generator & Mini-Subs
- Incline Shaft
- Office Area
- Overburden Stockpile
- PCD
- Parking
- Product Stockpile
- Sewer Treatment Plant
- Stormwater Drain
- Tip
- Topsoil Stockpile
- Ventilation Shaft
- Water Treatment Plant
- Weighbridge

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Date: 13/10/2016

0 0.25 0.5 1
Kilometres
1:20,000

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Plan 18

Umcebo Mining Hendrina Underground Coal Mine EIA

Ecological Sensitivity

29°44'0"E 29°48'0"E 29°52'0"E 29°56'0"E

26°12'0"S 26°16'0"S 26°20'0"S

Flamingos (Greater)
Secretary Bird
Eucomis Autumnalis
Satyrium
Aloe Ecklonis Population
KLEIN-OLIFANTSRIVIER
OLIFANTSRIVIER
N11
R517

Legend

- Project Area
- Sensitivity Points
- Arterial/National Route
- Main Road
- Minor Road
- Track
- Non-Perennial Stream
- Perennial Stream

Ecological Sensitivity

- Very High
- High
- Moderate
- Low

Infrastructure

- Access Road
- Alternative Access Road
- Conveyor
- Fence
- Haul Road
- Pipeline
- Powerline
- Seams
- Berms
- Buildings
- Crushing & Screening
- Generator & Mini-Subs
- Incline Shaft
- Office Area
- Overburden Stockpile
- PCD
- Parking
- Product Stockpile
- Sewer Treatment Plant
- Stormwater Drain
- Tip
- Topsoil Stockpile
- Ventilation Shaft
- Water Treatment Plant
- Weighbridge

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Revision Number: 1
Date: 13/10/2016

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Kilometres
1:90,000

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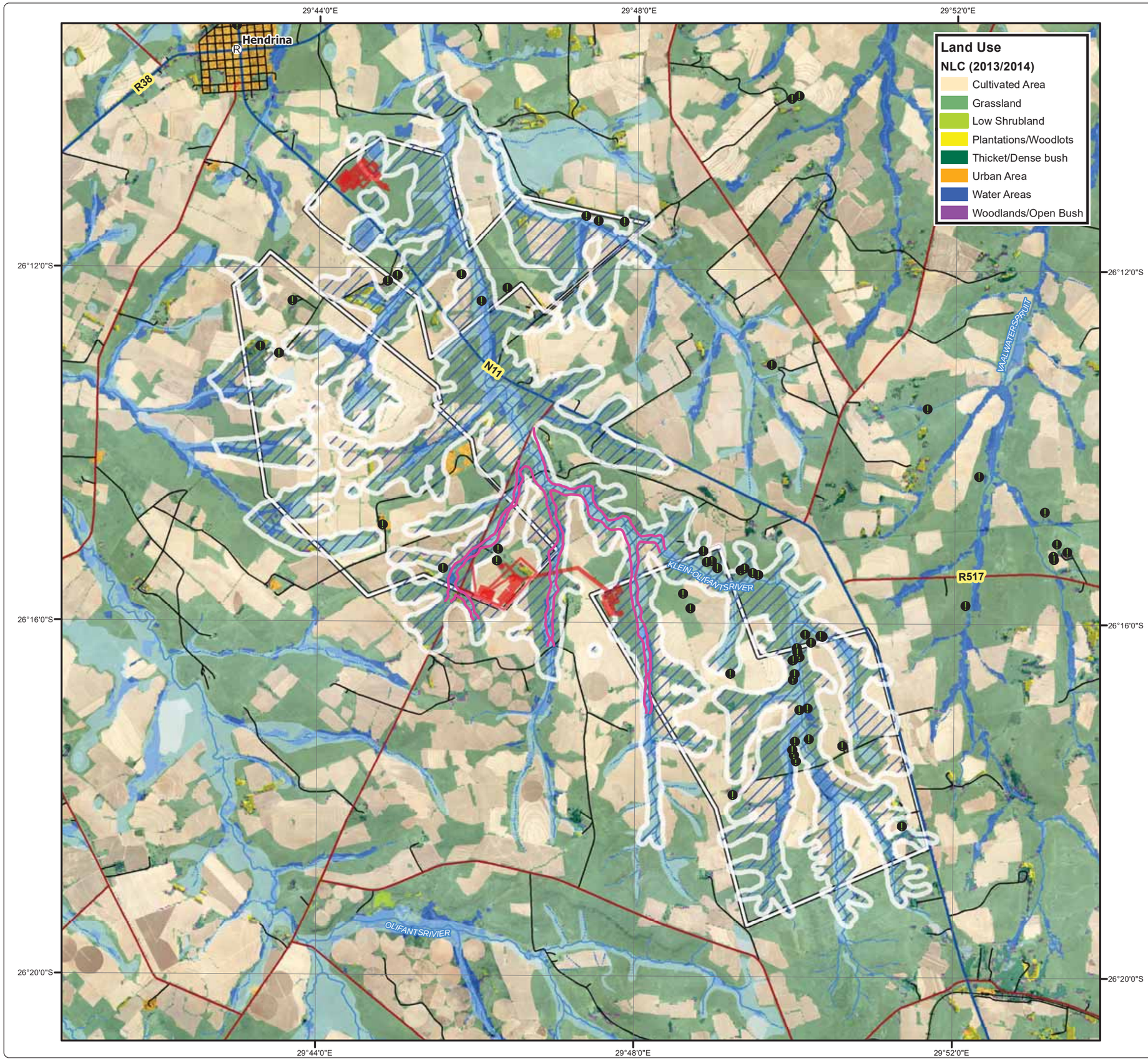
Plan 19

