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PROPOSED MOKOLO AND CROCODILE RIVER (WEST) WATER AUGMENTATION PROJECT (PHASE 2A) (MCWAP-2A):

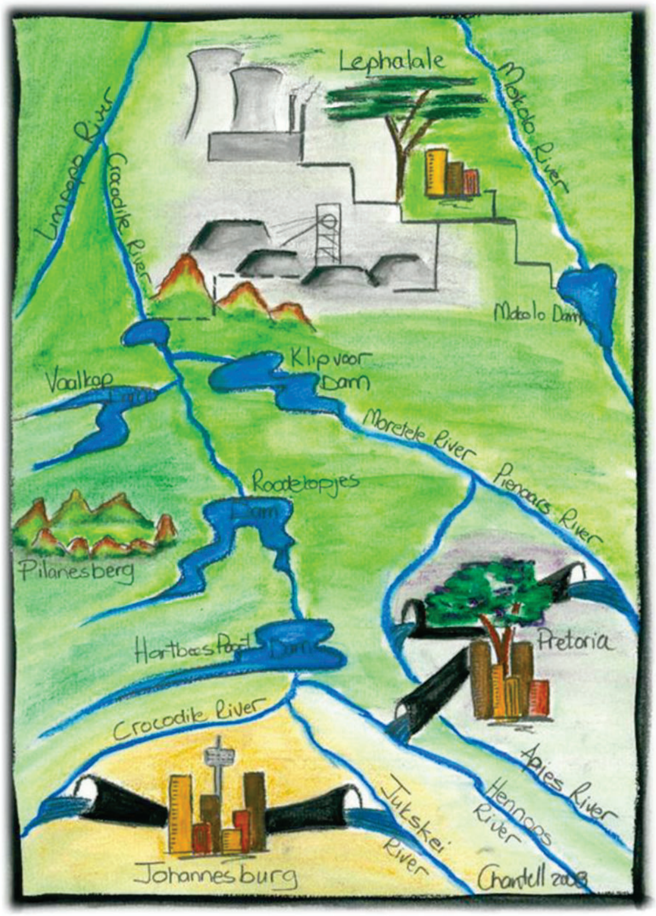
WATER TRANSFER INFRASTRUCTURE

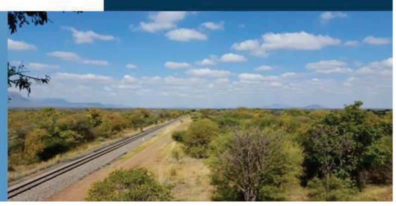
ENVIRONMENTAL IMPACT ASSESSMENT REPORT

FINAL

November 2018

[DEA Reference No. - 14/12/16/3/3/2/1100]





TITLE AND APPROVAL PAGE

Project Name:	***Proposed Mokolo and Crocodile River (West) Water Augmentation Project (Phase 2A) (MCWAP-2A): Water Transfer Infrastructure***
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EXECUTIVE SUMMARY

A. PROJECT BACKGROUND AND MOTIVATION

Major developments are planned for the Waterberg coalfields that are located in the Lephalale area. As a direct result of the aforementioned developments, the demand for water in the Lephalale area is expected to significantly increase into the future.

Due to the limited availability of water in the Lephalale area, the Department of Water and Sanitation conducted a feasibility study (completed in 2010) of the Mokolo Crocodile River (West) Water Augmentation Project to establish how the future water demands could be met. The phases of the proposed project include the following:

- **Mokolo Crocodile River (West) Water Augmentation Project (Phase 1)**: Augment the supply from Mokolo Dam to supply in the growing water use requirement for the interim period until a transfer pipeline from the Crocodile River West can be implemented. The solution must over the long term optimally utilise the full yield from Mokolo Dam and will be operated as a system together with Mokolo Crocodile River (West) Water Augmentation Project Phase 2A. Phase 1 is operational since June 2015.
- **Mokolo Crocodile River (West) Water Augmentation Project (Phase 2A)**: Transfer water from the Crocodile River (West) to the Steenbokpan and Lephalale areas, including the implementation of the River Management System in the Crocodile River (West) and certain tributaries. Phase 2A is the focus of this Environmental Impact Assessment.

The overall Mokolo Crocodile River (West) Water Augmentation Project Phase 2A consists of the following components:

- **Water Transfer Infrastructure** - transfer of water from Crocodile River (West) to Lephalale;
- Borrow Pits - sourcing of construction material; and
- River Management System - manage abstractions from, and the river flow in, the Crocodile River (West) between Hartbeespoort Dam and Vlieëpoort Weir, the Moretele River from Klipvoor Dam to the confluence with the Crocodile River (West), the stretch of Elands River from Vaalkop Dam to the confluence with the Crocodile River (West), and also the required flow past Vlieëpoort.

This Environmental Impact Assessment Report specifically deals with the <u>Water Transfer Infrastructure</u> component.

B. PROJECT LOCATION

The project is located within the western part of the Limpopo Province. The footprint of the proposed Water Transfer Infrastructure traverses the Thabazimbi Local Municipality and Lephalale Local Municipality, which fall within the Waterberg District Municipality.

The proposed pipeline route commences from the Vlieëpoort Mountains at the weir site in the Crocodile River, in the south-western point of the project area. From there it runs in a predominantly northern direction along existing roads, farm boundaries and a railway line, until it reached its destination near Steenbokpan (Alternative D3). Thabazimbi is situated approximately 10 km to the north-east of the Vlieëpoort weir site and Lephalale is situated approximately 30 km to the east of the Alternative D1 pipeline route's terminal point. The project infrastructure is mostly located on privately-owned properties that are primarily used for agricultural practices and game-farming.

C. ENVIRONMENTAL STATUTORY FRAMEWORK

The Environmental Impact Assessment Report provides and overview of the statutory framework for the proposed Mokolo Crocodile River (West) Water Augmentation Project Phase 2A.

The relationship between the proposed project and the following key pieces of environmental legislation is also discussed:

- National Environmental Management Act (Act No. 107 of 1998) and the Environmental Impact Assessment Regulations of 2014 (as amended);
- National Environmental Management: Waste Act (Act No. 59 of 2008);
- Mineral and Petroleum Resources Development Act (MPRDA) (Act No. 28 of 2002); and
- National Water Act (Act No. 36 of 1998).

D. SCOPING AND EIA PROCESS

The process for seeking authorisation under the National Environmental Management Act (No. 107 of 1998) is undertaken in accordance with Government Notice No. R. 982 of 4 December 2014 (as amended), promulgated in terms of Chapter 5 of this Act. Based on the types of activities involved the requisite environmental assessment for the project is a Scoping and Environmental Impact Assessment process.

In terms of the National Environmental Management Act (No. 107 of 1998) the lead decision-making authority for the environmental assessment is the Department of Environmental Affairs, as the project proponent (Department of Water and Sanitation) is a national department. Nemai Consulting was appointed by the Department of Water and Sanitation and the Trans-Caledon Tunnel Authority (implementing agent) as the independent Environmental Assessment Practitioner to undertake the environmental assessment for the proposed Mokolo Crocodile River (West) Water Augmentation Project Phase 2A: Water Transfer Infrastructure.

E. PROJECT DESCRIPTION

The following major scheme components of the proposed Water Transfer Infrastructure are described in the Environmental Impact Assessment Report:

- Vlieëpoort Abstraction Weir on the Crocodile River (West);
- Low-lift Pumping Station;

- Low-lift Rising Main (2 pipes);
- Sedimentation Works;
- Balancing Reservoir;
- High-lift Pumping Station;
- High-lift Rising Main to Break Pressure Reservoir;
- Break Pressure Reservoir;
- Gravity Pipeline from Break Pressure Reservoir to Operational Reservoir;
- Operational Reservoir;
- Gravity pipeline from Operational Reservoir to Medupi Tee-off via Steenbokpan; and
- Ancillary infrastructure (gauging weirs, River Management System, access roads, accommodation, offices, workshops and security measures).

F. ALTERNATIVES

Alternatives are the different ways in which the project can be executed to ultimately achieve its objectives. Alternatives considered during the Technical Pre-Feasibility and Feasibility Studies and initial Environmental Screening include the following:

- Alternative water resources -
  - Ground water;
  - Re-use of effluent in the project area;
  - Mokolo Dam;
  - Water from the Crocodile River (West);
  - Return flows in Crocodile River (West) and Vaal River Catchments;
  - Creating more storage by raising of existing dams and/or building new dams;
  - Abstraction point at Faure Weir; and
  - Water transfer from rivers beyond the borders of South Africa.

The feasible alternatives to the project components that are further discussed in the Environmental Impact Assessment Report include route options for the transfer and delivery systems.

As a standard practice and to satisfy regulatory requirements, the “no-go” option of not proceeding with the project is included in the evaluation of the alternatives. In addition, alternatives suggested by Interested and Affected Parties are also discussed.

G. PROFILE OF THE RECEIVING ENVIRONMENT

The Environmental Impact Assessment Report provides a general description of the status quo of the receiving environment in the project area, and also presents local and site-specific conditions of those environmental features investigated by the respective specialists. This allows for an appreciation of sensitive environmental features and possible receptors of the effects of the proposed project.

The study area includes the entire footprint of the proposed project components and related activities. A 100 m wide corridor (i.e. 50 m on either side of the centre line of the pipeline, as well as the access road to the abstraction weir) was adopted as the study area, which allows for possible deviations from the proposed alignment within this corridor (e.g. avoidance of sensitive features, if possible).

The receiving environment is assessed and discussed in terms of the following:

- ❖ Land Use and Land Cover;
- ❖ Climate;
- ❖ Geology;
- ❖ Soils;
- ❖ Geohydrology;
- ❖ Topography;
- ❖ Surface Water;
- ❖ Flora;
- ❖ Fauna;
- ❖ Socio-Economic Environment;
- ❖ Agriculture;
- ❖ Air quality;
- ❖ Noise;
- ❖ Historical and Cultural Features;
- ❖ Planning;
- ❖ Existing Structures and Infrastructure;
- ❖ Transportation;
- ❖ Waste Disposal Facilities;
- ❖ Aesthetic Qualities; and
- ❖ Tourism.

H. SPECIALIST STUDIES

The requisite specialist studies 'triggered' by the findings of the Scoping process, aimed at addressing the key issues and compliance with legal obligations, include the following:

1. Baseline Aquatic and Impact Study;
2. Terrestrial Ecological Impact Assessment;
3. Heritage Impact Assessment;
4. Agricultural Impact Assessment;
5. Wetland Impact Assessment;
6. Socio-Economic Impact Assessment;
7. Wildlife Impact Assessment; and
8. Hartbeespoort Dam Specialist Opinion.

The information obtained from the respective specialist studies was incorporated into the EIA report in the following manner:

1. The information was used to complete the description of the receiving environment in a more detailed and site-specific manner;
2. A summary of each specialist study is provided, focusing on the approach to the study, key findings and conclusions drawn;
3. The specialists' impacts assessment, and the identified mitigation measures, were included in the overall project impact assessment;
4. The evaluations performed by the specialists on the alternatives of the project components were included in the comparative analysis to identify the most favourable option;
5. Specialist input was obtained to address comments made by Interested and Affected Parties that related to specific environmental features pertaining to each specialist discipline; and

6. Salient recommendations made by the specialists were taken forward to the final EIA Conclusions and Recommendations.

I. IMPACT ASSESSMENT

The Environmental Impact Assessment Report assessed the pertinent environmental impacts that could potentially be caused by the proposed project during the pre-construction, construction and operational phases of the project.

Impacts were identified as follows:
- An appraisal of the project activities and components;
- Impacts associated with listed activities contained in Government Notice No. R. 983, R. 984 and R. 985 of 4 December 2014, as amended, for which authorisation has been applied for;
- An assessment of the receiving biophysical, social, economic and built environment;
- Findings from specialist studies;
- Issues highlighted by environmental authorities; and
- Comments received during public participation.

The impacts and the proposed management measures are discussed on a qualitative level and thereafter quantitatively assessed to ultimately determine the significance of the impacts. The assessment considered impacts before and after mitigation, where in the latter instance the residual impact following the application of the mitigation measures is evaluated.

The proposed mitigation of the impacts associated with the project includes specific measures identified by the technical team (including engineering solutions) and environmental specialists, stipulations of environmental authorities and environmental best practices. The Environmental Management Programme provides a comprehensive list of mitigation measures for specific elements of the project, which extends beyond the impacts evaluated in the body of the Environmental Impact Assessment Report.

Cumulative impacts are also discussed, which include the following (amongst others):
- Combined footprints of linear developments;
- Impacts to the transportation network;
- Loss of bushveld vegetation and the proliferation of exotic vegetation;
- Loss of species of conservation concern;
- Ecological Water Requirements;
- Impacts to Hartbeespoort Dam;
- Impacts related to climate change; and
- Changes in demographics in the region due to the influx of employment seekers.

J. ANALYSIS OF ALTERNATIVES

The Environmental Impact Assessment Report provides an appraisal of all the environmental and technical considerations associated with the various alternatives through a comparative analysis to eventually distil the Best Practicable Environmental Option. The implications of the “no-go” option are also assessed.

Based on the recommendations of the specialists, technical considerations and the comparison of the impacts, the following alternatives were identified as the Best Practicable Environmental Options for the related pipeline alignments:

- Section 1 – Central Route;
- Section 2 – Central Route;
- Section 3 – Central Route;
- Section 4 – Alternative D1; and
- Section 5 – Alternative D4.

K. PUBLIC PARTICIPATION

The Environmental Impact Assessment Report provides the details of the following tasks undertaken as part of the public participation process for the EIA phase:

- Maintaining the database of Interested and Affected Parties;
- Notification of review of the Draft Environmental Impact Assessment Report;
- Means of accessing the Draft Environmental Impact Assessment Report;
- Supplying of copies of the Draft Environmental Impact Assessment Report to Authorities and Agricultural Groups;
- Scheduling of focus group meetings, public meetings and an authorities meeting to present the Draft EIA Report; and
- Updating of the Comments and Responses Report.

L. EIA CONCLUSIONS AND RECOMMENDATIONS

Attention is drawn to specific sensitive environmental features for which mitigation measures are included in the Environmental Impact Assessment Report and Environmental Management Programme.

An Environmental Impact Statement is provided and critical environmental activities that need to be executed during the project life-cycle are also presented.

With the selection of the Best Practicable Environmental Option, the adoption of the mitigation measures included in the Environmental Impact Assessment Report and the dedicated implementation of the Environmental Management Programme, it is believed that the significant environmental aspects and impacts associated with this project can be suitably mitigated. With the aforementioned in mind, it can be concluded that there are no fatal flaws associated with the project and that authorisation can be issued, based on the findings of the specialists and the impact assessment, through the compliance with the identified environmental management provisions.

The Environmental Impact Assessment Report is concluded with key recommendations, which may also influence the conditions of the Environmental Authorisation (where relevant), if issued.

BESTUURSOPSOMMING

A. PROJEK AGTERGROND EN MOTIVERING

Groot ontwikkelings word beplan in die Waterberg Steenkool velde in die Lephalale gebied. As ŉ direkte gevolg van die voorgemelde ontwikkelings sal die behoefte aan water in die Lephalale gebied betekenisvol toeneem in die toekoms.

Weens die beperkte beskikbaarheid van water in die Lephalale gebied het die voormalige Departement van Waterwese die Mokolo en Krokodilrivier (Wes) Wateraanvullingsprojek Uitvoerbaarheid Studie van stapel gestuur om opsies vir die voorsiening van die water behoeftes te ondersoek. Die fases vir die voorgestelde infrastruktuur behels die volgende:

- **Mokolo en Krokodilrivier (Wes) Wateraanvullingsprojek (Fase 1):** Aanvulling vanaf Mokolodam om aan die groeiende water behoeftes te voldoen vir die interim periode totdat die oordragpyplyne vanaf die Krokodilrivier (Wes) geïmplementeer kan word. Die oplossing moet die volle lewering vanaf Mokolodam oor die langtermyn optimaal benut en sal as ŉ stelsel bedryf word tesame met die Mokolo en Krokodilrivier (Wes) Wateraanvullingsprojek (Fase 2A). Fase 1 is in bedryf vanaf Junie 2015.
- **Mokolo en Krokodilrivier (Wes) Wateraanvullingsprojek (Fase 2A)**: Oordrag van water vanaf Krokodilrivier (Wes) tot by die Steenbokpan en Lephalale gebiede, insluitend die implementering van die rivierbestuurstelsel in die Krokodilrivier (Wes) en sekere sytakke. Fase 2A is die fokus van hierdie Omgewingsimpakbepaling.

Die algehele Mokolo en Krokodilrivier (Wes) Wateraanvullingsprojek (Fase 2A) bestaan uit die volgende komponente:

- **Wateroordraginfrastruktuur** (hoofonderwerp van hierdie Omgewingsimpakbepaling) - oordrag van water van die Krokodilrivier (Wes) na Lephalale;
- Leengroewe – verkryging van konstruksiemateriaal; en
- Rivierbestuurstelsel – bestuur onttrekkings vanaf, asook die riviervloei in, die Krokodilrivier (Wes) tussen Hartbeespoortdam en die stuwal by Vlieëpoort, die Moretelerivier vanaf Klipvoordam tot by die samevloeiing met die Krokodilrivier (Wes), die Elandsrivier vanaf Vaalkopdam tot by die samevloeiing met die Krokodilrivier (Wes), asook die vereiste vloei verby Vlieëpoort.

Die Omgewingsimpakbepalingsverslag handel spesifiek oor die voorgestelde <u>Wateroordraginfrastruktuur</u>.

B. PROJEK LIGGING

Die projekgebied is geleë in die westelike gedeelte van die Limpopo-provinsie. Die voorgestelde Wateroordraginfrastruktuur oorkruis die Thabazimbi en Lephalale Plaaslike Munisipaliteite, wat beide in die Waterbergdistriksmunisipaliteit geleë is.

Die voorgestelde pyplynroete begin in die Vlieëpoortberge by die stuwal in die Krokodilrivier (Wes), in die suid-westelike gedeelte van die projekgebied area. Van daar volg die pyplynroete meestal ŉ noordelike rigting langsaan bestaande paaie, plaasgrense en ŉ spoorlyn tot by Steenbokpan (Alternatief D3). Thabazimbi is ongeveer 10 km noord-oos van die Vlieëpoortstuwal en Lephalale is ongeveer 30 km oos van die eindpunt van die Alternatief D1 pyplynroete. Die projekinfrastruktuur is meestal geleë op private eiendom wat hoofsaaklik benut word vir landbou en wildboerdery.

C. OMGEWINGSREGSRAAMWERK

Die Omgewingsimpakbepalingsverslag voorsien ŉ oorsig van die omgewingsregsraamwerk vir die voorgestelde Mokolo en Krokodilrivier (Wes) Wateraanvullingsprojek (Fase 2A).

Dit sluit in ŉ bespreking van die verhouding tussen die voorgestelde projek en die volgende omgwingswetgewing:

- Die Wet op Nasionale Omgewingsbestuur (Wet Nr. 107 van 1998) en die Omgewingsimpakbepalingsregulasies van 2014 (soos gewysig);
- Die Wet op Nasionale Omgewingsbestuur: Afval (Wet Nr. 59 van 2008);
- Die Wet op die Ontwikkeling van Minerale en Petroleum Hulpbronne (Wet Nr. 28 van 2002); en
- Die Nasionale Waterwet (Wet Nr. 36 van 1998).

D. OMVANGSBEPALING EN OMGEWINGSIMPAKBEPALING-PROSES

Die aansoekproses vir magtiging van die Wet op Nasionale Omgewingsbestuur (Wet Nr. 107 van 1998) word onderneem ingevolge die Omgewingsimpakbepalingsregulasies (Goewermentskennisgewing Nr. R. 982 van 4 Desember 2014, soos gewysig). Op grond van die gelyste aktiwiteite wat deur die Wateroordraginfrastruktuur genoodsaak word, sal ŉ Omvangsbepaling en Omgewingsimpakbepaling-proses uitgevoer word.

Kragtens die Wet op Nasionale Omgewingsbestuur (Wet Nr. 107 van 1998) is die besluitnemende owerheid die Departement van Omgewingsake, aangesien die projekvoorsteller (Departement van Water en Sanitasie) ŉ nasionale Departement is. Nemai Consulting is deur die Departement van Water en Sanitasie en die Trans-Caledon Tonnel Owerheid (Implementeringsagent) aangestel as die onafhanklike Omgewingsimpakbepalingspraktisyn om die Omgewingsimpakbepaling-proses uit te voer vir die voorgestelde Mokolo en Krokodilrivier (Wes) Wateraanvullingsprojek (Fase 2A): Wateroordraginfrastruktuur.

E. PROJEKBESKRYWING

Die volgende hoofkomponente van die voorgestelde Wateroordraginfrastruktuur word bespreek in die Omgewingsimpakbepalingsverslag:

- Vlieëpoort onttrekkingstuwal in die Krokodilrivier (Wes);
- Laedruk-pompstasie;
- Laedruk-stygleiding (2 pype);
- Ontslikkingswerke;

- Balanseerdamme;
- Hoëdruk-pompstasie;
- Hoëdruk-stygleiding tot by Drukbreekreservoir;
- Drukbreekreservoir;
- Swaartekragpyplyn vanaf Drukbreekreservoir tot by Operasionele bergingsdam;
- Operasionele bergingsdam;
- Swaartekragpyplyn vanaf Operasionele bergingsdam tot by Steenbokpan-gebied; en
- Aanvullende infrastruktuur (riviermeetstasies, rivierbestuurstelsel, toegangspaaie, huisvesting, kantore, werkswinkels en sekuriteitsmaatreëls).

F. ALTERNATIEWE

Alternatiewe opsies ten opsigte van ŉ Omgewingsimpakbepaling behels die verskillende maniere waarop ŉ projek uitgevoer van word om uiteindelik dieselfde doelwitte te bereik. Opsies wat oorweeg was tydens die voor-uitvoerbaarheid- en uitvoerbaarheid studies sluit in die volgende:

- Alternatiewe waterbronne –
  - Grondwater;
  - Hergebruik van afvalwater;
  - Mokolodam;
  - Water vanaf die Krokodilrivier (Wes);
  - Terugvloeie in Krokodilrivier (Wes) en Vaalrivier Opvangsgebiede;
  - Addisionele opgaring deur bestaande damme te verhoog en/of om nuwe damme te bou;
  - Onttrekkingspunt by Faure Stuwal; en
  - Water oordrag vanaf riviere buite Suid Afrika se grense.

Die projek-alternatiewe wat verder in die Omgewingsimpakbepalingsverslag bespreek word sluit in verskillende pyplynroetes vir die oordrag en lewerings-stelsels.

Volgens standaardpraktyk en ter bevrediging van wetlike vereistes word die opsie van "geen-ontwikkeling" ook in ag geneem. Opsies wat deur Belanghebbende en Geaffekteerde Partye voorgestel is, word ook bespreek.

G. OORSIG VAN GEAFFEKTEERDE OMGEWING

Die Omgewingsimpakbepalingsverslag gee ŉ algemene beskrywing van die stand van die omgewing in die projekgebied, wat vir die inagneming van sensitiewe omgewingskenmerke en moontlike geaffekteerde partye van die voorgestelde projek voorsiening maak.

Die studie-gebied sluit in die algehele omvang van die voorgestelde projek sowel as die verbandhoudende aktiwiteite. ŉ 100 m wye korridor (m.a.w. 100 m weerskante van die pyplyn se middellyn sowel as die toegangspad na die onttrekkingstuwal) is beoordeel tydens die

Omgewingsimpakbepaling, wat vir enige moontlike afwykings van die voorgestelde roete binne hierdie korridor voorsiening maak.

Die volgende aspekte van die geaffekteerde omgewing word beoordeel en bespreek in die Omgewingsimpakbepalingsverslag:

- Grondgebruik en dekking;
- Klimaat;
- Geologie;
- Geohidrologie;
- Grond;
- Topografie;
- Oppervlak water;
- Flora;
- Fauna;
- Sosio-ekonomiese omgewing;
- Landbou;
- Lug kwaliteit;
- Geraas;
- Historiese en kulturele kenmerke;
- Beplanning;
- Bestaande strukture en infrastruktuur;
- Vervoer;
- Stortingsterreine;
- Visuele kwaliteit; en
- Toerisme.

H. SPESIALIS-STUDIES

Die spesialis-studies wat uitgevoer is tydens die Omgewingsimpakbepaling, soos geïdentifiseer tydens die Omvangsbepalingsproses om moontlike sleutelkwessies aan te spreek, sluit die volgende in:

1. Akwatiese Impakbeoordeling;
2. Terrestriële Ekologiese Impakbeoordeling;
3. Erfenis Impakbeoordeling;
4. Landbou Impakbeoordeling;
5. Vleiland Impakbeoordeling;
6. Sosio-ekonomiese Impakbeoordeling;
7. Wild Impakbeoordeling; en
8. Hartbeespoortdam Spesialis Opinie.

Die inligting van die spesialis-studies is soos volg geïnkorporeer in die Omgewingsimpakbepalingsverslag:

1. Die inligting is gebruik om die geaffekteerde omgewing in verdere detail te beskryf;
2. 'n Opsomming van elke spesialis-studie, wat fokus op die benadering tot die studie, sleutelbevindings en gevolgtrekkings wat gemaak is, word voorsien;
3. Die impakbeoordeling van die onderskeie spesialiste, sowel as die gepaardgaande versagtende maatreëls, is in die algehele impakbepaling ingesluit;
4. Die bevindinge van die spesialiste ten opsigte van die alternatiewe projekkomponente is ingesluit in die vergelykende ontleding om sodoende die mees gunstige opsie te identifiseer;
5. Insette is ontvang vanaf die spesialiste om die kommentaar vanaf Belanghebbende en Geaffekteerde Partye in verband met spesifieke omgewingskenmerke aan te spreek; en

6. Aanbevelings gemaak deur die spesialiste is by die algehele Gevolgtrekkings en Aanbevelings van die Omgewingsimpakbepaling ingesluit.

I. IMPAK BEPALING

Die Omgewingsimpakbepalingsverslag het die tersaaklike impakte wat moontlik deur die projek veroorsaak kan word tydens die voor-konstruksie, konstruksie en bedryfsfases ontleed.

Impakte is soos volg geïdentifiseer:

- Ontleding van projek beskrywing en die omliggende omgewingsfaktore;
- Impakte geassosieer met aktiwiteite gemeld in Goewermentskennisgewing Nommer R. 983, R. 984 en R. 985 van 4 Desember 2014 (soos gewysig), waarvoor magtiging aansoek gedoen is;
- Bevindinge van die spesialiste;
- Impakte geïdentifiseer deur omgewingsowerhede; en
- Kommentaar ontvang tydens die openbare deelname proses.

Die impakte en gepaardgaande versagtende maatreëls word bespreek op ʼn kwalitatiewe vlak en daarna gekwantifiseer om uiteindelik die betekenisvolheid van die impakte te ontleed. As deel van die beoordeling word die impakte voor-en-na die versagtende maatreëls ontleed, en in die geval van die laasgenoemde word die oorblywende impak in ag geneem.

Die voorgestelde versagtende maatreëls geassosieer met die projek bestaan uit spesifieke maatreëls geïdentifiseer deur die tegniese span (ingesluit ingenieursoplossings) en omgewings-spesialiste, bepalings vanaf omgewingsowerhede sowel as beste omgewingspraktyke. Die Omgewingsbestuurprogram voorsien ʼn omvattende lys van versagtende maatreëls vir spesifieke projekelemente, wat wyer strek as die impakte beoordeel in die Omgewingsimpak Evalueringsverslag.

Kumulatiewe impakte word ook bespreek in die Omgewingsimpakbepalingsverslag, wat die volgende insluit:

- Gekombineerde omvang van lineêre ontwikkelings;
- Impakte op die vervoernetwerk;
- Verlies van bosveldplantegroei en verspreiding van eksotiese plantegroei;
- Verlies van spesies van bewaringsbelange;
- Ekologiese water vereistes;
- Impakte op Hartbeespoortdam;
- Impakte geassosieer met klimaatsverandering; en
- Veranderinge in die demografie van die gebied weens die instroming van mense wat op soek is na werksgeleenthede.

J. ONTLEDING VAN ALTERNATIEWE

Die Omgewingsimpakbepalingsverslag bevat ŉ vergelykende ontleding van al die omgewings en tegniese oorwegings aangaande die verskeie opsies. Die gevolge van die "geen-ontwikkeling" opsie word ook in ag geneem.

Gebaseer op die aanbevelinge van die spesialiste, tegniese oorwegings en die vergelyking van die impakte is die volgende opsies geïdentifiseer as die Beste Uitvoerbare Omgewingsopsies vir die pyplyn-roetes:

- Gedeelte 1 – Sentrale Roete;
- Gedeelte 2 – Sentrale Roete;
- Gedeelte 3 – Sentrale Roete;
- Gedeelte 4 – Opsie D1; en
- Gedeelte 5 – Opsie D4.

K. OPENBARE DEELNAME

Die Omgewingsimpakbepalingsverslag bevat die besonderhede van die volgende aktiwiteite wat as deel van die openbare deelname proses uitgevoer is:

- Onderhoud van die databasis van Belanghebbende en Geaffekteerde Partye;
- Kennisgewing aangaande die openbare besigtiging van die Konsep Omgewingsimpakbepalingsverslag;
- Maniere waarop die Omgewingsimpakbepalingsverslag besigtig kon word;
- Voorsiening van afskrifte van die Omgewingsimpakbepalingsverslag aan owerhede en landbougroepe;
- Skedulering van fokusgroepvergaderings, openbare vergaderings sowel as ŉ vergadering met owerhede om die Omgewingsimpakbepalingsverslag aan te bied; en
- Die opdatering van die Kommentaar en Terugvoeringsverslag.

L. GEVOLGTREKKINGS EN AANBEVELINGS VAN DIE OMGEWINGSIMPAKBEPALING

Aandag word gevestig op spesifieke sensitiewe omgewingskenmerke waarvoor versagtende maatreëls ingesluit is in die Omgewingsimpakbepalingsverslag en die Omgewingsbestuurprogram.

ŉ Omgewingsimpakverklaring word voorsien en kritiese omgewingsaktiwiteite wat uitgevoer moet word tydens die projek se lewensiklus word ook aangebied.

Met die keuring van die Beste Uitvoerbare Omgewingsopsies, die ingebruikneming van die versagtende maatreëls saamgevat in die Omgewingsimpakbepalingsverslag en die toegewyde implementering van die Omgewingsbestuurprogram, word dit geag dat die beduidende omgewingsaspekte en impakte verbonde aan die projek behoorlik versag kan word. Daarvolgens kan die gevolgtrekking gemaak word dat daar geen noodlottige/onomkeerbare fout verbonde is aan die projek nie en dat magtiging uitgereik kan word gebaseer op die bevindinge van die spesialis-studies en die impakassessering, indien daar voldoen word aan die geïdentifiseerde omgewingsbestuur-bepalings.

Die Omgewingsimpakbepalingsverslag word afgesluit met sleutelaanbevelings wat die voorwaardes van die Omgewingsmagtiging mag beïnvloed, indien dit uitgereik sou word.

AMENDMENTS PAGE

Date	Nature of Amendment	Amendment No.	Signature
December 2018	Final for Review and Decision-making by DEA	0	

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LIST OF ACRONYMS & ABBREVIATIONS

AC	Alternating Current
AIDS	Acquired Immunodeficiency Syndrome
BID	Background Information Document
BP	Borrow Pit
BPEO	Best Practicable Environmental Option
BPR	Break Pressure Reservoir
CBA	Critical Biodiversity Area
CMA	Catchment Management Agency
COD	Chemical Oxygen Demand
DAFF	Department of Agriculture, Forestry and Fisheries
DEA	Department of Environmental Affairs
DEA&DP	Department of Environmental Affairs and Development Planning
DEAT	Department of Environmental Affairs and Tourism
DM	District Municipality
DME	Department of Mineral and Energy
DMR	Department of Mineral Resources
DO	Dissolved Oxygen
DoE	Department of Energy
DWA	Department of Water Affairs
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation
EAP	Environmental Assessment Practitioner
EC	Electrical Conductivity
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EIA	Ecological Importance and Sensitivity
EMF	Environmental Management Framework
EMPr	Environmental Management Programme
ESAs	Ecological Support Areas
EWR	Ecological Water Requirements
FGD	Flue-Gas Desulphurisation
FRAI	Fish Response Assessment Index
GHG	Greenhouse Gas
GIS	Geographical Information System
GN	Government Notice
HDPE	High-density polyethylene
HGL	Hydraulic Gradient Line
HIV	Human Immunodeficiency Virus

IAPs	Interested and Affected Parties
IBA	Important Bird & Biodiversity Area
IDP	Integrated Development Plan
INGAA	Interstate Natural Gas Association of America
IPPs	Independent Power Producers
IRP	Integrated Resource Plan
ISP	Internal Strategic Perspective
IUCN	International Union for Conservation of Nature
IWULA	Integrated Water Use Licence Application
KZN	KwaZulu-Natal
LDEDET	Limpopo Department of Economic Development, Environment and Tourism
LEMA	Limpopo Environmental Management Act (Act No. 7 of 2003)
LIHRA	Limpopo Provincial Heritage Resources Authority
LM	Local Municipality
LSU	Large Stock Unit
MAR	Mean Annual Runoff
Masl	Metres above sea level
MCWAP	Mokolo Crocodile (West) Water Augmentation Project
MCWAP-1	Mokolo Crocodile (West) Water Augmentation Project Phase 1
MCWAP-2A	Mokolo Crocodile (West) Water Augmentation Project Phase 2A
MCWAP-3	Mokolo Crocodile (West) Water Augmentation Project Phase 3
MIRAI	Macroinvertebrate Response Assessment Index
MPRDA	Mineral and Petroleum Resources Development Act (Act No. 28 of 2002)
NEMA	National Environmental Management Act (Act No. 107 of 1998)
NEM:BA	National Environmental Management: Biodiversity Act (Act No. 10 of 2004)
NEM:PAA	National Environmental Management: Protected Areas Act (Act No. 57 of 2003)
NEM:WA	National Environmental Management: Waste Act (Act No. 59 of 2008)
NFA	National Forests Act (Act No. 84 of 1998)
NFEPAs	National Freshwater Ecosystem Priority Areas
NHRA	National Heritage Resources Act (Act No. 25 of 1999)
NOC	Non-overspill Crest
NWA	National Water Act (Act No. 36 of 1998)
NW&SMP	National Water and Sanitation Master Plan
OC	Overspill Crest
OHS	Occupational Health and Safety
OR	Operational Reservoir
PES	Present Ecological Status
PGS	Peak Ground Accelerations
PGDS	Provincial Growth and Development Strategy
PLC	Programmable Logic Controller
PMF	Probable Maximum Flood

PPP	Public Participation Process
REC	Recommended Ecological Category
RDD	Recommended Design Discharge
RDF	Recommended Design Flood
RHP	River Health Programme
RMF	Regional Maximum Flood
RSA	Republic of South Africa
SADC	South African Development Community
SAHRA	South African Heritage Resources Agency
SAHRIS	South African Heritage Resources Information System
SANS	South African National Standards
SASS5	South African Scoring System version 5
SANBI	South African National Biodiversity Institute
SAPS	South African Police Service
S&EIR	Scoping and Environmental Impact Reporting
SDF	Spatial Development Framework
SED	Safety Evaluation Discharge
SEF	Safety Evaluation Flood
SIPs	Strategic Integrated Projects
SMA	Scheme Management Authority
SMMEs	Small, Medium and Micro-sized Enterprises
SQR	Sub-Quaternary Reach
SR	Surge Reservoir
TAU-SA	Transvaal Agricultural Union South Africa
TCTA	Trans-Caledon Tunnel Authority
TD	Terminal Dam
TDS	Total Dissolved Solids
TR	Terminal Reservoirs
TWQR	Target Water Quality Range
UNESCO	United Nations Educational, Scientific and Cultural Organization
USPAP	Uniform Standards of Professional Appraisal Practice
VSDs	Variable Speed Drives
WMA	Water Management Area
WRC	Water Research Commission
WSDP	Water Services Development Plan
WTI	Water Transfer Infrastructure
WWTW	Wastewater Treatment Works

UNITS OF MEASUREMENT

°C	Degrees Celsius
dB	Decibel
ha	Hectare
km	Kilometre
km^2	Square kilometre
kV	Kilovolt
l	Litres
m	Metre
m^3	Cubic metre
m^3/a	Cubic metre per annum
mm	Millimetre
Ml	Megalitre
Mt	Million Tons
MVA	Megavolt-ampere
t	Tons
%	Percentage

1 PURPOSE OF THIS DOCUMENT

Water requirements will increase in the Lephalale area due to various planned and anticipated developments associated with the Waterberg coalfields. The Department of Water and Sanitation (DWS) commissioned the Proposed Mokolo and Crocodile River (West) Water Augmentation Project (MCWAP) Feasibility Study to investigate the options for meeting the aforementioned water requirements.

Nemai Consulting was appointed by DWS and the Trans-Caledon Tunnel Authority (TCTA) (implementing agent) to conduct the Environmental Impact Assessment (EIA) for MCWAP (Phase 2A) (MCWAP-2A) in terms of Government Notice (GN) No. R. 982 of 4 December 2014 (as amended). This document serves as the **Final EIA Report** for the proposed **MCWAP-2A Water Transfer Infrastructure** (WTI), which consists of the following:

- Weir and abstraction infrastructure, including a balancing dam, desilting woks, and a high-lift pumping station at Vlieëpoort (near Thabazimbi);
- Transfer system (approximately 100 km);
- Break Pressure Reservoir (BPR);
- Operational Reservoir (OR);
- Delivery system, consisting of a gravity pipeline (approximately 30 km) running from the Operational Reservoir to the terminal point near Steenbokpan; and
- Gauging weirs.

The Final Scoping Report and Plan of Study for the EIA were approved by the Department of Environmental Affairs (DEA) on 14 May 2018. This allowed for the commencement of the EIA phase. Thereafter, the Draft EIA Report was lodged for public review from 28 September until 29 October 2018. This document presents the Final EIA Report, which incorporates the outcomes of the aforementioned review period.

According to GN No. R. 982 of the 2014 EIA Regulations (as amended), the objective of the EIA process is to undertake the following, through a consultative process:

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

- Nature, significance, consequence, extent, duration and probability of the impacts occurring to inform identified preferred alternatives; and
- Degree to which these impacts -
    - Can be reversed;
    - May cause irreplaceable loss of resources; and
    - Can be avoided, managed or mitigated;

❖ Identify the most ideal location for the activity within the development footprint of the approved site as contemplated in the accepted Scoping Report based on the lowest level of environmental sensitivity identified during the assessment;

❖ Identify, assess, and rank the impacts the activity will impose on the development footprint on the approved site as contemplated in the accepted scoping report through the life of the activity;

❖ Identify suitable measures to avoid, manage or mitigate identified impacts; and

❖ Identify residual risks that need to be managed and monitored.

2 DOCUMENT ROADMAP

As a minimum, the EIA Report aims to satisfy the requirements stipulated in Appendix 3 of GN No. R 982 of 4 December 2014 (as amended). **Table 1** presents the document's composition in terms of the aforementioned regulatory requirements.

Table 1: EIA Report Roadmap

Chapter	Title	Correlation with GN No. R. 982	GN No. R. 982 Description
1	Purpose of this Document	–	–
2	Document Roadmap	–	–
3	Project Background and Motivation	–	–
4	Project Location	3(1)(b)	The location of the development footprint of the activity on the approved site as contemplated in the accepted Scoping Report, including: (i) the 21 digit Surveyor General code of each cadastral land parcel; (ii) where available, the physical address and farm name; and (iii) where the required information in items (i) and (ii) is not available, the coordinates of the boundary of the property or properties.
		3(1)(c)	A plan which locates the proposed activity or activities applied for as well as the associated structures and infrastructure at an appropriate scale, or, if it is - (i) a linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken; and (ii) on land where the property has not been defined, the coordinates within which the activity is to be undertaken.
5	Legislation and Guidelines Considered	3(1)(e)	A description of the policy and legislative context within which the development is located and an explanation of how the proposed development complies with and responds to the legislation and policy context.
6	Scoping and EIA Process	3(1)(a)	Details of- (i) the EAP who prepared the report; and (ii) the expertise of the EAP, including a curriculum vitae.
		3(1)(u)	An indication of any deviation from the approved scoping report, including the plan of study, including- (i) any deviation from the methodology used in determining the significance of potential environmental impacts and risks; and (ii) a motivation for the deviation.
		3(1)(v)	Any specific information that may be required by the competent authority.
7	Assumptions and Limitations	3(1)(p)	A description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and mitigation measures proposed.

Chapter	Title	Correlation with GN No. R. 982	GN No. R. 982 Description
8	Need and Desirability	3(1)(f)	A motivation for the need and desirability for the proposed development, including the need and desirability of the activity in the context of the preferred development footprint within the approved site as contemplated in the accepted Scoping Report.
9	Project Description	3(1)(d)	A description of the scope of the proposed activity, including- (i) all listed and specified activities triggered and being applied for; and (ii) a description of the associated structures and infrastructure related to the development.
		3(1)(g)	A motivation for the preferred development footprint within the approved site as contemplated in the accepted scoping report.
		3(1)(h)(i)	A full description of the process followed to reach the proposed development footprint within the approved site as contemplated in the accepted scoping report, including: (i) details of the development footprint alternatives considered.
		3(1)(h)(ix)	If no alternative development footprints for the activity were investigated, the motivation for not considering such.
		3(1)(t)	Where applicable, details of any financial provisions for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts.
10	Alternatives	3(1)(h)(i)	Details of the development footprint alternatives considered.
11	Profile of the Receiving Environment	3(1)(h)(iv)	The environmental attributes associated with the development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects.
12	Summary of Specialist Studies	3(1)(k)	Where applicable, a summary of the findings and recommendations of any specialist report complying with Appendix 6 to these Regulations and an indication as to how these findings and recommendations have been included in the final assessment report.
13	Impact Assessment	3(1)(h)(v)	The impacts and risks identified including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts- (i) can be reversed; (ii) may cause irreplaceable loss of resources; and (iii) can be avoided, managed or mitigated.
		3(1)(h)(vi)	The methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks.
		3(1)(h)(vii)	Positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects.
		3(1)(h)(viii)	The possible mitigation measures that could be applied and level of residual risk.
		3(1)(i)	A full description of the process undertaken to identify, assess and rank the impacts the activity and associated structures and infrastructure will impose on the preferred

Chapter	Title	Correlation with GN No. R. 982	GN No. R. 982 Description
			development footprint on the approved site as contemplated in the accepted scoping report through the life of the activity, including - (i) a description of all environmental issues and risks that were identified during the environmental impact assessment process; and (ii) an assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of mitigation measures.
		3(1)(j)	An assessment of each identified potentially significant impact and risk, including- (i) cumulative impacts; (ii) the nature, significance and consequences of the impact and risk; (iii) the extent and duration of the impact and risk; (iv) the probability of the impact and risk occurring; (v) the degree to which the impact and risk can be reversed; (vi) the degree to which the impact and risk may cause irreplaceable loss of resources; and (vii) the degree to which the impact and risk can be mitigated.
14	Analysis of Alternatives	3(1)(h)(ix)	If no alternative development locations for the activity were investigated, the motivation for not considering such.
		3(1)(h)(x)	A concluding statement indicating the location of the preferred alternative development footprint within the approved site as contemplated in the accepted Scoping Report.
		3(1)(n)	The final proposed alternatives which respond to the impact management measures, avoidance, and mitigation measures identified through the assessment.
15	Public Participation – EIA Phase	3(1)(h)(ii)	Details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs.
16	EIA Conclusions and Recommendations	3(1)(l)	An environmental impact statement which contains- (i) a summary of the key findings of the environmental impact assessment; (ii) a map at an appropriate scale which superimposes the proposed activity and its associated structures and infrastructure on the environmental sensitivities of the preferred development footprint on the approved site as contemplated in the accepted scoping report indicating any areas that should be avoided, including buffers; and (iii) a summary of the positive and negative impacts and risks of the proposed activity and identified alternatives.
		3(1)(m)	Based on the assessment, and where applicable, recommendations from specialist reports, the recording of proposed impact management outcomes for the development for inclusion in the Environmental Management Programme (EMPr) as well as for inclusion as conditions of authorisation.
		3(1)(o)	Any aspects which were conditional to the findings of the assessment either by the EAP or specialist which are to

Chapter	Title	Correlation with GN No. R. 982	GN No. R. 982 Description
			be included as conditions of authorisation.
		3(1)(q)	A reasoned opinion as to whether the proposed activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation.
17	References	-	-
Appendix A	Locality Maps	3(1)(c)	A plan which locates the proposed activity or activities applied for as well as the associated structures and infrastructure at an appropriate scale.
Appendix H	Technical Drawings		
Appendix I	Specialists' Reports	R23(5)	Specialist Reports containing all information set out in Appendix 6 of GN No. R. 982 of 4 December 2014 (as amended).
Appendix K	EMPr	R23(4)	Environmental Management Programme containing all information set out in Appendix 4 of GN No. R. 982 of 4 December 2014 (as amended).
Appendix M	Comments and Responses Report	3(1)(h)(ii)	Details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs.
		3(1)(h)(iii)	A summary of the issues raised by IAPs, and an indication of the manner in which the issues were incorporated, or the reasons for not including them.
Appendix X	Oath of Environmental Assessment Practitioner	3(1)(s)	An undertaking under oath or affirmation by the EAP in relation to: (i) the correctness of the information provided in the reports; (ii) the inclusion of comments and inputs from stakeholders and Interested and Affected Parties (IAPs); (iii) the inclusion of inputs and recommendations from the specialist reports where relevant; and (iv) any information provided by the EAP to IAPs and any responses by the EAP to comments or inputs made by IAPs.
N/A		3(1)(r)	Where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required and the date on which the activity will be concluded and the post construction monitoring requirements finalised.
N/A		3(1)(w)	Any other matters required in terms of section 24(4)(a) and (b) of the Act.

3 PROJECT BACKGROUND AND MOTIVATION

3.1 National Development Context

The South African Government adopted a National Infrastructure Plan in 2012 that intends to transform our economic landscape while simultaneously creating significant numbers of new jobs, and to strengthen the delivery of basic services. The plan also supports the integration of African economies. The National Infrastructure Plan consists of 18 Strategic Integrated Projects (SIPs) spread across the country.

SIP 1 aims to unlock SA's northern mineral belt in one of the poorest provinces (Limpopo) through key infrastructure provision in the Waterberg and Steelpoort districts, initiating new energy and industrial development, shifting coal from road to rail in Mpumalanga and increasing rail capacity to Richards Bay whilst supporting regional integration. 15% of the country's total power generation is situated in Waterberg. The assurance of water supply to the current power stations is not acceptable and places the country's power supply at risk. The components associated with SIP 1 thus include the proposed MCWAP-2. The former Minister of Water Affairs approved the implementation of MCWAP-1 (MCWAP (Phase 1)), MCWAP-2A and MCWAP-3 (MCWAP (Phase-3)) as Government Waterworks in terms of Section 109 of the National Water Act (Act No. 36 of 1998) (NWA) on 14May 2010, subject to the Environmental Authorisation of the project by the DEA. The MCWAP-3 (River Management System) was since merged with MCWAP-2A.

3.2 Increased Need for Water in the Lephalale Area

The Lephalale Municipal area falls in the Limpopo Catchment. The Mokolo (previously known as the Mogol) and the Lephalala (also referred to as the Phalala) Rivers run through the municipal area to the north, with the Matlabas River running along the south-eastern boundary and the Mogalakwena River along the eastern boundary. All four rivers feed into the Limpopo River which forms the north western border of South Africa with Botswana.

The Mokolo Dam (formerly known as the Hans Strijdom Dam) was constructed in the late 1970s and completed in July 1980, to supply water to Matimba Power Station, Grootegeluk Mine, Lephalale (Ellisras) Municipality and for irrigation downstream of the dam. Based on the water infrastructure, the current water availability and water use allows only limited spare yield existing for future allocations for the anticipated surge in

Box 1:	Why is water needed in Lephalale?
Water demand will increase in the Lephalale area due to the following planned and anticipated consequential developments due to the Waterberg coalfields: • Construction of Eskom's Medupi Power Station; • Possible development of further Eskom power stations; • Possible development of power stations by Independent Power Producers (IPPs); • Extension of the Grootegeluk mining operations and further mines; • Possible exploitation of gas; and • Accelerated growth in the population in the area.	

economic development in the area.