Umcebo Mining Hendrina Underground Coal Mine EIA

Environmental and Land Use



Legend

- Project Area
- R Other Town
- Arterial/National Route
- Main Road
- Minor Road
- Railway Line
- Non-Perennial Stream
- Perennial Stream
- Infrastructure

Sensitivity

- Identified Heritage Resources
- 1:100 Year Floodlines
- 100m Wetlands Buffer
- Delineated Wetlands
- NFEPA Wetlands

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0 1 2 4

Kilometres

1:80,000

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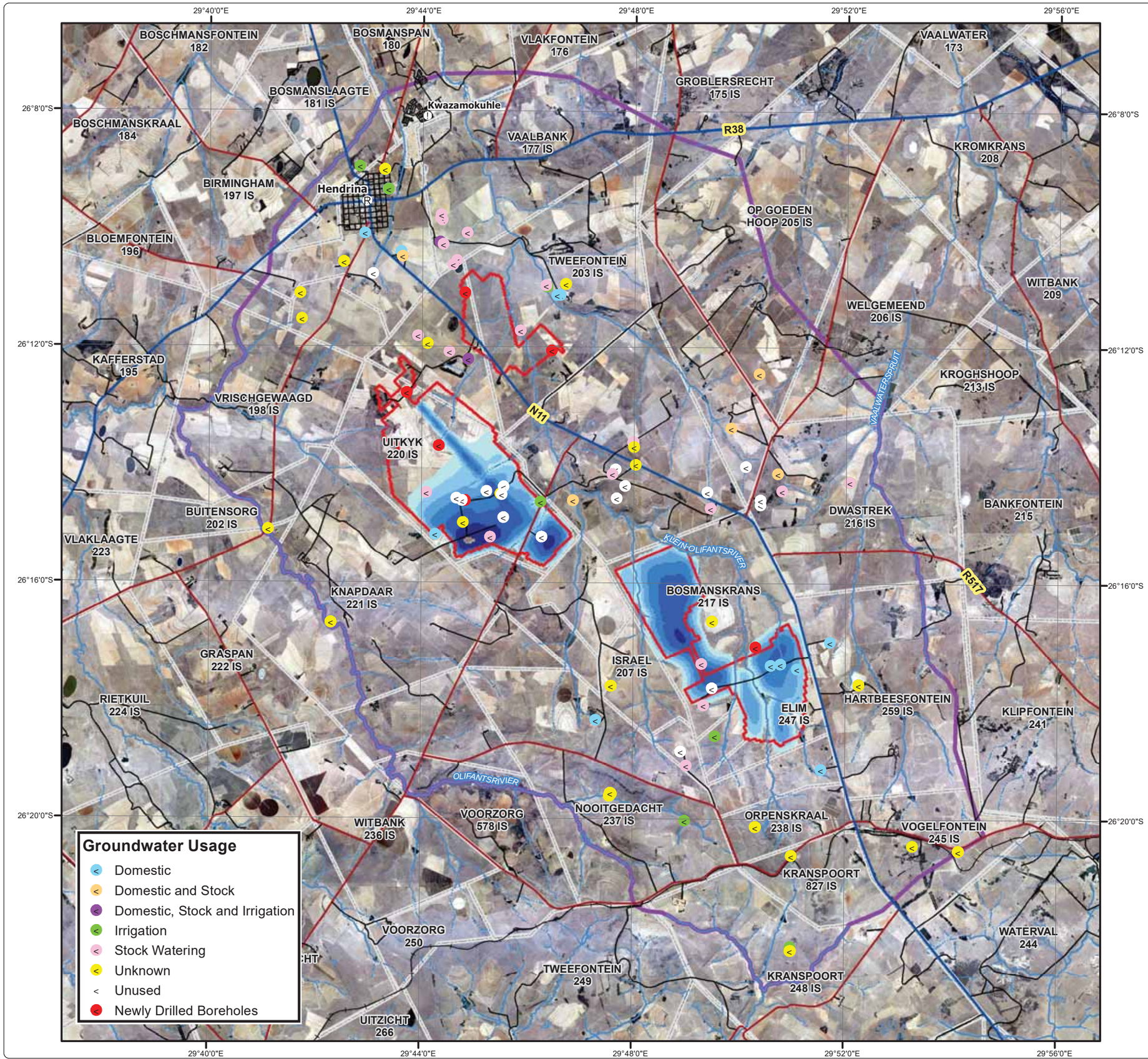
Plan 20