Large parts of the Mokolo River catchment area are located on the Waterberg coalfields (refer to **Figure 1**) where, according to preliminary estimates, almost half of South Africa's *in-situ* coal reserves are situated. As such, the Waterberg has long been considered the country's major coal resource for the future, especially once the current mining areas in the Witbank-Highveld coalfields of the Mpumalanga Province have been depleted (DWAF, 2008a). As a result, major developments are planned for the Lephalale area. As a direct result of the above developments, the demand for water in the Lephalale area is expected to significantly increase into the future.

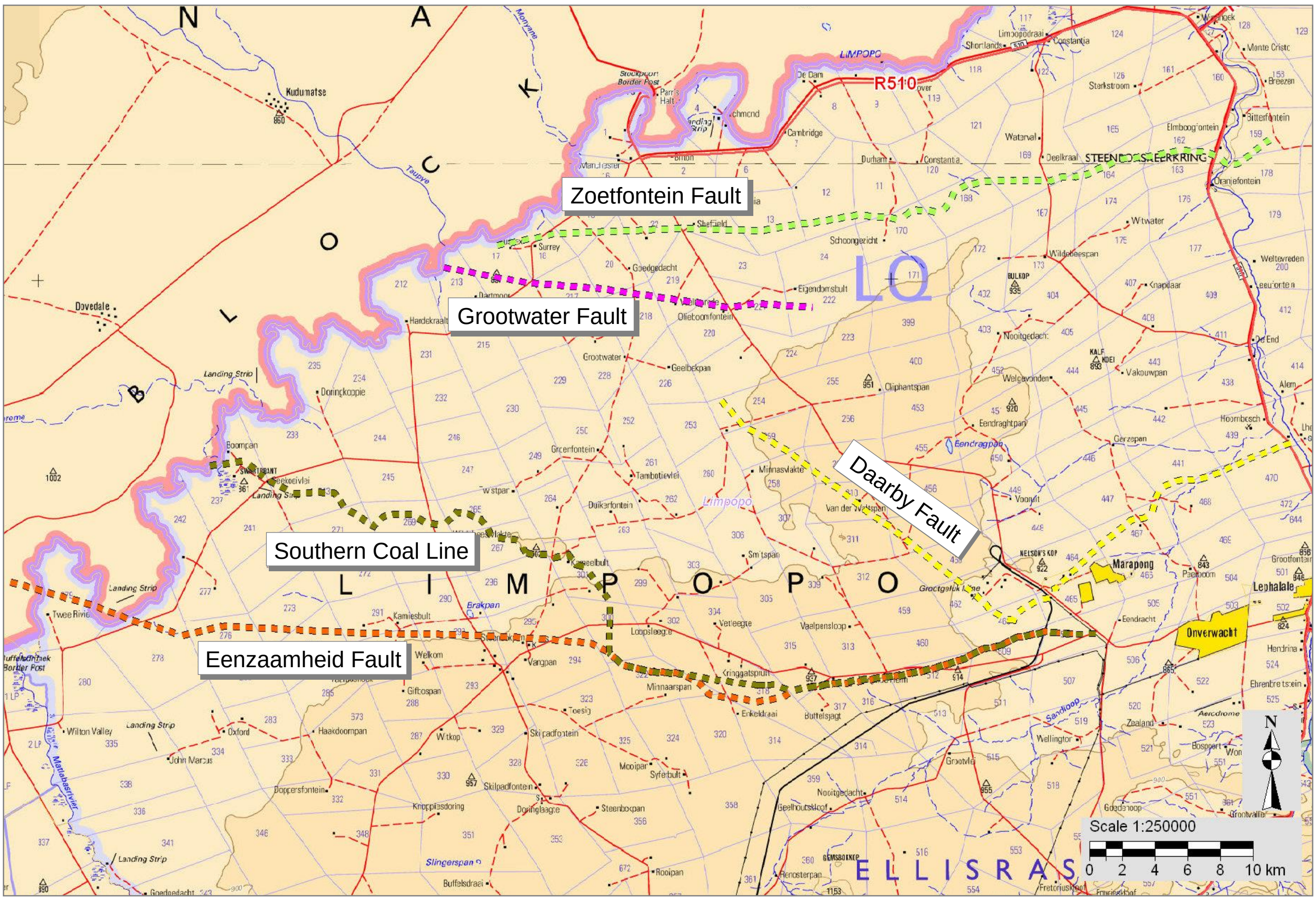


Figure 1: **Fault lines of the Waterberg Coalfield**

3.3 Inter-Basin Transfers In

According to the Crocodile River (West) Reconciliation Strategy 2015 (DWS, 2015), transfers of water into the catchment from the Vaal by Rand Water supplies a majority of the domestic water requirements in the larger Metros in the Southern Part of the catchment (see **Figure 2**).

The current and projected transfers into the Crocodile River (West) catchment from the Vaal River system by Rand Water for domestic supply are shown in **Table 2**.

Table 2: Projected water future transfer volumes into the Crocodile River (West) catchment from the Vaal by Rand Water for domestic water supply

	Projected transfers into the Crocodile River Catchment (million m^3/a)						
	2010	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**
Rand Water supply	523	524	577	624	686	725	765

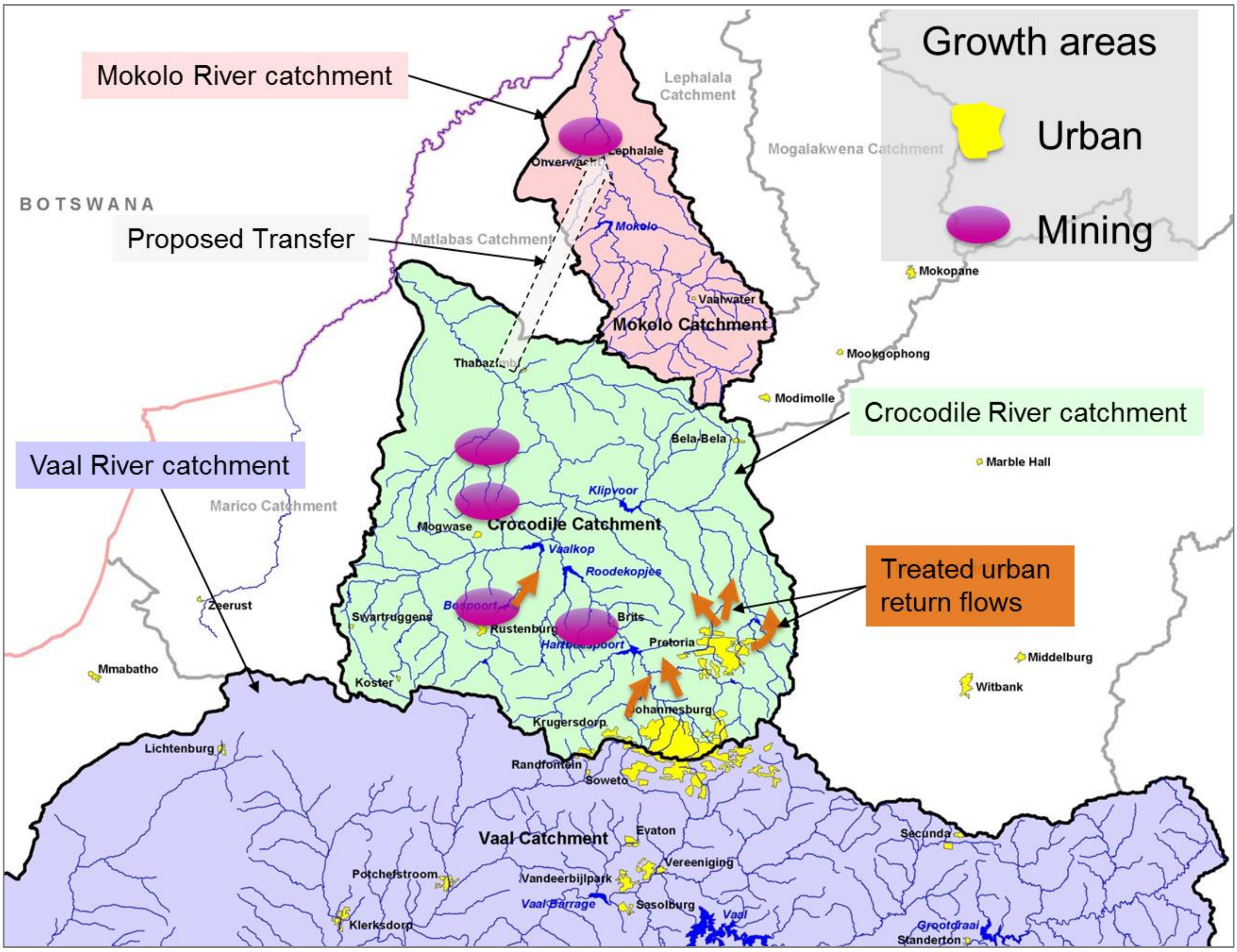


Figure 2: Context of the Crocodile West System

The availability of water for the proposed transfer of water as part of MCWAP-2A was modelled during the Reconciliation Study 2015 (DWS, 2015), which took into consideration the Existing Lawful Water Uses, including the Hartbeespoort Irrigation Board, Crocodile River (West) Irrigation Board and the Makoppa Irrigation Area. The return flows from growing urban areas that feed into the Hartbeespoort Dam (refer to **Table 2**) provide surplus water that is available and targeted for the proposed water transfer, which is more than the natural yield of the Crocodile River (West).

3.4 Meeting the Increased Water Demands

Due to the limited availability of water in the Lephalale area, the DWS conducted a feasibility study (completed in 2010) of the MCWAP to establish how the future water demands could be met. The phases of the proposed project include (shown in **Figure 3**):

- **MCWAP-1:** Augment the supply from Mokolo Dam to supply in the growing water use requirement for the interim period until a transfer pipeline from the Crocodile River West can be implemented. The solution must over the long term optimally utilise the full yield from Mokolo Dam and will be operated as a system together with MCWAP-2A when the latter is completed. Phase 1 is operational since June 2015. The pipeline section between Lephalale to Steenbokpan was not constructed as part of MCWAP-1 as originally envisaged, and will form part of the construction contract/s for MCWAP-2A. However, the Environmental Authorisation for this section was received as part of the EIA for MCWAP-1.
- **MCWAP-2A:** Transfer water from the Crocodile River (West) to the Steenbokpan and Lephalale areas, including the implementation of the River Management System in the Crocodile River (West) and its tributaries. MCWAP-2A is the focus of this EIA.

In essence, water from the Mokolo Dam will primarily be provided to existing consumers such as Matimba Power Station, Municipal users in the vicinity of Lephalale (Ellisras), as well as the new Medupi Power Station (partly), while the Crocodile River (West) Transfer Scheme will provide water to the new consumers such as Eskom including water requirements linked to flue gas desulphurisation (FGD) (pollution abatement measure) for Medupi and Matimba Power Stations.

It was originally intended that construction of the two MCWAP phases (MCWAP-1 and MCWAP-2A) should start concurrently, but with the smaller MCWAP-1 being able to deliver water much sooner than MCWAP-2A to meet Medupi's initial water requirements excluding FGD. However, due to significant/dynamic changes occurring in the national energy planning environment and their related water demand figures compared to the demand scenarios considered during the 2010 Feasibility Study, the implementation of MCWAP-2A was temporarily placed on hold. This decision was informed by two main aspects:

- Firstly, by the Department of Energy's (DoE) Integrated Resource Plan (IRP) (2010) published adopted in March 2011 and updated in November 2013, which redefined the country's future electric power supply energy mix and subsequently again in November 2016. The latest draft IRP was recently gazetted on 27 August 2018 requesting interested persons and organisations to submit written comments within 60 days its publication. The latest IRP confirms the need for Medupi and Matimba including FGD and therefore water supply to the Lephalale area although the transfer capacity from the Crocodile River (West) may be reduced but the WTI components will not be affected, albeit smaller. It is noteworthy that the IRP does not impact on MCWAP-2A's implementation schedule to meet Eskom's finance and licence obligations;
- Secondly, by Sasol's decision to cancel their plans for developing a coal to liquid fuel facility in the project area called Project Mafutha.

In order to address the impact of the reduced water demand from the revised energy planning process, DWS initiated a Post Feasibility Bridging Study (2015) to review and update the Feasibility Study findings for MCWAP-2A. The important development principles that have been formulated in the Feasibility Study Reports remain relevant. These documents still inform the basic configuration, design, construction and operation of the MCWAP. The bridging study aimed to redefine the capacity required for MCWAP-2A. Further optimisation is expected during the tender design phase

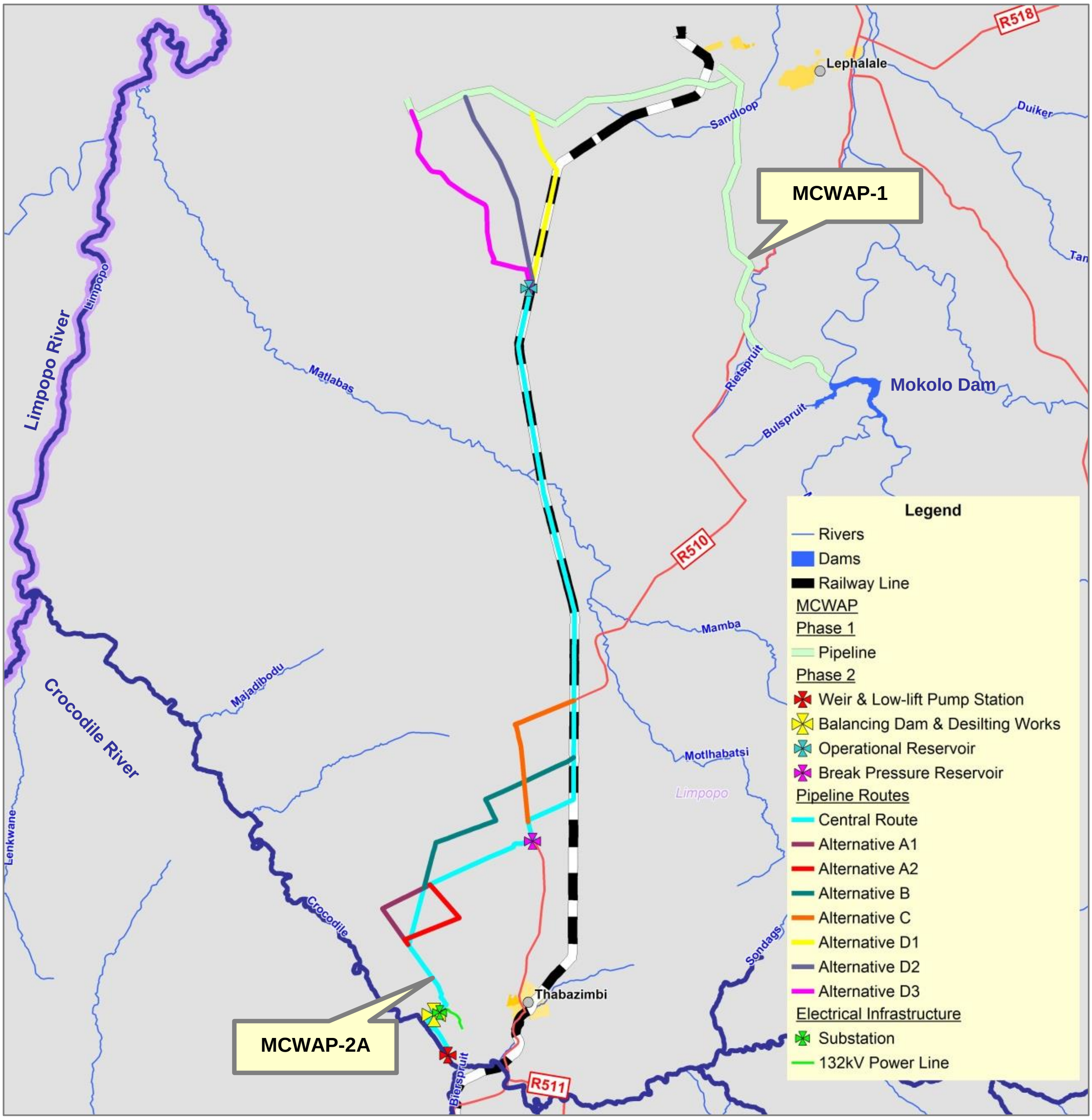


Figure 3: **MCWAP Phases 1 and 2**

(Note: gauging weirs and pipeline route Alternative E and D4 not shown)

The planning horizon of the initial water requirement investigation in the bridging study was 2050 which is a best practice also applied by DWS. The phased development option analysis favoured a MCWAP-2A capacity of 80 million m^3/a followed by a future parallel MCWAP-2B capacity of 30 million m^3/a. Post the essential completion of the bridging study report in December 2013, it however became clear during the initial water supply agreement discussions that the potential users' commitment was limited to a transfer scheme with a capacity of 100 million m^3/a. This was based on a planning horizon of 2040 plus long term commitment beyond 2040 confirmed at that stage. National Treasury facilitated discussions involving officials of TCTA, DWS, DoE, National Treasury, DMR, NERSA and DPE on how the off take should be funded. There were concerns about uncertainties of the integrated energy resource plan beyond 2035. The effective planning horizon then moved to 2035 which limited the MCWAP-2A capacity to 75 million m^3/a., i.e. the adopted transfer capacity. This specifically excludes provision for Coal 4 power station which had been scheduled in the development scenarios for commissioning after 2035.

DWS remains committed and focused on achieving the national strategic objective to unlock the Northern Mineral Belt with the Waterberg coalfield as the Catalyst. To achieve national objectives DWS will continue to monitor water requirements in the project area and should the need arise it is possible to construct a MCWAP-2B within the same pipeline servitude. As for MCWAP-2A it would be subject of a proper technical planning and to separate processes to seek authorisation in terms of the prevailing environmental legislation at that time. It is not currently envisaged to commence before 2040. Such planning and EIA process would take place over a period of about 4 years.

The MCWAP will also aim to satisfy most of the water requirements of the new anticipated developments from the increasing source of return flows from the Gauteng area. Operating Rules for both the Mokolo and the Crocodile River (West) systems need to be developed by DWS in a separate process and must take cognisance of this and ensure that Existing Lawful Use is giving effect to as stipulated by the NWA. Similarly, it is a legal requirement that provision is made for meeting the requirements of the Reserve, as catered for in the NWA.

3.5 Water Requirements

The water requirements of users in the MCWAP System were obtained from the Post Feasibility Bridging Study Report (2015). They are reflected in **Table 3** and shown in **Figure 4** and are aligned to a nominal transfer capacity of 75 million m^3/a, which is marginally (<10%) less than the maximum requirements beyond 2040.

Table 3: Combined Water Requirement Projection for the MCWAP in million m^3/a

USER GROUP	2019	2020	2025	2030	2035	2040	2045	2050
Committed Commercial Users (Eskom & Exxaro)	**23,92**	**27,02**	**34,62**	**42,75**	**42,75**	**42,75**	**42,75**	**42,75**
Eskom	**11,90**	**14,00**	**19,00**	**26,60**	**26,60**	**26,60**	**26,60**	**26,60**
Matimba Power Station	3,60	3,60	3,60	11,20	11,20	11,20	11,20	11,20
Medupi Power Station	8,30	10,40	15,40	15,40	15,40	15,40	15,40	15,40
Exxaro	**12,02**	**13,02**	**15,62**	**16,15**	**16,15**	**16,15**	**16,15**	**16,15**
IPP Exxaro Initiative	0,77	0,77	1,42	1,95	1,95	1,95	1,95	1,95
Exxaro Mine (Matimba and Medupi)	6,16	6,38	6,81	6,54	6,54	6,54	6,54	6,54
Mpumalanga	1,24	1,40	2,07	2,23	2,23	2,23	2,23	2,23
Export	0,85	0,95	1,21	1,26	1,26	1,26	1,26	1,26
Industrial	3,00	3,52	4,11	4,17	4,17	4,17	4,17	4,17
DoE Future Users	**5,86**	**10,60**	**24,51**	**40,18**	**43,79**	**42,99**	**53,79**	**53,79**
CF3 Power Generation	0,20	0,20	0,37	15,50	15,50	15,50	15,50	15,50
IPP other	0,17	0,33	0,50	0,50	0,50	0,50	0,50	0,50
CF3 Mines	2,06	2,06	5,54	6,00	6,00	6,00	6,00	6,00
Mpumalanga	3,43	5,48	8,05	8,35	11,00	10,60	16,00	16,00
Industrial	0,00	0,94	2,59	2,66	2,66	2,66	2,66	2,66
Export	0,00	1,58	7,46	7,17	8,13	7,73	13,13	13,13
Social Users	**11,96**	**12,47**	**13,02**	**14,08**	**13,97**	**14,02**	**14,20**	**14,39**
Lephalale Municipality	11,96	12,47	13,02	14,08	13,97	14,02	14,20	14,39
Total requirements excluding Incidental Users	**41,74**	**50,09**	**72,15**	**97,01**	**100,51**	**99,76**	**110,74**	**110,93**
Incidental Users	**0,40**	**0,40**	**0,40**	**0,40**	**0,40**	**0,40**	**0,40**	**0,40**
MCWAP-1	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10
MCWAP-2A	0,30	0,30	0,30	0,30	0,30	0,30	0,30	0,30
Total requirements including Incidental Users	**42,14**	**50,49**	**72,55**	**97,61**	**100,91**	**100,16**	**114,14**	**111,33**
Capacity MCWAP-1	**29,4**	**29,4**	**29,4**	**29,4**	**29,4**	**29,4**	**29,4**	**29,4**
Volume required in MCWAP-2A	**12,74**	**21,09**	**43,15**	**68,21**	**71,51**	**80,76**	**84,74**	**81,93**

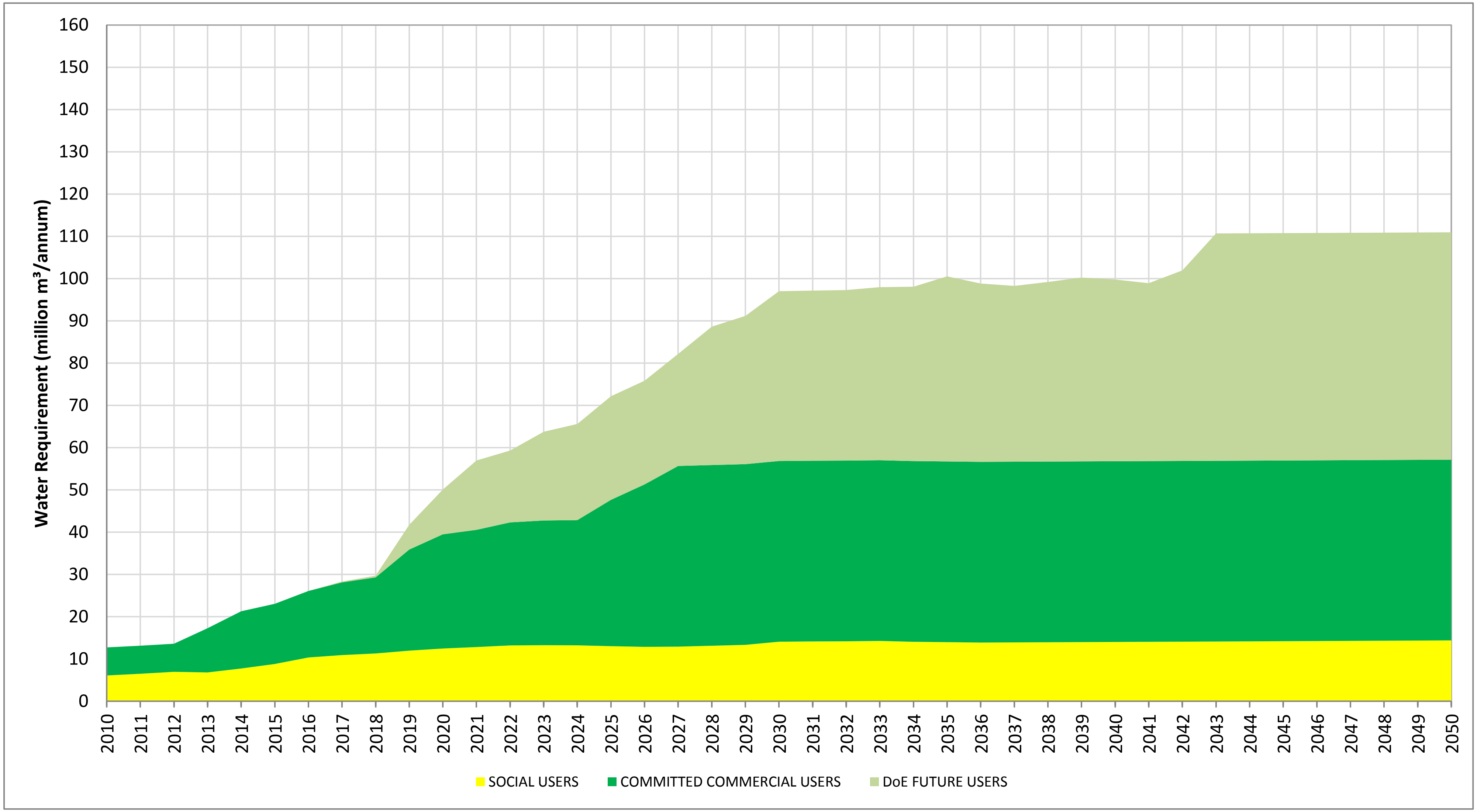


Figure 4: **Aggregated Water Requirement Projection**

3.6 MCWAP-2A Scope

The overall MCWAP-2A consists of the following components:

- WTI - transfer of water from the Crocodile River to Lephalale (refer to **Sections 9.2 – 9.7**), which is the subject of this EIA Report;
- Borrow Pits - sourcing of construction material; and
- River Management System - manage abstractions from, and the river flow in, the Crocodile River (West) between Hartbeespoort Dam and Vlieëpoort Weir, the Moretele River from Klipvoor Dam to the confluence with the Crocodile River (West), the stretch of Elands River from Vaalkop Dam to Crocodile confluence, and also the required flow past Vlieëpoort (refer to **Section 9.12**).

As mentioned, this EIA specifically deals with the WTI component.

3.7 DWS Project Life-cycle

The generic DWS project life cycle consists of the stages shown in **Figure 5**. The EIA, which takes place during the feasibility stage of the project life-cycle, makes a final recommendation on the preferred option which is submitted with motivation to management for approval and funding.

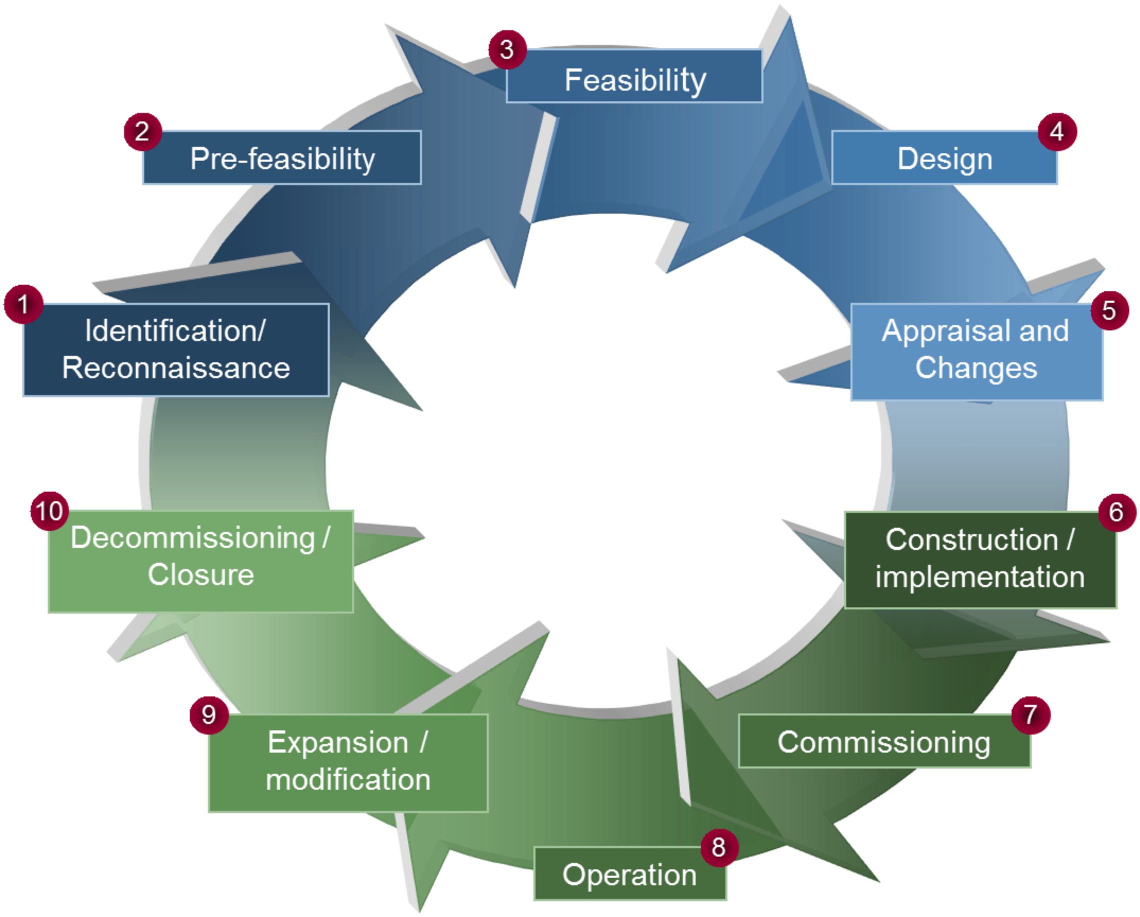


Figure 5: Generic DWS Project Life Cycle for Water Resource Management

As mentioned, DWS initiated a feasibility study in 2008 entitled “Mokolo and Crocodile River (West) Water Augmentation Project (MCWAP) Feasibility Study”. The feasibility study was commissioned to augment the water supply to the Lephalale area. The reports were completed in September 2010. Thereafter, DWS initiated a Post Feasibility Bridging Study to review and update the Feasibility Study findings for MCWAP-2A. The following technical reports are of particular relevance to the information contained within the EIA Report:

- P RSA A000/00/8809 - Pre-feasibility Stage: Supporting Report 1: Water Requirements;
- P RSA A000/00/8909 - Pre-feasibility Stage: Supporting Report 2: Water Resources;
- P RSA A000/00/9109 - Pre-feasibility Stage: Supporting Report 4: Dam, Weir and River Engineering;
- P RSA A000/00/9309 - Pre-feasibility Stage: Supporting Report 6: Crocodile River Transfer Scheme Options;
- P RSA A000/00/8109 - Feasibility Stage: Main Report: MCWAP Feasibility Study Technical Module Summary;
- P RSA A000/00/8609 - Feasibility Stage: Supporting Report 10: Requirements for the Sustainable Delivery of Water;
- P RSA A000/00/8309 - Feasibility Stage: Supporting Report 12: Phase 2 Feasibility Stage; and
- P RSA 000/A00/18413 - Feasibility Bridging Stage: MCWAP-2: Post Feasibility Bridging Study; Review Report.

4 PROJECT LOCATION

4.1 Geographical Context

The project is located within the western part of the Limpopo Province. The footprint of the proposed project traverses the Thabazimbi Local Municipality (LM) and Lephalale LM, which fall within the Waterberg District Municipality (DM). Refer to **Figure 6**. The locality map is provided in **Figure 7** and an aerial view is shown in **Figure 8**. Maps are also contained in **Appendix A**.

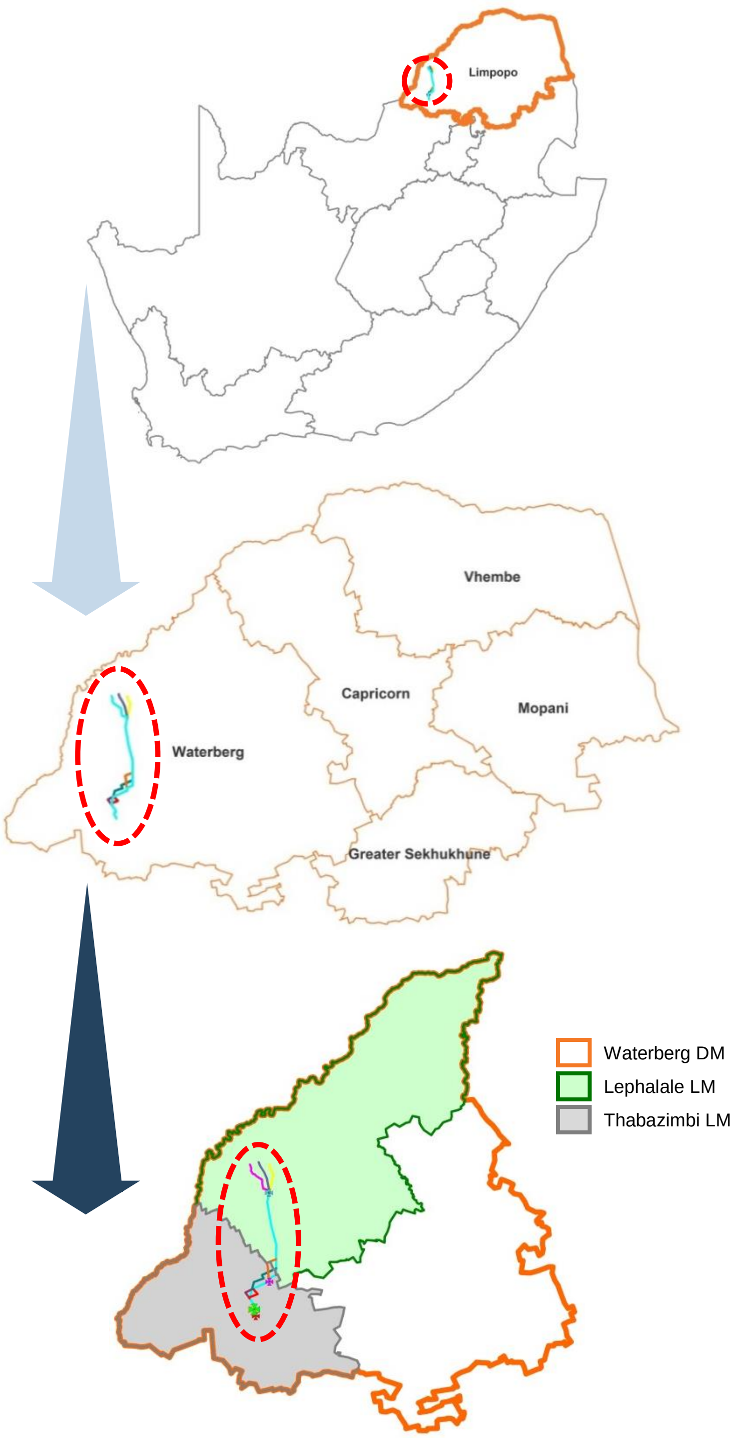


Figure 6: National, provincial and municipal maps of MCWAP-2A WTI

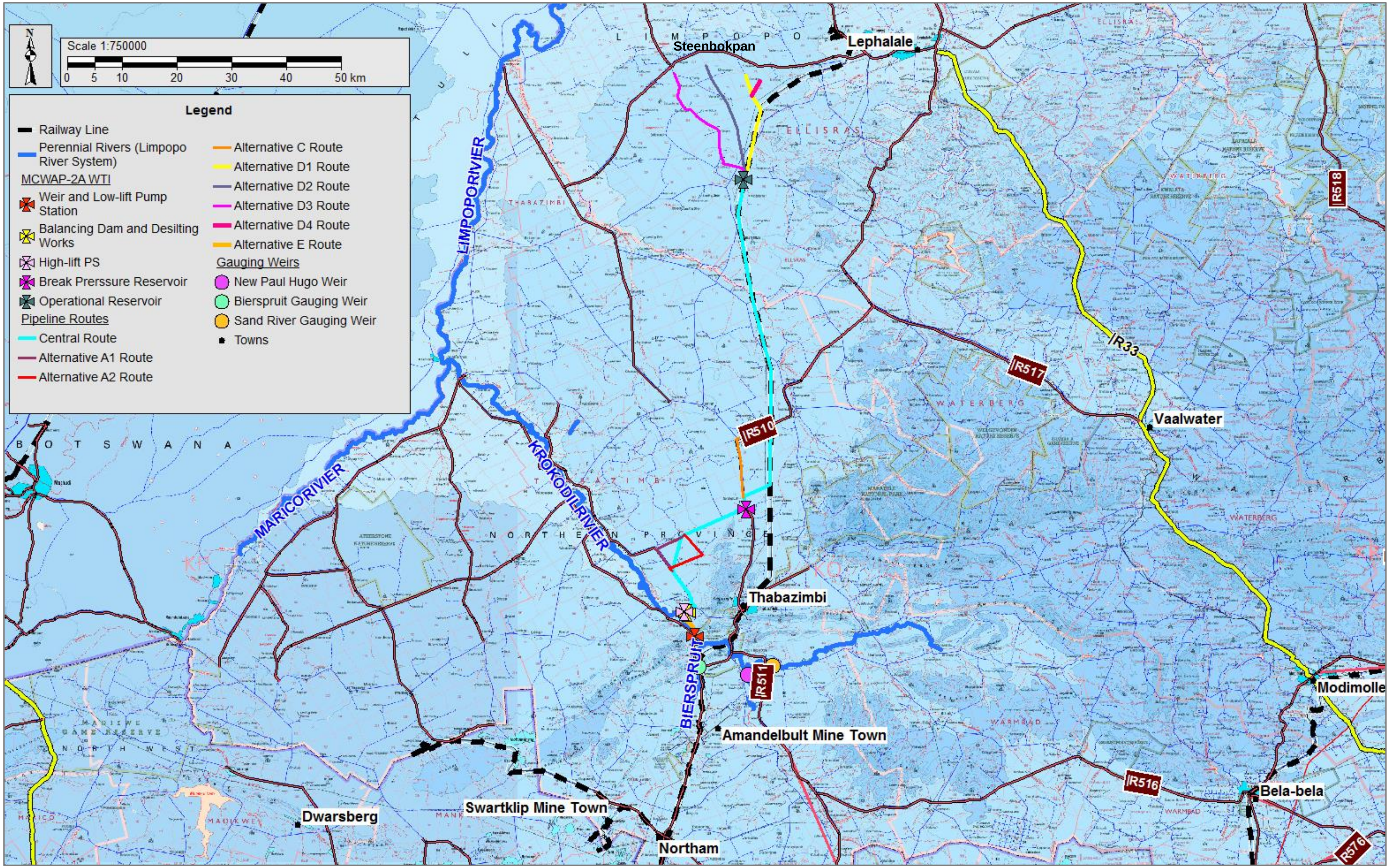


Figure 7: Locality map

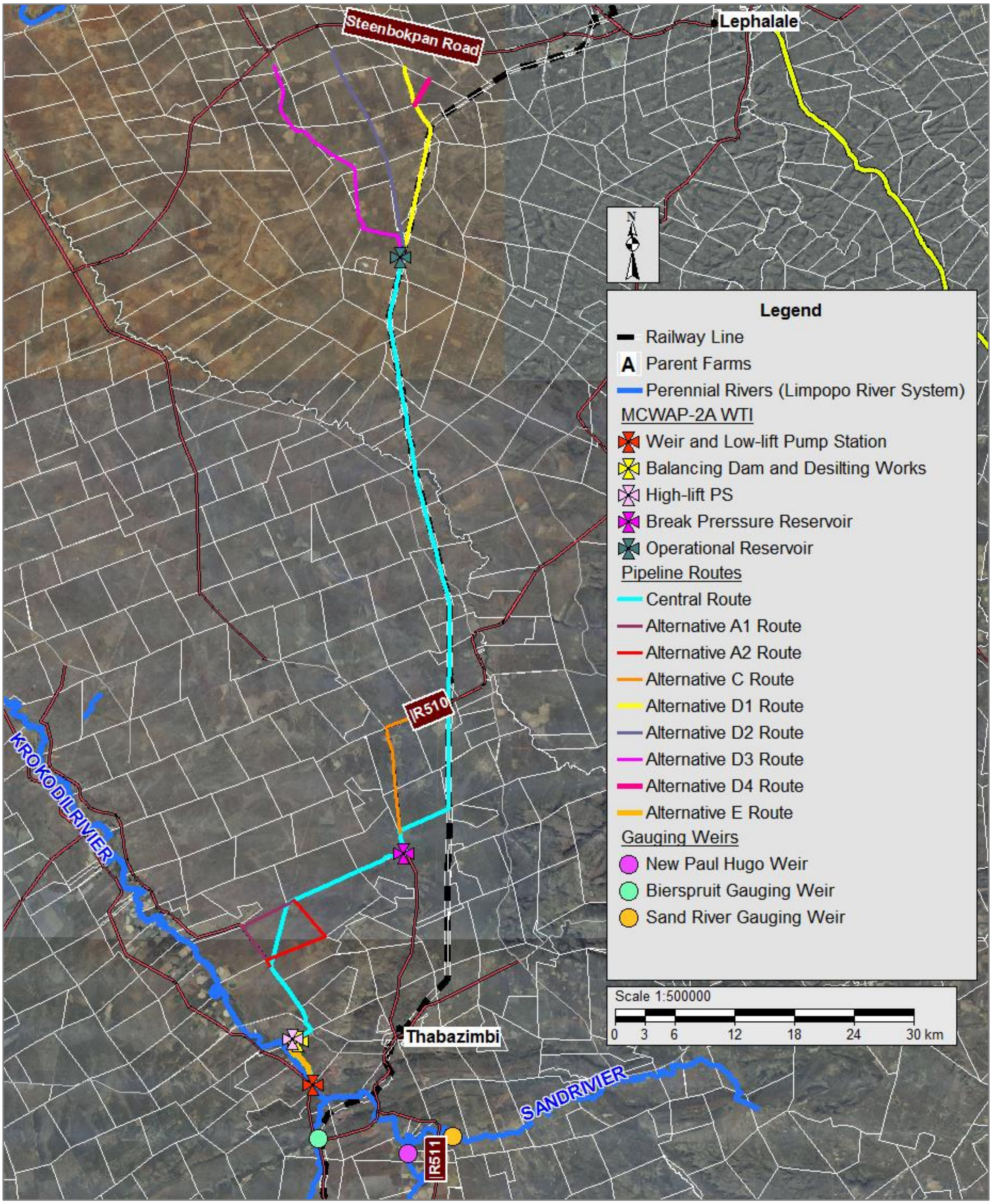


Figure 8: Orthophotograph of MCWAP-2A WTI

(Note: Farm Portions not shown due to scale)

The proposed pipeline route commences from the Vlieëpoort Mountains at the weir site on the Crocodile River, in the south-western point of the project area. From there it runs in a predominantly northern direction along existing roads, farm boundaries and a railway line, until it reaches its destination near Steenbokpan. A more detailed route description is provided in **Section 9.4.3** and detailed maps are contained in **Appendix C**.

Thabazimbi is situated approximately 10 km to the north-east of the Vlieëpoort weir site and Lephalale is situated approximately 30 km to the east of the Alternative D1 pipeline route's terminal point.

4.2 Affected Properties

The project infrastructure is mostly located on privately-owned properties that are primarily used for agricultural practices and game-farming.

Details of the properties that are directly affected by and adjacent to the proposed development are contained in **Appendix G**.

5 LEGISLATION AND GUIDELINES CONSIDERED

5.1 Legislation

5.1.1 *Environmental Statutory Framework*

The legislation that has a possible bearing on the proposed project from an environmental perspective is captured in **Table 4** below. **Note:** *this list does not attempt to provide an exhaustive explanation, but rather represents an identification of the most appropriate sections from pertinent pieces of legislation*.