Umcebo Mining Hendrina Underground Coal Mine EIA

Predicted Cone of Dewatering at the End of Operation in the Top Weathered Aquifer



Groundwater Usage

- Domestic
- Domestic and Stock
- Domestic, Stock and Irrigation
- Irrigation
- Stock Watering
- Unknown
- Unused
- Newly Drilled Boreholes

Legend

- Life of Mine Boundary
- Model Boundary
- R — Other Town
- ! — Settlement
- Arterial/National Route
- Main Road
- Minor Road
- Railway Line
- Non-Perennial Stream
- Perennial Stream
- Farm Boundary

Cone of Dewatering

Drawdown (m below surface)

- 0 - 0.2
- 0.2 - 0.3
- 0.3 - 0.4
- 0.4 - 0.5
- 0.5 - 0.6
- 0.7 - 0.8

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0 1 2 4 6
Kilometres
1:120,000

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Plan 21

Umcebo Mining Hendrina Underground Coal Mine EIA

Predicted Cone of Dewatering at the End of Operation in the Coal Seam Aquifer

29°40'0"E 29°44'0"E 29°48'0"E 29°52'0"E 29°56'0"E

26°8'0"S 26°12'0"S 26°16'0"S 26°20'0"S

BOSCHMANSFONTEIN 182
BOSMANSPAN 180
VLAKFONTEIN 176
VAALWATER 173
BOSMANSLAAGTE 181 IS
Kwazamokuhle
GROBLERSRECHT 175 IS
BOSCHMANSKRAAL 184
VAALBANK 177 IS
R38
KROMKRANS 208
BIRMINGHAM 197 IS
Hendrina
OP GOEDEN HOOP 205 IS
BLOEMFONTEIN 196
TWEEFONTEIN 203 IS
WITBANK 209
WELGEMEEND 206 IS
KAFFERSTAD 195
VAALWATERSPRUIT
KROGHSHOOP 213 IS
VRISCHGEWAAGD 198 IS
N11
UITKYK 220 IS
BUITENSORG 202 IS
DWASTREK 216 IS
BANKFONTEIN 215
VLAKLAAGTE 223
KLEIN-OLIFANTSRIVER
R517
KNAPDAAR 221 IS
BOSMANSKRANS 217 IS
GRASPAN 222 IS
ISRAEL 207 IS
RIETKUIL 224 IS
HARTBEESFONTEIN 259 IS
ELIM 247 IS
KLIPFONTEIN 241
OLIFANTSRIVIER
VOORZORG 578 IS
NOOITGEDACHT 237 IS
WITBANK 236 IS
ORPENSKRAAL 238 IS
VOGELFONTEIN 245 IS
KRANSPOORT 827 IS
VOORZORG 250
WATERVAL 244
TWEEFONTEIN 249
KRANSPOORT 248 IS
UITZICHT 266