Table 4: Environmental Statutory Framework

<table>
<tr><th>Legislation</th><th colspan="2">Description and Relevance</th></tr>
<tr><td>Constitution of the Republic of South Africa, (No. 108 of 1996)</td><td colspan="2">• Chapter 2 – Bill of Rights; and
• Section 24 – Environmental Rights.</td></tr>
<tr><td>National Environmental Management Act (NEMA) (No. 107 of 1998)</td><td colspan="2">• Section 24 – Environmental Authorisation (control of activities which may have a detrimental effect on the environment);
• Section 28 – Duty of care and remediation of environmental damage;
• Environmental management principles; and
• Authorities – DEA (national) and Limpopo Department of Economic Development, Environment and Tourism (LDEDET) (provincial).</td></tr>
<tr><td>GN No. R 982 of 4 December 2014 (as amended)</td><td colspan="2">• Purpose - regulate the procedure and criteria as contemplated in Chapter 5 of NEMA relating to the preparation, evaluation, submission, processing and consideration of, and decision on, applications for environmental authorisations for the commencement of activities, subjected to EIA, in order to avoid or mitigate detrimental impacts on the environment, and to optimise positive environmental impacts, and for matters pertaining thereto.</td></tr>
<tr><td rowspan="3">GN No. R. 983 of 4 December 2014 (as amended) (Listing Notice 1)</td><td colspan="2">• Purpose - identify activities that would require environmental authorisations prior to commencement of that activity and to identify competent authorities in terms of sections 24(2) and 24D of NEMA;
• The investigation, assessment and communication of potential impact of activities must follow a Basic Assessment process, as prescribed in regulations 19 and 20 of GN No. R 982 of 4 December 2014 (as amended). However, according to Regulation 15(3) of GN No. R 982, a Scoping and Environmental Impact Reporting Process (S&EIR) must be applied to an application if the application is for two or more activities as part of the same development for which S&EIR must already be applied in respect of any of the activities; and
• Activities under Listing Notice 1 that are relevant to this project follow.</td></tr>
<tr><td>GN No. R. 983 – Activity no. 9:
The development of infrastructure exceeding 1 000 metres in length for the bulk transportation of <u>water</u> 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;
excluding where-
(a) such infrastructure is for bulk transportation of water or storm water or storm water drainage inside a road reserve; or
(b) where such development will occur within an urban area.</td><td>Water pipelines that form part of the transfer scheme, based on 75 million m^3/a transfer capacity. Pipe diameter up to 2 400 mm.</td></tr>
<tr><td>GN No. R. 983 – Activity no. 12:
The development of -
(i) dams or weirs, where the dam or weir, including infrastructure and water surface area, exceeds 100 square metres; or
(ii) infrastructure or structures with a physical footprint of 100 square metres or more;</td><td>Various infrastructure and structures with a physical footprint of 100 square metres or more within watercourse(s) / within 32 m from watercourse(s), including:
• Abstraction works - Crocodile River;</td></tr>
</table>

Legislation	Description and Relevance	
	where such development occurs - (a) within a watercourse; (b) in front of a development setback; or (c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse; - Excluding - (aa) the development of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour; (bb) where such development activities are related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies; (cc) activities listed in activity 14 in Listing Notice 2 of 2014 or activity 14 in Listing Notice 3 of 2014, in which case that activity applies; (dd) where such development occurs within an urban area; (ee) where such development occurs within existing roads, road reserves or railway line reserves; or (ff) the development of temporary infrastructure or structures where such infrastructure or structures will be removed within 6 weeks of the commencement of development and where indigenous vegetation will not be cleared.	• *Gauging weirs - Crocodile River, Bierspruit and Sand River;* • *Pipeline crossings - tributaries of the Limpopo River system (including the Matlabas River main stem and tributaries) as well as tributaries of the Mokolo River system;* • *Access roads' crossings - tributaries of the Limpopo River system.*

	*GN No. R.983 – Activity no. 13:
	The development of facilities or infrastructure for the off-stream storage of water, including dams and reservoirs, with a combined capacity of 50000 cubic metres or more, unless such storage falls within the ambit of activity 16 in Listing Notice 2 of 2014.*
		• *Balancing Dam -*
		  ○ *Size - 620 x 440 m;*
		  ○ *Storage capacity – 3 days, 680 000m³ for 75 million m³/a transfer*
		• *BPR -*
		  ○ *Dimensions - 260 x 300 m;*
		  ○ *Storage capacity – 8 hours, 90 000 m^3 for 75 million m³/a;*
		• *OR -*
		  ○ *Dimensions - 260 x 300 m;*
		  ○ *Storage capacity - 8 hours, 90 000 m^3 for 75 million m³/a.*

	GN No. R.983 – Activity no. 14: The development of facilities or infrastructure, for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 cubic metres or more but not exceeding 500 cubic metres.	*"Dangerous goods" associated with the greater project, are fuel stores, as well as any dangerous goods to be used during the construction phase. Threshold of 80 m^3 (combined capacity) to be exceeded.* *Fuel and other dangerous goods will be stored at all site establishments, in accordance with prescribed best practices.*
	GN No. R.983 – Activity no. 19: The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse; but excluding where such infilling, depositing, dredging, excavation, removal or moving - (a) will occur behind a development setback; (b) is for maintenance purposes undertaken in accordance with a maintenance management plan; (c) falls within the ambit of activity 21 in this Notice, in which case that activity applies; (d) occurs within existing ports or harbours that will not increase the development footprint of the port or harbour; or	*Various infrastructure within watercourse(s) / within 32 m from watercourse(s), including:* • *Abstraction works - Crocodile River;* • *Gauging weirs - Crocodile River, Bierspruit and Sand River;* • *Pipeline crossings - tributaries of the Limpopo River system (including the Matlabas River main stem and tributaries) as well as tributaries of the Mokolo River system;* • *Access roads' crossings - tributaries of the Limpopo River system.*

Legislation	Description and Relevance	
	(e) where such development is related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies.	
	GN No. R.983 – Activity no. 24: *The development of a road -* *(i) for which an environmental authorisation was obtained for the route determination in terms of activity 5 in Government Notice 387 of 2006 or activity 18 in Government Notice 545 of 2010; or* *(ii) with a reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 metres;* *but excluding a road -* *(a) which is identified and included in activity 27 in Listing Notice 2 of 2014;* *(b) where the entire road falls within an urban area; or* *(c) which is 1 kilometre or shorter.*	*Access roads to the various sites (construction and operational phases) are expected to exceed thresholds.*
	GN No. R.983 – Activity no. 27: *The clearance of an area of 1 hectares or more, but less than 20 hectares of indigenous vegetation, except where such clearance of indigenous vegetation is required for-* *(i) the undertaking of a linear activity; or* *(ii) maintenance purposes undertaken in accordance with a maintenance management plan.*	*Clearance of large areas associated with the construction footprint, which includes the following large project components:* • *Balancing Dam - 620 x 440 m;* • *BPR - 260 x 300 m;* • *OR - 260 x 300 m;* • *Laydown areas, and* • *General site establishment.*
	GN No. R.983 – Activity no. 28: *Residential, mixed, retail, commercial, industrial or institutional developments where such land was used for agriculture, game farming, equestrian purposes or afforestation on or after 01 April 1998 and where such development:* *(i) will occur inside an urban area, where the total land to be developed is bigger than 5 hectares; or* *(ii) <u>will occur outside an urban area, where the total land to be developed is bigger than 1 hectare</u>;* *excluding where such land has already been developed for residential, mixed, retail, commercial, industrial or institutional purposes.*	*Footprint of project on land used for agricultural and game farming purposes. This includes the Balancing Dam which is 600 m x 370 m and ancillary structures (including workshops, offices and stores), which mostly occur on land used for agricultural purposes, outside of an urban area.*
	GN No. R.983 – Activity no. 30: *Any process or activity identified in terms of section 53(1) of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004).*	*Occurrence of sensitive biodiversity features at affected areas.*
	GN No. R.983 – Activity no. 56: *The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre-* *(i) where the existing reserve is wider than 13,5 meters; or* *(ii) where no reserve exists, where the existing road is wider than 8 metres;* *excluding where widening or lengthening occur inside urban areas.*	• *Access roads to the various sites (construction and operational phases).* • *Relocation of roads that will be inundated by abstraction weir.*
	GN No. R.983 – Activity no. 67: *Phased activities for all activities -* *(i) listed in this Notice, which commenced on or after the effective date of this Notice or similarly listed in any of the previous NEMA notices, which commenced on or after the effective date of such previous NEMA Notices;* *excluding the following activities listed in this Notice-* *17(i)(a-d);* *17(ii)(a-d);* *17(iii)(a-d);* *17(iv)(a-d);* *17(v)(a-d);* *20;*	*Possible phased activities that may collectively trigger this listed activity.*

Legislation	Description and Relevance	
	21; *22;* *24(i);* *29;* *30;* *31;* *32;* *34;* *54(i)(a-d);* *54(ii)(a-d);* *54(iii)(a-d);* *54(iv)(a-d);* *54(v)(a-d);* *55;* *61;* *64; and* *65; or* *(ii) listed as activities 5, 7, 8(ii), 11, 13, 16, 27(i) or 27(ii) in Listing Notice 2 of 2014 or similarly listed in any of the previous NEMA notices, which commenced on or after the effective date of such previous NEMA Notices;* *where any phase of the activity was below a threshold but where a combination of the phases, including expansions or extensions, will exceed a specified threshold*	
GN No. R. 984 of 4 December 2014 (Listing Notice 2)	• Purpose - identify activities that would require environmental authorisations prior to commencement of that activity and to identify competent authorities in terms of sections 24(2) and 24D of NEMA; • The investigation, assessment and communication of potential impact of activities must follow a S&EIR, as prescribed in regulations 21 - 24 of GN No. R 982 of 4 December 2014 (as amended); and • Activities under Listing Notice 2 that are relevant to this project follow.	
	GN No. R.984 – Activity no. 4: *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 more than 500 cubic metres.*	*"Dangerous goods" associated with the greater project, are fuel stores, as well as any dangerous goods to be used during the construction phase.* *Fuel and other dangerous goods will be stored at all site establishments, in accordance with prescribed best practices.*
	GN No. R.984 – Activity no. 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, excluding -* *(i) activities which are identified and included in Listing Notice 1 of 2014;* *(ii) activities which are included in the list of waste management activities published in* *terms of section 19 of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) in which case the National Environmental Management: Waste Act, 2008 applies;* *(iii) the development of facilities or infrastructure for the treatment of effluent, polluted water, wastewater or sewage where such facilities have a daily throughput capacity of 2 000 cubic metres or less; or* *(iv) where the development is directly related to aquaculture facilities or infrastructure where the wastewater discharge capacity will not exceed 50 cubic metres per day.*	*Approval will be required for the scouring of sediment back to the Crocodile River from the desilting works in terms of the NWA.*
	GN No. R.984 – Activity no. 11:	*Transfer scheme from Crocodile River*

Legislation	Description and Relevance	
	The development of facilities or infrastructure for the transfer of 50 000 cubic metres or more water per day, from and to or between any combination of the following - *(i) water catchments;* *(ii) water treatment works; or* *(iii) impoundments;* *excluding treatment works where water is to be treated for drinking purposes.*	*(West) to Lephalale with a capacity of 75 million m^3/a.*
	GN No. R.984 – Activity no. 15: *The clearance of an area of 20 hectares or more of indigenous vegetation, excluding where such clearance of indigenous vegetation is required for-* *(i) the undertaking of a linear activity; or* *(ii) maintenance purposes undertaken in accordance with a maintenance management plan.*	*Cumulative area to be cleared for entire project (except linear components) exceeds 20 hectares (ha).* *Status of vegetation to be confirmed as part of the Terrestrial Ecological Study.*
	GN No. R.984 – Activity no. 16: *The development of a dam where the highest part of the dam wall, as measured from the outside toe of the wall to the highest part of the wall, is 5 metres or higher or where the high water mark of the dam covers an area of 10 hectares or more.*	*Abstraction weir at Vlieëpoort. The lowest part of weir would be approximately 4 m - 6 m high above the river bed level.*
GN No. R. 985 of 4 December 2014 (Listing Notice 3)	• Purpose - list activities and identify competent authorities under sections 24(2), 24(5) and 24D of NEMA, where environmental authorisation is required prior to commencement of that activity in specific identified geographical areas only; • The investigation, assessment and communication of potential impact of activities must follow a Basic Assessment process, as prescribed in regulations 19 and 20 of GN No. R 982 of 4 December 2014 (as amended). However, according to Regulation 15(3) of GN No. R 982, S&EIR must be applied to an application if the application is for two or more activities as part of the same development for which S&EIR must already be applied in respect of any of the activities; and • Activities under Listing Notice 3 that are relevant to this project follow.	
	GN No. R.985 – Activity no. 2(e)(ii): *The development of reservoirs, excluding dams, with a capacity of more than 250 cubic metres.*	*Threshold exceeded by BPR, OR and Balancing Dam.* *Refer to **Table 5** for sensitive geographical areas that are affected.*
	GN No. R.985 – Activity no. 4(e)(i): *The development of a road wider than 4 metres with a reserve less than 13,5 metres.*	*Access roads to the various sites (construction and operational phases) are expected to exceed thresholds.* *Refer to **Table 5** for sensitive geographical areas that are affected.*
	GN No. R.985 – Activity no. 10(e)(i): *The development and related operation of facilities or infrastructure for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of 30 but not exceeding 80 cubic metres.*	*"Dangerous goods" associated with the greater project, are fuel stores, as well as any dangerous goods to be used during the construction phase. Threshold of 30 m^3 expected to be exceeded. Fuel and other dangerous goods will be stored at all site establishments, in accordance with prescribed best practices.* *Refer to **Table 5** for sensitive geographical areas that are affected.*
	GN No. R.985 – Activity no. 12(e)(i – ii): *The clearance of an area of 300 square metres or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan.*	*Clearance of large areas associated with the construction footprint.* *Refer to **Table 5** for sensitive geographical areas that are affected.*
	GN No. R.985 – Activity no. 14(e)(i): *The development of—* *(i) dams or weirs, where the dam or weir, including infrastructure and water surface area exceeds 10*	*Various infrastructure within watercourse(s) / within 32 m from watercourse(s), including:* • *Abstraction works - Crocodile*

Legislation	Description and Relevance	
	square metres; or *(ii) infrastructure or structures with a physical footprint of 10 square metres or more;* *where such development occurs—* *(a) within a watercourse;* *(b) in front of a development setback; or* *(c) if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse;* *excluding the development of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour.*	*River;* • *Gauging weirs - Crocodile River, Bierspruit and Sand River;* • *Pipeline crossings - tributaries of the Limpopo River system (including the Matlabas River main stem and tributaries) as well as tributaries of the Mokolo River system;* • *Access roads' crossings - tributaries of the Limpopo River system.* *Refer to **Table 5** for sensitive geographical areas that are affected.*
	GN No. R.985 – Activity no. 18(e)(i): *The widening of a road by more than 4 metres, or the lengthening of a road by more than 1 kilometre.*	*Access roads to the various sites (construction and operational phases) are expected to exceed thresholds. Dimensions to be confirmed.* *Refer to **Table 5** for sensitive geographical areas that are affected.*
	GN No. R.985 – Activity no. 23(e)(i): *The expansion of -* *(i) dams or weirs where the dam or weir is expanded by 10 square metres or more; or* *(ii) infrastructure or structures where the physical footprint is expanded by 10 square metres or more;* *where such expansion occurs -* *(a) within a watercourse;* *(b) in front of a development setback adopted in the prescribed manner; or* *(c) if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse;* *excluding the expansion of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour.*	*Upgrade of existing bridge(s) along access road(s).* *Refer to **Table 5** for sensitive geographical areas that are affected.*
	GN No. R.985 – Activity no. 26: *Phased activities for all activities -* *i. listed in this Notice and as it applies to a specific geographical area, which commenced on or after the effective date of this Notice; or* *ii. similarly listed in any of the previous NEMA notices, and as it applies to a specific geographical area, which commenced on or after the effective date of such previous NEMA Notices -* *where any phase of the activity was below a threshold but where a combination of the phases, including expansions or extensions, will exceed a specified threshold; -* *excluding the following activities listed in this Notice—* *7;* *8;* *11;* *13;* *20;* *21; and* *24.*	*Possible phased activities that may collectively trigger this listed activity.* *Refer to **Table 5** for sensitive geographical areas that are affected.*
National Water Act (Act No. 36 of 1998)	• Chapter 3 – Protection of water resources. • Section 19 – Prevention and remedying effects of pollution. • Section 20 – Control of emergency incidents. • Chapter 4 – Water use. • Authority – DWS.	

Legislation	Description and Relevance
National Environmental Management Air Quality Act (Act No. 39 of 2004)	• Air quality management • Section 32 – Dust control. • Section 34 – Noise control. • Authority – DEA.
National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)	• Management and conservation of the country's biodiversity. • Protection of species and ecosystems. • Authority – DEA.
National Environmental Management: Protected Areas Act (NEM:PAA) (Act No. 57 of 2003)	• Protection and conservation of ecologically viable areas representative of South Africa's biological diversity and natural landscapes. • Note that nearest protected areas, with a formal status in terms of the NEM:PAA, to the project footprint is the Marakele National Park (located approximately 3.5 km to the east of the Central Route).
National Environmental Management: Waste Act (Act No. 59 of 2008)	• Chapter 5 – licensing requirements for listed waste activities - GN No. R. 921 of 29 November 2013. • Authority – Minister (DEA) or MEC (provincial authority)
National Forests Act (No. 84 of 1998)	• Section 15 – Authorisation required for impacts to protected trees. • Authority – Department of Agriculture, Forestry and Fisheries (DAFF)
Minerals and Petroleum Resources Development Act (Act No. 28 of 2002)	• Permit required for borrow pits and quarries. • Authority – Department of Mineral Resources (DMR).
Occupational Health & Safety Act (Act No. 85 of 1993)	• Provisions for Occupational Health & Safety • Authority – Department of Labour.
National Heritage Resources Act (Act No. 25 of 1999)	• Section 34 – protection of structure older than 60 years. • Section 35 – protection of heritage resources. • Section 36 – protection of graves and burial grounds. • Section 38 – Heritage Impact Assessment for linear development exceeding 300m in length; development exceeding 5 000m^2 in extent, etc. • Authority – South African Heritage Resources Agency (SAHRA) and Limpopo Provincial Heritage Resources Authority (LIHRA)
Conservation of Agricultural Resources Act (Act No. 43 of 1983)	• Control measures for erosion. • Control measures for alien and invasive plant species. • Authority – Department of Agriculture.
National Road Traffic Act (Act No. 93 of 1996)	• Authority – Limpopo Department of Public Works, Roads and Infrastructure.
Limpopo Environmental Management Act (Act No. 7 of 2003)	• Deals with *inter alia* protected areas, wild and alien animals, professional hunting, aquatic biota and aquatic systems, invertebrates, indigenous plants, preservation of caves and cave-formations, limited development areas, mountain catchment areas, environmental pollution, as well as permits, permissions, exemptions and exclusions. • Authority –LDEDET.

The relationship between the project and certain key pieces of environmental legislation is discussed in the subsections to follow.

5.1.2 National Environmental Management Act

According to Section 2(3) of the National Environmental Management Act (NEMA) (Act No. 107 of 1998), "*development must be socially, environmentally and economically sustainable*", which means the integration of these three factors into planning, implementation and decision-making so as to ensure that development serves present and future generations.

The proposed MCWAP-2A WTI requires authorisation in terms of NEMA and the EIA is being undertaken in accordance the EIA Regulations of 2014 (as amended) that consist of the following:

- EIA procedure - GN No. R 982 (4 December 2014), as amended;
- Listing Notice 1 - GN No. R 983 (4 December 2014), as amended;
- Listing Notice 2 - GN No. R 984 (4 December 2014), as amended; and
- Listing Notice 3 - GN No. R 985 (4 December 2014), as amended.

MCWAP-2A WTI triggers activities under Listing Notices 1, 2 and 3, and thus needs to be subjected to a Scoping and EIA process. The listed activities are explained in the context of the project in **Table 4** and **Table 5**.

Table 5: Listed Activates Triggered by MCWAP-2A WTI Components

Project Components	Associated Infrastructure	Relevant Listed Activities	Description of relevance
Vlieëpoort abstraction weir	Weir and abstraction works	*GN No. R.983 –*	
		Activity no. 12	Infrastructure and structures with a physical footprint of 100 square metres or more within Crocodile River / within 32 m from Crocodile River.
		Activity no. 19	Construction activities within a watercourse.
		Activity no. 27	Clearance of more than 1 Ha of indigenous vegetation associated with the construction footprint.
		GN No. R.984 –	
		Activity no. 16	Lowest part of weir approximately 4 m - 6 m high above the river bed level.
		GN No. R.985 –	
		Activity no. 12(e)(ii)	Clearance of indigenous vegetation in Critical Biodiversity Area (CBA) 1.
		Activity no. 14(i),(ii)(a)&(c) (e)(i)(dd) & (ff)	Infrastructure within watercourses / within 32 m from watercourse inside a CBA 1.
Low-Lift Pumping station	Pumping station	*GN No. R.983 –*	
		Activity no. 12	Size: 25 x 70 m. Infrastructure and structures with a physical footprint of 100 square metres or more within 32 m from watercourse.
		GN No. R.985 –	
		Activity no. 12(e)(ii)	Clearance of indigenous vegetation in CBA 1.
		Activity no. 14(ii)(a)(c) (e)(i)(dd) & (ff)	Infrastructure within 32 m from watercourse inside CBA 1.
Pipeline	Pipeline (rising main, gravity main and delivery line) and associated structures	*GN No. R.983 –*	
		Activity no. 9	Bulk water pipeline.
		Activity no. 12	Pipeline traverses / closer than 32 m from watercourses.
		Activity no. 19	Construction activities within a watercourse.
		GN No. R.985 –	
		Activity no. 12(e)(ii)	Clearance of indigenous vegetation in CBA 1 and CBA 2.
		Activity no. 14(ii)(a)(c) (e)(i)(dd), (ff) & (hh)	Infrastructure within watercourses / 32 m from watercourses in CBA 1 and CBA 2.
Balancing Dam	Infrastructure for the off-stream storage of water & sediment storage compartments	*GN No. R.983 –*	
		Activity no. 13	Storage capacity: 68 0000m³ for 75 million m³/a transfer.
		Activity no. 27	Size: 620 x 440 m. Clearance of indigenous vegetation associated with the construction footprint. Majority of footprint located on cultivated and arable land.

Project Components	Associated Infrastructure	Relevant Listed Activities	Description of relevance
		Activity no. 28	Size: 620 x 440 m. Majority of footprint located on cultivated and arable land.
		GN No. R.985 –	
		Activity no. 2(e)(ii)(bb) & (dd)	Storage capacity: 68 0000m³ for 75 million m³/a transfer. Within CBA 2.
		Activity no. 12(e)(ii)	Clearance of indigenous vegetation in CBA 2.
Sedimentation Works	1. Infrastructure for the off-stream storage of water	*GN No. R.983 –*	
		Activity no. 27	8 Concrete channels each 120 m long x 2,5 m wide x 5 m deep. Clearance of indigenous vegetation associated with the construction footprint. Part of footprint located on cultivated and arable land.
		Activity no. 28	8 Concrete channels each 120 m long x 2,5 m wide x 5 m deep. Part of footprint located on cultivated and arable land.
		GN No. R.984 –	
		Activity no. 6	Scouring of sediment back to the Crocodile River from the desilting works
		GN No. R.985 –	
		Activity no. 12(e)(ii)	Clearance of indigenous vegetation in CBA 1.
	2. Drainage channel	*GN No. R.983 –*	
		Activity no. 9	Drainage / river return channel from sedimentation works.
		Activity no. 12	The drainage / river return channel from sedimentation works traverses a watercourse and will also be located within 32 m from watercourse(s).
		Activity no. 19	Construction activities within a watercourse.
		GN No. R.984 –	
		Activity no. 6	Scouring of sediment back to the Crocodile River from the desilting works
		GN No. R.985 –	
		Activity no. 12(e)(ii)	Clearance of indigenous vegetation in CBA 2.
		Activity no. 14(ii)(a) (e)(i)(dd) & (ff)	Infrastructure within a watercourse / 32 m from watercourse inside a CBA 1.
High-Lift Pumping station	Pumping station	*GN No. R.983 –*	
		Activity no. 28	Footprint located on cultivated and arable land.
BPR	Infrastructure for the off-stream storage of water	*GN No. R.983 –*	
		Activity no. 13	Storage capacity: 90 000 m³ for 75 million m³/a transfer.
		Activity no. 27	Size: 260 x 300m. Clearance of indigenous vegetation associated with the construction footprint.
		Activity no. 28	Size: 260 x 300 m.
		GN No. R.985 –	
		Activity no. 2(e)(ii)(bb) & (dd)	Storage capacity: 900 000 m³ for 75 million m³/a transfer. Within CBA 2.
		Activity no. 12(e)(ii)	Clearance of indigenous vegetation in CBA 2.
OR	Infrastructure for the off-stream storage of water	*GN No. R.983 –*	
		Activity no. 13	Storage capacity: 90 000 m³ for 75 million m³/a transfer.
		Activity no. 27	Size: 260 x 300 m. Clearance of indigenous vegetation associated with the construction footprint.
		Activity no. 28	Size: 260 x 300 m.
		GN No. R.985 –	
		Activity no. 2(e)(ii)(bb) & (dd)	Storage capacity: 900 000m³ for 75 million m³/a transfer. Within CBA 1.
		Activity no. 12(e)(ii)	Clearance of indigenous vegetation in CBA 1.
Gauging Weirs	Bierspruit Gauging Weir, Sand River Gauging Weir and New	*GN No. R.983 –*	
		Activity no. 12	Infrastructure and structures with a physical footprint of 100 square metres or more within affected watercourses / within

Project Components	Associated Infrastructure	Relevant Listed Activities	Description of relevance
	Paul Hugo Gauging Weir		32 m from affected watercourses.
		Activity no. 19	Construction activities within affected watercourses.
		Activity no. 27	Clearance of more than 1 Ha of indigenous vegetation associated with the construction footprint.
		GN No. R.985 –	
		Activity no. 12(e)(ii)	Clearance of indigenous vegetation – • Bierspruit Gauging Weir – CBA 1; • New Paul Hugo Gauging Weir – CBA 2.
		Activity no. 14(i)(a)(e)(i)(dd) & (ff)	Infrastructure within affected watercourses / within 32 m from affected watercourses – • Bierspruit Gauging Weir – CBA 1; • New Paul Hugo Gauging Weir – CBA 2.
Overall Scheme	Cumulative footprint of Infrastructure	*GN No. R.983 –*	
		Activity no. 28	Footprint of project on land used for agricultural and game farming purposes. This includes the balancing dam, sedimentation works, high-lift pumping station, reservoirs, ancillary structures (including accommodation, workshops, offices and stores) and construction camps, which mostly occur on land used for agricultural purposes, outside of an urban area.
		GN No. R.984 –	
		Activity no. 15	Cumulative area to be cleared for entire project (except linear components), including the balancing dam, sedimentation works, reservoirs, pumping stations, ancillary infrastructure and construction camps, exceeds 20 ha.
		Activity no. 11	*Transfer scheme from Crocodile River (West) to Lephalale with a capacity of 75 million m^3/a.*
Access Roads	Access roads (construction and operation)	*GN No. R.983 –*	
		Activity no. 12	Access roads traverse / closer than 32 m from watercourse(s).
		Activity no. 19	Construction activities within a watercourse.
		Activity no. 24	• Access roads where widths exceed 8 m. • Existing gravel road (D727) on the left bank will need to be raised locally at the Vlieëpoort abstraction weir.
		Activity no. 56	Widening of existing roads for access to the various sites (construction and operational phases). Relocation of roads that will be inundated by abstraction weir
		GN No. R.985 –	
		Activity no. 4(e)(i)(cc)(ee) & (gg)	Access roads situated in CBA 1 and CBA 2.
		Activity no. 12(e)(ii)	Clearance of indigenous vegetation in CBA 1 and CBA 2.
		Activity no. 14(e)(i)(dd) & (ff)	Watercourse crossings along access roads / within 32 m from watercourses inside CBA 1 and CBA 2
		Activity no. 18(e)(i)(cc), (ee) & (hh)	Widening existing access roads inside CBA 1 and CBA 2.
		Activity no. 23(e)(i)(cc)(ee) & (gg)	Expanding watercourse crossings along existing roads to create project access roads, inside CBA 1 and CBA 2.
Construction Camps	Construction camp (temporary)	*GN No. R.983 –*	
		Activity no. 14	“Dangerous goods” that are likely to be associated with the greater project, are fuel stores, as well as any dangerous goods to be used during the construction phase (e.g. explosives for blasting).
		Activity no. 27	Clearance of more than 1 ha of indigenous vegetation associated with the camp sites.
		Activity no. 28	Affects land used for agriculture and game farming.
		GN No. R.984 –	

Project Components	Associated Infrastructure	Relevant Listed Activities	Description of relevance
		Activity no. 4	"Dangerous goods" that are likely to be associated with the greater project, are fuel stores, as well as any dangerous goods to be used during the construction phase.
		Activity no. 15	Cumulative area to be cleared for all camp sites.
		GN No. R.985 –	
		Activity no. 10(e)(i)	Dangerous goods stored in CBA 1 and CBA 2.
		Activity no. 12(e)(ii)	Clearance of indigenous vegetation in CBA 1 and CBA 2.
Ancillary infrastructure	Accommodation, workshops, offices and stores	*GN No. R.983 –*	
		Activity no. 14	"Dangerous goods" likely to be associated with the workshops and stores.
		Activity no. 28	Affects land used for agriculture.
		GN No. R.985 –	
		Activity no. 10(e)(i)	Dangerous goods stored in CBA 1 and CBA 2.

Note that the dimensions of the project infrastructure and components should be regarded as approximates due to the dynamic nature of the planning and design process. As a conservative approach, all possible activities that could possibly be triggered by the project were included in the Application Form (contained in **Appendix D**). A refinement of these activities took place as the EIA process unfolded.

5.1.3 National Environmental Management: Waste Act

Amongst others, the purpose of the National Environmental Management: Waste Act (NEM:WA) (Act No. 59 of 2008) includes the following:

1. To reform the law regulating waste management in the country by providing reasonable measures for the prevention of pollution and ecological degradation and for securing ecologically sustainable development;
2. To provide for institutional arrangements and planning matters;
3. To provide for specific waste management measures;
4. To provide for the licensing and control of waste management activities;
5. To provide for the remediation of contaminated land; and
6. To provide for compliance and enforcement.

No authorisation will be required in terms of NEM:WA, as the project will not include any listed waste management activities in terms of GN No. R. 921 of 29 November 2013.

The following is noted with regards to waste management for MCWAP-2A WTI:

- Construction phase –
  - Excess material will be used to fill and rehabilitate borrow pits required as part of the project, or spoil sites will be created;
  - Temporary waste storage facilities will remain below the thresholds contained in the listed activities under Schedule 1 of NEM:WA;
  - The storage of general or hazardous waste in a waste storage facility will comply with the norms and standards in GN No. R. 926 of 29 November 2013;

    - The Environmental Management Programme (EMPr) will make suitable provisions for waste management, including the storage, handling and disposal of waste;
- Operational phase –
    - The intention is to scour the sediment from the desilting works back to the Crocodile River (explained in **Section 9.3.4**). DEA confirmed in writing on 12 April 2016 (refer to letter contained in **Appendix F**) that there is no need for a Waste Management Licence in this regard.

5.1.4 Mineral and Petroleum Resources Development Act

The purpose of the Mineral and Petroleum Resources Development Act (MPRDA) (Act No. 28 of 2002) is to make provision for equitable access to and sustainable development of the nation's mineral and petroleum resources and to provide for matters related thereto. This Act defines mining as "any operation or activity for the purposes of winning any mineral on, in or under the earth, water or any residue deposit, whether by underground or open working or otherwise and includes any operation or activity incidental thereto".

In terms of the MPRDA, as amended, a mining permit applies when the mineral in question can be mined in 2 years and the area does not exceed 5 ha. For larger areas a mining right will need to be applied for.

Borrow areas have been identified to source construction material for the project. Sources of material suitable for use as bedding or soft backfill to the pipe were sought at a nominal spacing of 5 km along the pipeline. Under Section 106(1) of the MPRDA, and in accordance with GN No. R. 762 of 25 June 2004, DWS is exempt from the provisions of Sections 16, 20, 22 and 27 "*in respect of any activity to remove any mineral for road construction, building of dams or other purpose which may be identified in such notice*". However, Section 106(2) of the MPRDA was amended as follows: "*Despite subsection (1), the organ of state so exempted must submit relevant environmental reports required in terms of Chapter 5 of the National Environmental Management Act, 1998, to obtain an environmental authorisation*."

Based on a Memorandum of Understanding in 2007 between the then DWAF and Department of Mineral and Energy (DME), it was agreed between these parties that for the construction and maintenance of Government Waterworks undertaken by DWS' own Construction Unit, this Department shall be deemed to comply with the requirements of financial provision. Provided that the estimated costs for the management, rehabilitation and closure of such quarries and borrowed areas or works are provided for within the approved budget for such Government Waterworks.

The new EIA Regulations of 2014 (as amended) include a number of provisions in terms of the transition of the environmental regulation of mining from the MPRDA to NEMA and the introduction of the One Environmental System. Amongst others, this is facilitated by the inclusion of mining activities under the 2014 Listing Notices. Separate approval will be sought from DMR for the borrow areas in terms of the activities triggered under the Listing Notices of 4 December 2014 (as amended).

5.1.5 National Water Act

The project entails the following activities that constitute water uses in terms of Section 21 of the NWA:
- Section 21(a) - Taking water from a water resource (water abstraction from the Crocodile River (West) as part of the transfer scheme; taking water for construction purposes);
- Section 21(b) - Storing water (Vlieëpoort abstraction weir);
- Section 21(c) - Impeding or diverting the flow of water in a watercourse (instream works for abstraction works, gauging weirs, access roads' crossings, pipeline crossings, etc.);
- Section 21(i) - Altering the bed, banks, course or characteristics of a watercourse (instream works for abstraction works, gauging weirs, access roads' crossings, pipeline crossings, etc.); and
- Section 21(f) - discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit (scouring sediment back to the Crocodile River (West)).

An Integrated Water Use Licence Application (IWULA) will be submitted separately to the DWS Limpopo Regional Office. The following requirements of the NWA will be catered for:
- Provision for the Reserve requirements of the Crocodile River (West); and
- Ensure that Existing Lawful Use is respected and protected.

The users taking water from the MCWAP-2A will need to apply separately for a Section 21(a) water use licence.

5.2 Guidelines

The following guidelines were considered during the preparation of the Scoping Report:
- Guideline on Alternatives, EIA Guideline and Information Document Series (DEA&DP, 2010a);
- Guideline on Need and Desirability (DEA&DP, 2010b);
- Integrated Environmental Management Guideline Series 7: Public Participation in the EIA Process (DEA, 2010); and
- Guidelines for Involving Specialists in the EIA Processes Series (Brownlie, 2005).

5.3 National and Regional Plans

The following regional plans were considered during the execution of the EIA phase (amongst others):

- Municipal Spatial Development Frameworks (SDFs) (where available);
- Municipal Integrated Development Plans (IDPs);
- Relevant national, provincial, district and local policies, strategies, plans and programmes;
- Environmental Management Framework (EMF) for the Waterberg DM (2010);
- Limpopo Provincial Conservation Plan version 2, September 2013;
- Limpopo Provincial Growth and Development Strategy (PGDS);
- Department of Energy’s IRP 2010-30;
- Lephalale LM Water Services Development Plan (WSDP); and
- Crocodile River (West) Water Supply System Reconciliation Strategy 2015.

5.4 Protocols

The Crocodile River (West) and Mokolo River catchments form part of the Limpopo River Basin, which is shared by Botswana, Mozambique, South Africa and Zimbabwe. All the basin states are signatories to the Revised Protocol on Shared Watercourses in the South African Development Community (SADC) Region (SADC Revised Protocol). In general, it is incumbent upon the RSA to pursue and establish close cooperation with the neighbouring states with regard to the study and execution of all projects likely to affect the regime of a shared watercourse such as the Limpopo. South Africa must therefore exchange information with the other Watercourse States and, if found necessary, negotiate the possible effects of planned measures on the condition of the Limpopo Water course. MCWAP-1 entails the yield of the existing Mokolo Dam and MCWAP-2A proposed to utilise return flows (water discharged from wastewater plants) originating from the Vaal River. It is therefore considered that the scheme does not fall within the conditions contained in the SADC Revised Protocol of a planned measure with possible adverse effects for other states in a shared watercourse as indicated in Article 4(1)(b) of the SADC Revised Protocol. As such, it is not considered to be necessary to negotiate the use of the water with the neighbouring states.

Notifications in terms Article 4(1)(a) of the SADC Revised Protocol of the RSA’s intention to proceed with implementation of the MCWAP, were therefore given to the co-basin states. In the February 2010 letters to the co-basin states RSA stated that the RSA perspective is that there will be no significant adverse effect to any one of the Limpopo Basin Permanent Technical Committee members as a result of the MCWAP, for the reasons given above. South Africa has therefore complied with the SADC Revised Protocol and international best practices.

6 SCOPING AND EIA PROCESS

6.1 Previous Environmental Assessments

The MCWAP Environmental Module was originally initiated at the end of 2008, under the EIA Regulations of 2006. The status of each of the original MCWAP applications is shown in **Table 6**.

Table 6: Status of original MCWAP applications

MCWAP Component	Environmental Assessment Process	DEA Ref. No.	Status
Phase 1	Scoping and EIA	12/12/20/1465	Environmental Authorisation issued on 03 December 2010
Phase 2	Scoping and EIA	12/12/20/1466	EIA application withdrawn following Scoping phase due to uncertainty with regards to water demands
De-bottlenecking	Basic Assessment	12/12/20/1467	Environmental Authorisation issued on 24 February 2010

MCWAP-2A was resuscitated for the following reasons:

- Government identified and approved 18 SIPs across the RSA to support economic development and address service delivery in the poorest provinces. SIP 1 entails the unlocking of the Northern Mineral Belt with Waterberg as the catalyst. Investment in rail, water and transmission infrastructure and energy generation will catalyse unlocking rich mineral resources in Limpopo resulting in thousands of direct jobs across the areas covered. The MCWAP includes the water infrastructure needed for SIP 1. Due to the priority accorded by Government to such SIP projects, it was prudent to give priority to the future water needs of the Lephalale area in support of the national development imperatives;
- MCWAP-1 augments the supply from Mokolo Dam and is already operational since June 2015. It serves as an interim measure to supply in the growing water requirements of Lephalale, Eskom and Exxaro. This solution will over the long term optimally utilise the full yield from Mokolo Dam. The sustainable yield of Mokolo Dam is however not sufficient to meet the increased needs of the users, including the pollution abatement measures (FGD) which is an environmental and funding condition;
- A suitably sized transfer pipeline from the Crocodile River (West) can be implemented timeously to meet the increased requirements to support the RSA's economy. MCWAP-1 will be operated as a system together with proposed MCWAP-2A when the latter is completed (if authorised). MCWAP-2A will also serve to provide the necessary assurance of water supply to the strategic end users from independent sources; and
- The water requirements have been finalised to the degree that is adequate to make informed economic decisions with respect to the transfer capacity of MCWAP-2A.

6.2 Environmental Assessment Practitioner

Nemai Consulting was appointed by DWS and TCTA (implementing agent) as the independent EAP to undertake the environmental assessment for the proposed MCWAP-2A WTI.

In accordance with Appendix 3, Section 3(1)(a) of GN No. R 982 of 4 December 2014 (as amended), this section provides an overview of Nemai Consulting and the company's experience with EIAs, as well as the details and experience of the EAPs that form part of the Scoping and EIA team.

Nemai Consulting is an independent, specialist environmental, social development and Occupational Health and Safety (OHS) consultancy, which was founded in December 1999. The company is directed by a team of experienced and capable environmental engineers, scientists, ecologists, sociologists, economists and analysts. The company has offices in Randburg (Gauteng) and Durban (KZN).

The core members of Nemai Consulting that are involved with the Scoping and EIA process for the project are captured in **Table 7** below, and their respective Curricula Vitae are contained in to **Appendix E**.

Table 7: Scoping and EIA Core Team Members

Name	Qualifications	Experience	Duties
Ms D. Naidoo	BSc Eng (Chem)	21 years	• Project Manager • Quality Control • EIA Process
Mr D. Henning	MSc (River Ecology)	17 years	• Project Leader • EIA Process
Mr S. Pienaar	BSc (Hons) (Environmental Studies)	6 years	• Public Participation • EIA Process
Mr C. Chidley	• BSc Eng (Civil); • BA (Economics, Philosophy) • MBA	22 years	• Quality Review • Technical Input • EMPr
Mr C. v. d. Hoven	BSc (Hons) (Environmental Studies)	2 years	• Public Participation • EIA Process

6.3 DEA Pre-application Consultation

A Pre-application Consultation Meeting was convened with DEA on 19 August 2015 (minutes of meeting attached to the Scoping Report). The purpose of the meeting included the following:

- To introduce the overall MCWAP-2A to DEA;
- To seek clarification regarding certain matters that pertain to the EIA process;
- To determine DEA's requirements; and
- To confirm the process and timeframes.

A follow-up meeting was convened with DEA on 17 March 2016 (minutes of meeting attached to the Scoping Report). The main purpose of the meeting included following up on matters raised during the DEA Pre-Application Consultation Meeting, providing an overview of the approach to the EIA and confirming the need for a Waste Management Licence.

Key outcomes of above pre-application consultation with DEA include the following:

- It was agreed that the Application Form and draft Scoping Report, which has been subjected to a 30-day review period, be submitted to DEA at the same time to avoid potential problems associated with the strict timeframes under the EIA Regulations of 2014 (as amended).
- Separate applications will be submitted for the following project components -
  - WTI;
  - Borrow Pits; and
  - River Management System.
- A broader Public Involvement Programme will be undertaken as part of the River Management System, which extends beyond the scope of the EIA's public participation process. This will entail engaging with the relevant interest groups, which include -
  - Formal agricultural groups (including the Hartbeespoort Irrigation Board, Crocodile-West Irrigation Board, Makoppa Farmers and the Transvaal Agricultural Union-SA); and
  - Hartbeespoort Dam IAPs.
- DEA confirmed in writing on 12 April 2016 (refer to letter contained in **Appendix F**) that there is no need for a Waste Management Licence in terms of NEM:WA for scouring the sediment from the desilting works back to the Crocodile River (explained in **Section 9.3.4**).

6.4 Environmental Assessment Triggers

An Application for Environmental Authorisation in terms of NEMA was made for the proposed development of MCWAP-2A WTI. Based on the outcomes of the pre-application consultation meeting with DEA, the Application Form and draft Scoping Report were submitted to the Department at the same time (see **Section 6.3**).

The process for seeking authorisation under NEMA is undertaken in accordance with GN No. R. 982 of 4 December 2014 (as amended), promulgated in terms of Chapter 5 of NEMA. Based on the types of activities involved, the requisite environmental assessment for the project is a Scoping and EIA process. Refer to **Section 5** for the project’s legal framework and specifically the activities triggered by the project in terms of Listing Notices 1, 2 and 3 of the EIA Regulations of 2014 (as amended).

6.5 Environmental Assessment Authorities

In terms of NEMA the lead decision-making authority for the environmental assessment is DEA, as the project proponent (DWS) is a national department. However, due to the geographic location of the project the LDEDET is regarded as one of the key commenting authorities in terms of NEMA during the execution of the EIA, and all documentation will thus be copied to this Department (amongst others).

Various other authorities with jurisdiction over elements of the receiving environment or project activities (refer to **Section 5.1**) were also consulted during the course of the EIA. Refer to the database contained in **Appendix L** for a list of the government departments that were notified during the EIA process to date.

6.6 Formal Process

6.6.1 Overview of EIA Process

As mentioned, separate applications will be submitted for the WTI, Borrow Pits and River Management System. An outline of the Scoping and EIA process for the proposed MCWAP-2A WTI is provided in **Figure 9**.

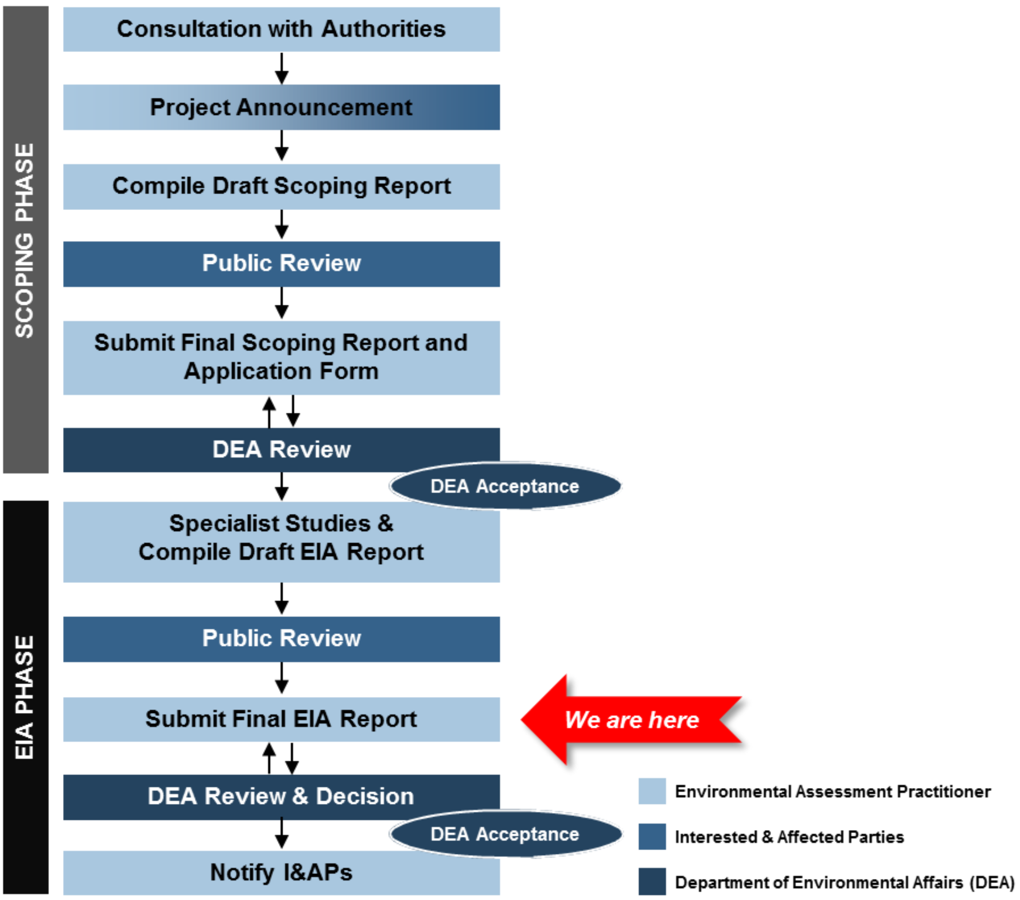


Figure 9: **EIA process**

6.6.2 *The EIA Process to Date*

The following key milestones have been reached as part of the EIA process to date (amongst others):

1. A Pre-Application Consultation Meeting was convened with DEA on 19 August 2015 and a follow-up meeting was held with the Department on 17 March 2016.
2. The project was announced through the distribution of a Background Information Document and Reply Form, as well as the notification of IAPs via onsite notices, newspaper advertisements, emails, direct communication and public meetings in May 2016.
3. Focus Group Meetings were held with irrigators in January 2018.
4. A Draft Scoping Report, which conformed to Appendix 2 of GN No. R. 982 (4 December 2014), was compiled. This document included the following salient information (amongst others):
   a. A Scoping-level impact assessment to identify potentially significant environmental issues for detailed assessment during the EIA phase;
   b. Screening and investigation of feasible alternatives to the project for further appraisal during the EIA phase; and
   c. A Plan of Study, which explained the approach to be adopted to conduct the EIA for the proposed project.
5. The Application for Environmental Authorisation and Draft Scoping Report were submitted to DEA on 5 March 2018.
6. Notification of review of the Draft Scoping Report was undertaken in March 2018. The Draft Scoping Report was lodged for review from 6 March until 11 April 2018.
7. Public meetings and an Environmental Authorities Meeting were held in March 2018 to present the Draft Scoping Report.
8. A Comments and Response Report was compiled (which was updated during the execution of the Scoping process), which summarised the issues raised by IAPs and the project team's response to these matters.
9. The Final Scoping Report was submitted to DEA on 20 April 2018.
10. DEA accepted the Scoping Report and Plan of Study for the EIA on 14 May 2018 (refer to **Appendix B1**), which allowed the commencement of the EIA phase.
11. An extension was subsequently requested from DEA for the submission of the Final EIA Report to this Department, due to the vast project footprint that needed to be assessed and the various specialist studies that needed to be completed (amongst others). Although DEA did not grant the extension, it was indicated that if the application lapses then a new application and a Draft EIA Report must be submitted to the Department in terms of Regulation 21(2) of the EIA Regulations of 2014 (as amended) and that the timeframes as prescribed in these regulations will still be applicable. The application lapsed on 30 August

2018 and a new Application Form (contained in **Appendix D**) and Draft EIA Report were submitted to DEA, in accordance with Regulation 21(2) of the EIA Regulations of 2014 (as amended). Notification of the lapsing of the application and the way forward for the EIA in terms of the aforementioned regulation was provided to IAPs on 04 September 2018 (refer to **Appendix O**).

12. The Draft EIA Report was lodged for review from 28 September until 29 October 2018.

6.7 Objectives of the EIA Phase

The objectives of the EIA phase, based on GN No. R. 982 of the 2014 EIA Regulations (as amended), are captured in **Section 1**.

6.8 Alignment with the Plan of Study

The Plan of Study, which was contained in the Scoping Report and accepted by DEA, explained the approach to be adopted to conduct the EIA for the proposed project. The manner in which the EIA Report addresses the requirements of the Plan of Study is shown in **Table 8**.

Table 8: Alignment of EIA Report with Plan of Study

No.	Plan of Study Requirement	EIA Report Reference
1.	Assess pertinent environmental issues identified during Scoping through: 1. Applying an appropriate impact assessment methodology; 2. Conducting specialist studies; 3. Obtaining technical input; and 4. Identifying suitable mitigation measures.	• **Section 12**; and • **Section 13**
2.	Assessment of feasible alternatives.	• **Section 14**
3.	Specialist studies to be completed in accordance with Terms of Reference.	• **Section 12**; and • **Appendix I**
4.	Public participation to include the following: • Update the database of IAPs; • Allow for the review of the Draft EIA Report; • Convene public meetings; • Compile and maintain a Comments and Responses Report; and • Notification of DEA Decision.	**Section 15**
5.	EIA Report to satisfy the minimum requirements stipulated in Appendix 3 of GN No. R. 982 of 2014 EIA Regulations (as amended).	**Section 2**
6.	Authority Consultation.	**Section 15**

6.9 Addressing DEA Requirements

6.9.1 Acceptance of the Scoping Report

The manner in which DEA's specific requirements, as listed in the letter received from this Department for the acceptance of the Scoping Report (refer to **Appendix B1**), have been attended to are described in **Table 9**.