Groundwater Usage

- Domestic
- Domestic and Stock
- Domestic, Stock and Irrigation
- Irrigation
- Stock Watering
- Unknown
- Unused
- Newly Drilled Boreholes

Legend

- Life of Mine Boundary
- Model Boundary
- R Other Town
- ! Settlement
- Arterial/National Route
- Main Road
- Minor Road
- Railway Line
- Non-Perennial Stream
- Perennial Stream
- Farm Boundary

Cone of Dewatering

Drawdown (m below surface)

- 0.36 - 5
- 5 - 25
- 25 - 50
- 50 - 75
- 75 - 100
- 100 - 120

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Kilometres
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Plan 22

Umcebo Mining Hendrina Underground Coal Mine EIA

Predicted Contamination Plume in the Coal Seam Aquifer, 100 Years after Mine Closure

Legend

- Life of Mine Boundary
- Model Boundary
- R — Other Town
- ! — Settlement
- Arterial/National Route
- Main Road
- Minor Road
- Railway Line
- Non-Perennial Stream
- Perennial Stream
- Farm Boundary

Contamination Plume

Concentration (%)

- 0 - 0.1
- 0.1 - 25
- 25 - 50
- 50 - 75
- 75 - 100

Groundwater Usage

- Domestic
- Domestic and Stock
- Domestic, Stock and Irrigation
- Irrigation
- Stock Watering
- Unknown
- Unused
- Newly Drilled Boreholes

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0 1 2 4 6
Kilometres
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Plan 23

Umcebo Mining Hendrina Underground Coal Mine EIA

Wetland Impact Assessment

29°44'0"E 29°48'0"E 29°52'0"E 29°56'0"E

26°12'0"S 26°16'0"S 26°20'0"S

Hendrina

R38 N11 R517

KLEIN-OLIFANTSRIVIER OLIFANTSRIVIER

Legend

- Project Area
- R Other Town
- Arterial/National Route
- Main Road
- Minor Road
- Non-Perennial Stream
- Perennial Stream

Wetland Delineation

- 100m Buffer
- Channelled Valley Bottom
- Klein Olifants River
- Pan
- Seep
- Valley Bottom

Seam Depth

- 0 m
- 25 - 30 m
- 30 - 35 m
- 35 - 40 m
- >40 m

Infrastructure

- Access Road
- Alternative Access Road
- Conveyor
- Fence
- Haul Road
- Pipeline
- Powerline
- Berms
- Buildings
- Crushing & Screening
- Generator & Mini-Subs
- Incline Shaft
- Office Area
- Overburden Stockpile
- PCD
- Parking
- Product Stockpile
- Sewer Treatment Plant
- Stormwater Drain
- Tip
- Topsoil Stockpile
- Ventilation Shaft
- Water Treatment Plant
- Weighbridge

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0 1 2 4
Kilometres
1:100,000

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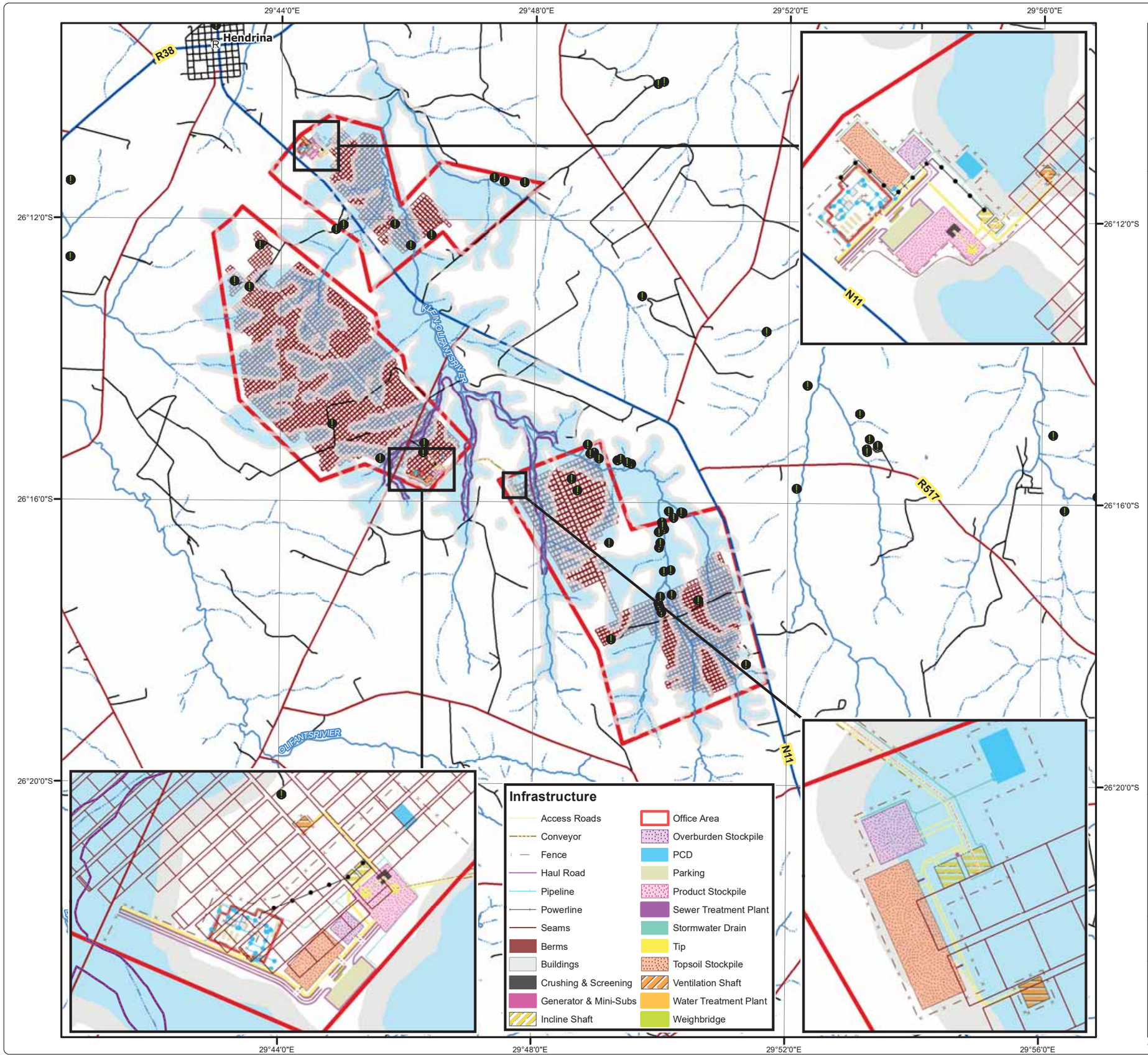
Plan 24

Umcebo Mining Hendrina Underground Coal Mine EIA

Final Site Layout



Legend

- Project Area
- Identified Heritage Resources
- R Other Town
- Arterial/National Route
- Main Road
- Minor Road
- Non-Perennial Stream
- Perennial Stream
- 1:100 Year Floodlines
- 100m Wetlands Buffer
- Wetlands

Infrastructure

- Access Roads
- Conveyor
- Fence
- Haul Road
- Pipeline
- Powerline
- Seams
- Berms
- Buildings
- Crushing & Screening
- Generator & Mini-Subs
- Incline Shaft
- Office Area
- Overburden Stockpile
- PCD
- Parking
- Product Stockpile
- Sewer Treatment Plant
- Stormwater Drain
- Tip
- Topsoil Stockpile
- Ventilation Shaft
- Water Treatment Plant
- Weighbridge