Table 9: DEA's Specific Requirements - Acceptance of the Scoping Report

No.	DEA Requirements	Response/Status
1.	Please ensure that all relevant stakeholders are provided with an opportunity to comment on the EIA Report (list of stakeholders provided). Proof of correspondence with the various stakeholders must be included in the Final EIA Report. Should you be unable to obtain comments, proof should be submitted to the Department of the attempts that were made to obtain comments.	The approach to Public Participation during the EIA phase is explained in **Section 15**.
2.	The total footprint of the proposed development must be indicated. The location of the pipeline with the proposed corridor and the associated infrastructure must be mapped at an appropriate scale.	• The project footprint is explained in **Section 9**. • Detailed maps are contained in **Appendices A** and **C**.
3.	A clear description of all associated infrastructure must be provided. This description must include, but not limited to the following: • Access roads infrastructure (old and new); and • All supporting onsite infrastructure.	Refer to **Section 9.10.**
4.	With regards to infilling and excavation of watercourses for the construction of the pipeline and associated infrastructure, the applicant is required to provide an indication of the preferred alternate locations from which the material used for infilling will be sourced and where excavated material will be stored and/or disposed of. In addition, the impacts associated with this activity must be adequately assessed in the EIA Report.	Potential spoil sites (old borrow sites from construction of the railway line and roads) were identified. A description of each proposed spoil site is provided in **Table 21**. Refer to mitigation measures contained in the EMPr for managing impacts to watercourses (e.g. a buffer zone of 30 m from the edge of the delineated riparian zone is recommended for construction activities such as mixing areas, stockpiles and laydown yards). Refer to **Section 13.8.6.3** for the mitigation measures recommended as part of the Baseline Aquatic and Impact Study.
5.	Should a Water Use Licence be required, proof of application for a licence needs to be submitted.	An IWULA will be compiled (refer to **Section 5.1.5**). The Water Use Licence Application and Appeals Regulations (GN No. R. 267 of 24 March 2017) prescribe the procedure and requirements for IWULA, as contemplated in section 41 of the NWA, as well as an appeal in terms of the NWA. The intention was

No.	DEA Requirements	Response/Status
		to undertake the IWULA in parallel with the EIA, however, during a meeting with the DWS Limpopo North Proto CMA in December 2017 the DWS officials indicated that an IWULA needed to be compiled and submitted separately due to the timeframes indicated in the aforementioned regulations.
6.	The listed activities represented in the EIA Report and the application form must be the same and correct. Only activities that are applicable and relevant to the development must be included in both the application form and the EIA Report. Should there be activities that are no longer applicable to the development, the application form must be amended and submitted together with the EIA Report.	The listed activities are explained in the context of the project in **Table 4** and **Table 5**.
7.	The EAP must engage with the relevant provincial authority with regards to development in geographic areas triggering GN R. 985: Activities 2, 4, 10, 12, 14, 18, 23 and 26. Please ensure that only the relevant sensitive geographic areas are applied for under these listed activities.	Enquiry made with LDEDET. Refer to **Table 5** for details of activities triggered under Listing Notice 3.
8.	The EIA Report must provide an assessment of the impacts and mitigation measures for each listed activity applied for.	Refer to **Section 12**.
9.	Please make sure that correct contact details of all authorities (provincial, local and district municipalities) including email addresses are provided in the application form.	An updated list of authorities with jurisdiction was provided to the DEA Case Officer.
10.	The EIA Report must provide the corner/bend-point coordinates for the proposed pipeline (as well as start, middle and end points) and these must be attached as a separate appendix to the EIA Report, as well as the start, middle and end points of all roads proposed for construction or widening.	Refer to **Table 13**.
11.	Please ensure that the EIA Report correctly indicated only the affected provinces, district and local municipalities for this specific application, as far as the location of the activity is concerned.	Refer to **Section 4.1**.
12.	The EIA Report must provide a detailed need and desirability motivation as to why there is a need for the development and why the specific location is desirable.	Refer to **Section 3** and **Section 8**.
13.	The EIA Report must include all items as specified in Appendix 3 of GN R 982; including: • The 21 digit Surveyor General code of each cadastral land parcel; and • Where available, the physical address and farm name of the property or properties;	Refer to **Appendix G**.
14.	Information on services required on the site, e.g. sewage, refuse removal and water. Who will supply these services and has an agreement and confirmation of capacity been obtained?	Refer to **Section 9.10.**
15.	Please provide in the EIA Report an indication of the time period that will be required to complete construction of the applied for pipeline and associated infrastructure (i.e. number of years or months to be required complete the development, once construction commences).	Refer to **Section 9.9.**
16.	A construction and operational phase EMPr to include mitigation and monitoring measures. The EMPr to be submitted as part of the EIA Report must include the recommendations and mitigation measures recorded in the EIA Report and the specialist studies conducted.	The EMPr is contained in **Appendix K.**
17.	Please ensure that the Final EIA Report includes at least one	Refer to Locality Maps contained in

No.	DEA Requirements	Response/Status
	A3 regional map of the area and that the locality maps included in the Final EIA Report illustrate the different proposed alignments. The maps must be of acceptable quality and as a minimum, have the following attributes: • Maps are relatable to one another; • Cardinal points; • Co-ordinates; • Legible legends; • Indicate alternatives; • Latest land cover; • Vegetation types of the study area; and • A3 size locality map.	**Appendix A**. The latest land cover is shown in **Figure 73** and vegetation types are shown in **Figure 92**.
18.	Further it must be reiterated that, should an application for Environmental Authorisation be subject to the provisions of Chapter 11, Section 38 of the National Heritage Resources Act, Act 25 of 1999, then this Department will not be able to make not issue a decision in terms of your application for Environmental Authorisation pending letter from the pertinent heritage authority categorically stating that the application fulfils the requirements of the relevant heritage resources authority as described in Chapter 11, Section 38 (8) of the National Heritage Resources Act, Act 25 of 1999.	The Heritage Impact Assessment undertaken as part of the EIA will be submitted to LIHRA and SAHRA, and will be uploaded to the South African Heritage Resources Information System (SAHRIS).
19.	The applicant is hereby reminded to comply with the requirement of Regulation 45 with regard to the time period allowed for complying with the requirements of the Regulations, and Regulations 43 and 44 with regard to allowance of a comment period for interested and affected parties on all reports submitted to the competent authority for decision-making. The reports referred to are listed in Regulation 43(1).	Refer to **Section 15** for details of the review period.
	You are requested to submit two (2) copies of the EIA Report to the Department and at least one electronic copy (CD/DVD) of the complete final report with the hard copy documents.	To be complied with as part of final submission to DEA.

6.9.2 Comments on the Draft EIA Report

The manner in which DEA's comments on the Draft EIA Report (refer to **Appendix B2**), have been attended to are described in **Table 10**.

Table 10: DEA's Specific Requirements – Comments on the Draft EIA Report

No.	DEA Requirements	Response/Status
1.	A clear and detailed description of each and every activity applied for must be included in both the application form and final EIAr, in chronological order. The description of these listed activities and sub-activities must clearly indicate how they relate or link to the proposed development, and the exact thresholds or capacities for materials and infrastructure must be indicated. If these cannot be provided in the final EIAr, reasons must be provided.	The listed activities are explained in the context of the project in **Table 4** and **Table 5**. Note that the dimensions of the project infrastructure and components should be regarded as approximates due to the dynamic nature of the planning and design process. As a conservative approach, all possible activities that could possibly be triggered by the project were included in the Application

No.	DEA Requirements	Response/Status
		Form (contained in **Appendix D**). A refinement of these activities took place as the EIA process unfolded.
2.	There are activities in the application form where the description states that "Activity to be confirmed following Terrestrial Ecological Study". Kindly ensure that activities that are still to be confirmed as stated in the application form are confirmed when submitting the final EIAr. Furthermore; please ensure that a clear description of how these activities relate or link to the proposed development is provided. If the activities no longer form part of the application, an amended application form must be submitted. Please ensure that activities are not just included in the application form with no correlation to what is being proposed.	The relevance of the activities triggered by the project in terms of GN No. R.985 (as amended), based on the findings from the Terrestrial Ecological Impact Assessment, is presented in **Table 5**.
3.	With regards to infilling and excavation of watercourses for the construction of the pipeline and associated infrastructure, the applicant is required to provide an indication of the preferred and alternate locations from which the material used for infilling will be sourced and where excavated material will be stored and/or disposed of. In addition, the impacts associated with this activity must be adequately assessed in the EIAr.	This activity relates to various infrastructure associated with MCWAP-2A that is located within watercourse(s) or within 32 m from watercourse(s) (refer to information provided in **Table 4** and **Table 5**). Potential spoil sites (old borrow sites from construction of the railway line and roads) were identified for the potential spoiling of excess soil and rocks from construction activities. A description of each proposed spoil site is provided in **Table 21**. Refer to mitigation measures contained in the EMPr for managing impacts to watercourses (e.g. a buffer zone of 30 m from the edge of the delineated riparian zone is recommended for construction activities such as mixing areas, stockpiles and laydown yards). Refer to **Section 13.8.6.3** for the mitigation measures recommended as part of the Baseline Aquatic and Impact Study.
4.	The EAP must engage the relevant provincial authority with regards to development in geographic areas triggering GNR 985, as amended.	An enquiry with regards to GN No. R.985 (as amended) was made with Mr. T. Ngoasheng from the LDEDET: Environmental Impact Management. Refer to **Table 5** for details of activities triggered under Listing Notice 3.
5.	Please ensure that the coordinates of the proposed development are provided in the final EIAr.	Refer to coordinates provided in **Section 9.2** and in **Table 13**.
6.	It is noted that alternatives have been identified. However, please provide a description of the advantages and disadvantages that the proposed activity or alternatives will have on the environment and on the community that may be affected by the activity as per Appendix 2 (1) (c) (d) and 2 (h) of GN R.982 of 2014. Alternatively, you should submit written proof of an investigation and motivation if no reasonable or	Alternatives to the project are presented in **Section 10**. The feasible options are taken forward in the impact prediction (see **Section 13**), where the potential positive and adverse effects to the environmental features and attributes are examined further. A

No.	DEA Requirements	Response/Status
	feasible alternatives exist in terms of Appendix 2 (2)(x)(xi). A detailed motivation for the power line route alternative selected as "preferred" as well as reasons for other alternatives to be deemed as not feasible must be provided in the final EIAr.	comparative analysis of the alternatives from environmental (including specialist input) and technical perspectives is provided in **Section 14**. Note that there is an incorrect reference in DEA's comments to a power line route, which does not apply to MCWAP-2A.
7.	Please ensure that the final EIAr includes a legible route layout map; an environmental sensitivity map indicating all environmental sensitive areas and features; a map combining a layout map superimposed (overlain) on the environmental sensitivity map; and a regional map of the area. Please be informed that Google maps will not be accepted for decision-making purposes. Furthermore; the layout map must include the following: • Wetlands, drainage lines, rivers, stream and water crossing of roads and powerlines indicating the type of bridging structures that will be used; • The location of sensitive environmental features on site e.g. CBAs, heritage sites, wetlands, drainage lines etc. that will be affected by the powerline and its associated infrastructure; • Substation(s) and/or transformer(s) sites including their entire footprint; • Location of access and service roads; • Connection routes (including pylon positions) to the distribution/transmission network; • All existing infrastructure on the site, especially roads; • Buffer areas; and • All "no-go" areas.	**Appendix A** contains layout maps of the project (regional locality map and orthophotograph), as well as a sensitivity map. Detailed layouts on a finer scale are provided in **Appendix C**, where the project layout is overlaid on orthophotographs. Note that there are incorrect references in DEA's comments to electrical infrastructure, which do not apply to MCWAP-2A.
8.	Please ensure that all issues raised and comments received during the circulation of the draft EIAr from registered I&APs and organs of state which have jurisdiction (including this Department's Biodiversity & Conservation Unit) in respect of the proposed activity are adequately addressed in the final EIAr. Proof of correspondence with the various stakeholders must be included in the final EIAr. Should you be unable to obtain comments, proof should be submitted to the Department of the attempts that were made to obtain comments. The public participation process must be conducted in terms of Regulation 39, 40 41, 42, 43 and 44 of the Environmental Impact Assessment (EIA) Regulations, 2014, as amended	The EIA Comments and Responses Report (contained in **Appendix M**) provides a comprehensive summary of comments, issues and queries received from IAPs to date. This report also attempts to address the comments through input received from the relevant members of the project and environmental teams. **Section 15** provides an overview of the Public Participation process during the EIA phase. Copies of the Draft EIA Report were provided to the following authorities (refer to **Appendix Q** for proof of deliveries): • DEA - Integrated Environmental Authorisations: Public Sector; • DEA - Biodiversity & Conservation Unit; • LDEDET; • DWS Limpopo Regional Office; • DAFF;

No.	DEA Requirements	Response/Status
		• DMR; • LIHRA; • SAHRA (via SAHRIS); and • Waterberg DM; • Thabazimbi LM; and • Lephalale LM.
9.	A Comments and Response Report (CRR) must be submitted with the final EIAr. Please refrain from summarising comments made by I&APs, and all comments from I&APs must be copied verbatim and responded to clearly and fully. Please note responses such as "*noted*" are not acceptable.	All comments received following the public review of the Draft EIA Report were included in the updated EIA Comments and Responses Report (contained in **Appendix M**). Written comments received from IAPs were included as received, without any editing.
10.	The comments and responses report must be done in a table format that has proper headings (these must include: name of the person providing the comments, organization, the comment, the date of the comment and your response). Comments must be separated and not clustered together. This would make for easy reading when reviewing.	This format was used during the compilation of the EIA Comments and Responses Report (contained in **Appendix M**).
11.	All specialist studies must be final, and provide detailed mitigation measures and recommendations, and must not recommend further studies to be completed post EA.	The final specialist studies are contained in **Appendix I**. As the EIA was based on the outcomes of the Feasibility Study, and the project layout will be optimised during the pending design phase, some environmental investigations are recommended after the EIA.
12.	Recommendations provided by specialist reports must be considered and used to inform the preferred Layout Plan and the EMPr.	The preferred alignment of the proposed pipeline is based on the findings of the specialist studies (refer to **Section 14**). Mitigation measures that emanated from the specialist studies were included in the EMPr.
13.	The requirements of the letter for acceptance of the final Scoping Report dated 15 May 2018 still stand and must be considered in the compilation of the final EIAr.	The manner in which DEA's specific requirements, as listed in the letter received from this Department for the acceptance of the Scoping Report (refer to **Appendix B1**), have been attended to are described in **Table 9**.
14.	You are further reminded that the final EIAr to be submitted to this Department must comply with all the requirements in terms of the scope of assessment and content of the EIAr in accordance with Appendix 3 of the EIA Regulations, 2014, as amended.	**Table 1** presents the EIA Report's composition in terms of the requirements stipulated in Appendix 3 of GN No. R.982 (as amended).
15.	If this application for Environmental Authorisation is subject to the provisions of Chapter II, Section 38 of the National Heritage Resources Act, Act 25 of 1999, then this Department will require a letter from the pertinent heritage authority categorically stating that the application fulfils the requirements of the relevant heritage resources authority as described in Chapter II, Section 38(8) of the National Heritage Resources Act, Act 25 of 1999.	The Heritage Impact Assessment undertaken as part of the EIA was submitted to LIHRA and SAHRA, and was uploaded to SAHRIS on 27 September 2018.

6.10 Screening of Alternatives

Various options to meeting the project's objectives were considered during the Technical Feasibility Study, which eventually lead to the identification of alternatives to be investigated as part of the EIA. Refer to further discussion on screened alternatives under **Section 10**. The "no-go option" is also be evaluated to understand the implications of the project not proceeding (see **Section 10.3.2**).

The feasible options are taken forward in the impact prediction (see **Section 13**), where the potential positive and adverse effects to the environmental features and attributes are examined further.

A comparative analysis of the alternatives from environmental (including specialist input) and technical perspectives is provided in **Section 14**. This includes a systematic comparison of the implications of the project options to enable the selection of a Best Practicable Environmental Option (BPEO).

6.11 Impact Prediction

The potential environmental impacts associated with the proposed project were identified during the Scoping phase through an appraisal of the following:

- Proposed locations and footprint of the project infrastructure and components, which included site investigations as well as a desktop evaluation with a Geographical Information System (GIS) and aerial photography;
- Activities associated with the project life-cycle (i.e. pre-construction, construction, operation and decommissioning);
- Profile of the receiving environment and the potential sensitive environmental features and attributes;
- Input received during public participation from authorities and IAPs; and
- Legal and policy context.

The Scoping exercise aimed to identify and qualitatively predict potentially significant environmental issues for further consideration and prioritisation during the EIA stage (see **Section 13**). Note that "significance" relates to whether the effect (i.e. change to the environmental feature / attribute) is of sufficient importance that it ought to be considered and have an influence on decision-making.

During the EIA stage a detailed quantitative impact assessment is conducted to identify all impacts, which are evaluated via contributions from IAPs, the project team and requisite specialist studies, and through the application of the impact assessment methodology contained in **Section 13.4**. Suitable mitigation measures are proposed to manage (i.e. prevent, reduce, rehabilitate and/or compensate) the environmental impacts, and are included in the EMPr (see **Appendix K**).

7 ASSUMPTIONS AND LIMITATIONS

The following assumptions and limitations accompany the EIA process:

- As the design of the project components is still in feasibility stage, and due to the dynamic nature of the planning environment, the dimensions and layout of the infrastructure may change as the project life-cycle advances.
- Regardless of the analytical and predictive method employed to determine the potential impacts associated with the project, the impacts are only predicted on a probability basis. The accuracy of the predictions is largely dependent on the availability of environmental data and the degree of understanding of the environmental features and their related attributes.
- The Agriculture Impact Assessment (Index, 2018a) noted the following assumptions:
  - Grazing land will be temporary lost for a 50 metres strip along the path of the pipeline. The browsing value of trees, however, will be lost notwithstanding the grass returning.
  - Fallow and old lands are now mostly upgraded veld grazing. There are some areas along the Crocodile River that are now fallow, but which is potentially irrigable.
  - Irrigated lands are mostly under centre pivot irrigation systems, which has permanent and expensive underground infrastructure that will have to be considered in the routing of the pipeline. Fertility of irrigated land is usually built up over time and must also be taken into consideration in the evaluation. Traversing the pivot irrigation system will lead to a temporary loss of the land along the pipeline and may influence cropping depending on the season when construction takes place.
  - Housing and farming infrastructure is a cost item but will not directly impact on the farming income, unless it is used as packing sheds, which is then part of the production process. Loss of infrastructure should be dealt with under the social assessment of the EIA.
- The Baseline Aquatic and Impact Study (The Biodiversity Company, 2018) noted the following limitations:
  - A single dry season aquatic survey was completed for this assessment. Thus, temporal trends were not investigated;
  - The aquatic study addressed water courses associated with the project, and not wetlands. NFEPAs have been addressed in this report to identify floodplains and pans at a desktop level. Furthermore, buffers for identified NFEPA wetlands have not been provided for in this report;
  - The impact assessment completed in this study was completed in accordance to DWS Risk Assessment Guidelines for Section 21(c) and 21(i);
  - As result of the footprint area and access to the project area, the focus of the in-field assessment was on watercourses directly impacted by the project;
  - Access to Sand River Gauging Weir was limited during the field survey, therefore a downstream site was assessed to characterise the reach; and
  - Riparian assessments were based on available contour data and ground-truthed in the field. The accuracy of the riparian delineation is of low confidence.

- The Heritage Impact Assessment (PGS, 2018) noted the following assumptions and limitations:
  - Not detracting in any way from the comprehensiveness of the fieldwork undertaken, it is necessary to realise that the heritage resources located during the fieldwork do not necessarily represent all the possible heritage resources present within the area. Various factors account for this, including the subterranean nature of some archaeological sites and the current dense vegetation cover. As such, should any heritage features and/or objects not included in the present inventory be located or observed, a heritage specialist must immediately be contacted. Such observed or located heritage features and/or objects may not be disturbed or removed in any way until such time that the heritage specialist has been able to make an assessment as to the significance of the site (or material) in question. This applies to graves and cemeteries as well. In the event that any graves or burial places are located during the development, the procedures and requirements pertaining to graves and burials will apply as set out below; and
  - Areas not assessed need to be investigated in the field by an archaeologist / heritage specialist before construction commences.
- The Socio-Economic Impact Assessment (Bews & Chidley, 2018) noted the following assumptions and limitations:
  - It is assumed that information obtained during the public participation phase provide a comprehensive account of the community structure and community concerns for the project;
  - The study was done with the information available to the specialist at the time of executing the study, within the available time frames and budget. The sources consulted are not exhaustive and additional information which might strengthen arguments, contradict information in this report and/or identify additional information which might exist. However, the specialist did take an evidence-based approach in the compilation of this report and did not intentionally exclude information relevant to the assessment;
  - It is assumed that no relocation of families or people will take place for this project.
- The Terrestrial Ecological Impact Assessment (Nemai Consulting, 2018b) noted the following limitations:
  - Given the magnitude of the project and the various extent of erven and portions of farms in the area, some farms/areas were not easily accessible. However, detailed walk down surveys once the final routes have been selected will be required;
  - A separate Wildlife Impact Assessment report was conducted by Ben Orban from NABRO Ecological Analysts CC for this EIA Process.
  - Fauna species directly or indirectly observed during the site visits were supplemented with those that are likely to occur in the area based on their distribution and habitat preferences; and
  - Since environmental impact studies deal with dynamic natural systems additional information may come to light at a later stage and Nemai Consulting can thus not accept responsibility for conclusions and mitigation measures made in good faith based on

information gathered or databases consulted at the time of the investigation. Detailed walk-down surveys once the routes are finalised will be required in order to reduce impacts identified in this report.

8 NEED AND DESIRABILITY

This section serves to expand on the motivation / need and desirability for the proposed development that is provided in **Section 3.2**. The format contained in the Guideline on Need and Desirability (DEA&DP, 2010b) was used in **Table 11**. Need (time) and desirability (place) relates to, amongst others, the nature, scale and location of development being proposed, as well as the wise use of land.

Table 11: Need and Desirability of the Project

No.	Question	Response
		NEED ('timing')
1.	Is the land use (associated with the activity being applied for) considered within the timeframe intended by the existing approved Spatial Development Framework (SDF) agreed to by the relevant environmental authority? (i.e. is the proposed development in line with the projects and programmes identified as priorities within the IDP).	The IDP for the Lephalale LM (2016) acknowledges the need for MCWAP and specifically states the following: "*It is imperative to note that the outcome of the MCWAP project need to be implemented to address expected water shortages before any development in node area 1 will be viable, as currently the area does not have sufficient water resources to sustain any new development*". MCWAP-2A is also included as one of the strategic projects in terms of Key Performance Area 2: Basic Services and Infrastructure investment. It is noted that Thabazimbi LM's water supply is from Magalies Water. According to the spatial vision presented in the IDP for the Thabazimbi LM (2017), the proposed footprint of MCWAP-2A falls primarily within the activity and government corridor, which extends northwards from the town of Thabazimbi (similar to Zone 11 of the Waterberg DM EMF).
2.	Should development, or if applicable, expansion of the town/area concerned in terms of this land use (associated with the activity being applied for) occur here at this point in time?	• The timing of the project is driven by the water demands associated with the development of the Waterberg Coalfields, where the water users include power generation, coal mining to support power generation, other industrial / mining activities and urban use by the Lephalale LM. • Several possible weir sites along the Crocodile River (West) were evaluated for suitability with respect to topography, access, founding conditions and river morphology. This led to the selection of two possible sites, namely the Vlieëpoort Upper Site and the Boschkop Lower Site. The choice of the final abstraction point was largely determined by the extent of river losses and additional costs associated with river management actions, as well as the need for and benefit of implementing a phased approach to deliver water to the end users. • To minimise impacts, the proposed pipeline route attempts to remain alongside existing linear-type infrastructure, such as roads (main roads and dirt roads), the railway line (i.e. section of approximately 56km), transmission lines, industrial corridors and farm boundaries where the environment is regarded as less sensitive.

No.	Question	Response
3.	Does the community/area need the activity and the associated land use concerned (is it a societal priority)? This refers to the strategic as well as local level (e.g. development is a national priority, but within a specific local context it could be inappropriate)	• MCWAP-2A features prominently on SIP 1, which aims to unlock SA's northern mineral belt in one of the poorest provinces (Limpopo). • The assurance of water supply to the current power stations including water supply for FGD near Lephalale is not acceptable and places the country's power supply and economic position at risk. • The concerns raised by IAPs with regards to the proposed project primarily fall into the following categories: • Concerns related to the footprint of the physical infrastructure and associated impacts to land use as well as existing structures and infrastructure; • Concerns related to water availability in the Crocodile River (West); and • Concerns related to the cumulative impacts associated with the various developments that are linked to the Waterberg Coalfields.
4.	Are the necessary services with appropriate capacity currently available (at the time of application), or must additional capacity be created to cater for the development?	Bulk power is required for the operation of the high-lift and low-lift pumping stations associated with the MCWAP-2A WTI. Eskom has confirmed that the proposed MCWAP-2A substation can be accommodated into the network without any capacity constraints. The proposed substation will be supplied from the new planned Thabatshipi – Thabazimbi Combined 132 kV Power Line. A separate application will be submitted by Eskom to seek approval for the bulk power required for MCWAP-2A. The services required for the development are explained in **Section 9.10**.
5.	Is this development provided for in the infrastructure planning of the municipality, and if not what will the implication be on the infrastructure planning of the municipality (priority and placement of services)?	The project aims to supply bulk water to a number of strategic end users. The Lephalale LM, as one of the intended water users, will need to ensure that it is able to optimally utilise this water as part of infrastructure planning. See the response in item no. 1 above in terms of the reference to MCWAP-2A contained in the IDP for the Lephalale LM.
6.	Is this project part of a national programme to address an issue of national concern or importance?	Yes. Refer to response provided above for item no. 3 in terms of the project's SIP status.
7.	Is the development the best practicable environmental option (BPEO) for this land/site?	The site selection for the project infrastructure is discussed in item no. 2 above. Refer to **Section 14.6** for the selected BPEOs for the project alternatives, based on a comparative analysis.
8.	Would the approval of this application compromise the integrity of the existing approved municipal IDP and SDF as agreed to by the relevant authorities?	It is not anticipated that the proposed project will contradict or be in conflict with the municipal IDPs and SDFs (refer to response provided above to item no. 1).

No.	Question	Response
9.	Would the approval of this application compromise the integrity of the existing environmental management priorities for the area (e.g. as defined in EMFs), and if so, can it be justified in terms of sustainability considerations?	In terms of the EMF for the Waterberg DM (Environomics & NRM Consulting, 2010b), the project falls within the following Environmental Management Zones (refer to **Section 11.16.3**): • Zone 4: Game and cattle farming (including hunting) areas with commercial focus; • Zone 5: Mining and industrial development focus areas; • Zone 6: Restricted mining focus areas in aesthetic and/or ecological resource areas; and • Zone 11: Major infrastructure corridors. It is noted that Zone 11 facilitates the routing of bulk infrastructure, such as the pipeline associated with MCWAP-2A. The EIA will further assess whether MCWAP-2A is incompatible with the desired state established for the remaining zones. Refer to **Section 11.9.3** for a discussion of the project in relation to Critical Biodiversity Areas.
10.	Do location factors favour this land use (associated with the activity applied for) at this place? (this relates to the contextualisation of the proposed land use on this site within its broader context).	As part of the technical analysis a number of locational factors were considered in selecting the abstraction site and pipeline route, as discussed in item no. 2 above. The specialist studies further investigate the location based on sensitive environmental features and receptors.
11.	How will the activity or the land use associated with the activity applied for, impact on sensitive natural and cultural areas (built and rural/natural environment)?	See compilation of significant environmental issues associated with the proposed project contained in **Section 13**.
12.	How will the development impact on people's health and wellbeing (e.g. in terms of noise, odours, visual character and sense of place, etc.)?	
13	Will the proposed activity or the land use associated with the activity applied for, result in unacceptable opportunity costs?	The affected land is rural in nature and primarily used for agricultural and game farming purposes. Opportunity costs, which are associated with the net benefits forgone for the development alternative, will be considered in the Socio-economic Study during EIA phase.
14	Will the proposed land use result in unacceptable cumulative impacts?	Cumulative impacts are discussed in **Section 13.22**.

9 PROJECT DESCRIPTION

9.1 General

The information presented in this section was primarily sourced from the Technical Feasibility Study reports.

Note: The sizing and location of the project-related infrastructure takes place within a dynamic planning environment, with various role-players, affected landowners, authorities and other stakeholders. Subsequent project modifications that emanated from discussions with the IAPs, findings from specialist studies and technical considerations were conveyed during the public participation of the EIA phase and were incorporated into the EIA report, which was lodged in the public domain.

9.2 MCWAP-2A WTI Components

The major scheme components for MCWAP-2A WTI are listed in **Table 12**. Refer to location alternatives and coordinates provided in **Table 13**, with selected points shown in **Figure 10**.

Table 12: MCWAP-2A WTI Components

Component	Main Features
Vlieëpoort Abstraction Weir on the Crocodile River (West)	Type: Mass gravity concrete structure Spillway: Stepped Ogee Height: approximately 4 – 6 m above river bed level to be optimised during tender design stage Two 2 m^3/s pump inlets plus 1 standby Abstraction capacity: 125 million m^3/a Energy dissipation: Roller bucket Outlet works: 5 m^3/s
Low-lift Pumping Station	Construction: Concrete Capacity Civil: 125 million m^3/a Capacity Mechanical and Electrical: 75 million m^3/a with provision to increase to max 125 million m^3/a Power requirement: 4MVA Continuous abstraction aligned with releases Size: 25 x 70 m
Low-lift Rising Main (2 pipes)	Type: Steel pipes with welded joints Length: 5 340 m Diameter: ND1300 Capacity Civil: 75 million m^3/a
Sedimentation Works	Type: 8 Concrete channels each 120 m long x 2,5 m wide x 5 m deep Capacity: Civil: 75 million m^3/a
Balancing Reservoir	Type: Earth fill Size: 620 x 440 m Compartments: 5 each 400 m long x 100 m wide by 10,5 to 13 m deep Capacity Civil: 75 million m^3/a state storage volume
High-lift Pumping Station	Construction: Reinforced concrete, masonry and steel frame structure Capacity: 75 million m^3/a pumped over 95% of time (Q=3.1 m^3/s) Power requirement: 20MVA

Component	Main Features
	Size: 120 x 300 m
High-lift Rising Main to BPR	Type: Steel pipes with welded joints Length: 29 000 m Diameter: ND1300 Capacity Civil: 75 million m^3/a
BPR	Type: Lined earth fill embankment Capacity Civil: 90 000 m^3 Size: Three compartments of 30 000 m^3
Gravity Pipeline from BPR to OR	Type: Steel pipes with welded joints Length: 63 570 m Capacity Civil: 75 million m^3/a Diameter: ND1700
OR	Type: Lined earth fill embankment Capacity Civil: 90 000 m^3 Size: Three compartments of 30 000 m^3
Gravity pipeline from Operational Reservoir to Medupi Tee-off via Steenbokpan	Type: Steel pipes with welded joints Diameter – Length: ND2200 – 9 200 m ND1400 – 17 000 m ND1200 – 18 250 m ND900 – 14 560 m Capacity Civil: 75 million m^3/a
Ancillary infrastructure	Gauging Weirs Crocodile (West) River Management System Access roads Accommodation, offices, workshops and security measures

The main MCWAP-2A WTI components and the related alternatives are discussed in the sections to follow. Note the following:

1. As discussed, the dimensions and layout of the infrastructure may change as the technical study advances through the detailed design stage if Environmental Authorisation is obtained. All dimensions should thus be regarded as approximates;
2. All property descriptions are based on 2013 cadastral information;
3. All distances and coordinates provided should be regarded as approximates, as they are based on a desktop estimate from GIS; and
4. Although coordinates are provided for the centreline of the pipeline, as well as the access road to the abstraction weir, the EIA considered a 100 m wide corridor (i.e. 50 m on either side of the centre line), which allows for possible deviations from the proposed alignment within this corridor (e.g. avoidance of sensitive features, if possible).

Table 13: MCWAP-2A WTI Components with alternative and coordinates

Project Components	Alternatives	Coordinates		
Vlieëpoort abstraction weir	-	1)	Central point:	24°38’00.80”S, 27°18’59.63”E
Low-lift pumping station	-	2)	Central point:	24°37’59.66”S, 27°18’59.68”E
Low-lift rising main	-	3)	Start point:	24°38’00.31”S, 27°19’00.39”E
		4)	End point:	24°35’54.47”S, 27°18’05.05”E
Balancing dam	-	5)	Central point:	24°35’43.72”S, 27°17’59.18”E
Desilting works	-	6)	Central point:	24°35’51.49”S, 27°18’06.98”E
Sediment Storage Compartments	-	7)	Central point:	24°35’39.62”S, 27°18’12.42”E
High-lift pumping station	-	8)	Central point:	24°35’33.54”S, 27°17’50.80”E

Project Components	Alternatives	Coordinates		
Pipeline (rising main, gravity main and delivery line)	Central Route	9)	Start point:	24°35'30.68"S, 27°17'55.45"E
		10)	End point:	23°53'41.79"S, 27°24'12.09"E
		11)	Bend point 1:	24°35'06.27"S, 27°18'53.69"E
		12)	Bend point 2:	24°34'40.13"S, 27°18'31.42"E
		13)	Bend point 3:	24°34'30.36"S, 27°18'35.41"E
		14)	Bend point 4:	24°31'38.55"S, 27°16'30.32"E
		15)	Bend point 5:	24°28'19.01"S, 27°17'28.58"E
		16)	Bend point 6:	24°25'55.64"S, 27°23'09.38"E
		17)	Bend point 7:	24°25'46.21"S, 27°23'37.23"E
		18)	Bend point 8:	24°25'33.97"S, 27°24'13.39"E
		19)	Bend point 9:	24°25'31.98"S, 27°24'25.69"E
		20)	Bend point 10:	24°24'24.48"S, 27°24'02.18"E
		21)	Bend point 11:	24°23'12.01"S, 27°26'55.36"E
		22)	Bend point 12:	24°12'18.29"S, 27°26'59.22"E
		23)	Bend point 13:	23°56'55.01"S, 27°23'26.22"E
	Alternative A1	24)	Start point:	24°31'38.53"S, 27°16'30.19"E
		25)	End point:	24°28'08.53"S, 27°17'51.07"E
		26)	Bend point 1:	24°29'31.41"S, 27°14'51.08"E
	Alternative A2	27)	Start point:	24°31'38.53"S, 27°16'30.19"E
		28)	End point:	24°28'08.53"S, 27°17'51.07"E
		29)	Bend point 1:	24°31'20.41"S, 27°16'15.31"E
		30)	Bend point 2:	24°30'03.67"S, 27°19'41.27"E
	Alternative C	31)	Start point:	24°24'30.47"S, 27°24'03.26"E
		32)	End point:	24°17'26.57"S, 27°26'54.98"E
		33)	Bend point 1:	24°18'51.28"S, 27°23'13.73"E
	Alternative D1	34)	Start point:	23°53'35.59"S, 27°24'13.39"E
		35)	End point:	23°43'24.68"S, 27°24'18.13"E
		36)	Bend point 1:	23°46'42.99"S, 27°25'52.56"E
		37)	Bend point 2:	23°45'22.16"S, 27°24'56.07"E
	Alternative D2	38)	Start point:	23°53'35.59"S, 27°24'13.39"E
		39)	End point:	23°42'28.25"S, 27°20'05.92"E
		40)	Bend point 1:	23°53'07.87"S, 27°24'20.09"E
		41)	Bend point 2:	23°48'27.32"S, 27°23'19.97"E
		42)	Bend point 3:	23°46'10.98"S, 27°22'16.62"E
		43)	Bend point 4:	23°43'47.85"S, 27°20'38.77"E
	Alternative D3	44)	Start point:	23°53'35.59"S, 27°24'13.39"E
		45)	End point:	23°43'18.15"S, 27°16'40.67"E
		46)	Bend point 1:	23°52'27.67"S, 27°23'56.32"E
		47)	Bend point 2:	23°52'01.52"S, 27°21'49.58"E
		48)	Bend point 3:	23°51'52.09"S, 27°21'55.16"E
		49)	Bend point 4:	23°51'20.40"S, 27°21'39.51"E
		50)	Bend point 5:	23°50'18.68"S, 27°21'28.88"E
		51)	Bend point 6:	23°48'44.29"S, 27°21'20.79"E
		52)	Bend point 7:	23°46'50.94"S, 27°18'29.68"E
		53)	Bend point 8:	23°46'46.14"S, 27°17'58.92"E
		54)	Bend point 9:	23°45'36.39"S, 27°17'04.95"E
		55)	Bend point 10:	23°44'34.35"S, 27°17'13.94"E

Project Components	Alternatives	Coordinates		
	Alternative D4	56)	Start point:	23°45’22.16”S, 27°24’56.07”E
		57)	End point:	23°44’03.94”S, 27°25’45.82”E
	Alternative E	58)	Start point:	24°37'58.67"S; 27°19'01.21"E
		59)	End point:	24°35'54.18"S; 27°18'05.08"E
		60)	Bend point 1:	24°37'54.33"S; 27°18'58.27"E
		61)	Bend point 2:	24°37'54.33"S; 27°18'58.27"E
		62)	Bend point 3:	24°37'49.05"S; 27°18'55.57"E
		63)	Bend point 4:	24°37'49.05"S; 27°18'55.57"E
		64)	Bend point 5:	24°37'38.16"S; 27°18'51.31"E
		65)	Bend point 6:	24°37'38.16"S; 27°18'51.31"E
		66)	Bend point 7:	24°37'25.70"S; 27°18'46.96"E
		67)	Bend point 8:	24°37'25.70"S; 27°18'46.96"E
		68)	Bend point 9:	24°37'19.01"S; 27°18'45.70"E
		69)	Bend point 10:	24°37'19.01"S; 27°18'45.70"E
		70)	Bend point 11:	24°37'10.29"S; 27°18'40.09"E
		71)	Bend point 12:	24°37'10.29"S; 27°18'40.09"E
		72)	Bend point 13:	24°37'06.41"S; 27°18'40.03"E
		73)	Bend point 14:	24°37'06.41"S; 27°18'40.03"E
		74)	Bend point 15:	24°37'04.24"S; 27°18'40.66"E
		75)	Bend point 16:	24°37'04.24"S; 27°18'40.66"E
		76)	Bend point 17:	24°37'01.72"S; 27°18'40.32"E
		77)	Bend point 18:	24°37'01.72"S; 27°18'40.32"E
		78)	Bend point 19:	24°36'55.31"S; 27°18'34.54"E
		79)	Bend point 20:	24°36'55.31"S; 27°18'34.54"E
		80)	Bend point 21:	24°36'53.32"S; 27°18'29.95"E
		81)	Bend point 22:	24°36'53.32"S; 27°18'29.95"E
		82)	Bend point 23:	24°36'51.02"S; 27°18'28.22"E
		83)	Bend point 24:	24°36'51.02"S; 27°18'28.22"E
		84)	Bend point 25:	24°36'45.49"S; 27°18'24.43"E
		85)	Bend point 26:	24°36'45.49"S; 27°18'24.43"E
		86)	Bend point 27:	24°36'42.94"S; 27°18'24.24"E
		87)	Bend point 28:	24°36'42.94"S; 27°18'24.24"E
		88)	Bend point 29:	24°36'40.59"S; 27°18'22.21"E
		89)	Bend point 30:	24°36'40.59"S; 27°18'22.21"E
		90)	Bend point 31:	24°36'39.98"S; 27°18'20.04"E
		91)	Bend point 32:	24°36'39.98"S; 27°18'20.04"E
		92)	Bend point 33:	24°36'35.71"S; 27°18'14.17"E
		93)	Bend point 34:	24°36'35.71"S; 27°18'14.17"E
		94)	Bend point 35:	24°36'24.67"S; 27°18'09.26"E
		95)	Bend point 36:	24°36'24.67"S; 27°18'09.26"E
		96)	Bend point 37:	24°36'24.80"S; 27°17'52.95"E
		97)	Bend point 38:	24°36'24.80"S; 27°17'52.95"E
		98)	Bend point 39:	24°36'24.39"S; 27°17'51.82"E
		99)	Bend point 40:	24°36'24.39"S; 27°17'51.82"E
		100)	Bend point 41:	24°36'23.51"S; 27°17'51.63"E
		101)	Bend point 42:	24°36'23.51"S; 27°17'51.63"E
		102)	Bend point 43:	24°36'22.20"S; 27°17'52.55"E

Project Components	Alternatives	Coordinates	
		103) Bend point 44:	24°36'22.20"S; 27°17'52.55"E
		104) Bend point 45:	24°36'18.38"S; 27°17'52.30"E
		105) Bend point 46:	24°36'18.38"S; 27°17'52.30"E
		106) Bend point 47:	24°36'15.73"S; 27°17'46.10"E
		107) Bend point 48:	24°36'15.73"S; 27°17'46.10"E
		108) Bend point 49:	24°36'13.60"S; 27°17'44.08"E
		109) Bend point 50:	24°36'13.60"S; 27°17'44.08"E
		110) Bend point 51:	24°36'12.68"S; 27°17'43.57"E
		111) Bend point 52:	24°36'12.68"S; 27°17'43.57"E
		112) Bend point 53:	24°36'11.57"S; 27°17'43.32"E
		113) Bend point 54:	24°36'11.57"S; 27°17'43.32"E
		114) Bend point 55:	24°36'09.95"S; 27°17'41.29"E
		115) Bend point 56:	24°36'09.95"S; 27°17'41.29"E
		116) Bend point 57:	24°36'09.32"S; 27°17'40.95"E
		117) Bend point 58:	24°36'09.32"S; 27°17'40.95"E
		118) Bend point 59:	24°36'07.66"S; 27°17'41.58"E
		119) Bend point 60:	24°36'07.66"S; 27°17'41.58"E
		120) Bend point 61:	24°36'04.51"S; 27°17'44.48"E
		121) Bend point 62:	24°36'04.51"S; 27°17'44.48"E
		122) Bend point 63:	24°36'03.46"S; 27°17'46.52"E
		123) Bend point 64:	24°36'03.46"S; 27°17'46.52"E
		124) Bend point 65:	24°35'58.28"S; 27°17'52.78"E
		125) Bend point 66:	24°35'58.28"S; 27°17'52.78"E
BPR	BPR (Central Route)	126) Central point:	24°25'36.02"S, 27°24'19.42"E
OR	-	127) Central point:	23°53'33.95"S, 27°24'07.22"E
Bierspruit Gauging Weir	-	128) Central point:	24°40'53.10"S, 27°19'20.62"E
Sand River Gauging Weir	-	129) Central point:	24°40'47.22"S, 27°27'12.75"E
New Paul Hugo Gauging Weir	-	130) Central point:	24°41'40.86"S, 27°24'32.92"E
Access Roads	-	131) Start point:	24°37'58.26"S; 27°18'58.34"E
		132) End point:	24°37'20.34"S; 27°18'47.29"E
		133) Bend point 1:	24°37'53.63"S; 27°19'01.13"E
		134) Bend point 2:	24°37'28.73"S; 27°18'53.43"E

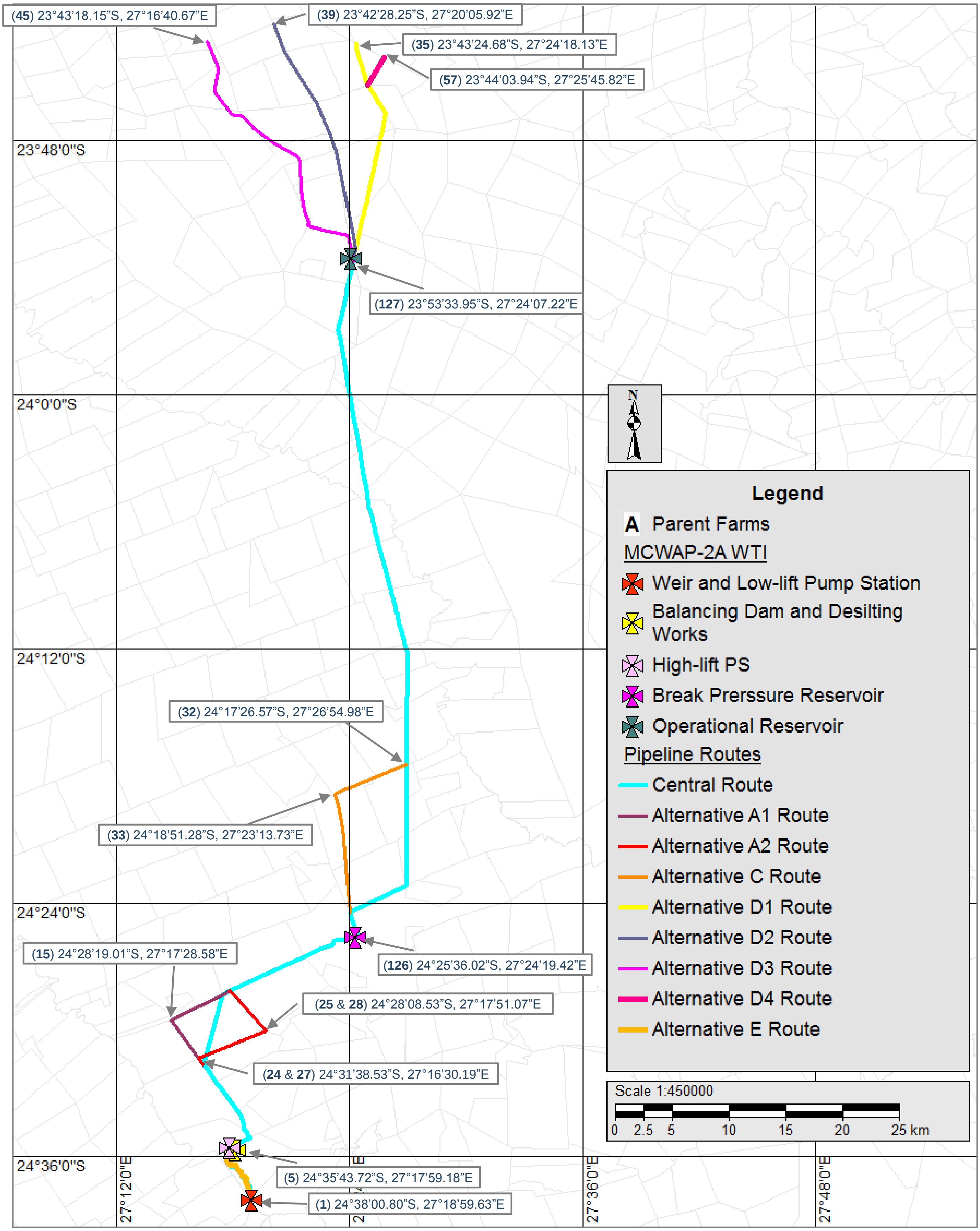


Figure 10: **MCWAP-2A WTI layout with selected coordinates**

(Note: gauging weirs not shown; Farm Portions not shown due to scale)

9.3 Abstraction Works

9.3.1 Abstraction Weir

9.3.1.1 Alternative Sites Considered

According to DWAF (2010), a large number of possible sites for an abstraction weir were identified during the Conceptual and Pre-feasibility stages using aerial photography, which were tested against the following predetermined selection criteria (see **Figure 11**):

1. Weir to be located downstream of main supply dams in Crocodile River (West) being Vaalkop, Roodekopjes and Klipvoor Dams. Consequently, only the weir sites downstream of Pienaars River confluence will meet with this criterion;
2. Weir to be located at a bend in the river with the abstraction works on the outside of the bend. The river bend helps the generation of secondary flow patterns to facilitate coarse sediment diversion past the pumping station intakes;
3. Abstraction works to be located on the same side of the river as the main pipeline route to avoid an expensive river crossing of the pipeline;
4. River valley to be narrow as possible to simplify flood management and to make the footprint of the works in the flood plain as small as possible. Nearby high ground to locate balancing dam and high lift pumps above the Probable Maximum Flood (PMF) level is essential;
5. Potential for outflanking by the river changing course to be manageable or not present;
6. River channel to be narrow as possible to minimise the cost of the weir;
7. Founding conditions. Bed rock to be present to avoid costly foundation treatment and to ensure structural integrity during flood conditions;
8. Weir basin to be as small as possible to reduce evaporation losses and minimise impacts on upstream landowners;
9. The location of the weir to result in the shortest possible length of pipeline to the users;
10. Weir to be as close as possible to sources of water to curtail river losses;
11. Proximity (positive) of existing infrastructure such as access roads, power lines, etc., resulting in potential cost savings in the extent of additional infrastructure to be provided;
12. Presence (negative) of existing infrastructure such as other structures in the river, provincial roads, power lines, mining activities, etc., to be avoided as far as possible in the upstream reach of influence of the abstraction weir; and
13. Lowest potential for flood damage. Damage at the abstraction works under extreme flood conditions should not cause the supply of water from to be interrupted for any prolonged periods, because of the strategic importance of the water requirements to be supplied. The forms of flood damage that would fall into this category include loss of structural integrity, clogging of the Works by debris, outflanking, isolation of the works due to loss of access and interruption of power supply to the Works.

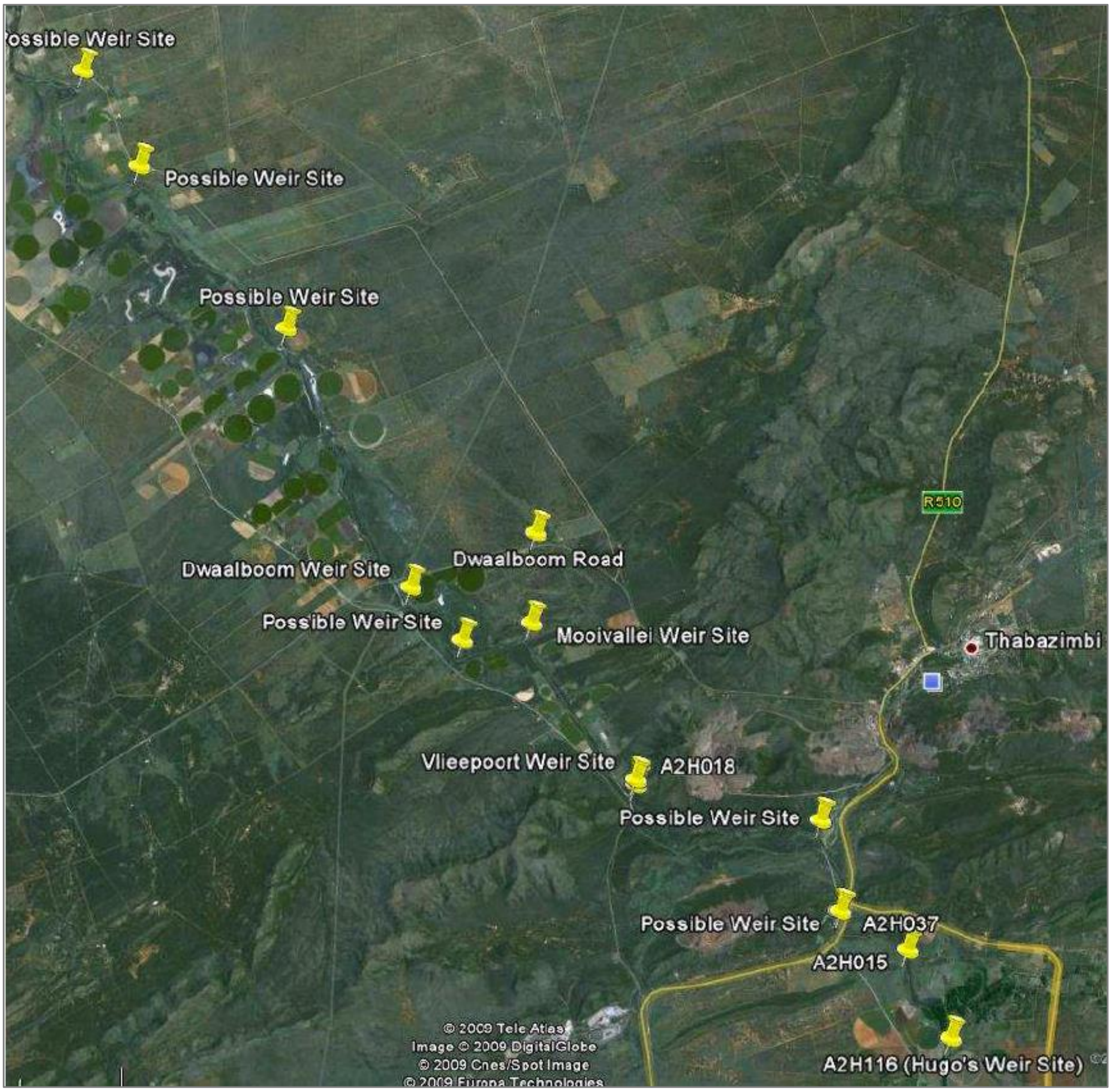


Figure 11: Abstraction Sites considered along the Lower Crocodile River (West) (DWAF, 2010)

The sites between Boschkop and Vlieëpoort and those downstream of Mooivallei (Makoppa reach) were discounted after the first round of evaluations.

9.3.1.2 Faure Site

Based on engagements with farmers from the Makoppa area during the EIA to date, various queries were raised in terms of locating the abstraction weir further downstream. The Faure Site is the location of the present DWS gauging weir A2H128. The site is approximately 50,7 km downstream of the Vlieëpoort Weir site (river channel distance) and is located on the wide flood plain forming the bottom reach of the lower Crocodile River (West) (DWAF, 2010) (**Figure 12**).

A general feature along the Crocodile River is the deep alluvial sands and silts that filled the river valleys and flood plains with depths of 10 to 20m reported. Rock exposures along the river are a rarity (DWAF, 2010).

Figure 12: Plan view of the Faure Site (DWAF, 2010)

An evaluation of the Faure Site is provided in **Table 14**.

Table 14: Site Evaluation Summary for Faure Weir (DWAF, 2010)

Criterion No.	Description	Comments
1	Downstream of Pienaars River Confluence	Yes.
2	Abstraction works on outside of river bend	The existing Faure gauging weir is located on a straight section of river, with only a very slight bend to the right.
3	Abstraction works on same side of river as pipeline	The abstraction works would have to be on the other side of the river, requiring an expensive river crossing.
4	Narrow river valley or flood plain	Very wide, open floodplain. A 20m deep flood would flow about 9km wide. The minimum structure length across the river channel is estimated to be 2,5km.
5	Potential for outflanking to be manageable	High risk of outflanking. From aerial photography it is clear that the river channel has migrated in the past, just upstream of the site.
6	Narrow river channel	Yes, approximately 30m wide.
7	Good founding conditions	No information available, but should be similarly situated on deep sands.
8	Small weir basin	Hard to gauge depth of the channel, but assuming it is not very deep, even a low weir structure will result in very shallow weir basin with large surface are resulting in high evaporation losses.
9	Pipeline length to users as short as possible	Approximately 10km shorter pipeline than from Vlieëpoort might be required, but no detailed routes were looked at, some obstacles or

Criterion No.	Description	Comments
		deviations might increase the length of the pipeline.
10	Upstream river length as short as possible to curtail losses	Very long river conveyance, 50km longer than to Vlieëpoort.
11	Proximity of access roads, power lines etc.	Good access roads are located close to the site, power lines are also present.
12	Upstream infrastructure affected by higher flood levels	Irrigated farmlands and a road bridge 1km upstream.
13	Potential for flood damage	High, situated in the middle of the floodplain. High risk of outflanking, from aerial photography it is clear that the river channel has migrated in the past, just upstream of the site. Access to the site would not be possible during a flood due to the very wide and flat floodplain.

Due to non-compliance with evaluation criteria (2), (3), (4), (5), (10) and (13) this site was not regarded as suitable.

9.3.1.3 Boschkop Lower Site and Vlieëpoort Upper Site

The following two abstraction locations were identified as viable for further consideration during the pre-feasibility stage of the project (see **Figure 13**):

- Boschkop Lower Site on the farm Boschkop 138 JQ (25°05’37.3’’S, 27°31’54.0’’E); and
- Vlieëpoort Upper Site on the farm Mooivalei 342 KQ (24°38’00.80”S, 27°18’59.63”E).

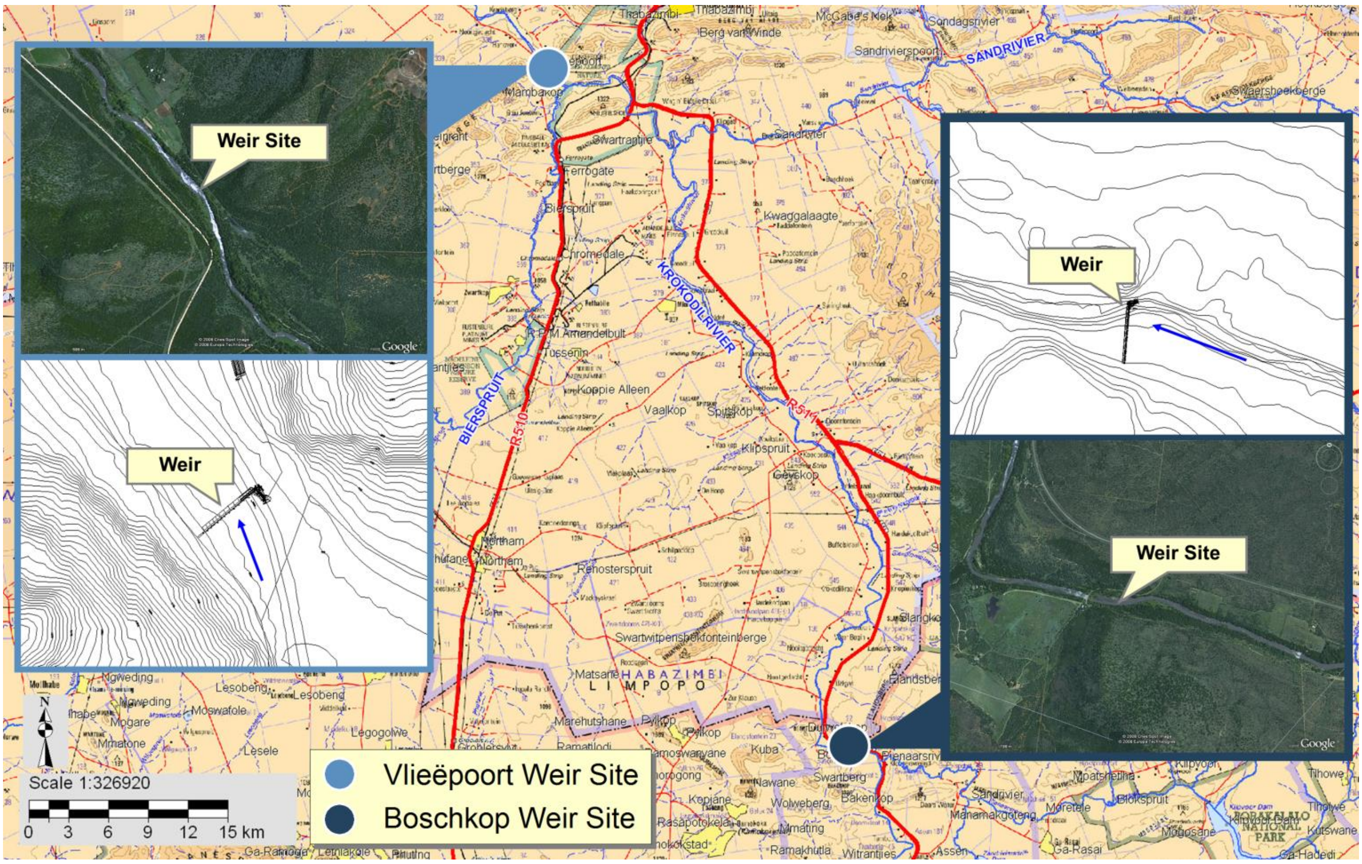


Figure 13: **Boschkop Lower Site and Vlieëpoort Weir Sites**

The choice of abstraction point was largely determined by the extent of river losses and additional costs associated with river management actions between the abovementioned two abstraction sites, as well as the need for and benefit of implementing a phased approach to deliver water to the end users. Based on these criteria, the Vlieëpoort site is regarded as the preferred option due to the following:

- More favourable topographical conditions;
- Shorter rising main to BPR; and
- Better founding conditions.

9.3.1.4 Vlieëpoort Abstraction Weir

Layout

Refer to **Figure 14** and **Figure 15** for photographs of the proposed site for the Vlieëpoort abstraction weir and a general layout, respectively.

Figure 14: Upstream (top) and downstream (bottom) view at Vlieëpoort weir site

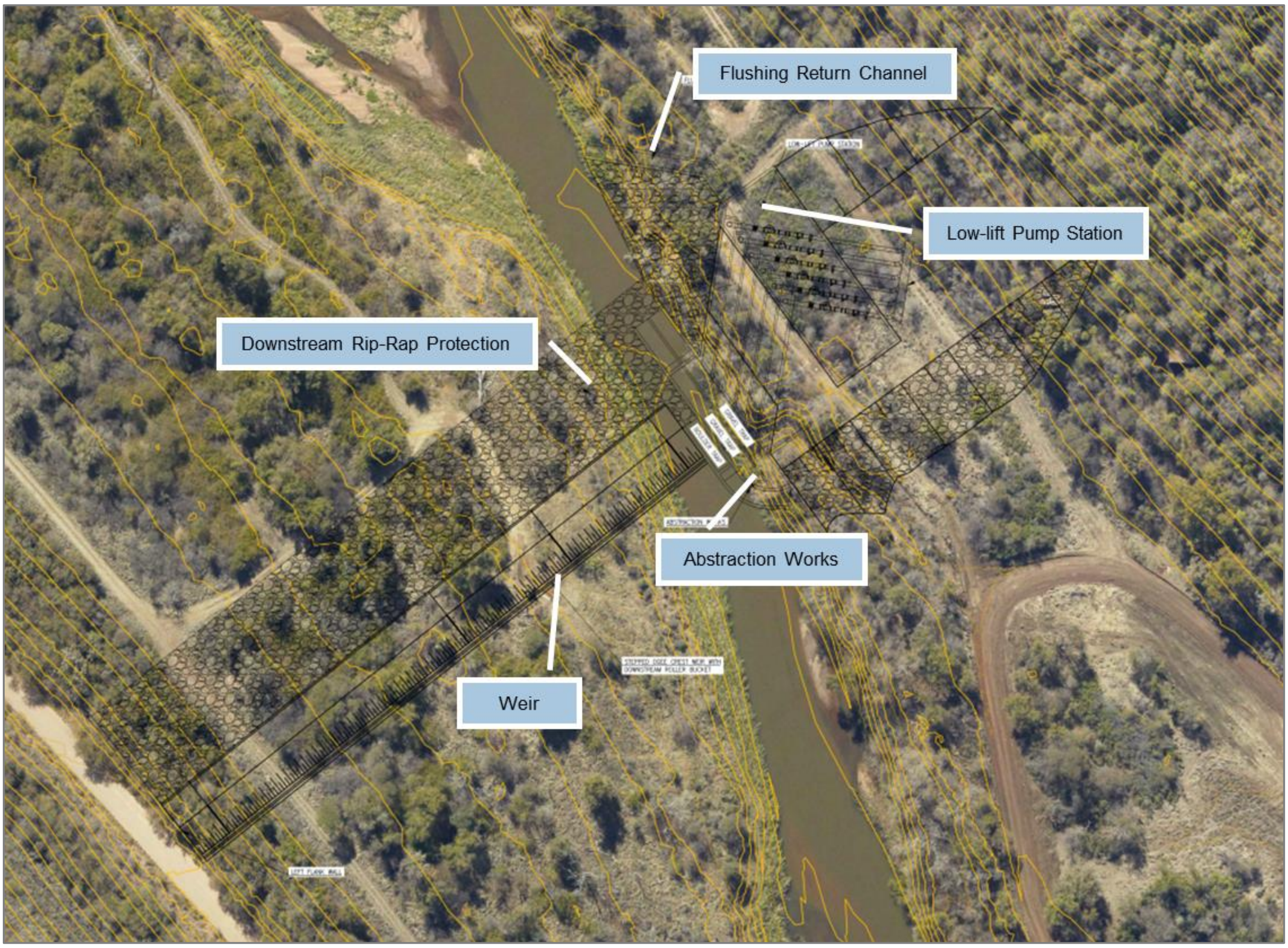


Figure 15: General layout - Vlieëpoort weir

Description

Refer to the drawing for the Vlieëpoort abstraction weir contained in **Appendix H**. Pertinent sizing data for the Vlieëpoort River Abstraction Works are summarised below.

Table 15: Vlieëpoort abstraction weir design and sizing data

No.	Design Data	Value
1	Recommended Design Flood (RDF) (1:200 year Recurrence Interval Flood)	5 740 m^3/s
2	Safety Evaluation Flood (SEF) (PMF)	11 180 m^3/s
3	1:20 year Recurrence Interval Flood	2 870 m^3/s
4	1:50 year Recurrence Interval Flood	4 020 m^3/s
5	River bed Level	890.0 masl
6	Lowest OC Level	893.2 masl
7	Non-overspill Crest (NOC) Level (PMF plus 0.5m Freeboard).	912.8 masl
8	Overspill Crest (OC) Length	153m
9	Total Length of Structure	308m

The Vlieëpoort abstraction weir has a significant hazard rating and can be classified as category II structure based on the Regulations Regarding the Safety of Dams in terms of Section 123(1) of the NWA. The Recommended Design Discharge (RDD) for the weir is the 1:100 year flood and the Safety Evaluation Discharge (SED) the Regional Maximum Flood (RMF). Due to the economic importance of the project however, it was decided that the all electrical equipment and access to the sites be located above the PMF level.

The lowest part of Vlieëpoort abstraction weir would be about 4 - 6m high, depending on the number of pump bays and will be located nearest to the low-lift pumping station. The mass concrete weir structure's height gradually increases towards the left bank (looking downstream) following the original ground level to a level above the PMF flood level in order to prevent outflanking. A concrete roller bucket energy dissipation structure may be required just downstream of the weir.

Initial geotechnical investigations indicate that significant work will be required to prepare the foundation for the weir. Foundation work must be deep enough to prevent seepage and piping underneath the weir.

The Vlieëpoort abstraction weir is not designed for storage and it is assumed it will silt up. Sedimentation will however not affect the abstraction works.

The areas immediately upstream and downstream of the Vlieëpoort abstraction weir will be cleared and suitable erosion protection measures such as grassing and rip-rap will be applied. The existing gravel road (D727) on the left bank will need to be raised locally at the weir.

The Vlieëpoort abstraction weir will make provision for a gauging facility to monitor flows downstream of the abstraction works.

The methodology for the construction of the abstraction weir will be as follows:

- River diversion works;
- Clear and grub, remove and stockpile topsoil;
- Excavate using heavy equipment to foundation level;
- Foundation construction;
- Construction of mass and reinforced concrete structures;
- Backfill excavations;
- Place rip-rap and other erosion protection measures; and
- Reinstate and rehabilitate all disturbed areas.

Pictures during the construction phase of a similar weir structure are provided in the figures to follow.

Figure 16: **Example of site clearance and earthworks in progress (weir on Ash River)**

Figure 17: **Example of construction of mass concrete weir structure (on Ash River)**

Figure 18: **Example of downstream rip-rap protection placement (weir on Ash River)**

Figure 19: Example of weir structure (on Ash River) soon after completion

9.3.1.5 Flood Hydrology

A HEC-RAS model of the Crocodile River (West) was set up to determine the flood levels in the Crocodile River. The model was also used to determine and check the impact of the proposed Abstraction Works on flood levels and on infrastructure up- and downstream of the Works. The calculated flood levels are summarised in **Table 16** below. The calculated flood lines are shown in the drawings contained in **Appendix H**.

Table 16: Crocodile River Flood Levels

Flood Event	Flow rate (m^3/s)	Flood level at Weir (masl)	Flood level at Balancing Dams (masl)
1:100	4995	908.54	904.39
1:200	5741	909.10	904.73
RMF	7456	910.26	905.42
PMF	10789	912.01	906.59

The model was also used to determine the impact of the proposed abstraction weir on existing upstream infrastructure, specifically a low level mine haul road and railway bridge crossing the river some 7,5km upstream of the proposed weir. The baseline model shows that the existing haul road bridge currently overtops at flow rates exceeding 130 m^3/s. The proposed weir has the effect of reducing the flow rate to 90 m^3/s at which the road bridge will overtop. This is a significant effect and will increase the frequency at which the road is not usable and further investigation is required to determine a suitable solution (as required) as the mine is being closed. The effect on the railway bridge is insignificant. The model indicated that the railway bridge will overtop between 4 000 and 4 100 m^3/s with or without the proposed weir. These and other matters within the weir basin will be dealt with when the land is acquired in terms of the Expropriation Act for the construction of the abstraction weir including the impoundment up to the 1:100 year flood level and a buffer zone in accordance with DWS policy.

9.3.2 River Abstraction (Low-lift) Pumping station

The low-lift pumping station building will be in concrete, about 25 m high and will be situated on the eastern bank of the river. The structure will be approximately 70 m long parallel to the right river bank, and will extend approximately 25 m into the right bank.

A gravel trap, which is a low side weir, will be constructed in front of the pump wells. This gravel trap will allow coarser gravel particles to settle out before water reaches the low-lift pumps. The top of the gravel trap wall is below the lowest overspill crest of the weir. A radial gate is installed at the downstream end of the trap. The trap will be flushed from time to time back into the river downstream of the weir.

The low-lift pumping station is divided into several (8 – 10) separate pumping bays. The inlet openings will be covered by trash racks to prevent debris from entering the pumps. A trash rack cleaning mechanism will be provided as cleaning will be required regularly. Larger debris, such as tree stumps, is expected to flow over the weir structure. Some silt and sand build-up is expected in the pumping bays. Each bay will be provided with a sluice gate on the downstream end to allow for flushing when required. The sluice gate discharges into a flushing channel which will direct the flushing water and silt back to the river. Flushing the bays regularly will ensure that the silt concentration is low and will not have a major impact on the silt load in the river. Flushing should ideally be done during minor flood events when the silt load in the river is already high.

Electrical supply to the site will be in the form of overhead cables to a switchyard, which will be situated sufficiently close to the pumping station. Further distribution may be overhead power lines or underground cabling. A separate application will be submitted by Eskom to seek approval for the bulk power required for MCWAP-2A.

An earthfill embankment with a crest level above the PMF level will connect the structure to the right bank and prevent outflanking of the structure during large floods. Appropriate erosion and flood protection measures such as riprap on the slopes of the embankment may be required. The embankment will provide access to the low-lift pumping station. The resulting flood lines will be checked during detail design. The aim is to minimise the upstream impacts and the embankment may be replaced with a bridge structure.

Where founding on rock is not possible, jet-grouting or other suitable methods will be applied to provide a sufficient foundation.

The methodology for the construction of the low-lift pumping station is as follows:
- Clear and grub, remove and stockpile topsoil;
- Excavate using heavy equipment to foundation level;
- Jet-grout rig to construct grouted curtain walls below the foundation level;
- Construction of mass and reinforced concrete structures;
- Backfill excavations;

- Construction of flank embankment;
- Place rip-rap and other erosion protection measures;
- Installation of mechanical and electrical equipment; and
- Replace topsoil, landscape and grass all disturbed areas.

Refer to **Figure 20** for photographs of an example of a Low-Lift Pumping station.

Figure 20: Example of Low-Lift Pumping station (Lower Thukela abstraction weir)

9.3.3 *Low-lift Rising Main*

The layout of the low-lift rising main route options from the low-lift pumping station to the high-lift pumping station is shown in **Figure 21**. The pipeline specifications are similar to what are provided in **Table 20**. The methodology for the installation of the pipeline is similar to what is explained in **Section 9.4.4**.

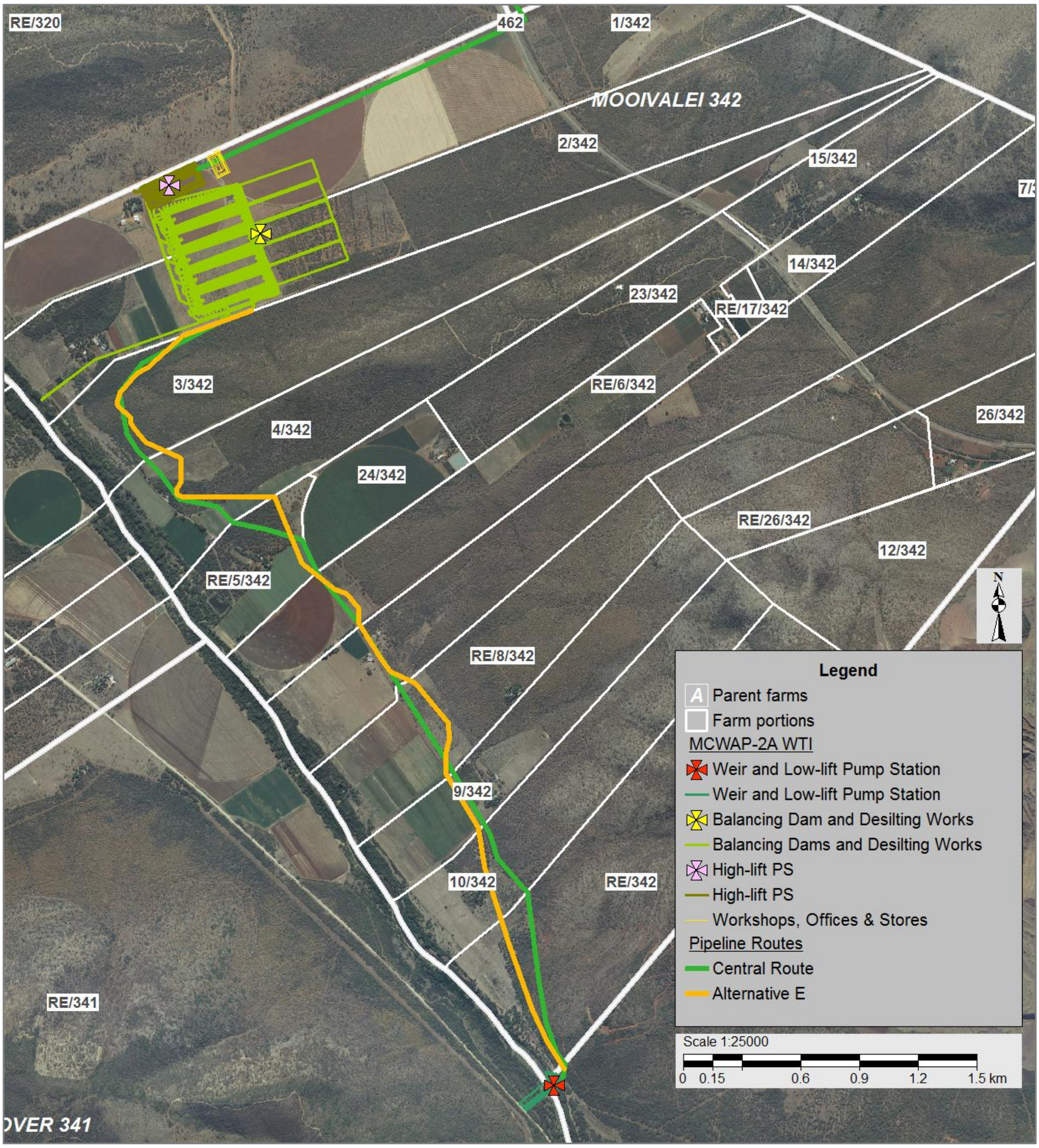


Figure 21: Rising main route options (Central Route and Alternative E) in Mooivallei area

Alternative – Central Route

From the low-lift pumping station the Central Route follows the alignment of a gravel road (see **Figure 22**), in a north-westerly direction. The following properties are crossed by this route:

- Portion 10 of the Farm Donkerpoort 344 KQ - ±70m
- Remainder of the Farm Mooivalei 342 KQ - ± 900m;
- Portion 10 of the Farm Mooivalei 342 KQ - ± 415m;
- Portion 9 of the Farm Mooivalei 342 KQ - ± 309m;
- Portion 8 of the Farm Mooivalei 342 KQ - ± 508m; and
- Portion 7 of the Farm Mooivalei 342 KQ - ± 360m.

Figure 22: Views along gravel road at Mooivallei Farms

Thereafter the pipeline deviates from the gravel road to continue in a predominantly north-western direction. The route traverses the following properties:

- Portion 6 of the Farm Mooivalei 342 KQ - ± 350m;
- Portion 24 of the Farm Mooivalei 342 KQ - ± 108m;
- Portion 5 of the Farm Mooivalei 342 KQ - ± 423m; and
- Portion 4 of the Farm Mooivalei 342 KQ - ± 567m.

The pipeline travels for ± 1 180m on Portion 3 of the Farm Mooivalei 342 KQ, initially following a north-western direction and then turning north-eastwards, before it reaches the desilting works on Portion 2 of the Farm Mooivalei 342 KQ.

Alternative E

Based on comments received during the Scoping phase, a new pipeline route alternative was identified by the IAPs in the Mooivallei area, namely Alternative E. Alternative E follows a predominantly north-westerly direction, traversing the following properties:

- Remainder of the Farm Mooivalei 342 KQ - ± 800m;
- Portion 10 of the Farm Mooivalei 342 KQ - ± 460m;
- Portion 9 of the Farm Mooivalei 342 KQ - ± 310m;
- Portion 8 of the Farm Mooivalei 342 KQ - ± 570m;
- Portion 7 of the Farm Mooivalei 342 KQ - ± 380m.
- Portion 6 of the Farm Mooivalei 342 KQ - ± 380m;
- Portion 5 of the Farm Mooivalei 342 KQ - ± 470m;
- Portion 4 of the Farm Mooivalei 342 KQ - ± 760m; and
- Portion 3 of the Farm Mooivalei 342 KQ - ± 1 200m.

9.3.4 Desilting Works

9.3.4.1 Description

The desilting works with flushing facility will be located adjacent to the balancing dam within the earthfill embankment. The desilting works will consist of at least eight 120 m long concrete channels, typically 2,5 m wide with a depth varying from 4,0 m to 5,5 m and will protrude about 1 – 2 m above the top of the balancing reservoir embankment. The outlet of each channel combines into a channel, feeding a steel gravity fed pipe to the balancing reservoir inlet works.

The layout of the desilting works is shown in **Figure 23** (drawing provided in **Appendix H**).

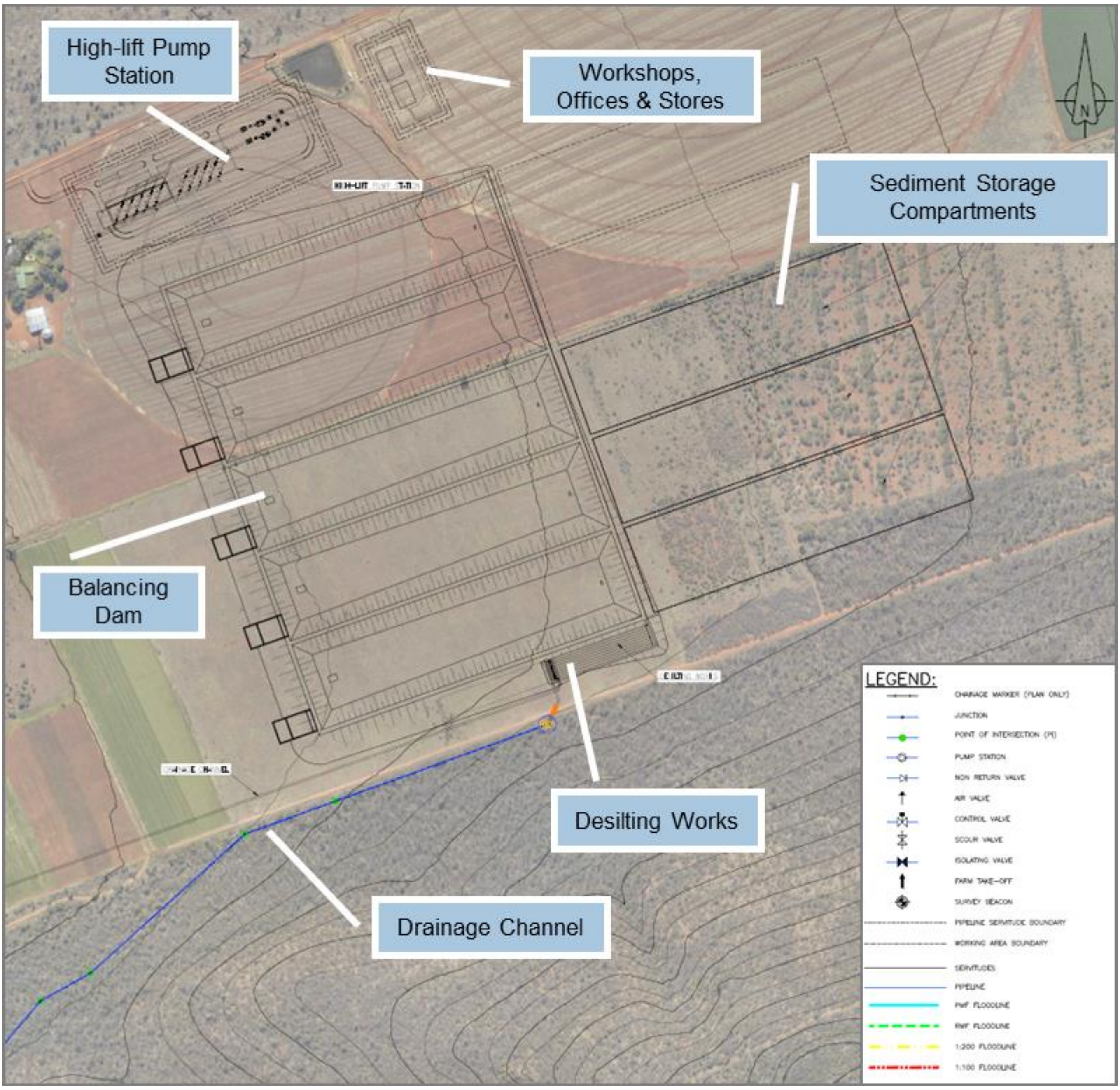


Figure 23: General layout – balancing dam, desilting works and high-lift pumping station

The flushing facility will flush to a silt settling pond. The pond will allow the silt in the flushing water to settle out, and clear water will leave the pond and return to the Crocodile River via a suitable river return conduit and outlet structure with erosion protection works. This return conduit will be combined with the reservoir spillway collector.

The structure will be constructed using the following methodology:

- Clear and grub, remove and stockpile topsoil;
- Excavate or build fill using heavy equipment to foundation level;
- Cast reinforced concrete structures;

- Install the inlet manifold and outlet pipes inside the balancing reservoir embankments with concrete valve and access chambers;
- Complete fill around structures and pipework;
- Install mechanical (sluice gates, valves etc.) and electrical equipment; and
- Replace topsoil, landscape and grass all disturbed areas and embankment/cut slopes.

Refer to the pictures to follow for similar type infrastructure.

Figure 24: Lebalelo Weir Desilting Works (example)

Figure 25: View towards inlet end of Lebalelo Weir Desilting Works (example)

Figure 26: View of inside of channel at Lebalelo Weir Desilting Works (example)

Figure 27: River return channel at Lebalelo Weir Desilting Works (example)

9.3.4.2 Sediment Management

The bulk water transfer process requires careful management of the dynamic sediment load conditions in the Crocodile River (West) system. The sediment load during base flow or low flow conditions are insignificant. This was verified by actual sampling during base flow conditions over the last 5 years by the project's technical team. The bulk of the annual expected sediment load is transported during flood events. The option exists to limit water abstraction during the rising stages of floods to reduce the volume of abstracted suspended sediment. However, for the purpose of reviewing the potential impact of a desilting facility, it was conservatively assumed that pumping will continue during floods.

The annual sediment load consists largely of natural soil particles classified as having a gravel fraction, a sand fraction, a silt fraction and a clay fraction based on the particle size distribution. Sediment will deposit upstream of the proposed abstraction weir. The sediment will thus be effectively stored in the river. When abstracting water for MCWAP-2A, up to 4% of the sediment load that is in suspension will be abstracted as well. When scouring the approach channels of the proposed abstraction works, some of the sand and gravel fraction deposits will be washed down stream. It is important to maintain a holistic view of all the sediment interfacing processes associated with the MCWAP-2A infrastructure.

The up to 4% of the sediment load that is abstracted in suspension is foreseen to require the following management interventions:

1) The volume of fine sand and silt fraction entering the balancing dams at the high-lift pumping station needs to be limited. This is done using a proposed desilting facility. Should this not be done an additional silt storage facility will be required. (Approximately 400 000 m^3 over a projected 50 year period);
2) Introducing a desilting facility upstream of the balancing dams at the high-lift pumping station will remove on average 15 000 t of fine sand and silt annually. It also means that annually 15 000 t of sediment needs to be scoured back to the river;
3) The desilting facility has a capacity of approximately 10 000 m^3. As mentioned, the proposed facility consists of eight channels of 120 m long 2, 5 m wide and between 4 and 5,5 m deep. Six of the channels provide sufficient silt storage capacity to allow a single scouring operation annually. The scouring process is flood event driven;
4) Provision is made in the balancing dams to permanently store approximately 5 000 t of sediment per annum; and
5) Allowance is also made to pump approximately 2 000 t of sediment in suspension (clay fraction) annually.

An analysis was undertaken to establish a quality profile of the silt to be abstracted from the Crocodile River. A copy of the analysis is contained in **Appendix J**. The test results for heavy metals were found to be well within allowable limits in terms of the following:

- Netherlands National Institute of Public Health and the Environment;
- South African Water Quality Guidelines (Irrigation); and
- Waste Discharge Standards (DWA 2010 Guidelines).

An important factor to bear in mind is that the abstracted suspended sediment is less than 4% of total average annual sediment load in the river and that only up to 2% is planned to be returned. In addition, it is understood that the chemical characteristics of sediment in river are the same as for the sediment to be returned.

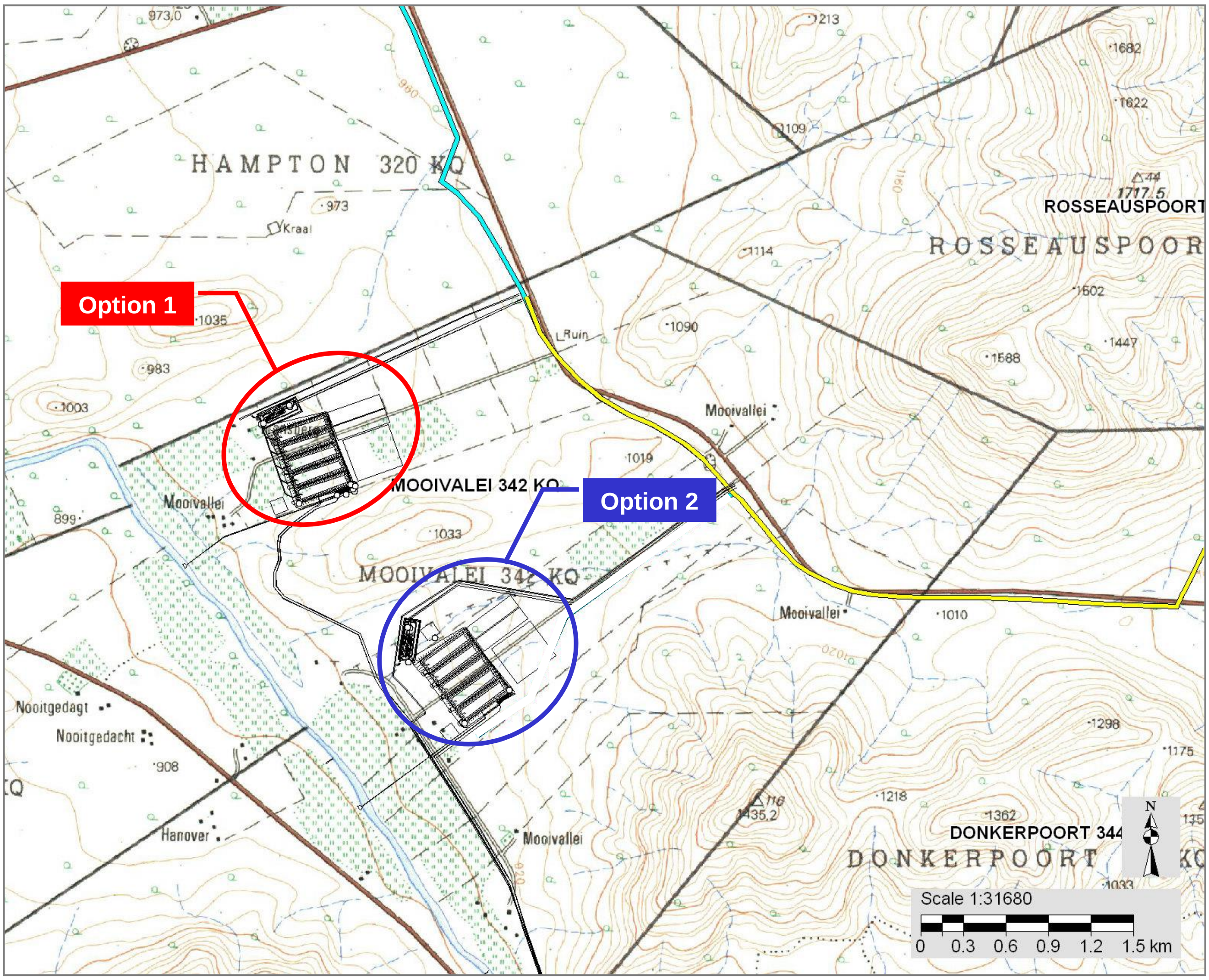
DEA confirmed in writing on 12 April 2016 (refer to letter contained in **Appendix F**) that there is no need for a Waste Management Licence for the scouring of the sediment back to the Crocodile River.

9.3.5 <u>Balancing Dam</u>

<u>Alternatives</u>

The following alternative sites were initially identified for the proposed balancing dam (see **Figure 28**):

- **Option 1:** Portions 1 and 2 of the Farm Mooivalei 342 KQ; and
- **Option 2:** Portions 5, 6, 7 and 23 of the Farm Mooivalei 342 KQ.



<u>Figure 28:</u> **Potential alternative sites for balancing dam**

Option 2 was discarded due to geotechnical constraints (unfavourable dolomitic conditions) associated with the underlying geology of the site.

Description

The balancing dam (or reservoir) will be in the form of an artificial dam formed by shallow excavation and surrounding earthfill embankments (see examples in **Figures 29** and **30**). The footprint area of the reservoir including the desilting works is expected to be approximately 620 m x 440 m. The reservoir will be divided into 5 compartments, each with top dimensions of approximately 400 m x 100 m. The depth varies from 13,0 m at the inlet side to 10,5 m at the outlet side.

An outlet structure from each compartment connects to the intake manifold of the high-lift pumping station. Each compartment will require a 25 m wide concrete spillway which discharges into collector which will return any spilled water to the river. An erosion protected outlet structure will be provided where the water is discharged into the river.

The balancing dam will also be equipped with a silt flushing facility although only infrequent use, perhaps once every 10 years, is expected. The silt settling pond provided as part of the desilting works will also be used to separate the silt and the water flushed from the dam.

The reservoir will be lined with an appropriate waterproof lining (HDPE or similar material). Should the reservoir be located on dolomite, additional measures to prevent leakage include a double waterproof liner with a leakage detection system.

The embankment facing the river will be approximately 15 m high, gradually decreasing in height as the dam extends up the hill. All embankment and cut slopes will be grassed.

The layout of the balancing dam is shown in **Figure 23** (drawing provided in **Appendix H**).

The structure will be constructed using the following methodology:

- Clear and grub, remove and stockpile topsoil;
- Excavate using heavy equipment to foundation level;
- Construct earthfill embankments;
- Construct reinforced and mass concrete structures;
- Apply lining system;
- Lay required pipework;
- Backfill excavations; and
- Replace topsoil, landscape and grass all disturbed areas.

See examples of similar infrastructure in the figures to follow.

Figure 29: A long-distance view of the balancing reservoirs at Lebalelo Weir (example)

Figure 30: A close-up view of one compartment at Lebalelo Weir (example)

9.3.6 High-lift Pumping station

The high-lift pumping station will be located adjacent to the balancing dam. Footprint area of the pumping station will be approximately 120 m x 300 m, with a height of 13,5 m. The pumping station will be a reinforced concrete, masonry and steel frame structure. Other structures located within the pumping station area will include a guardhouse, electrical building, various reinforced concrete valve chambers, stores and maintenance facilities. The area perimeter will be secured by security fencing.

The pumping station will be designed to deliver water at a wide range of flows at high efficiency by means of variable speed drives (VSDs). All pumps will be controlled via a Programmable Logic Controller (PLC) from either locally or from the control centre.

The pumping station superstructure will be designed such that noise from the machines is dissipated within the structure. Facade detailing will be such that the structure blends as well as possible with the natural environment.

A drawing of the high-lift pumping station is provided in **Appendix H**. Pictures during the construction phase of a similar pumping station are provided below.

Figure 31: Excavation (left) and foundation (right) for a High-lift Pumping station (example)

Figure 32: Steelwork and completed structure for a High-lift Pumping station (example)

9.3.7 General

- Site accommodation for abstraction works – the intention is to not provide any accommodation for operations and Maintenance staff on site. However, overnight accommodation would have to be provided for security staff (3 shifts) to protect the Key National Point. Alternative accommodation (e.g. in Thabazimbi) will be sought.

- The contractor will require areas for site establishment such as offices and stores. Two areas will be required, one at the abstraction weir site and one at the balancing dam site.
- The low-lift pumping station as well as the balancing dam, desilting works and high-lift pumping station will be manned 24 hours a day, 7 days a week by both security personnel and operators.
- All structures will be fenced off (except the pipelines) with a permanent security fence.
- All relevant structures will be provided with hand rails and other safety measures as required to ensure the safety of all personnel.
- Access to the site will be provided by a new access road which will follow the existing access roads as far as possible. The existing alignment will need to be diverted around the balancing dam and high-lift pumping station. It will then again follow the existing alignment of the access road to the farms of Mooivallei. An additional section of about 1,5 km of road will be required along the low pressure pipeline to the low-lift pumping station from where the existing road ends.

9.3.8 Operation and Maintenance

Since it is planned that both transfer systems, i.e. MCWAP-1 (Mokolo Dam) and MCWAP-2A (Crocodile River), will be managed by the same MCWAP Scheme Management Authority (SMA), it is proposed that both the transfer schemes are controlled and managed from one operational control centre.

The following operational functions will be performed at the Phase 2 abstraction works, desilting works and balancing dam:

1) Abstraction weir -
    - Low flows over the stepped overspill crest of the weir will be measured and become part of the data informing the River Management System. It will also make provision for a gauging facility to monitor flows downstream of the weir. These measures will allow for the monitoring of the flow downstream thereby allowing verification that the minimum downstream water requirements are met;
2) Low-lift pumping station -
    - Monitoring of river releases and flows as provided by the Crocodile (West) River Management Authority (CR CMA);
    - Monitoring of the water level over the abstraction weir;
    - Monitoring of the "general health" of all the mechanical & electrical equipment;
    - Monitoring of all security and control access;
    - Monitoring of the flow out of the low-lift pumping station;
    - Control of gravel trap radial gate and pump bay sluice gates;
    - Control of automatic trash rack cleaning system;

- On/Off control of individual submersible pumps in various configurations to deliver a specific total abstraction rate.

3) Low Pressure Pipeline -
    - Monitor cathodic protection system;
    - Open or close relevant interconnecting valves as may be required.
4) Desilting Works -
    - Monitoring of silt levels;
    - Monitoring of the "general health" of all the mechanical & electrical equipment;
    - Control of inlet manifold valves;
    - Control of outlet sluice gates/valves;
    - Control of flushing sluice gates/valves;
    - Systematic removal or discharge of silt from infrastructure.
5) Balancing Dam -
    - Monitoring of flow into reservoir;
    - Monitoring of flow out of reservoir
    - Monitoring of water levels in all compartments;
    - Monitoring of leakage detection system;
    - Monitoring of all security and control access;
    - Monitoring of the "general health" of all the mechanical & electrical equipment;
    - Control of inlet manifold valves;
    - Control of outlet valves; and
    - Control of silt flushing valves.

9.4 Pipeline

9.4.1 Previous Options Considered

Conveyance Options

The following conveyance options to transfer water from the Crocodile River (West) to the end users were investigated during the MCWAP Pre-Feasibility Study (DWAF, 2008b):

- River conveyance;
- Canal conveyance; and
- Pipeline conveyance.

Due to the high cost and environmental impact of implementing the pipeline conveyance along the full conveyance route, it was decided to do partial conveyance via the Crocodile River (West). Consideration was also given to the technical and environmental feasibility of a canal system. The table to follow summarises the main points considered.

Table 17: Comparison: Pipeline vs. Canal

Pipelines	Canals
1. Requires narrower permanent servitude. 2. Does not require intermediate balancing storage. 3. Can be re-lined after 20 to 30 years without significant implications 4. Pipeline problems can be repaired in relative short periods. 5. Minimal environmental impact during operation.	1. Wide permanent servitude – approximately 40 m. 2. Requires large intermediate balancing storage. 3. Canal must be re-built or replaced with pipeline system when it reaches the end of its useful life. 4. Failure of a canal section in fill can have catastrophic consequences. 5. Major environmental impact. 6. Fragmentation of land. 7. Impacts on water quality 8. Higher maintenance costs.

Taking the above aspects into consideration it was decided not to consider options involving canal conveyance further in the pre-feasibility assessment and that only the pipeline / river conveyance options would be investigated.

Phased Approach

During the Pre-Feasibility Study, the following approach to the transfer scheme was considered:

- Un-phased (full capacity) scheme implemented in a single construction phase with an ultimate net transfer capacity of ± 200 million m^3/a (excluding system losses).
- Phased approach where the capacity is provided through two parallel pipes constructed during two consecutive construction phases.
  - Phase 2A – First phase pipeline from Vlieëpoort weir with a net transfer capacity of 110 million m^3/a; and
  - Phase 2B – Second phase pipeline from Vlieëpoort weir to achieve ultimate required net transfer capacity of ± 200 million m^3/a.

Route Options

The basic options initially considered during the Pre-Feasibility Study to convey water from the Crocodile River (West) to the Terminal Dam / Balancing Reservoir are summarised in **Table 18**.