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Revision Number: 1
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Kilometres
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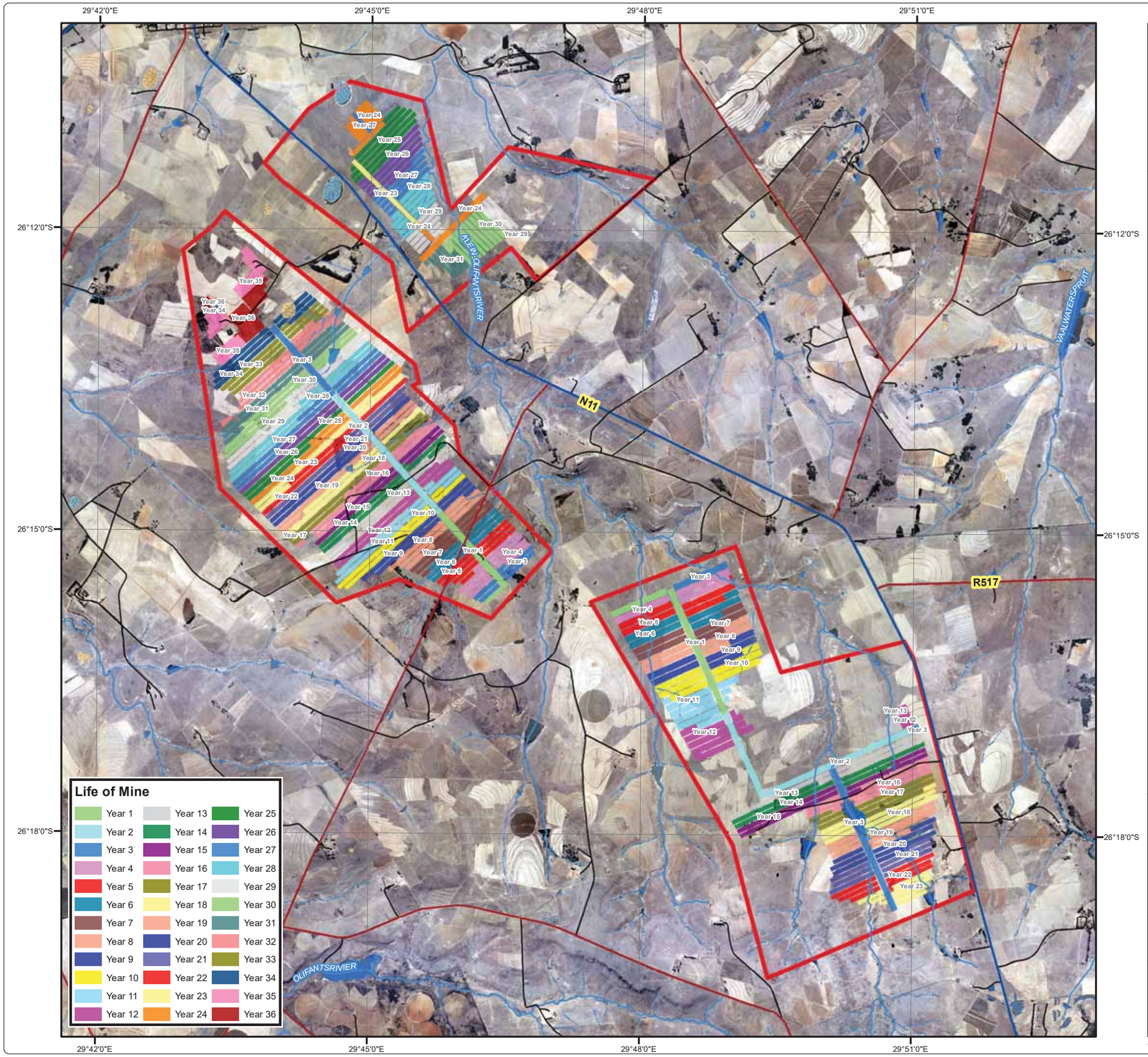
Plan 25

Umcebo Mining Hendrina Underground Coal Mine EIA

Proposed Life of Mine



Legend

- Project Area
- Arterial/National Route
- Main Road
- Minor Road
- Dam Wall
- Non-Perennial Stream
- Perennial Stream
- Dam/Lake
- Non-Perennial Pan
- Perennial Pan
- Wetland

Life of Mine

Year 1	Year 13	Year 25
Year 2	Year 14	Year 26
Year 3	Year 15	Year 27
Year 4	Year 16	Year 28
Year 5	Year 17	Year 29
Year 6	Year 18	Year 30
Year 7	Year 19	Year 31
Year 8	Year 20	Year 32
Year 9	Year 21	Year 33
Year 10	Year 22	Year 34
Year 11	Year 23	Year 35
Year 12	Year 24	Year 36