Table 18: Crocodile River (West) Basic Transfer and Delivery Options

Approach	Phase	Description
Vlieëpoort Weir Abstraction Options		
Un-Phased	2	• Abstraction at Vlieëpoort Weir • Conveyance to Terminal Dam/BPR • Supply end users via the delivery system
Phased	2A	• Abstraction at Vlieëpoort Weir • Conveyance to Terminal Dam/BPR • Supply end users via delivery system
	2B	• Augment transfer capacity from Vlieëpoort Weir with parallel pipeline • Conveyance to Terminal Dam/BPR • Supply end users via delivery system

Approach	Phase	Description
Boschkop Weir Abstraction Options		
Un-Phased	2	• Abstraction at Boschkop Weir • Conveyance to Terminal Dam/BPR • Supply end users via delivery system
Phased	-	• Abstraction at Boschkop Weir • Conveyance to Terminal Dam/BPR • Supply end users via delivery system
	-	• Augment transfer capacity from Boschkop Weir with parallel pipeline • Conveyance to Terminal Dam/BPR • Supply end users via delivery system
Boschkop/Vlieëpoort Weir Abstraction Options		
Phased	2A	• Abstraction at Vlieëpoort Weir • Conveyance to Terminal Dam/BPR • Supply end users via delivery system
	2B	• Augment transfer capacity from Vlieëpoort Weir with parallel pipeline • Conveyance to Terminal Dam/BPR • Supply end users via delivery system
	3	• Abstraction from Boschkop Weir • Conveyance to Vlieëpoort Weir to reduce river losses and transfer further to Terminal Dam/BPR

Another option that was considered during the Reconnaissance Study entailed a transfer from Boschkop to Mokolo River which would discharge into the headwaters of the river upstream of Mokolo Dam. This option was discarded due to undesirable water quality impacts, where the transferred water is of poorer quality than that of the Mokolo River.

Alternative pipeline routes were identified in accordance with the above basic options. The following aspects were considered in defining and evaluating the different pipeline routes:

- Possible abstraction and delivery locations;
- Existing roads, as well as boundaries between land owners along the routes;
- Historical and planned future mining activities in the area;
- Existing and planned future services and infrastructure;
- Site constraints, potential river/stream crossings, and road and railway crossings;
- Geotechnical conditions based on a high level geotechnical screening;
- Cathodic protection requirements with special consideration of the impact that the potential future 765 kV overhead power line corridors might have on the AC mitigation requirements;
- Environmental overview; and
- Social impact of the proposed pipe route

Based on the two abstraction weir sites (Boschkop and Vlieëpoort), water from the Crocodile River (West) can be delivered along alternative route(s) to either one of the two identified Terminal Dam sites (Sites 1 or 3), or via a break pressure balancing reservoir (24 hour storage) to Terminal Reservoirs at the major consumer sites. **Figure 33** is a schematic diagram of the alternative pipeline route options and system nodes that were initially considered.

A total of 8 route options were investigated at pre-feasibility level. Geotechnical, cathodic protection, environmental and social reviews were undertaken for each of the routes and considered in the selection of the preferred alignment (i.e. Central Route with pipe sections 24, 7, 19, 18, 16 and 31).

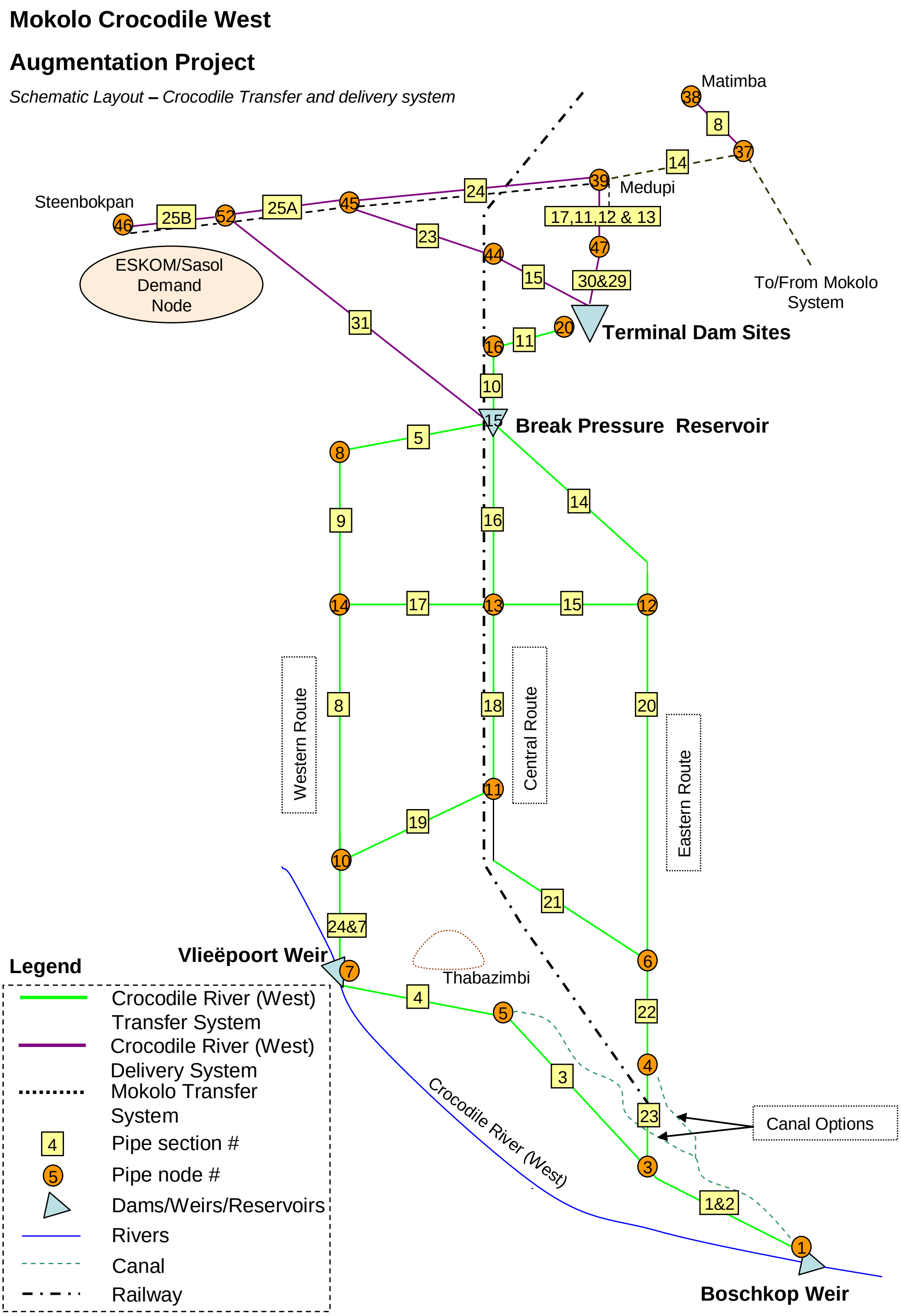


Figure 33: Schematic diagram of Crocodile River (West) transfer and delivery system

Three basic operational configurations of the Central Route Alternative rising and gravity main and reservoirs were considered. These are described below.

Central Route Alternative 1 – Configuration 1a (see Figure 34):

Pumping station and rising main via the **Central Route**. Pump from Vlieëpoort Weir via the balancing dam to a BPR at chainage 32000 (PI 48). The BPR was sized for 4 hours of storage (at peak flow). From the BPR water flow under gravity to the OR, sized to provide 8 hours storage. The flow is distributed from the OR under gravity to the end user Terminal Reservoirs (TR).

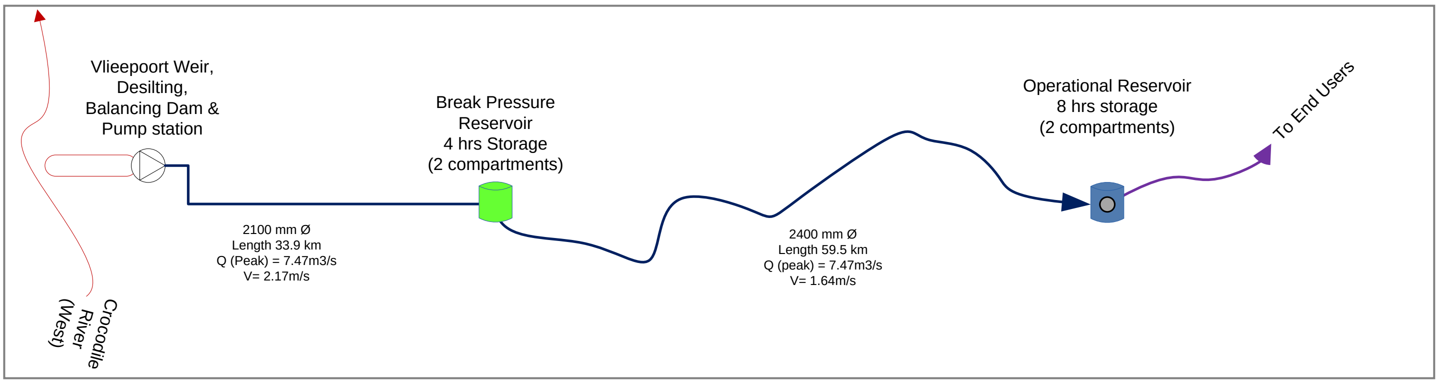


Figure 34: Schematic diagram of Central Route Alternative 1 – Configuration 1a (Q = flow in m^3/s; V = flow velocity in m/s)

Central Route Alternative 2 – Configuration 1b (see Figure 35):

Pumping station and rising main via **Central Route**. Pumping from Vlieëpoort Weir via the balancing dam directly to the OR. A 20 Ml Surge Reservoir (SR) is required at chainage 32000 (PI 48). The flow is distributed from the OR under gravity, to the end user's TR.

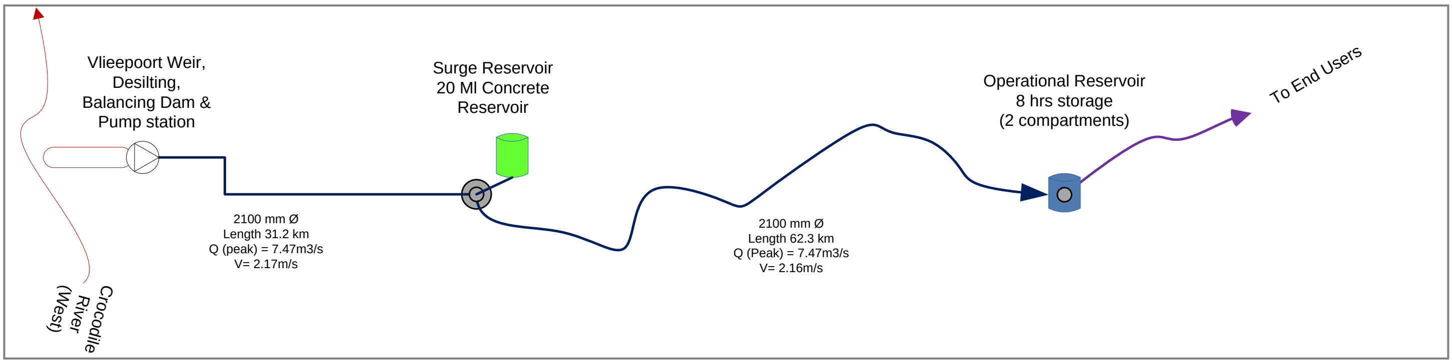


Figure 35: Schematic diagram of Central Route Alternative 2 – Configuration 1b (Q = flow in m^3/s; V = flow velocity in m/s)

Central Route Alternative 3 – Configuration 2b (see Figure 36):

This scenario is similar to Scenario 1b, however it follows **alternative route 1** towards the west from Vlieëpoort Weir to the OR. A 20 Ml SR is included at chainage 42000 (PI 38) on alternative route 1.

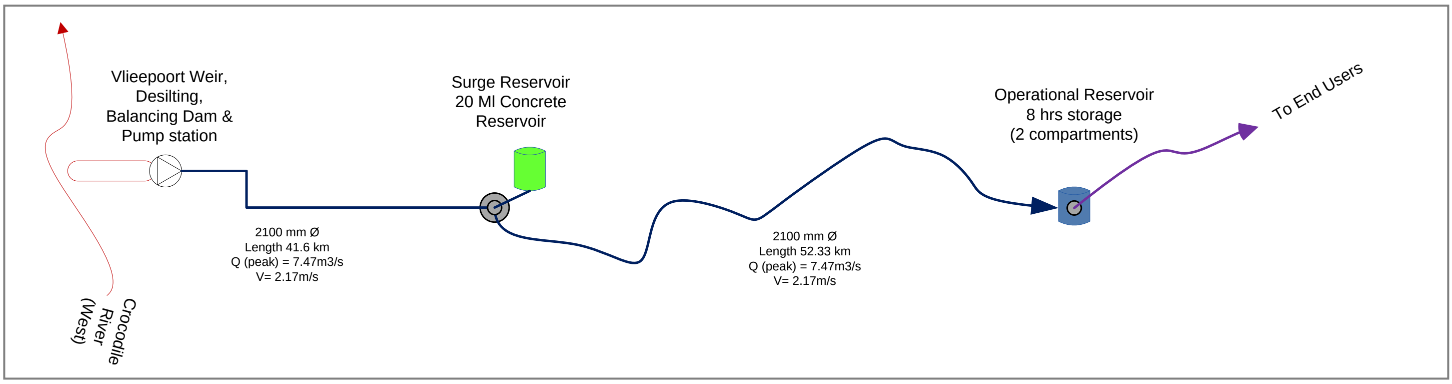


Figure 36: **Schematic diagram of Central Route Alternative 2 – Configuration 1b (Q = flow in m^3/s; V = flow velocity in m/s)**

Configuration 1a was recommended for implementation by the MCWAP Technical Team for the following reasons:

- Minor difference in the total life cycle cost compared to scenario 1b. This difference will be reduced further if the price of steel pipes reduces.
- Due to the flat Hydraulic Gradient Line (HGL) during low flow conditions, a BPR must be provided in the vicinity of chainage 32000m for operational reasons to prevent negative pressures in the pipeline.
- Significant advantages can be gained by reducing the length of the rising main and avoid 'downhill pumping', thereby improving the operational control of the system.
- Easier future upgrade capability to increase the capacity of the system in order to achieve up to 50% more throughput.

Options assessed as part of previous EIA

During public participation as part of the previous EIA for MCWAP (Phase 2) (refer to **Section 6.1**) and the broader Public Involvement Process, several additional alternative routes were identified through comments received from IAPs.

These routes are compared to the routes that are being assessed under the current EIA for MCWAP-2A WTI in **Table 19** (shown in **Figure 37**). As presented in the aforementioned table, the main change in terms of the routes that are currently being assessed is the discarding of the Regorogile Township Alternative (Alternatives C, C1, C2, C3 and E) due to the reasons presented. The alternative routes to the Central Route are also differently named to logically distinguish between the options.

Table 19: Status of pipeline routes assessed as part of previous EIA

Pipeline Routes – previous EIA	Pipeline Routes – current EIA	Comments
Transfer System - Vlieëpoort Abstraction Site to OR		
Alternative – Central Route	Unchanged	
Alternative A	Alternative A1	Name changed.
Alternative B	Alternative A2	Name changed.
Alternatives C, C1, C2, & C3	Discarded	• Geotechnical constraints. • Difficult conditions for construction in the densely populated built up area of the Regorogile Township. • Potentially insufficient quantities of borrow material along route. • Regorogile Township Alternative may take comparatively 11% longer. • Special surge mitigation measures will have to be installed on the Regorogile Township Alternative at the peak of the first ridge. • Potential occurrence of Red Data species may be present on the mountain slope south of Regorogile Township. • The social risk of flooding and catastrophic damage to houses due to a pipe failure in the Regorogile Township is considered to be high. • Security and vandalism of the pipeline and fittings in the areas adjacent to the Regorogile Township is considered to be a high risk. • Attempts at illegal connections may be fatal.
Alternative D	Alternative C	Name changed.
Alternative E	Discarded	Linked to Regorogile Township Alternative.
Alternative I	Alternative B	Route discarded as part of the Feasibly Study.
Alternative – Central Route (low-lift rising main)	Alternative E	New route identified in Mooivallei area based on outcomes of Scoping phase.
Delivery System - OR to Terminal Point		
Alternative F	Alternatives D1 & D4	Name changed.
Alternative G	Alternative D2	Name changed.
Alternative H	Alternative D3	Name changed.

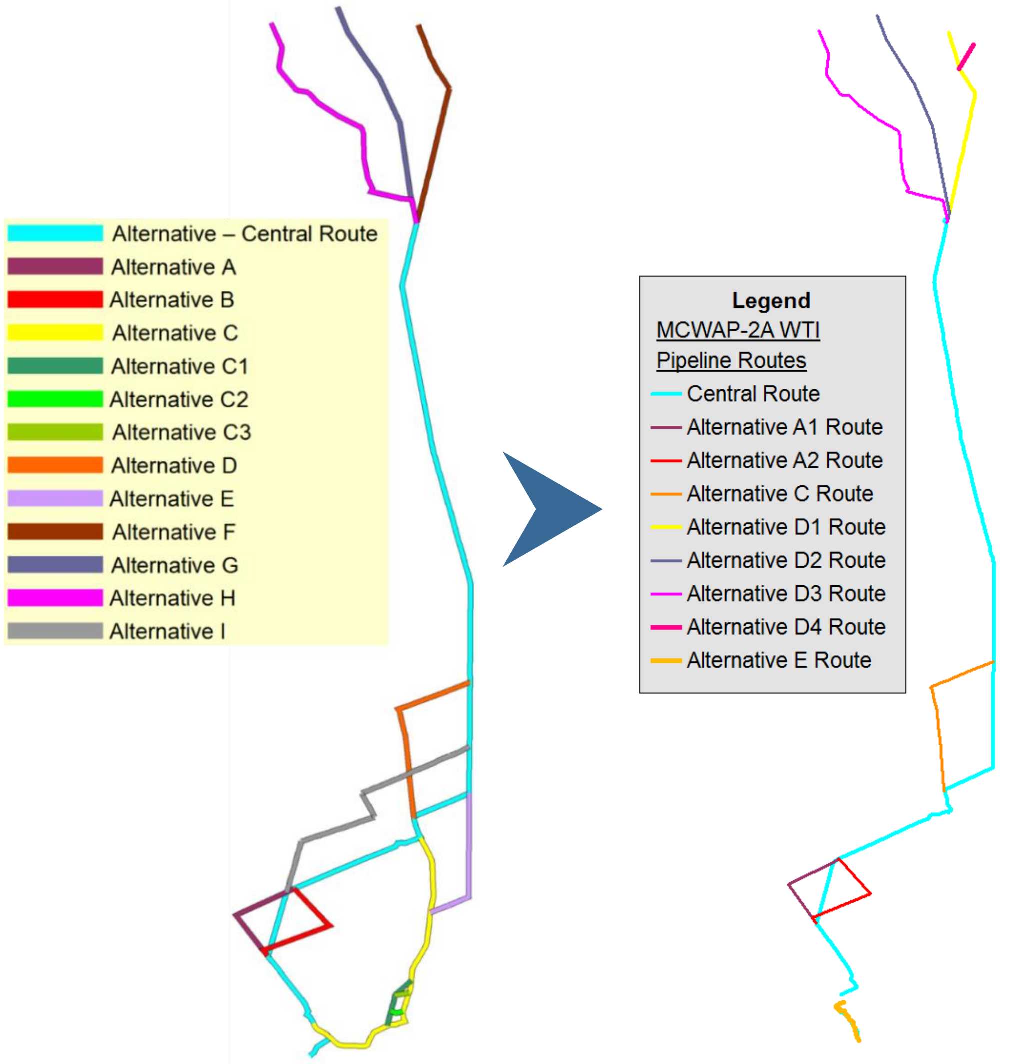


Figure 37: Pipelines routes – previous EIA (left) and current EIA (right)

9.4.2 *Pipeline Specifications*

The pipeline specifications are provided in **Table 20**.

Table 20: Pipeline specifications

Pipe diameter	Up to 2400 mm
Pipe material	Steel pipes with welded joints.
Installation	• Underground, with a minimum cover above the pipe of 1,0 m. • Access/valve chambers will be located at approximately 500 m intervals along the route. It will be concrete structures protruding slightly above natural ground level.
Servitude Width	Typically 40 m during construction (temporary) (see **Figure 38**) and 25 m permanent.
Servitude Conditions	• Permanent access to the pipeline servitude will be required after construction. • Pipeline markers (concrete posts) will be installed at changes in direction and at regular intervals along the route. • Farming activities (stock and crop farming) can continue within the servitude area after rehabilitation (between 1 and 2 years after construction), taking cognisance of the need for permanent access to the pipeline servitude.

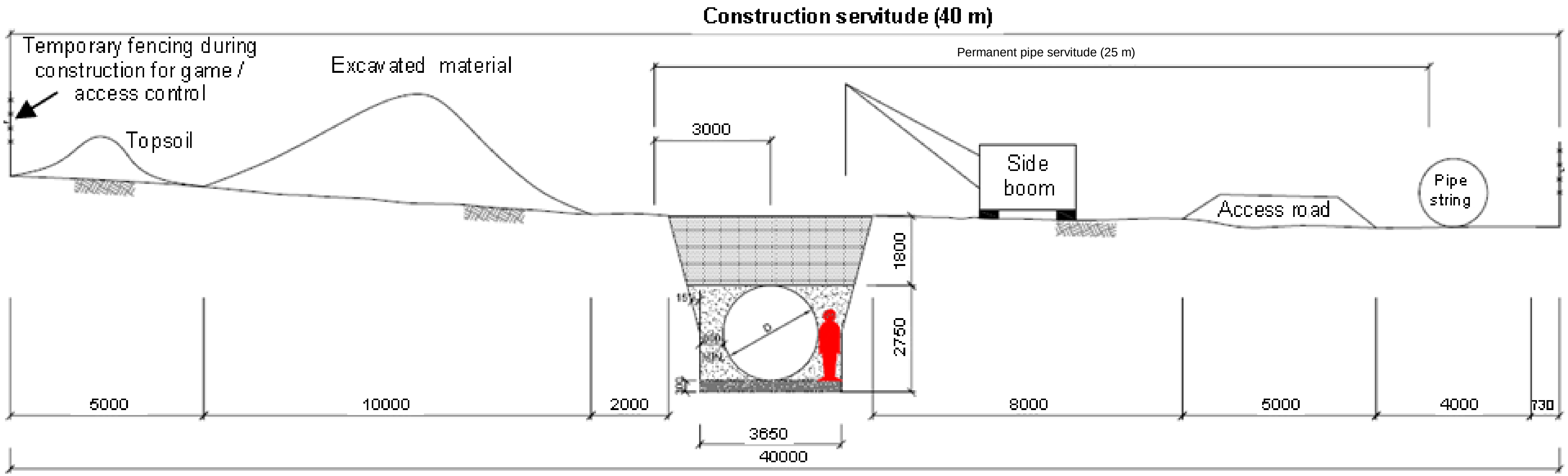


Figure 38: **Typical construction servitude cross-section**

(Note: not specific to MCWAP-2A – merely indicative)

9.4.3 *Pipeline Routing*

The following aspects were considered in defining the MCWAP-2A pipeline alternative routes:

- Abstraction and water supply locations;
- Existing linear infrastructure (e.g. roads, railway line, power lines) as well as boundaries between landowners along the routes;
- Environmental and social impacts of the pipeline location;
- Comments received from IAPs during the public participation process;
- Existing servitudes;
- Historical and planned future mining activities in the area, both sub-surface and open cast;
- Site constraints, potential watercourse crossings, road and railway crossings; and
- Geotechnical overview.

In some instances where the pipeline follows linear infrastructure (e.g. railway line) and between farm boundaries, the exact route still needs to be finalised in terms of which side of the aforementioned features it will run alongside to. The study area for the EIA included a 100 m corridor (i.e. 50m on either side of the centre line) for the pipeline, which allows for possible deviations from the proposed alignment within this corridor (e.g. avoidance of sensitive features, if possible). The comparative analysis of the project's feasible alternatives is included in **Section 14**. Note that it is not possible to locate the pipeline within servitudes or reserves of existing infrastructure, and it will thus need to be constructed on the adjoining private properties.

A coarse overview of the pipeline route options follows. As mentioned, all distances provided should be regarded as approximates, as they are based on a desktop estimate from GIS and 2013 cadastral data. For detailed maps on the pipeline alternative routes, please refer to **Appendix C**.

9.4.3.1 Transfer System - Vlieëpoort Abstraction Site to OR

Low-lift Rising Main

Refer to **Section 9.3.3** for a description of the route options for the low-lift rising main.

Alternative – Central Route

From the high-lift pumping station, the rising main travels in a north-easterly direction on Portion 1 of the Farm Mooivalei 342 KQ for approximately 1,8 km. It then crosses underneath the D1649 and turns north-westerly to follow this road (on the eastern side) for ± 1 km (see **Figure 39**), on the boundary of the Farm Stratford 462 KQ.

The route then turns to follow the Rooibokkraal Road for ± 6,7 km (on eastern side), in a predominantly north-westerly direction along the following properties (see **Figure 40**):

- Stratford 462 KQ (± 1,6 km);
- Meklenberg 311 KQ (± 3,3 km); and

- Portion 1 of the Farm Mecklenburg 310 KQ (±1,9 km).

Figure 39: **View along D1469**

Figure 40: **View along Rooibokkraal Road**

On Portion 1 of the Farm Mecklenburg 310 KQ the Central Route turns north-easterly to follow the existing power line servitude, crossing the following properties (see **Figure 41**):

- Portion 1 of Mecklenburg 310 KQ (± 800 m);
- Portion 7 of the Farm Paarl 124 KQ (± 3 km);
- Portion 6 of the Farm Paarl 124 KQ (± 150 m); and
- Remainder of the Farm Paarl 124 KQ (± 2,2 km).

Figure 41: **View along power line servitude (Portion 1 of the Farm Mecklenburg 310 KQ)**

Thereafter the route bends in a more easterly direction to follow a gravel road that runs between the following properties (see **Figure 42**):

- ❖ Remainder of the Farm Paarl 124 KQ (± 720 m);
- ❖ Buffelsvley 127 KQ (± 7,8 km);
- ❖ Karoobult 126 KQ (± 7 km);
- ❖ Zondagskuil 130 KQ (± 4,9 km); and
- ❖ Portion 1 of the Farm Leeuwbosch 129 KQ (± 3,7 km).

Figure 42: View along gravel road

From the BPR on Portion 1 of the Farm Leeuwbosch 129 KQ the pipeline crosses underneath R510 and turns north-westerly to follow the road (on the eastern side) for ± 2,2 km, along the boundary of Portion 2 of the Farm Diepkuil 135 KQ (see **Figure 43**).

Figure 43: View along R510

The route then turns more easterly to follow a dirt road between the following properties (see **Figure 44**):

- ❖ Portion 2 of the Farm Diepkuil 135 KQ (± 2,4 km);

- Portion 1 of the Farm Tarantaalpan 132 KQ (± 470 m);
- Portion 2 of the Farm Tarantaalpan 132 KQ (± 1,6 km);
- Remainder of the Farm Tarantaalpan 132 KQ (± 3,2 km); and
- Portion 3 of the Farm Diepkuil 135 KQ (± 3 km).

Figure 44: View along dirt road (Portion 2 of the Farm Diepkuil 135 KQ on right)

Thereafter the route follows the railway line (on the western side) for ± 56km, affecting the following properties (see **Figure 45**):

- Remainder of the Farm Blaauwpan 133 KQ (± 4,5 km);
- Portion 6 of the Farm Ruigtevley 97 KQ (± 2,3 km);
- Portion 5 of the Farm Ruigtevley 97 KQ (± 3,8 km);
- Portion 4 of the Farm Witklip 665 KQ (± 4,2 km);
- Portion 37of the Farm Groenrivier 95 KQ (± 1,1 km);
- Matsulan 98 KQ (± 2,8 km);
- Matlabas 94 KQ (± 2,4 km);
- Remainder of Haarlem Oost 51 KQ (± 1,2 km);
- Portion 16 of Haarlem Oost 51 KQ (± 3,9 km);
- Remainder of Grootfontein 50 KQ (± 1,9 km);
- Portion 1 of Grootfontein 50 KQ (± 2 km);
- Portion 1 of Welgevonden 16KQ (± 220 m);
- Remainder of Welgevonden 16 KQ (± 1,3 km);
- Portion 2 of Welgevonden 16 KQ (± 720 m);
- Portion 9 of Welgevonden 16 KQ (± 1,3 km);
- Portion 5 of Welgevonden 16KQ (± 380 m);
- Portion 1 of Schoonwater 14 KQ (± 830 m);
- Remainder of Rietfontein 15 KQ (± 3,4 km);
- Portion 1 of Rietfontein 15 KQ (± 1,1 km);
- Portion1 of Inkermann 10 KQ (± 2,3 km);
- Groenland 397 LQ (± 1,9 km);
- Mabulskop 406 LQ (± 3,5 km);
- Diepspruit 386 LQ (± 1,4 km);

- Portion 2 of the Farm Zandfontein 382 LQ (± 4,7 km); and
- Portion 4 of the Farm Rooipan 357 LQ (± 2,1 km) (site earmarked for OR).

Figure 45: Views along railway line

Alternative A1

Alternative A1 deviates from the Central Route option by continuing in a north-westerly direction along the Rooibokkraal Road, affecting the following properties:

- Portion 1 of the Farm Mecklenburg 310 KQ (for ± 660 m);
- Portion 7 of the Farm Paarl 124 KQ (± 1,2 km); and
- Portion 6 of the Farm Paarl 124 KQ (± 2,6 km).

The route then turns north-easterly to follow the boundaries of the following properties before connecting to the Central Route:

- Portion 6 of the Farm Paarl 124 KQ (± 3,2 km);
- Portion 11 of the Farm Tarentaalkraal 120 KQ (± 410 m);
- Amsterdam 123 KQ (± 4,6 km);
- Remainder of the Farm Paarl 124 KQ (± 2,5 km); and
- Buffelsvley 127 KQ (± 730 m).

Alternative A2

Alternative A2 deviates from the Central Route option by continuing in a north-westerly direction along the Rooibokkraal Road, alongside Portion 1 of the Farm Mecklenburg 310

KQ (for ± 660 m). Thereafter the route turns in a north-easterly direction to follow the boundaries of the following properties:

- Portion 1 of the Farm Mecklenburg 310 KQ (for ± 6,2 km);
- Portion 7 of the Farm Paarl 124 KQ (± 3,4 km); and
- Portion 4 of the Farm Paarl 124 KQ (± 2,9 km).

The route then turns north-westerly to follow the boundaries of the following properties before connecting to the Central Route:

- Portion 4 of the Farm Paarl 124 KQ (± 2,4 km);
- Remainder of the Farm Paarl 124 KQ (± 2,4 km); and
- Karoobult 126 KQ (± 4,8 km).

Alternative B

Route Alternative B of the proposed pipeline route was discarded during the Feasibility Study, based on considerations related to the suitable location for the BPR.

Alternative C

Alternative C deviates from the Central Route by continuing in a north-westerly direction along the R510 (eastern side), potentially affecting the following properties:

- Portion 12 of the Farm Honingvley 99 KQ (± 1,4 km);
- Portion 13 of the Farm Honingvley 99 KQ (± 1,5 km);
- Portion 14 of the Farm Honingvley 99 KQ (± 1,8 km); and
- Remainder of the Farm Honingvley 99 KQ (± 1,5 km).

The pipeline then crosses underneath the R510 and turns in a north-eastern direction to continue following the R510 (on the northern side), running along the boundaries of the following properties before connecting to the Central Route and following the railway line:

- Portion 4 of the Farm Vaalpenspan 90 KQ (± 570 m);
- Remainder of the Farm Vaalpenspan 90 KQ (± 21 km);
- Portion 1 of the Farm Vaalpenspan 90 KQ (± 1,2 km);
- Portion 1 of the Farm Witklip 665 KQ (± 1,5 km);
- Remainder of the Farm Witklip 665 KQ (± 230 m); and
- Portion 4 of the Farm Witklip 665 KQ (± 1,3 km).

9.4.3.2 Delivery System - OR to Terminal Point

Alternative D1

From Portion 4 of the Farm Rooipan 357 LQ, where the OR is situated, the pipeline route for Alternative D1 continues alongside the railway line in a north-easterly direction, potentially affecting the following properties:

- Portion 2 of the Farm Rooipan 355 LQ (± 2,4 km);
- Naauwpoort 363 LQ (± 2.4km);

- Portion 5 of the Farm Rhenosterpan 361 LQ (± 900 m);
- Remainder of the Farm Rhenosterpan 361 LQ (± 960 m);
- Portion 4 of the Farm Rhenosterpan 361 LQ (± 1,3 km);
- Portion 6 of the Farm Rhenosterpan 361 LQ (± 3,1 km); and
- Portion 1 of the Farm Zandnek 358 LQ (± 1,7 km).

The route then turns away from the railway line in a north-westerly direction and passes the following properties before connecting to the link pipeline to Lephalale:

- Portion 1 of the Farm Zandnek 358 LQ (± 3 km);
- Portion 1 of the Farm Geelhoutskloof 359 LQ (± 3k m);
- Taaiboschpan 320 LQ (± 3,8 km); and
- Enkeldraai 314 LQ (± 3,8 km).

Alternative D2

From the OR the pipeline route for Alternative D2 runs along the following properties:

- Portion 2 of the Farm Rooipan 355 LQ (± 2,6 km);
- Naauwpoort 363 LQ (± 600 m);
- Portion 5 of the Farm Rhenosterpan 361 LQ (± 750 m);
- Portion 2 of the Farm Rhenosterpan 361 LQ (± 2,5 km);
- Portion 3 of the Farm Rhenosterpan 361 LQ (± 1,2 km);
- Portion 6 of the Farm Rhenosterpan 361 LQ (± 2 km);
- Portion 1 of the Farm Leliefontein 672 LQ (± 1,7 km);
- Remainder of the Farm Zandnek 358 LQ (± 4,6 km);
- Portion 3 of the Farm Zandheuvel 356 LQ (± 4,6 km);
- Remainder of the Farm Zandheuvel 356 LQ (± 900 m);
- Portion 1 of the Farm Zandheuvel 356 LQ (± 1 km);
- Mooipan 325 LQ (± 5,2 km);
- Remainder of the Farm Zyverbult 324 LQ (± 5,2 km);
- Portion 2 of the Farm Toezicht 323 LQ (± 2,6 km); and
- Minnaarspan 322 LQ (± 2,6 km).

The route ends on the Remainder of the Farm Vangpan 294 LQ, where it connects to the link pipeline to Lephalale.

Alternative D3

From the OR, the route runs on the boundaries of the following properties:

- Portion 2 of the Farm Rooipan 355 LQ (± 3 km);
- Remainder of the Farm Rooipan 355 LQ (± 43 km);
- Portion 4 of the Farm Rooipan 357 LQ (± 3 km);
- Remainder of the Farm Rooipan 357 LQ (± 2,7 km); and
- Remainder of the Farm Grootlaagte 354 LQ (± 2 7 km).

The route then follows the Steenbokpan – Sentrum Road (see **Figure 46**), potentially affecting the following properties, before connecting to the link pipeline to Lephalale:

- Portion 1 of the Farm Rooipan 355 LQ (± 2,4 km);
- Remainder of the Farm Rooipan 355 LQ (± 2,4 km);
- Portion 1 of the Farm Rooipan 357 LQ (± 2 km);
- Portion 5 of the Farm Rooipan 357 LQ (± 2 km);
- Portion 1 of the Farm Leliefontein 672 LQ (± 2,4 km);
- Remainder of the Farm Leliefontein 672 LQ (± 2,4 km);
- Portion 3 of the Farm Zandheuvel 356 LQ (± 1,2 km);
- Remainder of the Farm Zandheuvel 356 LQ (± 1,3 km);
- Portion 1 of the Farm Zandheuvel 356 LQ (± 1,4 km);
- Remainder of the Farm Doornlaagte 353 LQ (± 3 km);
- Remainder of the Farm Schuldpadfontein 328 LQ (± 2 km);
- Portion 2 of the Farm Schuldpadfontein 328 LQ (± 2 km);
- Portion 1 of the Farm Schuldpadfontein 328 LQ (± 2,2 km);
- Portion 1 of the Farm Paardevley 329 LQ (± 1,6 km);
- Portion 23 of the Farm Theunispan 293 LQ (± 690 m); and
- Portion 11 of the Farm Theunispan 293 LQ (± 690 m).

Figure 46: View along Steenbokpan – Sentrum Road

Alternative D4

Alternative D4 deviates from Alternative D1 to avoid a pan located on the Farm Taaiboschpan 320 LQ (refer to **Section 10.3.3**). From the south-western corner of the Farm Enkeldraai 314 LQ this route runs in a north-easterly direction for ± 2.8 km before connecting to the link pipeline to Lephalale.

9.4.4 Construction Phase

9.4.4.1 Pipeline

The generic methodology for the installation of the pipeline under normal conditions is as follows:

- Pegging of route;
- Marking of protected trees;
- Remove topsoil in the area where construction will take place and stockpile separately for later re-instatement;
- Excavate pipe trench (refer to the construction servitude diagram contained in **Figure 38** for an illustration of the typical trench geometry);
- Install and compact pipe bedding;
- Install pipe sections by means of side booms (special cranes) and weld joints (see **Figure 47**);

Figure 47: Typical trench excavation and pipe installation activities

- Repair field joints and backfill and compact pipe trench in layers;
- Construct air and scour valves. Air valves, which are generally positioned at high points along the route, release air from the pipeline as it fills, allow air into the pipeline when it is draining and 'bleed' off air during normal operations. The scour valves serve to drain water from the pipeline (typically during maintenance), and are located a low points along the route for drainage purposes. A detailed hydraulic analysis for the positioning of the valves will be performed as part of the detail design;
- Construct access chambers (see **Figure 48**);
- Re-shape the impacted area to its original topography and replace stripped topsoil (see **Figure 49**);
- Install final Cathodic Protection;
- Install AC mitigation measures;
- Install pipeline markers at changes in direction and at regular intervals along the route; and
- Rehabilitation.

Figure 48: **Typical examples of chambers (left - during construction; right – completed)**

Figure 49: **Typical views of reinstated (left) and rehabilitated (right) pipeline routes**

Watercourse crossings will generally consist of pipe sections encased in concrete in accordance with the relevant DWS criteria. The typical construction methodology for a river crossing is as follows (see **Figure 50**):

- An earthen berm (coffer dam) and temporary bypass canal is constructed to divert the water around the construction site.
- The trench is excavated across the dry river channel
- A concrete bedding is constructed first, followed by the installation and restraining of the pipe to prevent flotation. Encasement is completed by the construction of further concrete lifts.
- Once the concrete has set, the temporary coffer dam is removed and the bypass canal backfilled to re-instate the flow.
- The impacted area is re-shaped to its original topography.
- The disturbed area is rehabilitated.
- If erosion of the disturbed river banks is a concern, suitable measures will be implemented to ensure the stabilisation of the river structure.

Figure 50: Examples of typical river crossings

9.4.4.2 Weir

A possible approach to the construction of the weirs follows.

A cofferdam will be temporarily built upstream of the constructed portion of the weir. This earth cofferdam will direct the river flow towards the river diversion and prevent river flow to the weir construction area in the riverbed. An example of a coffer dam during the construction of a weir structure is provided in **Figure 51**.

Cofferdam construction would proceed using a “tip and push” methodology. Trucks would drop the earth material at the end of the cofferdam and a bulldozer will push the earth material into the river, along the centre line of the cofferdam. Cofferdam removal would proceed in a similar manner, with a tracked excavator ripping up the dam and the spoil being removed via trucks that have been reversed onto the cofferdam up to its edge.

Figure 51: Example of a cofferdam used to create a dry works area

9.4.4.3 Access Roads

Permanent as well as temporary (construction period) access roads are required for the project. Where possible, the access roads attempt to follow existing tracks and farms roads.

Key activities associated with the crossing of watercourses include –

- Clearing of construction footprint for access road;
- Construction of the road with gravel surfacing;
- Stormwater management with daylighting channels and/or culverts, as required; and
- Reinstatement and rehabilitation, as required.

9.4.5 First Order Cathodic Protection and AC Mitigation

Cathodic protection and AC mitigation will be necessary where the proposed pipeline route runs parallel to and crosses (a) existing and proposed future high voltage power line routes, and (b) electrified railway lines.

Mutual interference effects between the pipeline and a high voltage power line could result in danger to safety of personnel under normal operation and fault conditions, risk to the pipeline integrity under fault conditions, risk of AC-enhanced corrosion under normal operation and risk of damage to the coating from electrical stress under fault conditions. Hence, AC mitigation is necessary.

9.4.6 Operational Phase

The key tasks during the operational phase for the pipeline include the following:

- Operation of the transfer scheme;
- Create access track along pipeline servitude;
- Conduct routine maintenance inspections of the project infrastructure;
- Scouring of pipeline, where the water conveyed and stored within this system will be released into the receiving watercourses along the alignment from scour valves. A detail hydraulic analysis will be conducted to determine the optimum positioning of the scour valves;
- Undertake maintenance and repair works, where necessary; and
- On-going consultation with directly affected parties.

9.4.7 Decommissioning Phase

It is envisaged that the pipeline will be used indefinitely, under suitable maintenance. Decommissioning is thus not considered applicable to the scheme. However, should decommissioning be required the activity will need to comply with the appropriate and prevailing environmental legislation and best practices at that time.

9.5 Break Pressure Reservoir

The pipeline route from the Vlieëpoort high-lift pumping station crosses over high ground. The elevation in this area is such that a BPR can be located to enable gravity flow onwards to the OR.

The proposed BPR is located on Portion 1 of the Farm Leeuwbosch 129 KQ (see photographs in **Figure 52**). A general layout is provided in **Figure 53** (drawing contained in **Appendix H**).

The BPR will generally be in the form of an artificial dam formed by shallow excavation and surrounding earthfill embankments. The final depth and size of the reservoirs will be determine by the site topography (cut and fill balance) with the aim of minimising surface area to reduce evaporation and maximum flow through to prevent stagnation of the water.

The reservoir will have to be lined with an appropriate waterproof lining system (HDPE or similar material) and suitable sub-surface drainage must be provided. The reservoir will also be compartmentalised to allow for normal operation, maintenance and cleaning, as well as the mitigating requirements relating to water quality that may be required.

Figure 52: South-western view of site for BPR (R510 on foreground)

DESCRIPTION	VALUE
NON SPILL OVER CREST	1105.00 mASL
BASE LEVEL	1097.96 mASL
	1100.00 mASL
EMBANKMENT HEIGHT	6.34 m (MAXIMUM)
	1.62 m (MINIMUM)
SLOPES	SIDE SLOPES 1 : 2
	FLOOR 1 : 100
COMPARTMENT VOLUME	50 000 m^3
WATER LEVEL	1104.00 mASL
FREE BOARD	1 m
WATER DEPTH	6.04 m (MAXIMUM)
	5.00 m (MINIMUM)
SPILLWAY DEPTH	0.6 m
SPILLWAY WIDTH	12 m

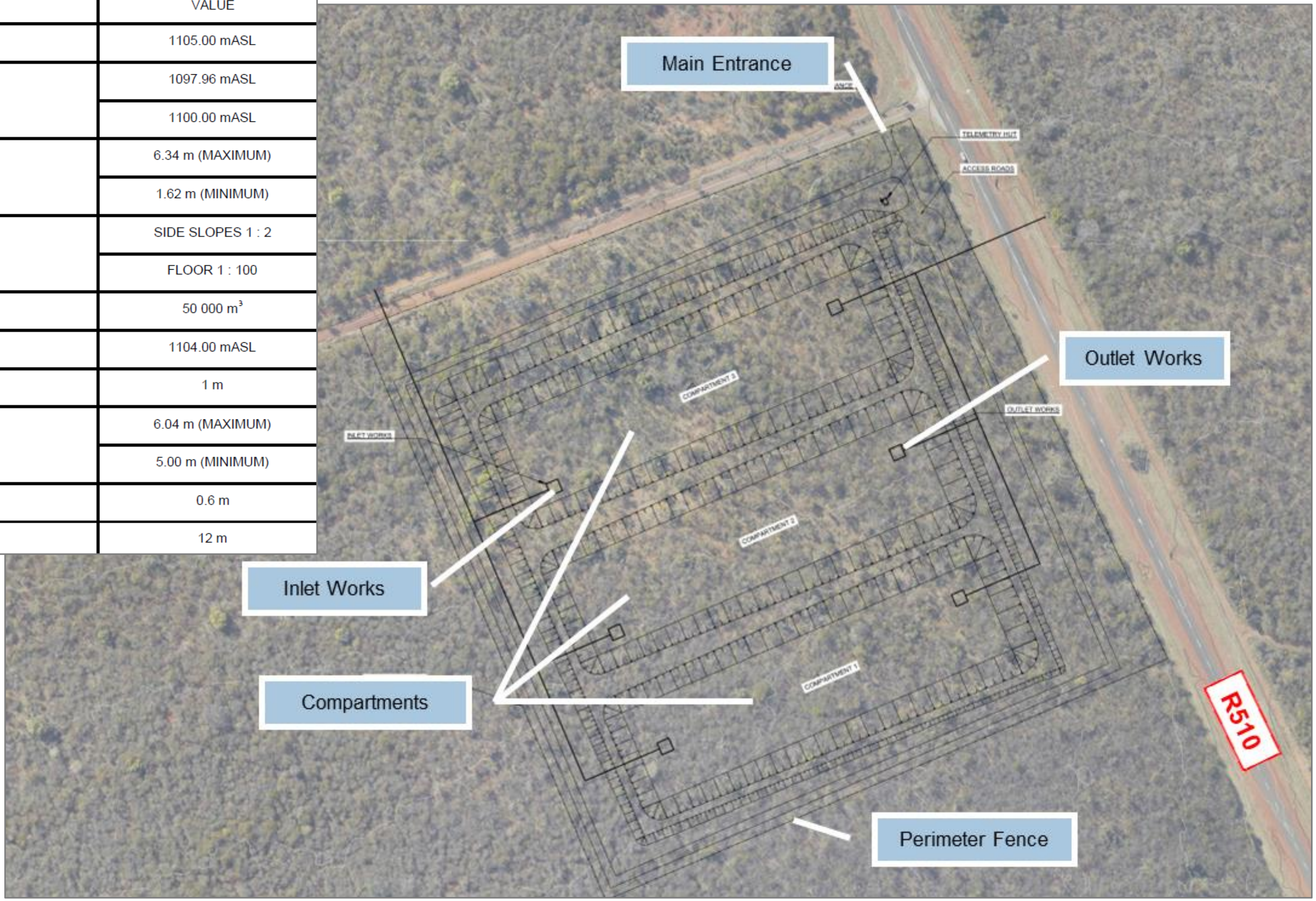


Figure 53: **Layout - BPR**

9.6 Operational Reservoir

9.6.1 Terminal Dams

Potential Terminal Dam (TD) sites were investigated as part of the feasibility study. TD storage provides the advantage that users can be supplied under gravity from a source located relatively close to the point of consumption. This reduces the risk of non-supply and simplifies the operation of the pump system used to transfer the water to the users.

Four sites were identified as possible sites for construction of a TD on the Farm Witvogelfontein 362LQ (see **Figure 54**), with Sites No 1 and 3 identified as most favourable (DWAF, 2008c). The identified potential dam sites are located at positions where the respective river valleys provide a storage basin, and a narrowing of the valley suggests the possibility of constructing a dam wall. The TD is essentially an off-channel storage dam which will be filled with water diverted from the Crocodile River; as such dam sites are not dependent on the expected run-off characteristics.