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Kilometres
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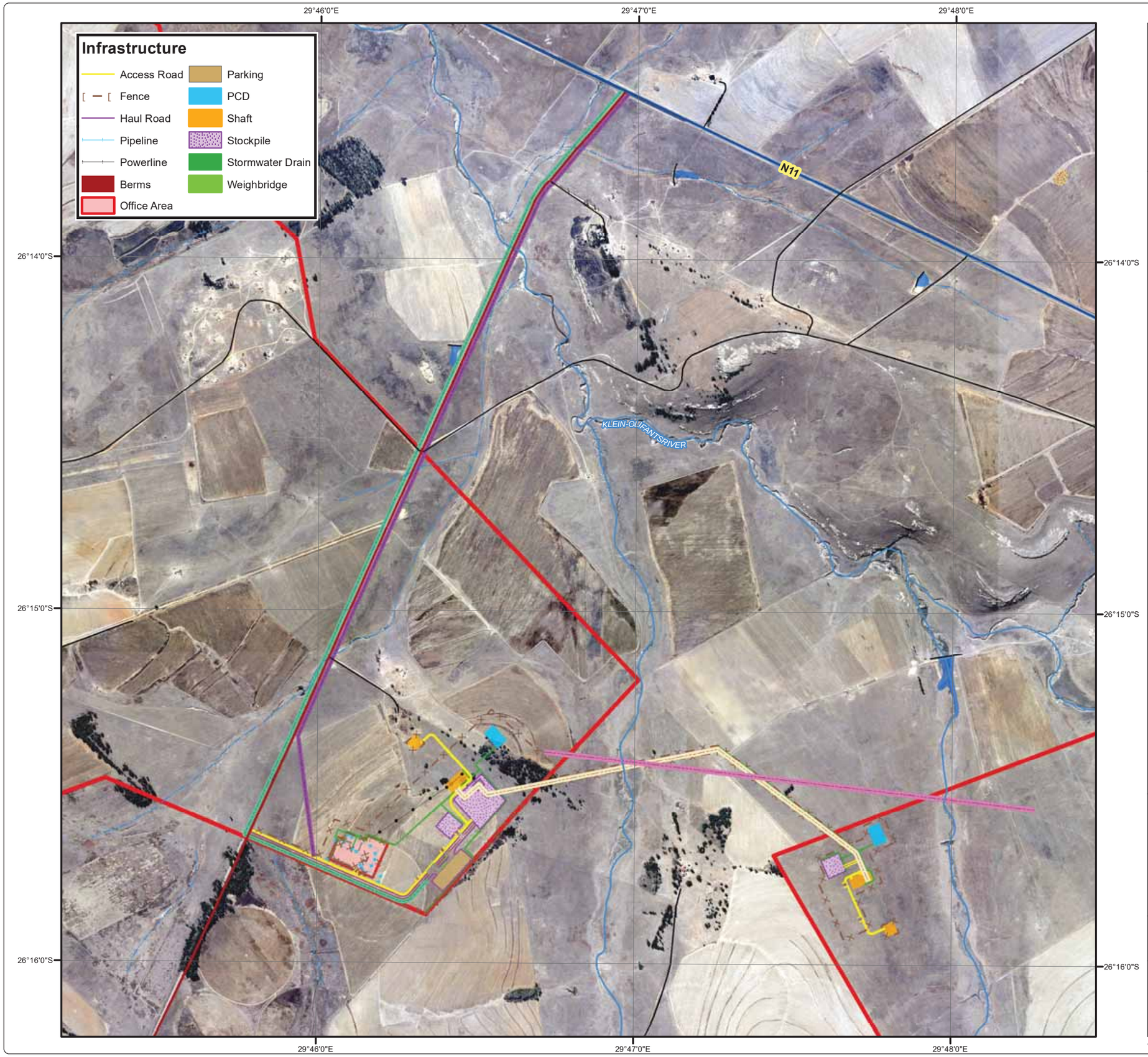
Plan 26

Umcebo Mining Hendrina Underground Coal Mine EIA

Route Alternatives



Legend

- Project Area
- Arterial/National Route
- Main Road
- Minor Road
- Dam Wall
- Non-Perennial Stream
- Perennial Stream
- Dam/Lake
- Non-Perennial Pan

Road Alternatives

- Alternative Road Routing
- Preferred Road Routing

Conveyor Belt Alternatives

- Overland Conveyor 1
- Overland Conveyor 2

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Kilometres
1:20,000

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