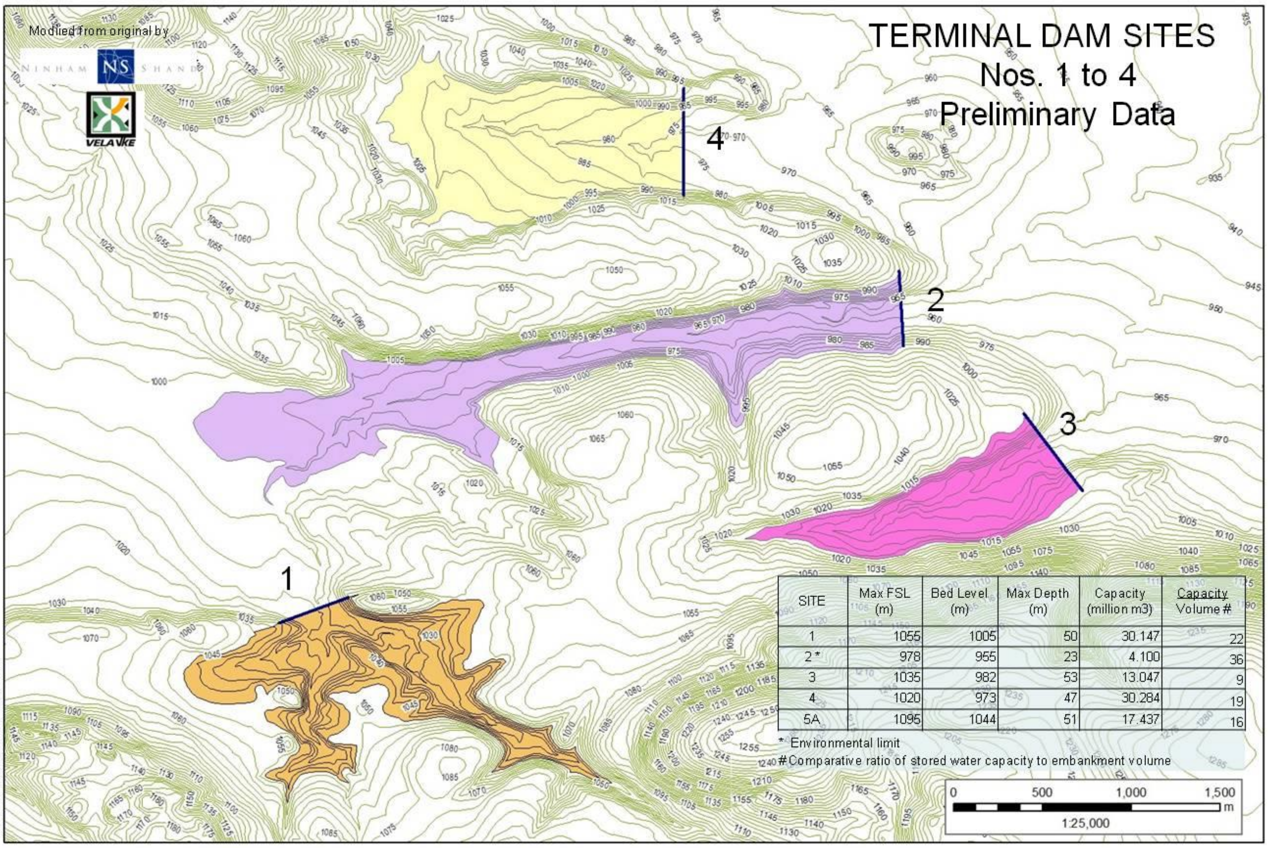


Figure 54: Terminal Dam Sites (DWAF, 2008c)

9.6.2 Terminal Reservoirs

As a more preferred alternative to TDs the use of Terminal Reservoirs located at the end user sites were investigated. This option comprises the Crocodile River (West) transfer pipeline feeding into an OR from where a gravity pipeline will feed multiple users Terminal Reservoirs (at each of the large users) with 18 days storage capacity (see **Figure 55**).

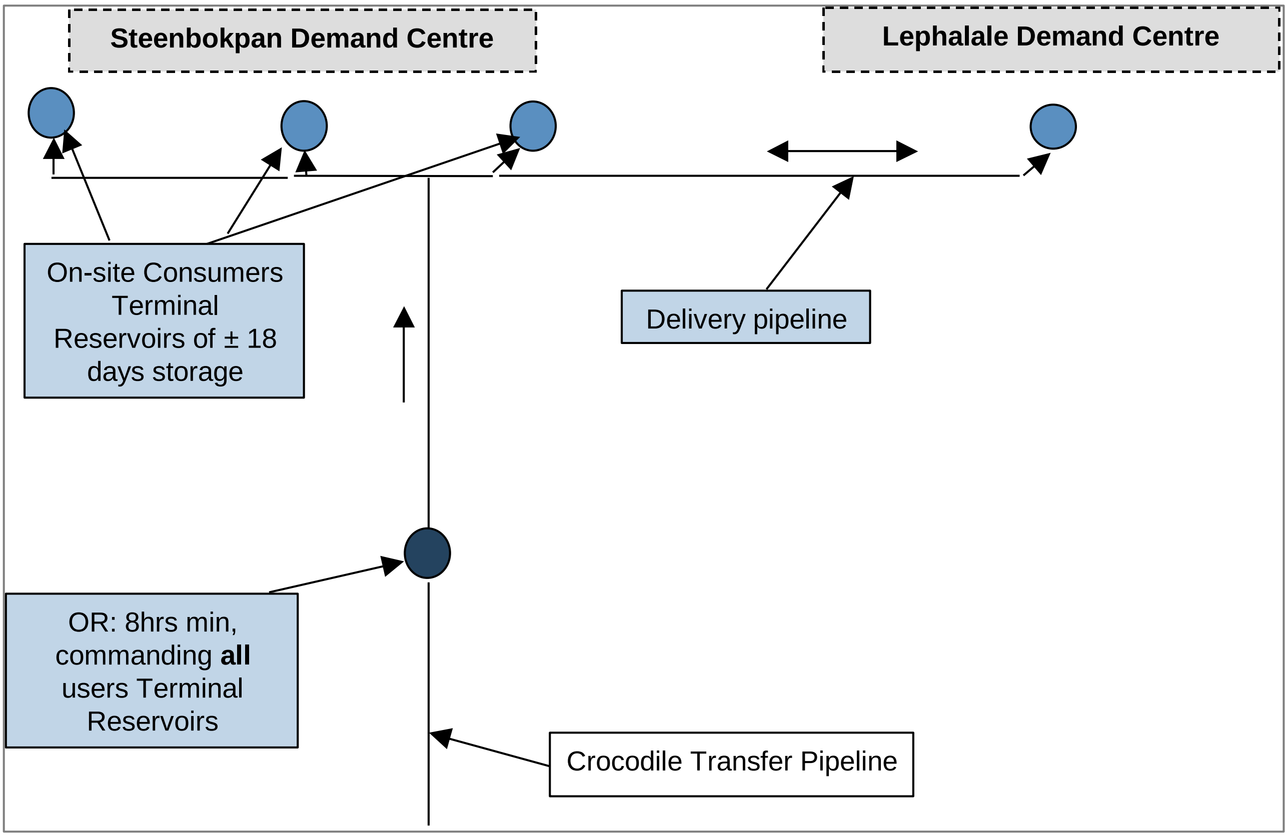


Figure 55: Multiple Terminal Reservoirs

The OR is located on Portion 4 of the Farm Rooipan 357 LQ (refer to photograph in **Figure 56**). A general layout is provided in **Figure 57** (drawing contained in **Appendix H**).

Figure 56: North-western view of site for OR

DESCRIPTION	VALUE
NON SPILL OVER CREST	1019.00 mASL
BASE LEVEL	1011.00 mASL
	1012.55 mASL
EMBANKMENT HEIGHT	5.49 m (MAXIMUM)
	2.95 m (MINIMUM)
SLOPES	SIDE SLOPES 1 : 2
	FLOOR 1 : 100
COMPARTMENT VOLUME	50 000 m^3
WATER LEVEL	1018.00 mASL
FREE BOARD	1 m
WATER DEPTH	7 m (MAXIMUM)
	5.45 m (MINIMUM)
SPILLWAY DEPTH	0.6 m
SPILLWAY WIDTH	12 m

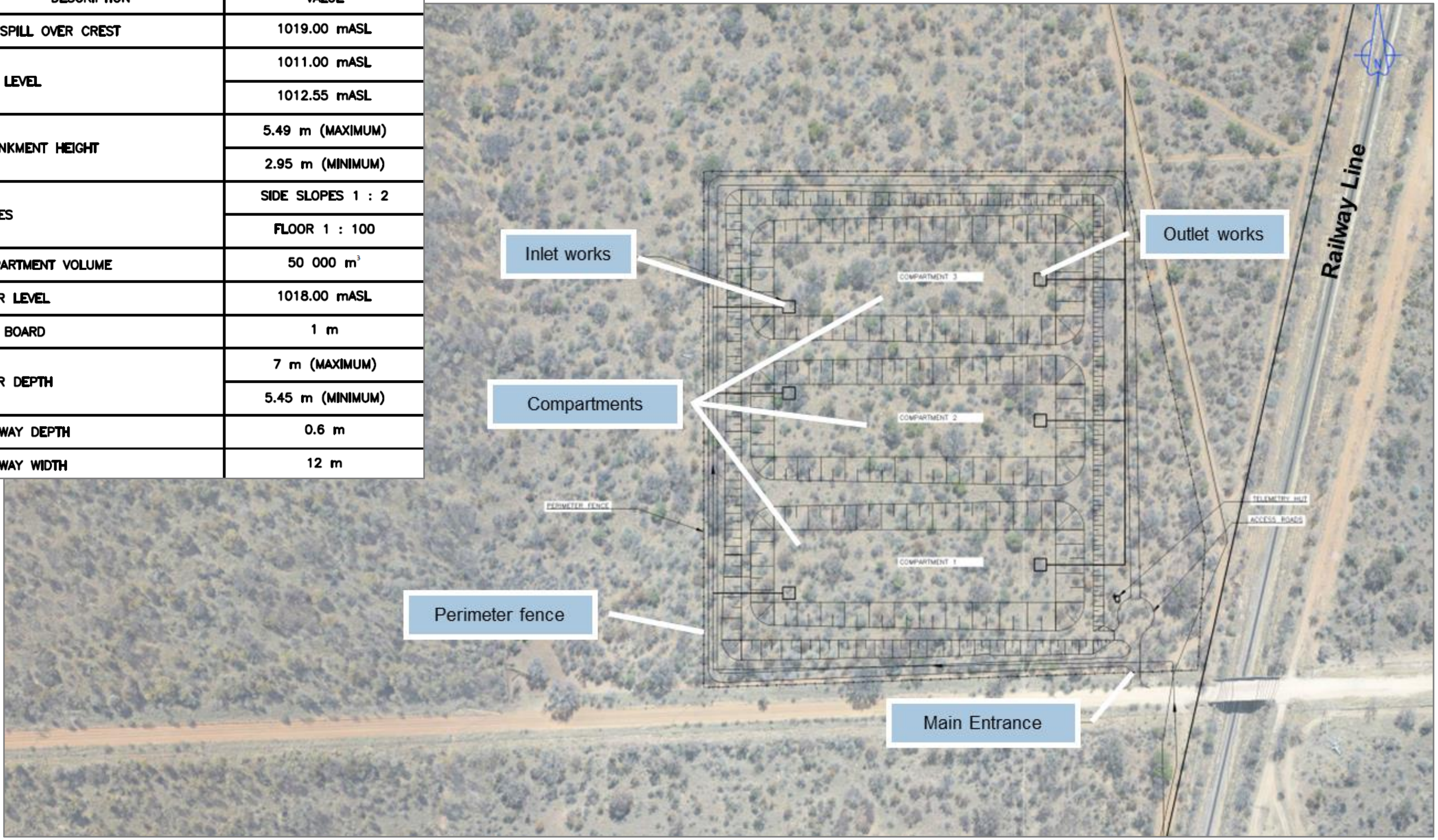


Figure 57: **Layout - OR**

The OR is located at the end of the transfer system and start of the delivery system. It serves to control water supply to the users from a point relatively close to the points of consumption to reduce the risk on non-supply. The depth of the reservoir excavation and the height of the earthfill embankment were optimised to balance the volume of cut and fill. It is further proposed that the reservoir be lined with an appropriate waterproof lining system (HDPE or similar material) and suitable sub-surface drainage provided.

The advantages of using Terminal Reservoirs include:
- ❖ The system retains the simplicity of operation;
- ❖ The overall pipeline lengths will be shorter and less costly than via the TDs option;
- ❖ Management of water quality will be simplified;
- ❖ The water can gravitate from the OR (assume 8 hrs storage) to the on-site consumer Terminal Reservoirs; and
- ❖ The overall impact on the environment will be less than for the TD option, and will be concentrated closer to the mining and other industrial areas.

9.7 Gauging Weirs

9.7.1 New Weirs on the Bierspruit and Sand River

The Bierspruit and Sand River are the only two remaining significant watercourses along the Crocodile River (West) downstream of Roodekopjes Dam that has not been dammed (or gauged). The confluences of these two rivers with the Crocodile River (West) are located downstream of Hugo's Weir and upstream of Vlieëpoort. This means that the contributions made by the Sand River and Bierspruit to the flow in the Crocodile River (West) are not known other than through run-off calculations and cursory visual observations. The flows and specifically floods emanating from the two catchments could therefore have a significant impact on river flow patterns and riverine environment along the Crocodile River (West) downstream of Vlieëpoort. Flows from the Bierspruit and Sand River should also be measured to ensure that these flows are allowed to pass the Vlieëpoort Abstraction Works.

According to DWS (2016), the following sites have been identified for gauging weirs, which will allow for water flow to be measured, have been identified as part of MCWAP Phase 2 (refer to **Figure 58 – 59**):
- ❖ Bierspruit - 24°40'53.10"S, 27°19'20.62"E; and
- ❖ Sand River - 24°40'47.22"S, 27°27'12.75"E.

Examples of typical crump weir structures used as flow measuring weirs are shown in **Figure 60** (see drawings of an example of a weir in **Appendix H**).

Figure 58: Possible sites for gauging weirs on the Bierspruit and Sand River

Figure 59: Photographs of Bierspruit (left) and Sand River (right) gauging weir sites

Figure 60: Examples of a crump weir gauging structure

9.7.2 New Paul Hugo Weir

The existing Paul Hugo Weir (A2H116), which is situated approximately 20 km upstream of the proposed Vlieëpoort Weir site on the Crocodile River, is an existing farmer owned abstraction weir.

According to DWS (2016), low flow gauging can be improved by the construction of a crump weir about 70 metres downstream of the diversion weir at the approximate location: 24°41'40.86"S, 27°24'32.92"E (shown in **Figure 61**). Suitable rock foundation is available within the bed of river channel at this point and the weir could be designed to measure flows accurately from 200 litres per second up to 8 m^3/s. The instrument housings will be located outside the river channel and proper erosion protection will be provided.

Refer to **Figure 60** for examples of typical crump weir structures that are similar to what is being proposed (see drawings of an example of a weir in **Appendix H**).

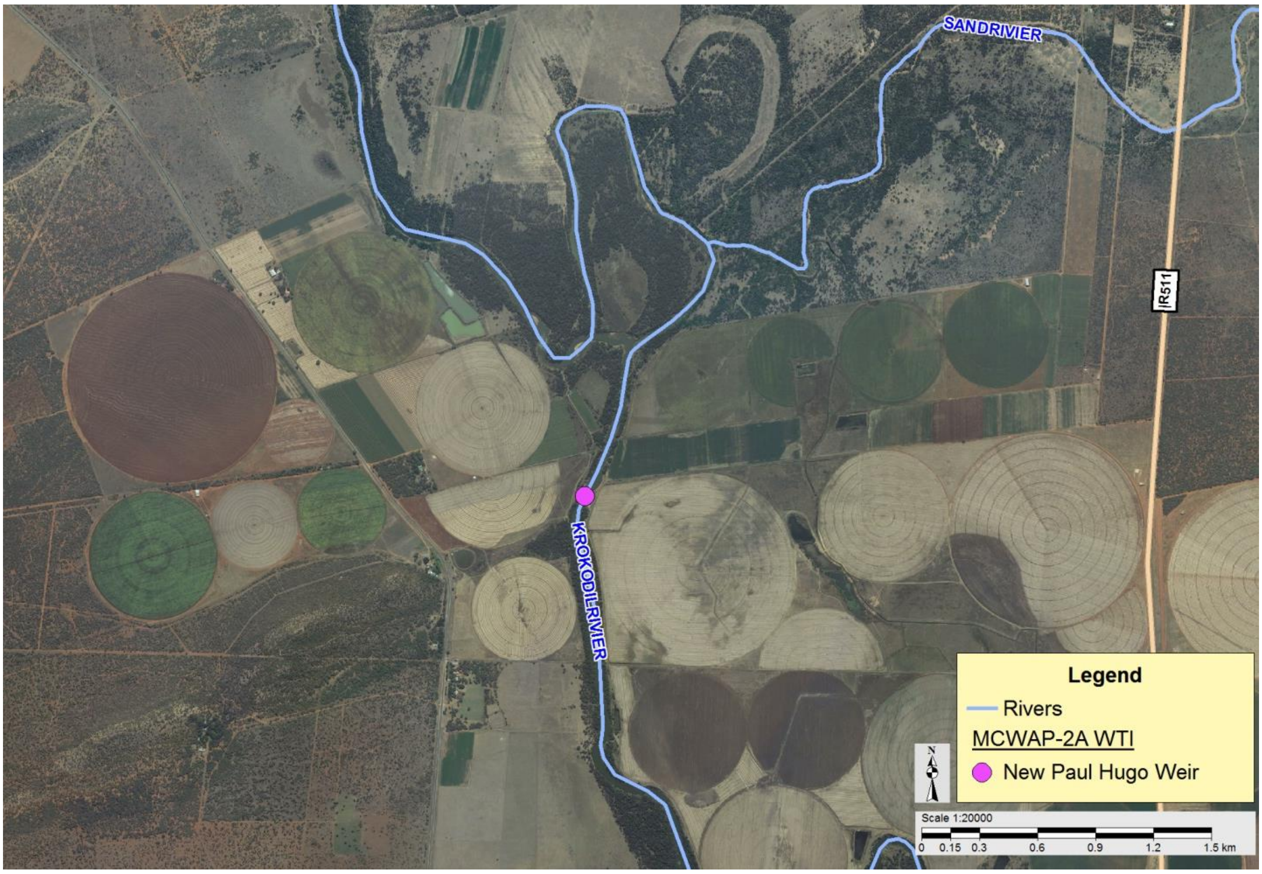


Figure 61: Possible site for gauging weir near Paul Hugo Weir

9.7.3 Existing Weir Downstream of Hartbeespoort Dam

The gauging structure (A4H083) immediately downstream of Hartbeespoort Dam (S 25.71892°, E 27.84381°), which is shown in **Figure 62**, will require structural changes to improve gauging accuracy.

Figure 62: **Weir downstream of Hartbeespoort Dam**

9.8 Bulk Power Supply

The capacity of the existing high and medium voltage networks in the area was investigated and the need for upgrading of the existing systems or the construction of new infrastructure to supply the sites was determined.

Additional infrastructure will be required to provide 132 kV loop in – loop out firm supplies to the Vlieëpoort site. The installation at Vlieëpoort will include a substation and transformer yard from which all power requirements will be serviced.

Eskom confirmed that the MCWAP 2 substation can be accommodated into the network without any capacity constraints. The proposed substation will be supplied from the new Thabatshipi – Thabazimbi Combined 132 kV Power Line (shown in **Figure 63**).

The infrastructure associated with the MCWAP-2A Bulk Power Supply includes the following (shown in **Figure 64** in relation to MCWAP-2A WTI):

- Power lines - Two 132 kV Kingbird lines running in parallel (approximately 4 km each). The servitude requirements per line will be 31 m (15,5 m from the centre line). Steel monopole structures may possibly be used for each line with the height of each structure dependent on the topography.
- Substation - The proposed substation will be situated at the balancing dam, near to the high-lift pumping station. It will be equipped with 2x20 MVA 132/11 kV transformers, thus maintaining a 20 MVA firm capacity at all times. The substation servitude will be 100 m x 100 m.

As mentioned, Eskom will submit a separate application to DEA to seek approval for the bulk power required for MCWAP-2A. The details of the bulk power components will be covered within this application.

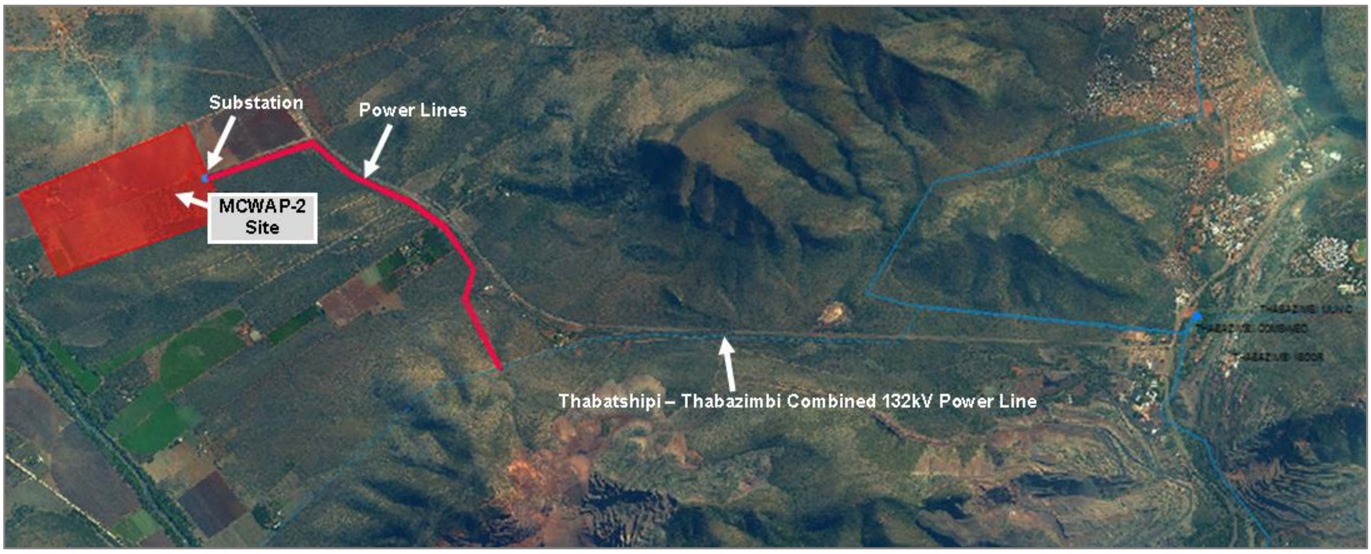


Figure 63: Supply of bulk power from the new Thabatshipi – Thabazimbi Combined 132kV Power Line

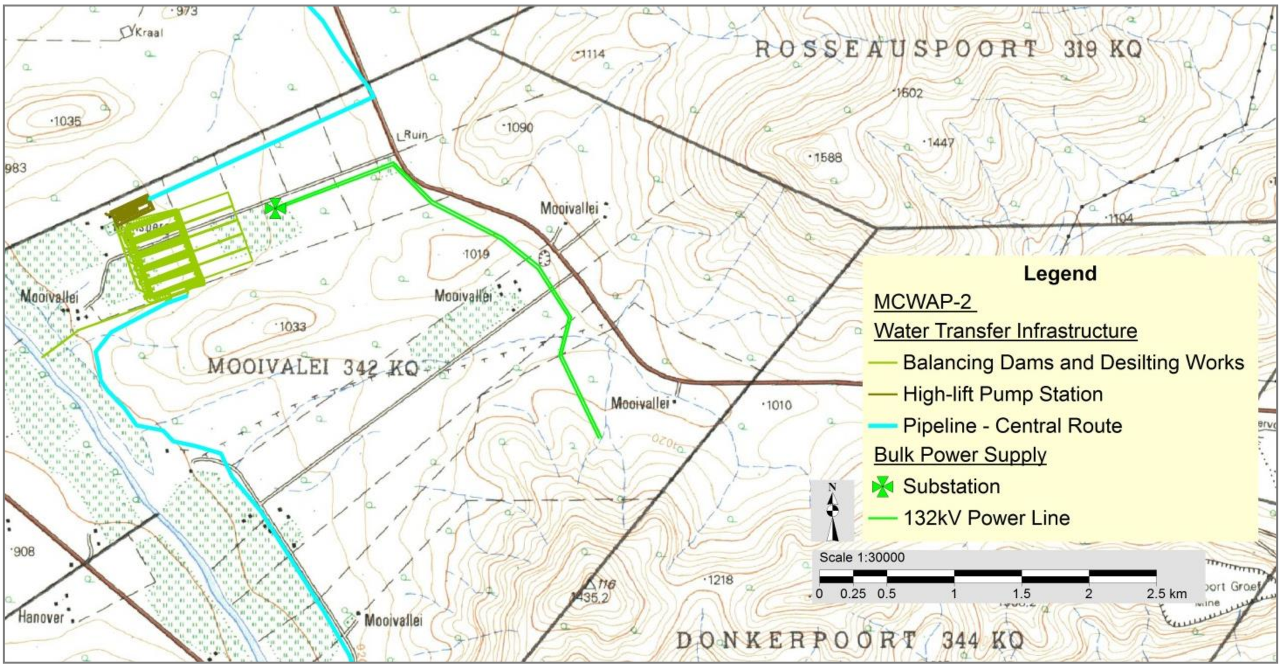


Figure 64: Bulk power supply in relation to MCWAP-2A WTI footprint

9.9 Implementation Programme & Project Budget

The indicative implementation dates for the construction phase of MCWAP-2A WTI are as follows:

- Commencement of construction : Fourth Quarter 2019
- Construction duration : 42 months
- Commissioning : Third Quarter 2023
- Site Closure & Rehabilitation : Fourth Quarter 2025

The estimated project budget based on the 75 million m^3 capacity is approximately R12 billion.

9.10 Resources Required for Construction and Operation

This section briefly outlines the resources that will be required to execute the project. The TCTA was directed to implement and co-fund the MCWAP-2A, it is therefore for the securing of resources for MCWAP-2A's implementation. Following operational declaration of the MCWAP-2A it will be handed over to DWS for operation and maintenance.

9.10.1 Water

During the construction stage, water will be required for various purposes, such as concrete batching, washing of plant and equipment in dedicated areas, dust suppression, potable use by construction workers, etc. Water for construction purposes will be sourced directly from watercourses on site and groundwater (boreholes) will also be utilised. Water tankers will also supply water to the site. Water for operational purposes will include domestic supply to the operational control centre.

All water uses triggered in terms of Section 21 of the NWA will comply with DWS' requirements. Further provisions will be included in the EMPr as part of the EIA Report.

9.10.2 Sanitation

Sanitation services will be required for construction workers in the form of chemical toilets, which will be serviced at regular intervals by the supplier. Conservancy tanks will be provided at the residential labour camps and site offices.

Ablution facilities will also be provided as part of the permanent infrastructure for the operational control centre. The locations of the tanks will be selected to minimise environmental impacts. The tanks will be properly maintained by the operator.

Further provisions will be included in the EMPr as part of the EIA Report.

9.10.3 Waste

Solid waste generated during the construction phase will be temporarily stored at suitable locations (e.g. at construction camps) and will be removed at regular intervals and disposed of at approved waste disposal sites within each of the local municipalities that are affected by the project. All the waste disposed of will be recorded.

According to the Integrated Waste Management Plan for the Thabazimbi LM (2016), the Thabazimbi landfill and the Northam landfill are both licenced. According to the IDP for the Lephalale LM (2016), there is a permitted landfill within the municipality.

All storage of general or hazardous waste in a waste storage facility (e.g. onsite waste transfer station) will comply with the national Norms and Standards (GN R. 926 of 29 November 2013). The waste storage facility will be established at the camp where waste from site will be collected, sorted, weighed and placed in skips and recycling containers for removal to service providers and appropriate registered landfill sites (hazardous and general sites, as required).

Wastewater, which refers to any water adversely affected in quality through construction-related activities and human influence, will include the following:

- Sewage;
- Water used for washing purposes (e.g. equipment, staff); and
- Drainage over contaminated areas (e.g. cement batching / mixing areas, workshop, equipment storage areas).

All wastewater discharges will comply with legal requirements associated with the NWA, including the General Authorisation that specifically deals with Section 21(f) and Section 21(g) water uses. Suitable measures will be implemented to manage all wastewater generated during the construction period. Further provisions will be included in the EMPr as part of the EIA Report.

9.10.4 Roads

Permanent access roads will be required for the operational phase, whereas temporary access and haul roads will need to be created for construction purposes. Existing roads will be used as far as possible.

Refer to the access to the Vlieëpoort Abstraction Site shown in **Figure 65**. Note that as part of the EIA a 100 m wide corridor was considered for the access road, however, the final right-of-way servitude will be approximately 10 m wide and is proposed to run from the D1649 (a public road) to the Vlieëpoort Abstraction Site and the Mooivallei works. The left flank of the Vlieëpoort Abstraction Weir may be accessed from the D727 public road.

9.10.5 Electricity

The bulk power requirements during the construction and operational phases of the project are discussed in **Section 9.8**.

9.10.6 Construction Camps

It is anticipated that provision will be made for the following facilities at the construction camps:

- Concrete batching plant;
- Site offices;
- Parking;
- Materials testing laboratory;
- Workshops and stores;
- Reinforcing steel bending yard;
- Weather station;
- Sand and crushed stone stockpile areas;
- Areas for the handling of hazardous substances;
- An explosives storage magazine;
- Wash bays for construction plant;
- Radio communication infrastructure;
- Facilities for the bulk storage and dispensing of fuel for construction vehicles,
- Ablution facilities; and
- A solid waste disposal facility (main camps only).

Refer to **Appendix C** for the location and approximate sizes of the construction camps required for the construction phase of MCWAP-2A.

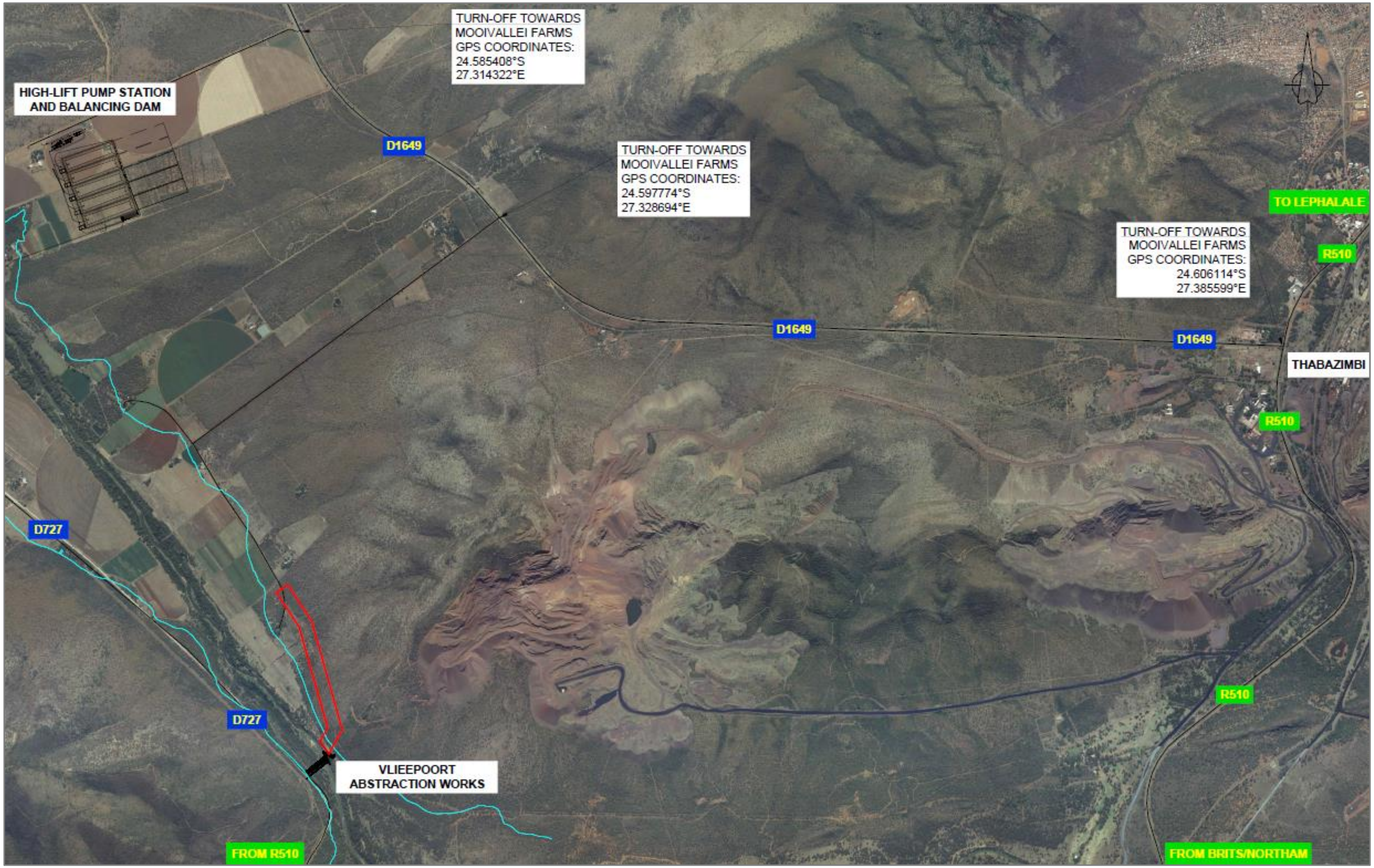


Figure 65: Access to Vlieëpoort Abstraction Site

9.10.7 Construction Workers

The appointed Contractor will make use of skilled labour where necessary. In those instances where casual labour is required, TCTA will specify that such persons are sourced from local communities as far as possible.

9.10.8 Workshops, Offices and Stores

Provision is made for ancillary structures (including workshops, offices and stores) adjacent to the desilting works and high-lift pumping station. Refer to the layout of the desilting works contained in **Appendix H**.

9.11 Spoil Sites

Potential spoil sites (old borrow sites from construction of the railway line and roads) were identified. A description of each proposed spoil site is provided in **Table 21** below, which emanates from the geotechnical investigations conducted in 2012.

Table 21: Potential Spoil Sites

Site no.	Co-ordinates (WGS84, Lo27)		Approx. km distance	Estimated volume (m^3)	Comments
	Y	X			
A	-031 600	2 719 400	8	30,000	Old BP
B	-041 150	2 702 400	34.3	20,000	Old BP
C	-040 650	2 699 850	36.6	30,000	Old BP (1km north along R510)
D	-045 491	2 698 008	19,8	40,000	Old BP

Site no.	Co-ordinates (WGS84, Lo27)		Approx. Chainage (m)	Estimated volume (m^3)	Comments
	Y	X			
D	-045 491	2 698 008	7,800	80,000	Old BP
E	-045543	2 693 229	12,700	20,000	Old BP
F	-045 760	2 687 880	18,000	80,000	Old BP(E of railway)
G	-045 734	2 686 134	19,800	50,000	Old BP(E of railway)
H	-045 603	2 682 846	23,100	45,000	Old BP

Site no.	Co-ordinates (WGS84, Lo27)		Approx. Chainage (m)	Estimated volume (m^3)	Comments
	Y	X			
I	-045 385	2 677 101	28,800	45,000	Old BP
J	-044 873	2 675 751	30,300	70,000	Old BP
K	-041 476	2 659 299	47,100	15,000	Old BP(E of railway)
L	040 900	2 656 731	49,800	20,000	Old BP

Site no.	Co-ordinates (WGS84, Lo27)		Approx. Chainage (m)	Offset (m) (from preferred route)	Estimated volume (m^3)	Comments
	Y	X				
M	-037 949	2 644 719	0,820/	7,000 N*	10,000	Old BP
N	-042 426	2 637 474	12,700	1,200 S*	50,000	Old BP
O	-035 909	2 642 131	18,000	3,000 S	5,000	Old BP
P	-027 383	2 624 039	19,800	1,400 W*	10,000	Old BP

9.12 River Management

A River Management System is required to monitor, control and manage the releases into the river, the flows in the river and abstractions from the river. This will apply to the Crocodile River (West) between Hartbeespoort Dam and Vlieëpoort Abstraction Works, including the releases and spills from such Works, as well as the Moretele River from Klipvoor Dam to the confluence with the Crocodile River (West) and the Elands River from Vaalkop Dam to the confluence with the Crocodile River (West). It includes a servitude-of-aqueduct to be acquired as described in **Section 9.13** below over such stretches of the said rivers. The system should also include the management of all abstractions within the so-called “red-line” zone, which is considered to be abstractions from the river.

The water requirements between the four upstream dams (i.e. Hartbeespoort, Roodekopjes, Klipvoor and Vaalkop) and Vlieëpoort, the flows required past Vlieëpoort and the other factors that will affect the flow in the river at Vlieëpoort such as rainfall, evaporation from the river water surface, evapo-transpiration from the riverine vegetation, tributary and diffuse inflows and diffuse seepage outflows from the river, will need to be considered as part of the overall River Management System.

Operating rules of the Lower Crocodile (West) system with MCWAP 2 releases will be complex due to:

- Multiple users along the river stretch (irrigation, transfer and Ecological Reserve), with varying entitlements and assurance of supply criteria;
- Multiple dams from which releases for users need to be made;
- Cascading releases of water for transfer from Vlieëpoort;
- Dynamic water requirements and availability (e.g. return flows);
- Limited current gauging locations on Lower Crocodile (West) River;
- Some uncertainty around conveyance losses (including surface water groundwater interactions - sand aquifers);
- Limited storage potential to regulate water releases at Vlieëpoort; and
- Water quality concerns.

The factors be taken into consideration in the Crocodile River (West) Management System are shown in **Figure 66**.

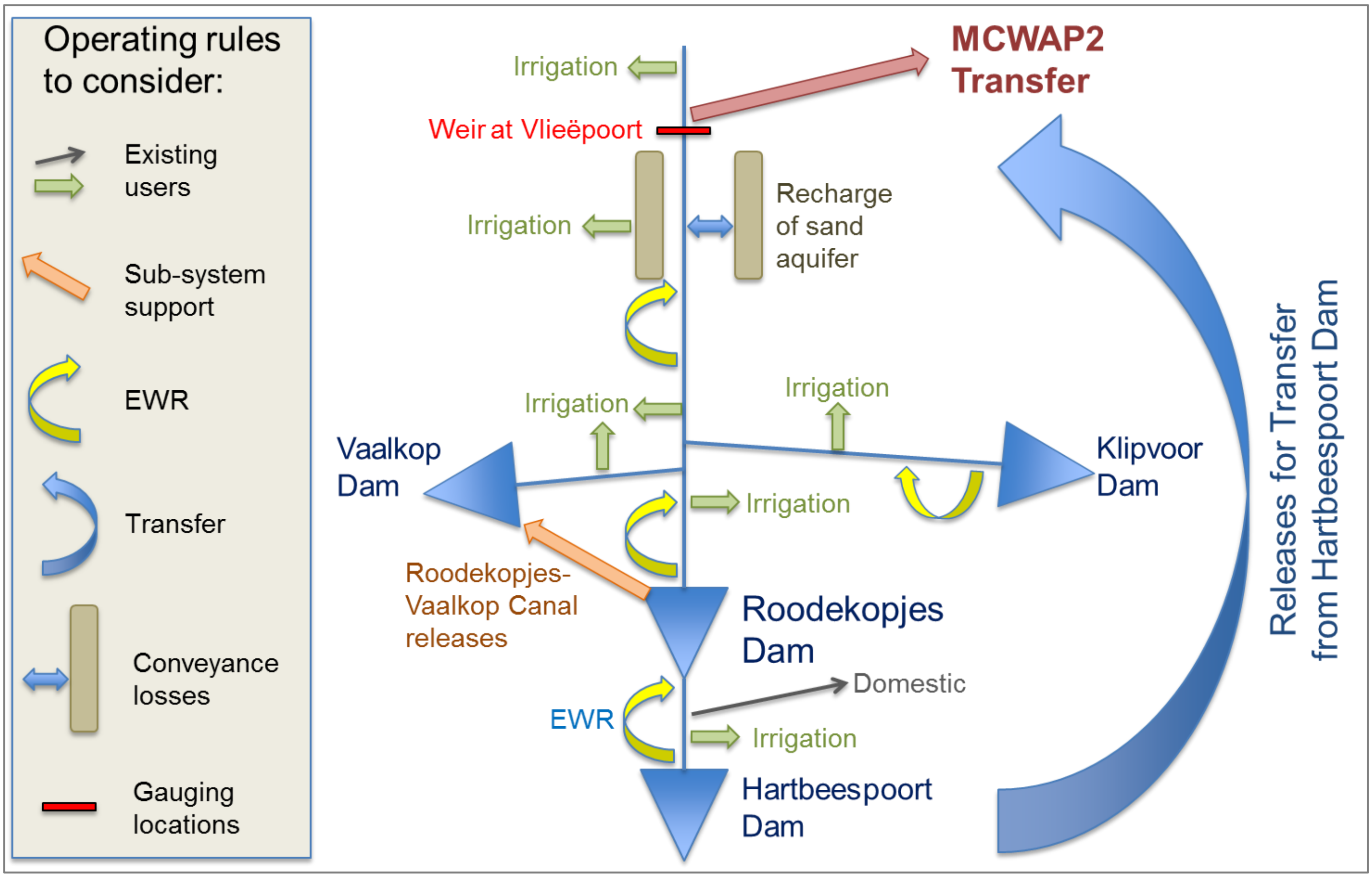


Figure 66: **Factors be taken into consideration in the Crocodile (West) River Management Plan (DWS, 2015)**

The components of the River Management System include the following (shown in **Figure 67**):

- 4 Existing dams;
- Possible new river outlet at Hartbeespoort Dam or revised operating procedures;
- Possible new river outlet at Roodekopjes Dam or revised operating procedures;
- 13 Existing river gauging stations;
- 3 new river gauging stations;
- Smart metering of direct abstraction;
- Smart metering of indirect abstraction (boreholes);
- Conveyance capacity in Crocodile River (West);
- Data communication network; and
- Integrated operational centre.

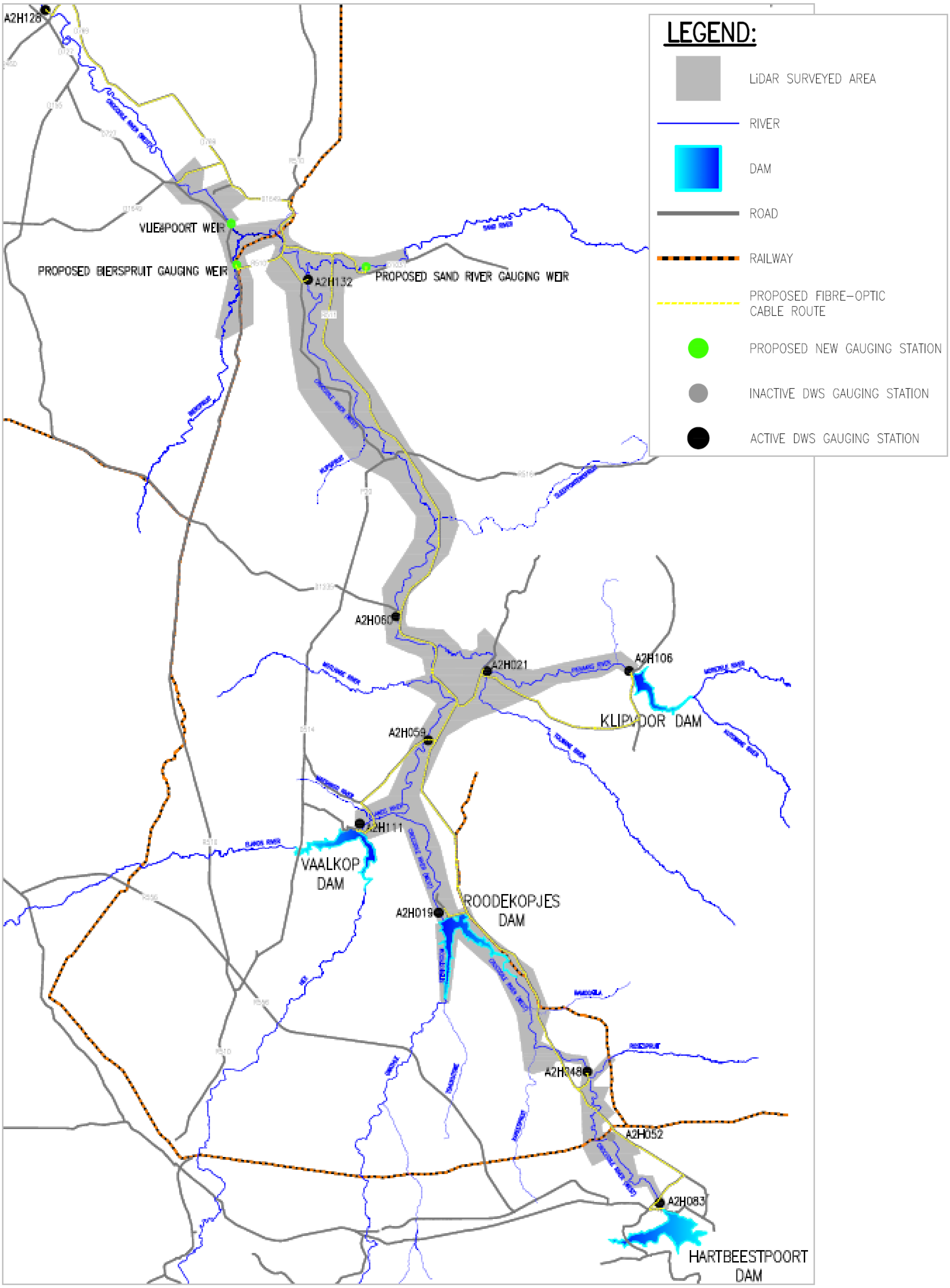


Figure 67: **River Management System**

9.13 Land Acquisition

Land is required for constructing the selected scheme. In addition, servitudes are required for operation and maintenance purposes.

The following will be required:

- The River Management System includes a perpetual servitude-of-aqueduct in terms of the NWA over such stretches of the rivers stated in **Section 9.12** above enabling the Minister to utilise such stretches as part of the government waterworks;
- Permanent servitudes for the new pipeline and accesses need to be acquired and registered in terms of the NWA. A permanent servitude of aqueduct (25 m minimum width) will accommodate the new pipelines. The defined area will not be fenced off following construction (unless requested by the landowner) and no improvements may be erected or established within such area. The defined area may only be used for grazing purposes or for the cultivation of crops with a weak (shallow) root system. Access to pipeline servitudes will not be controlled, but restrictions will be placed on activities inside the servitudes. Existing fencing will be reinstated and gates installed where these fences cross the servitude-of-aqueduct. A permanent right-of-way servitude to accommodate the permanent accesses, need to be acquired and registered. A service road (to basic standards) will be provided along the servitude for maintenance purposes and will be patrolled on a regular basis. Servitudes need to be marked with concrete servitude markers;
- A servitude-of-abutment where gauging facilities are implemented will be needed and also a right-of-way servitude to enable access to such facilities, and
- Land to accommodate the Vlieëpoort Abstraction Weir (including the basin) and Abstraction Works, as well as the ancillary structures (pumping stations, housing, workshops, BPR, OR) will need to be acquired (purchased) and gauging weirs.

Negotiations with the landowners to acquire and register the relevant land rights (servitudes and purchases) will be undertaken by TCTA, as the project’s implementing agent. TCTA’s land rights acquisition strategy will adhere to all statutory requirements prevailing at the time, as per the Promotion of Administrative Justice Act (No. 99 of 2000), the Expropriation Act (No. 63 of 1975) and the NWA as already delegated by the Minister of Water and Sanitation to TCTA.

Determination of compensation will be done in terms of the prevailing Expropriation Act when the acquisition is done (currently Section 12 of the Expropriation Act (No. 63 of 1975)), which in case of the servitude right will include an amount to make good actual financial losses caused by the acquisition of the right. In case of the servitude-of-aqueduct along the new pipeline rights, in principle, compensation is payable for both temporary (during construction and rehabilitation) and permanent servitude rights, as may be required. In the case of existing permanent servitudes (where applicable), the available rights will need to be investigated.

Although the Right of Use to the land will belong to the infrastructure custodian, the landowner will still be permitted access and certain use of the servitude area (depending on the limitations specified in the servitude conditions).

9.14 Offtake Points for Livestock and Game Watering

It is DWS' standing policy to only provide offtake points for livestock and/or game watering to authorised directly affected landowners. A limited volume of water will be set aside for this purpose. Such users will have to apply for a water use licence (Chapter 4 of the NWA) and enter into an agreement with DWS. Water tariffs will be payable in accordance with the prevailing Pricing Strategy. The water will be too expensive for irrigation purposes. This matter will form part of the negotiations with the individual landowners.

10 ALTERNATIVES

10.1 Introduction

Alternatives are the different ways in which the project can be executed to ultimately achieve its objectives. Examples could include carrying out a different type of action, choosing an alternative location or adopting a different technology or design for the project.

The sub-sections to follow discuss the project alternatives considered during the EIA process. A detailed comparative analysis of feasible alternatives from environmental (including specialist input) and technical perspectives is provided in **Section 14**.

10.2 Screened Alternatives

Alternatives considered during the Technical Pre-Feasibility and Feasibility Studies and initial Environmental Screening are discussed in this section.

10.2.1 Alternative Water Resources

Alternative water resources to those described in this report were considered and found to be inadequate or not feasible. These water resources are discussed in the sub-sections to follow.

10.2.1.1 Ground Water

Drilling around the Lephalale area was undertaken by the DWA's Geo-hydrological Division as part of a Water Research Commission (WRC) research project. The aim was to establish the extent and potential of deep groundwater resources in this area. The drilling took place through the primary aquiver, where most of the local boreholes are situated into the deep secondary aquiver. At this stage it is for exploratory purposes and if it shows potential, production boreholes might be developed, with close monitoring of a possible impact on the primary shallow aquifer, although such an impact is regarded as unlikely.

This will however be only for primary use or during construction stage of new developments. The expected extent of this source is not even remotely within the range of the required industrial demands.

10.2.1.2 Re-use of Effluent in the Project Area

The very high cost of the imported water will be a great incentive for the new water users to re-use water as far as possible. This as well as recycling of the treated effluent from the municipal Wastewater Treatment Works to industries has been taken into account in the determination of the water demand quantities. Relative to the total demand, it is not a very significant quantity, but may not be ignored. This will also mean that the principle of zero effluent will be applied to large users so that the risk of pollution of local streams is limited.

10.2.1.3 Mokolo Dam

The potential to obtain additional water from Mokolo Dam on a sustainable basis is limited. The spare yield has already been fully allocated in MCWAP-1.

10.2.1.4 Crocodile Water

Based on current knowledge, it is not envisaged that irrigation water entitlements on the Crocodile River (West) will need to be obtained, even though the current legislation does make provision for the purchasing of such water entitlements.

10.2.1.5 Return Flows in Crocodile River (West) and Vaal River Catchments

The water resources considered for the new development is to be mainly the growing volume of return flows originating from urban developments in the Gauteng and surrounding areas. This will be the first major source of water. Once the demand exceeds the available source in the Crocodile River (West), it will be augmented from the surplus available effluent emanating from sewage plants to the south of Johannesburg which will be transferred from the Vaal River catchment to the Crocodile River (West) to supplement these supplies.

10.2.1.6 Creating More Storage by Raising of Existing Dams and/or Building New Dams

The Klipvoor and Vaalkop Dams were completed in the 1970's, and Mokolo Dam was completed in 1980. The raising of Dams such as the Klipvoor Dam and Mokolo Dam, as well as the construction of additional dams on the Crocodile River system remains an option to be considered in the future for further water resources development. However, the creation of storage poses the following challenges:

- It does not provide adequate yield;
- It is costly and not viable in current circumstances;
- It also has the further challenge in that the Crocodile and Mokolo catchments are part of the international river basin shared with three other countries. Agreement will have to be secured in terms of the Revised SADC Protocol on Shared Water Courses that will take a significant period of time to obtain;
- In the Crocodile River System with a high percentage of return flows passing through, the ability of the dam to store high flows (floods) for later use is diminished and make it less effective; and
- Filling times required.

The available storage in the Crocodile River (West) is not being used optimally at this stage due to the steady stream of return flows that has kept Hartbeespoort Dam spilling most of the time during the past decade and a half. This storage capacity will be better utilised once the transfer of water to the Lephalale area commences.

The raising of dams and the creation of additional storage on rivers are always options that DWS considers in their water resource planning activities and will be investigated further for the longer term water resource development. In this regard the Crocodile (West) Reconciliation Strategy (DWS, 2015) propose the investigation of a possible balancing dam to reregulate the return flows. Due to the absence of suitable sites for a reregulation balancing dam and the factors mentioned above the project team opted for a River Management System as discussed in **Section 9.12** as the preferred option to be implemented at this stage.

10.2.1.7 Abstraction Point at Faure Weir

Various abstraction points have been analysed from the confluence of the Crocodile and Pienaars Rivers to the confluence of the Crocodile and Limpopo Rivers. Due to the geomorphology of the Crocodile River (West) and other evaluation criteria only two suitable sites were identified and investigated further. Due to non-compliance with 6 of the 13 evaluation criteria the Faure Weir site is not suitable (refer to **Section 9.3.1.2**). The estimated capital cost of the Faure Weir is 7,6 times more than the estimated cost of the Vlieëpoort Weir. There is also additional evaporation and seepage losses in the river reach between the two weir sites.

10.2.1.8 Water Transfer from Rivers beyond the Borders of South Africa

It was found that the cost and the time frames required for such development render this option unfeasible.

10.3 Alternatives to Project Components

10.3.1 General

The alternatives to the project components, which include the screened or initial alternatives assessed as part of previous studies, are listed in **Table 22**. This information is based on the discussions in **Section 9**.

Table 22: Alternatives of Project Components

Project Components	Screened / Initial Alternatives	Feasible Alternatives
Abstraction Weir	• Boschkop Upper Site (Original Dam Site) • Boschkop Lower Site • Nooitgedacht DWA Gauging Weir • Hugo's Weir (Existing Farmer Abstraction Weir) • Vlieëpoort Upper Site (Original Site) • Vlieëpoort Lower Site	Vlieëpoort Upper Site
Balancing Dam & Desilting Works	• Option 1: Portions 1 and 2 of the Farm Mooivalei 342 KQ; and	Option 1

Project Components	Screened / Initial Alternatives	Feasible Alternatives
	• Option 2: Portions 5, 6, 7 and 23 of the Farm Mooivalei 342 KQ	
Conveyance	• River conveyance • Canal conveyance • Pipeline conveyance	River and pipeline conveyance
Transfer System - Vlieëpoort Abstraction Site to OR	• Alternative – Central Route • Alternative A • Alternatives C, C1, C2, & C3 • Alternative D • Alternative E • Alternative I	• Alternative – Central Route • Alternative A1 • Alternative A2 • Alternative C • Alternative E (new)
Delivery System - OR to Terminal Point	• Alternative F • Alternative G • Alternative H	• Alternative D1 • Alternative D2 • Alternative D3 • Alternative D**4**
BPR	BPR (Central Route)	BPR (Central Route)
OR	• Terminal Dam(s) • OR & Terminal Reservoirs	OR & Terminal Reservoirs
Disposal of abstracted sediment	• Partial storage and discharge back to the river • Complete storage	Partial storage and discharge back to the river

10.3.2 No-Go Option

The "no-go option" is evaluated in **Section 13.22** to understand the implications of the project not proceeding.

10.3.3 Alternatives Suggested by Interested and Affected Parties

Alternatives suggested by IAPs as part of the previous EIA, as extracted from the Scoping Report (DWA, 2011), include the following:

1. Mr. T. Roux from the Remainder of the Farm Paarl 124 KQ recommended that the route follows existing roads along the western and northern boundary, rather than traverse the property alongside high voltage power lines. The lead to the adoption of the current Alternative A1.
2. Mr. J. Prinsloo from the Farm Mecklenburg 310 KQ suggested that the pipeline follow the road servitude between the farms Mecklenburg 310 KQ and Paarl 124 KQ. This lead to the adoption of the current Alternative A2.
3. Representatives from Thaba Tholo and other parties recommended that the pipeline should go through Thabazimbi / Regorogile Township and connect to the R510 road rather than following the original western route around the ridges. Although this option was initially included (referred to as Alternative C), it was discarded for the reasons provided in **Table 19***.*
4. Mr. D. Smit from the Farm Blaauwpan 133 KQ suggested that the pipeline follows the R510 road until it crosses the railway line, which lead to the adoption of the current Alternative C.
5. Mr. H. Boegman, in his capacity as the chairperson of the Steenbokpan Environmental Forum and the landowner of the Farm Mooipan 325 LQ, requested that existing infrastructure (i.e. railway line) be followed as far as possible instead of routing the pipeline through pristine bushveld. Mr. M. Barnard (landowner of Portion 1 of the Farm Rooipan 355 LQ and Portions

1, 2, 3 and 5 of the Farm Rhenosterpan 361 LQ) also recommended that the railway line be followed instead of the farm boundaries of the abovementioned farms since he is operating the farms as one unit and therefore does not have internal boundaries in place. The lead to the adoption of the current Alternative D1.

During public participation conducted as part of the Announcement Phase of the current EIA the following alternatives were suggested:

- Mr H. Steenkamp (landowner of the Farm Doornlaagte 353 LQ) suggested that the route Alternative D3 rather be straightened to follow farm boundaries as opposed to the Steenbokpan – Sentrum Road in some sections to avoid coming close to existing farm houses. Mr Steenkamp did not formally provide an alternative route to the project team, and could therefore not be assessed in detail for technical viability. In accordance with the approach employed for the alignment of the pipeline, the current alignment of Alternative D3 follows the existing Steenbokpan Road (D175). The suggested route was not adopted as it will lead to the fragmentation of the affected properties. Construction access would be more difficult to the (i) south (boundary between the Farms Grootlaagte 354 LQ and Rooipan LQ 355) (ii) centrally (boundary between the Farms Doornlaagte 353 LQ and Zandheuvel 356 LQ); and (iii) at the northern end of this alternative. Additional access roads will also be required to the borrow pits adjacent to Alternative D3. The security risk associated with a second access parallel to the existing road will also have to be considered by the land owners.

During public participation as part of the Scoping phase the following alternatives were suggested.

- Mr. N. Roets (landowner of Portion 8 of the Farm Mooivallei 342 KQ) suggested 3 alternative pipeline routes from the Vlieëpoort abstraction weir to the desilting works (refer to **Figure 68**). The technical team investigated the suggested alternative routes and determined that the suggested blue and purple lines could not be adopted as they were deemed to not be technically viable. The reason being is that the proposed abstraction point is on the right flank of the river, looking downstream. These routes (blue and purple) imply two additional river crossings, which will not be acceptable from a cost and risk perspective. The yellow route is not viable as it will directly affect the farmhouse. Alternative E was subsequently included as an option for the pipeline route in the Mooivallei area following the Scoping phase.
- Alternatives suggested by Mr. G. Bauer (landowner of portion 10 of the Farm Mooivallei 342 KQ), as well as the feedback from the project team regarding the viability of these options, follow:
    - Alternative A: move the weir site from Vlieëpoort to a position on the river immediately adjacent to the storage dam (see **Figure 69**); Alternative A could not be adopted because from a river hydraulic perspective the location of the abstraction weir is mostly determined by the topography, the geology and the river morphology, which impacts on the sediment management. The Vlieëpoort site is the preferred site from this perspective. Alternative A as a weir site is not a technically feasible option and contrary to the assumption presented,

the cost of the weir structure at the suggested position "A" will likely increase. Various technical and geotechnical studies were performed in the selection and optimisation of the weir site for the project. The weir was positioned in the narrowest part of the valley at Vlieëpoort. Moving it downstream will significantly increase not only the length of the weir, but also the associated jet grout cut-off which will have substantial cost implications, certainly dwarfing any land expropriation costs as well as the cost saving of a shorter pipeline.

- Alternative B: the pipeline to follow the road on the south western side of the Crocodile River (West) and to cross the river adjacent to the storage dam (see **Figure 70**). This alternative is not technically viable and the same goes for the alternative pipeline route on the left bank of the Crocodile River (West). The reason being that the abstraction works need to be located on the right bank of the river (outside of the river bend) to minimize sediment abstraction. One could cross the river with a pipeline encased in the weir. But the second crossing will be a costly and risky exercise, especially given the founding conditions on very deep sands, not to mention another river diversion being required during construction. A significant length of stainless steel pipeline may also be required in the river crossings further raising the costs. From an environmental perspective, another river crossing would not be preferred.

Figure 68: Alternative pipeline routes suggested by Mr. N. Roets

Figure 69: **Alternative A weir site suggested by Mr. G Bauer**

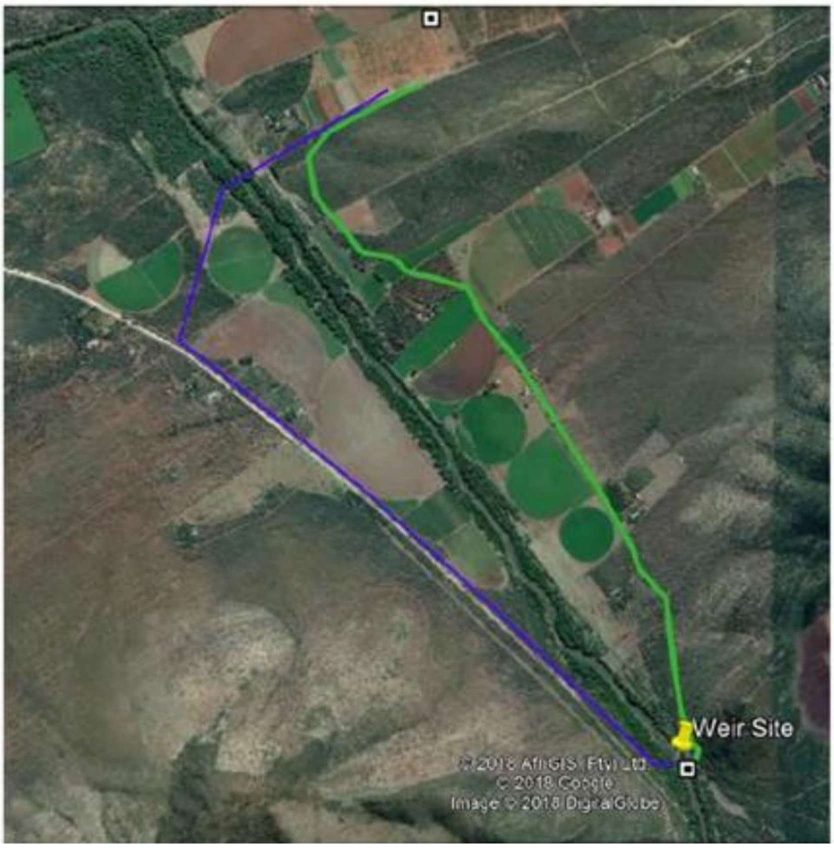


Figure 70: **Alternative B pipeline route suggested by Mr. G Bauer**

During public participation as part of the EIA phase the following alternatives were suggested:

- A concern was raised by the landowners of the Farm Taaiboschpan 320 LQ, along option D1 pipeline route, of the potential impacts of construction on the pan that is located on this property. The wetland specialist had considered the impacts on this pan as part of his assessment. However, as further mitigation, a deviation of the pipeline route was identified (termed Alternative D4 – shown in **Figure 71**) to avoid the pan by more than 500m, based on a buffer noted by the concerned landowners. Alternative D4 will terminate at a different point along the pipeline that was previously authorised as part of MCWAP Phase 1. Alternative D4 affects the Farm Enkeldraai, and the landowner of this property (Mr. T.J. Sauer) indicated that the pipeline can traverse his farm (refer to Comments and Responses Report contained in **Appendix M**). DEA was notified of the addition of Alternative D4.This new route was incorporated into the Final EIA Report as the BPEO for the northern part of Section 5 of the pipeline route alternatives.
- Mr. B. Enslin, on behalf of his Clients, suggested a deviation of the pipeline alignment along the Central Route, between the Farms Buffelsvley 127 KQ, Karoobult 126 KQ, Zondagskuil 130 KQ and Leeuwbosch 129 KQ (shown in **Figure 72**). The Central Route remains the BPEO at this stage. Adequate mitigation measures are to be implemented based on the EMPr, as well as the outcomes of the land acquisition process. A meeting was held with B. Enslin on 26 November 2018 to provide feedback with regards to the proposed route deviation. The technical aspects below were considered in the appraisal of the new proposed route –
  - The route profile is technically feasible with a continuous uphill grade (based on Google Earth Data).
  - The proposed alternative route from where it deviates from the current route is 18.5km in length to the Break Pressure Reservoir, compared to the current route length of 13km. The proposed alternative will thus require an additional 5.5km of rising main pipeline. The total rising main length is increased from 29km to 34.5km. This represents an increase in length of the rising main pipeline of 19%.
  - Impact on capital cost is an additional 14% increase on the Rising Main cost and 7.5% on pump station cost.
  - Impact on energy costs due to additional friction losses is approximately 16% per annum over the life of the project.
  - The Feasibility Study considered the route with the least impacts, considering a variety of factors.
  - A key determinant in the routing of the pipeline in this area is the location of the BPR. The proposed route deviation follows Route Alternative B, which was discarded during the Feasibility Study, based on considerations related to the suitable location for the BPR.
  - The new longer rising main and hydraulic grade line will impact on the pump station design (efficiencies in the pump station have a significant cost implication).

- The area has pockets of dolomite, and additional geotechnical investigations (including test pitting, core drilling and geophysical studies) would need to be undertaken to assess the new route in detail.
- The current pipeline route aims to stay well clear the neighbouring Thaba Tholo's fences/operations (due to particular bio security issues). The new route runs close to the aforementioned property for a longer length.

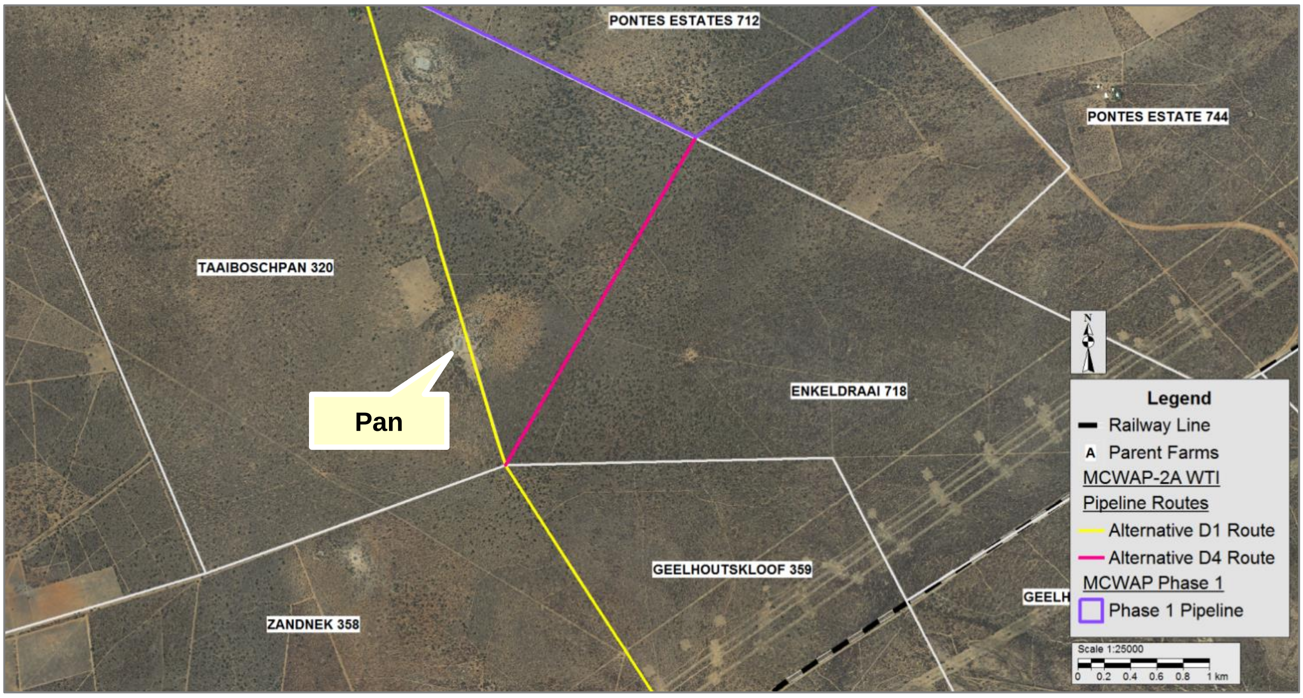


Figure 71: Alternative D4 pipeline route

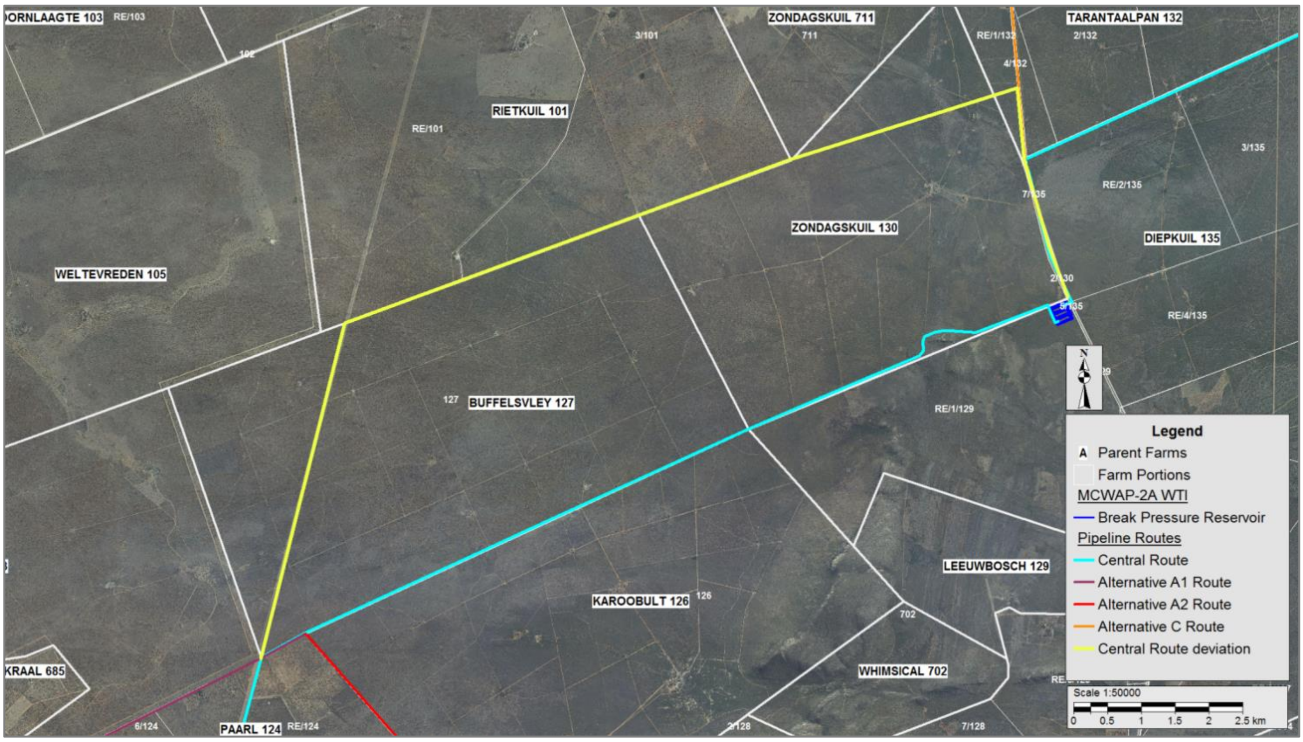


Figure 72: Alternative pipeline route suggested by B. Enslin

Although alternatives weren't necessarily suggested by most IAPs, various concerns regarding the pipeline (e.g. impact on game during construction, loss of land from servitude, etc.) were raised by IAPs that are contained in the Comments and Responses Report (see **Appendix M**). These factors were also considered during the comparative analysis of alternatives (see **Section 14**).

11 PROFILE OF THE RECEIVING ENVIRONMENT

11.1 General

This section provides a general description of the status quo of the receiving environment in the project area. This serves to provide the context within which the EIA exercise was conducted. It also allows for an appreciation of sensitive environmental features and possible receptors of the effects of the proposed project.

The study area includes the entire footprint of the project components and related activities. A 100 m wide corridor (i.e. 50 m on either side of the centre line of the pipeline, as well as the access road to the abstraction weir) was adopted as the study area during the EIA phase, which allows for possible deviations from the proposed alignment within this corridor (e.g. avoidance of sensitive features, if possible).

Where necessary, the regional context of the environmental features is also explained, with an ensuing focus on the local surrounding environment. The reader is referred to **Section 12** for more elaborate explanations of the specialist studies and their findings for specific environmental features.

This section allows for an appreciation of sensitive environmental features and possible receptors of the effects of the proposed project. The potential impacts to the receiving environment are discussed further in **Section 13**.

11.2 Land Use & Land Cover

The dominant land use and land cover in the areas earmarked for the project infrastructure is shown in **Figure 73** and provided in **Table 23**.

The project area is of a rural nature. The proposed infrastructure is mostly located on privately-owned properties that are primarily used for agricultural practices and game-farming. Sensitive aspects associated with the aforementioned land uses include (amongst others) cultivated commercial fields, orchards and pivots (primarily in the Mooivallei area), agricultural infrastructure and facilities (e.g. pipelines, boreholes, dams), and sensitive game species (e.g. exotic game). In addition, agricultural activities are located downstream of the abstraction point that require water for irrigation and stock watering purposes.

Further details of the agricultural land use in the project area are contained in the Agricultural Impact Assessment (contained in **Appendix I3**), and are discussed in **Section 12.7**.

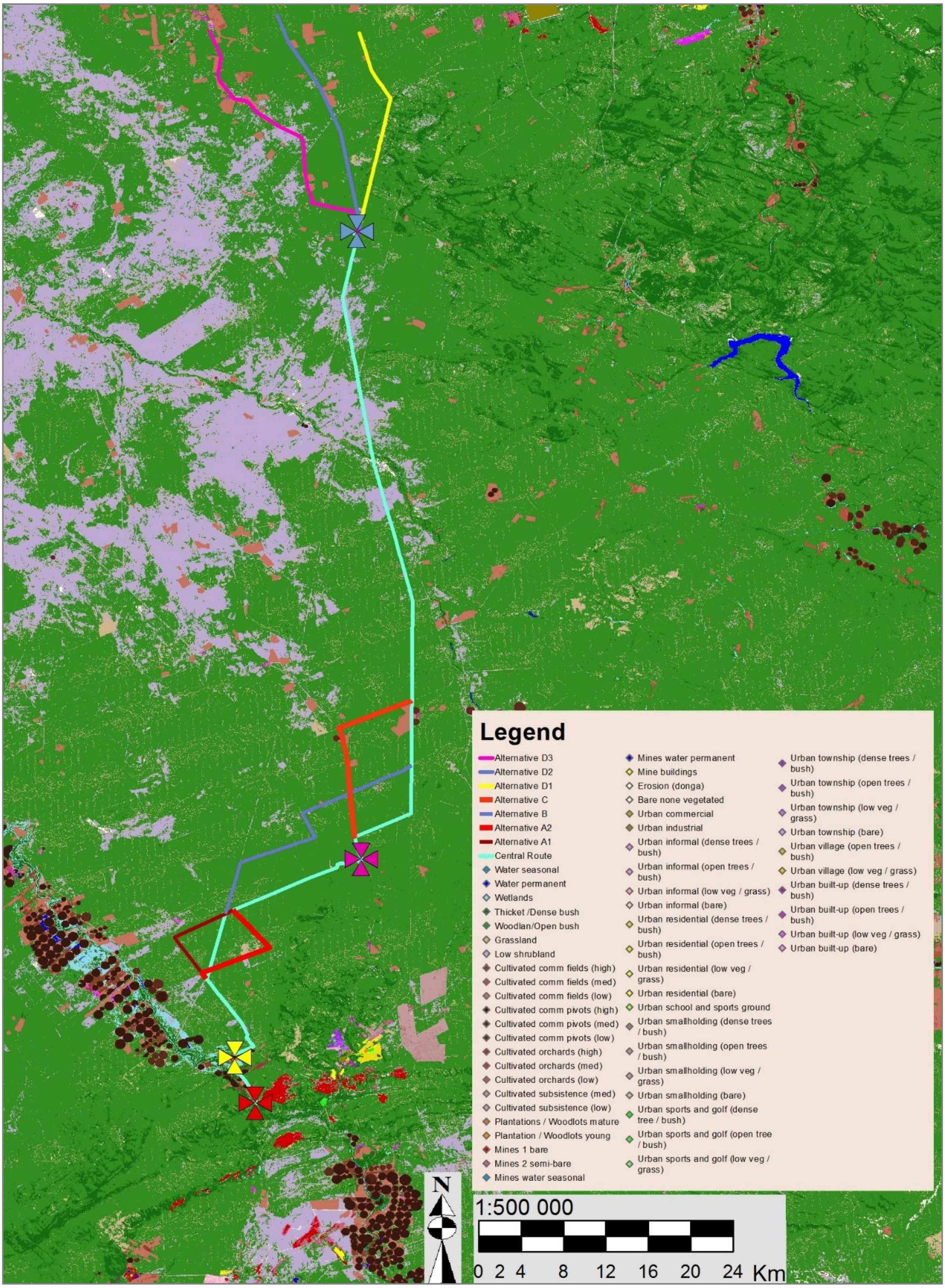


Figure 73: **Land Cover**

(Note: Pipeline Route Alternative B was discarded; gauging weirs and route Alternatives E & D4 not shown)

Table 23: Land use & land cover

Project Components	Alternatives	Dominant Land Use & Land Cover
Vlieëpoort abstraction weir	-	Natural grassland and woodland.
Low-lift pumping station	-	Natural grassland and woodland.
Low-lift rising main	-	Natural grassland, woodland and cultivated land.
Balancing dam	-	Primarily cultivated land (including pivots). Minimal natural grassland and woodland along drainage channel.
Desilting works & Sediment Storage Compartments	-	Primarily cultivated land. Minimal woodland on land earmarked for sediment storage compartments.
High-lift pumping station	-	Cultivated land.
Pipeline	Central Route	Natural grassland, woodland and cultivated land.
	Route A1	Primarily woodland.
	Route A2	Primarily woodland with some cultivated land.
	Route B	Natural grassland and woodland.
	Route C	Natural grassland and woodland. Some cultivated land.
	Route D1 & D4	Primarily woodland with some grassland.
	Route D2	Primarily woodland with some grassland and cultivated land.
	Route D3	Primarily woodland with some grassland and cultivated land.
BPR	BPR (Central Route)	Woodland.
OR	-	Woodland.

11.3 Climate

11.3.1 General

The information to follow was obtained from the South African Weather Service for the weather stations in Thabazimbi and Lephalale. Note that further details pertaining to the climate in the project area are provided in the Agricultural Impact Assessment (contained in **Appendix I3**).

11.3.2 Temperature

Thabazimbi

Average daily maximum and minimum temperatures measured at the weather station in Thabazimbi are shown in **Tables 24** and **24**, respectively.

Table 24: Average Daily Maximum Temperature (°C) by month– Thabazimbi station

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2006	29.8	29.5	27.2	27	23.2	22.6	24.8	24.7	29.5	32.9	30.8	33.6
2007	33,9	35,5	34,1	29,2	24,4=	23,7	22,9	27	32,2	29,2	31,3	29,6
2008	29,2	31	28,8	27,6	26,2	24,2	23,8	28,2	31,6	34,7	32,1=	33,2=
2009	31,9	30,5=	28,8	29,1	26	23,4	21,6	25,6	31,3	30,8=	31,5	33,3
2010	31,6	32,7	32,6	26,2	25,7	22,6	22,8	27,1	32,6	34,5	32,9	31,9
2011		31,4	31,5	26,4	25,3	23	22	26,5	31	29,6=	33,1=	31,1
2012	32,2	34	31,9	28,4	27,9	23,7	24,7	27,9	29,9	31,9	33,2	31
2013	32,9	34	32,1	28,4	26,4	24,9	23,8	26,6	31,4	31,8	34,4	31
2014	33,3	32,2	28,1	27	26,4	23,8	23,4	26,6	31,5	32,1	31,3	31,9
2015	33	35,3	32,9	29	29,1	23,4	24,4	29,4	31,1	35,3	34,8	37,5

= indicates that the average is unreliable due to missing daily values

Table 25: Average Daily Minimum Temperature (°C) by month– Thabazimbi station

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2006	20,2	19,1	16,8	11,5	4,5	1,6	2,4	6,3	10,3	16,5	17,6	20,1
2007	18,6	18,5	17,9	13,4	2,7=	3,6	1,9	5,4	14	16,1	17,5	18,1
2008	19	18,2	17	9,5	7,4	3,2	2,8	7,1	11,7	18,6	19,9=	21,1=
2009	20,7	19,6=	16,1	11,3	7,8	5,6	1,1	5,2	13,1	16,8=	18,3	19,3
2010	20,6	19,2	18,8	15,4	9,5	2,3	4,9	5,3	11,3	18,1	19,1	19,1
2011		19,1	17,9	14,5	7,8	2	1,3	5,5	13	13,1=	17,5=	20,2
2012	19,8	20,1	16,9	11,5	7	3,5	3,7	7,4	12,3	16,6	18,4	18,5
2013	20,4	20	18	12,5	6	3,2	4,6	6,4	14,1	17,6	19,4	20,2
2014	20,6	20,5	18,8	12,4	6,9	2,8	3,1	8	13,1	17,2	18,9	20,5
2015	20,4	20,2	19,3	14,4	7,8	4,3	5,6	8	15,4	19,6	19,3	21,9

= indicates that the average is unreliable due to missing daily values

Lephalale

Average daily maximum and minimum temperatures measured at the weather station in Lephalale are shown in **Tables 26** and **27**, respectively.

Table 26: Average Daily Maximum Temperature (°C) by month– Lephalale station

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2006	31,1	30,9	27,2	27,6	24,5	23,9	25,3	25,2	29,4	33	31,9	34,1
2007	32,6	35,3	33,2	28,5	26,1	24	23,2	27,3	31,9	28,8	30,3	28,8
2008	29,7	33,4	30,6	29,2	27,4	25,3	24,1	28,4	31,5	33,9	31,5	32,4
2009	31,6	30,8	28,9	29,4	26,5	24,3	22,5	26,3	31,2	31,9	33,3	35,8
2010	35,5	36,6	36,3	29,3	28,5	23,8	24	27,5	32,4	35,1	32,8	33,1
2011	31,2	32,5	34,1	28,2	27,9	24,8	23,7	27	32,6	32,7	33,5	31,2
2012	33,2	35	33,8	29,6	28,9	25,3	25,6	28,3	30,2	31	32,4	31,3
2013	32,1	33,8	31,3	28,8	27	26	24,9	27,1	32,1	32,1	34,8	30,8
2014	32,4	31,9	28,7	27,3	26,7	24,8	24,3	27,4	31,6	32,2	31,4	31,3
2015	33	35,2	33,3	29,8	30,6	25,3	26,2	30,5	31,7	36,3	34,9	36,7

Table 27: Average Daily Minimum Temperature (°C) by month– Lephalale station

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2006	20,3	20	17,2	13,1	6,9	5,4	5,7	7,1	11,5	17,1	18,1	19,8
2007	18,6	19	17,6	13,4	6,1	4,4	2,7	6,4	13,6	15,2	15,8	17,3
2008	19,2	18,7	17,9	11,8	10,4	6,4	5,8	8,9	12	17,6	19,3	19,9
2009	20,5	19,3	17	12,3	9,8	6,8	4,1	6,9	13,9	17,6	19,5	21,9
2010	22,9	23	22,3	19,2	14,2	6,5	7,3	8,4	13,6	18,3	19,8	20,2
2011	20,7	19,6	20,1	16,4	11,3	5,1	4,8	8,1	13,3	17,3	19,7	20,2
2012	20,6	21	18,9	13,9	10,3	7,1	6,6	8,8	14,2	17,5	18,5	19,9
2013	21	20,3	18,2	14,4	9,2	6,4	7,4	8,7	14,8	17	20	20,3
2014	21,1	20,6	19,3	14,7	9,9	6,3	5,9	9,1	14	16,7	18,9	20
2015	20,7	22	20,4	16,7	11,7	8,5	9	11,3	16,3	20,3	20,1	23

11.3.3 Precipitation

The area is classified as semi-arid and precipitation occurs mainly in the summer, with the maximum rainfall experienced during November - March.

Thabazimbi

The monthly daily rainfall for the last ten years for Thabazimbi is shown in **Table 28**.

Table 28: Monthly Daily Rain (mm) by month– Thabazimbi station

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2006	23	239,8	96,2	2	3,6	0,8	0	3,6	0	55,6	71,6	64,8
2007	32,4	11,4	0,4	22,2	0	17,8	4,4	0	58	65,4	42,2	83,2
2008	186,4	6,4=	79,0=	2,4	11,2	2,4	3,6	0	0	0,2	63,6=	24,2=
2009	50,6	0,0=	16,8	0	5,2	41	0	0	0	5,6=	0,4	9,4
2010	1,2	0	26,6	71	39,2	0	0	0	0	0	0	0,0=
2011				0,2	0,2	0,0=	0,0=	0,0=	0	0,0=	0,2=	0
2012	36,8	11	1	0	0	0	0	0	0	24	5,4	19
2013	14,2	12,8	92	22,6	0	0	0	0,6	29,4	41,2	11,8	89,4
2014	36,6	31,2	146,6	12,2	2,2	0	0	0	1,4	15,8	36,4	95,4
2015	75,6	40,6	54,2	37,8	0	0	0,6	0	16,2	12,4	46,4	67,4

= indicates that the average is unreliable due to missing daily values

Lephalale

The monthly daily rainfall for the last ten years for Lephalale is shown in **Table 29**.

Table 29: Monthly Daily Rain (mm) by month– Lephalale station

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2006	143,6	68,8	52,2	12,4	11	0	0	2	1,6	3,2	42	81,4
2007	11,8	24,2	47,4	36,6	0	0,2	1,4	0	30,2	90,2	113,4	74,6
2008	142,4	0	60,8	1,2	11	0	1	0	0	15,2	166,2	80,8
2009	116,8	62	69,8	0,6	4,8	8,4	0,2	0	0	42,6	74,6	85,4
2010	77,8	19,6	18,8	75,2	51	0	0	0	0	36	52,4	61,4
2011	150,4	3,4	3,6	2,4	0	0	0	0	0	73	51,8	82,8
2012	66	52	29,2	0	0	0	0	0	4	93,6	61,4	167,2
2013	118	9,2	21	55	0	0	0	0	0	21,2	19,2	122,8
2014	29,8	20,6	218,8	27,4	0,4	0,2	0	0	0	23,4	24,6	162,4
2015	24,6	48	29,4	21,6	0	1,6	2,2	0	12,2	29,8	57,6	63,8

11.3.4 Design Considerations

Climatic factors (including evaporation and rainfall) were taken into consideration as part of the engineering investigations undertaken as part of the Technical Feasibility Study. This was used *inter alia* during the hydrological modelling to determine the yield of the Crocodile River (West) system.

Refer to **Section 13.3** for discussions on climate change.

11.4 Geology

11.4.1 General Geological Setting

Refer to the simplified geological map in **Figure 74** for the discussion to follow. A variation in the geology generally occurs from the south to the north. The geology in the southern regions consists predominantly of dolomites and granites, changing to predominantly Waterberg quartzite, dolomite and granite in the central regions with Khalahari sands and Waterberg quartzite becoming more prominent towards the north and west.

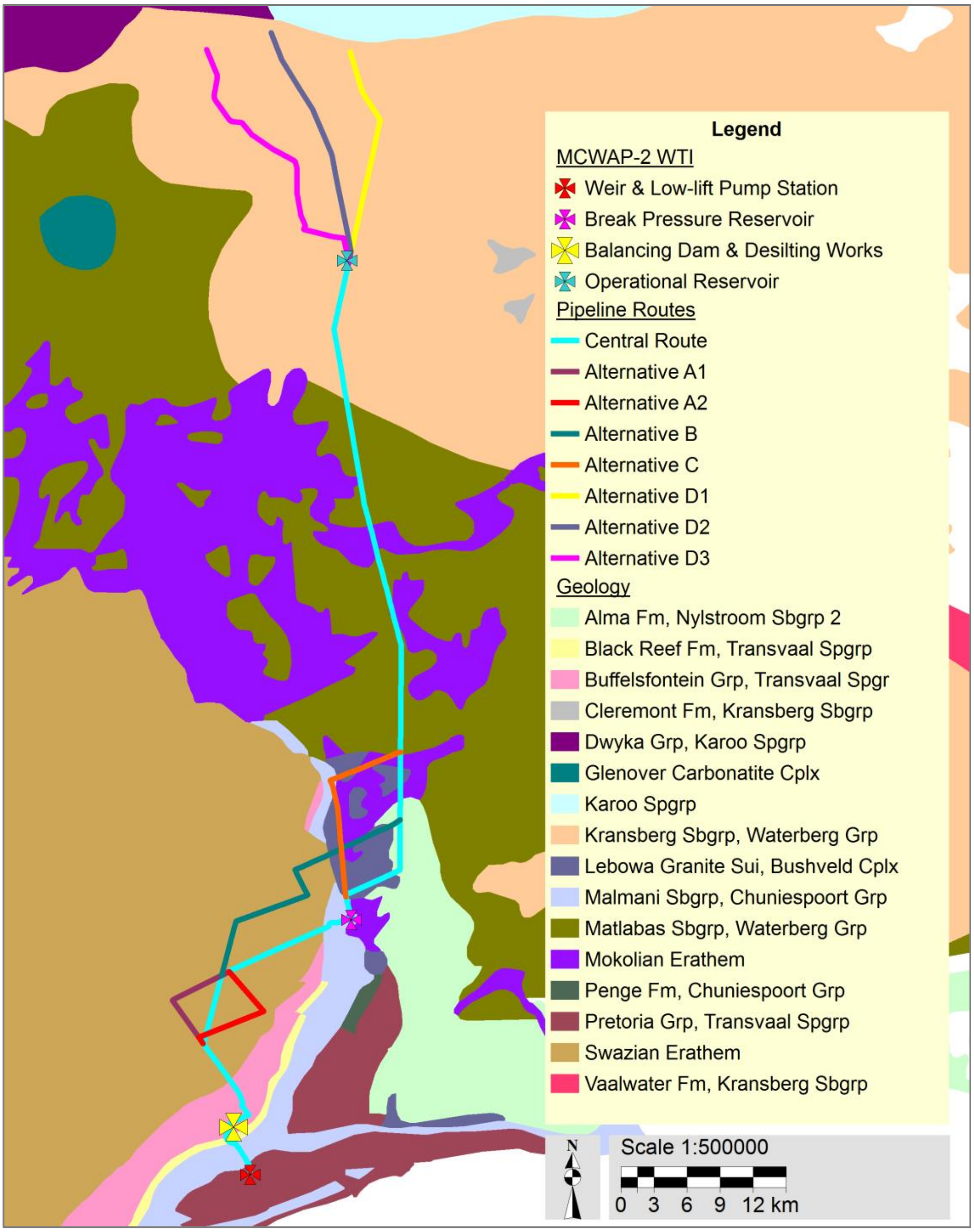


Figure 74: Simplified geology

(Note: Pipeline Route Alternative B was discarded; gauging weirs and route Alternatives E & D4 not shown)

The information to follow was primarily sourced from the Feasibility Study Geotechnical Investigations (DWA, 2008).

Lithology and Stratigraphy

The large geographical area of the scheme, which extends from the proposed Vlieëpoort weir site in the south, to the delivery area near Steenbokpan in the north, also has, as a further consequence, an extensive geological coverage. The oldest lithologies are found in the southern portion of the study area, becoming progressively younger towards the north. The oldest lithologies encountered belong to the late Archaean to early Protozeroic (i.e. approximately 2 650 to 2 050 million years) Transvaal Supergroup, and comprise the dolomitic rocks and ironstone formations of the Chuniespoort Group, and the slightly younger shales, quartzites and lavas of the Pretoria Group.

The central portion of the study area is underlain by the sandstones of the Waterberg Group which are considered to be between 1 700 and 2 000 million years in age. The northern portion of the study area is underlain by rocks of the Karoo Supergroup which comprises a succession of sandstone, siltstone, shale and mudstone and are approximately 150 to 270 million years in age. Extensive diabase intrusions are particularly prevalent with the central portion of the study area where they are seen to have intruded the sandstones of the Waterberg Group. Extensive areas, particularly in the north, are covered by Quaternary Age sands which are younger than 1,8 million years.

Structural Geology

The structural geology of the study area is similarly highly complex and a single paragraph cannot do these complexities justice. The older, Transvaal Supergroup rocks in the south of the study area have a moderate to shallow dip of 15° to 30° towards the south-east; reflecting the intrusion of the younger Bushveld Complex, which depressed these underlying strata. These Transvaal Supergroup rocks are extensively faulted. Although faults are generally of limited extent, some major faults, which can be traced for distances in excess of 50 km, can be identified.

In the south, the sandstones of the Waterberg Group dip at shallow angles in a northerly direction, but become almost horizontal towards the north. Prominent NE- and NWstriking lineaments are recognized and likely represent intrusive diabase dykes. The Karoo sedimentary strata are essentially sub-horizontally bedded, but are extensively faulted. Some of the faults may be traced for significant distances.

Economic Geology

The envisaged abstraction weir is not intended as a storage facility and the elevated water level will largely be confined within the current river bank. No new inundation of any mineable mineral reserves will therefore occur as a result of impounding. In the north, beyond the Eenzaamheid Fault, coal is extracted on a large scale from the Ecca sediments. The pipeline routes are generally located south of this fault, except for limited transgressions in the vicinity of the Medupi Power Station.

Coal is found in South Africa in 19 coalfields located mainly in the provinces of KwaZulu-Natal, Mpumalanga, Limpopo and the Free State, with lesser amounts in Gauteng, North West and the Eastern Cape. The Waterberg coal reserve is estimated at 75 000 Mt of coal, which is approximately 40 % of South Africa’s remaining coal reserves (Ninham Shand, 2008). The coal seams mined at the Grootegeluk Mine form part of the Upper (Volksrust formation) and Middle Ecca (Vryheid formation) with an average coal thickness of 115 meters. The Thabazimbi area is rich in mineral deposits. A section of the Thabazimbi iron ore mine (undergoing closure at the time of writing this report) is situated upstream of the proposed Vlieëpoort weir site, on the Farm Donkerpoort 344KQ.

Seismic Hazard

Published seismic hazard maps of southern Africa indicate Peak Ground Accelerations (PGAs) in the order of 0,1 g to 0,04 g within the study area, becoming progressively lower towards the north. These accelerations might be considered to represent a moderate to low level of seismic hazard.

Climate and Weathering

The study area straddles the climatic N = 5 line which indicates that neither chemical decomposition nor mechanical disintegration are dominant modes of weathering, and that both modes of weathering are likely to have an influence.

11.4.2 Geophysical Survey

A geophysical survey was carried out at sites earmarked for project infrastructure. The purpose of the survey was to identify any linear features such as faults and to map changes in bedrock depth. Key findings include:

- Vlieëpoort abstraction weir –
  - Drilling proved that the site is underlain by banded ironstone that is overlain by up to forty metres of alluvium.
  - According to the Thabazimbi 1:250 000 scale geological map, the local geological strike is SW-NE and the dip is about 25º towards the south east. There are several faults in the area including one with a SW-NE trend that may cross the site.
  - Significant work is required to prepare the foundation for the abstraction weir. Foundation work must be deep enough to prevent seepage and piping underneath the weir.
- Low-lift rising main –
  - The site is underlain by dolomite with rock head typically around twenty-five metres below surface, according to the drilling results.
  - The Thabazimbi 1:250 000 scale geological map indicates that the local geological strike is SW-NE and that the dip is about 25º towards the south east.
- Balancing dam –
  - The site is mapped as being underlain by lava and sedimentary rock of the Ventersdorp Group that dips at an angle of 27º towards the south east (2426 Thabazimbi 1:250 000 scale geological map).
  - Post-survey drilling to a depth of about ten metres indicates that beneath a thin cover of transported material, the site is blanketed with agglomerate. Lava was encountered beneath the agglomerate in two holes (BH45 and 65). Given the distance between the two holes and their orientation in respect to each other, the intersections of lava presumably reflect two separate eruptions.
  - Several faults and dykes with east-west and SW-NE trends are recorded in the vicinity but none cross the site.

❖ BPR –
- According to the Thabazimbi 1:250 000 scale geological map, the area is underlain by dolomite whose geological strike is north-south. In places the dolomite is intruded by diabase and overlain by Waterberg Group arenaceous rock.

11.5 Soils

The soil classes encountered in the project area are shown in **Figure 75**. The majority of the project infrastructure falls within areas characterised by freely drained, structureless soils. Sections of the pipeline route options traverse areas with red or yellow structureless soils and a section of the Central Route crosses and area consisting of lithosols.

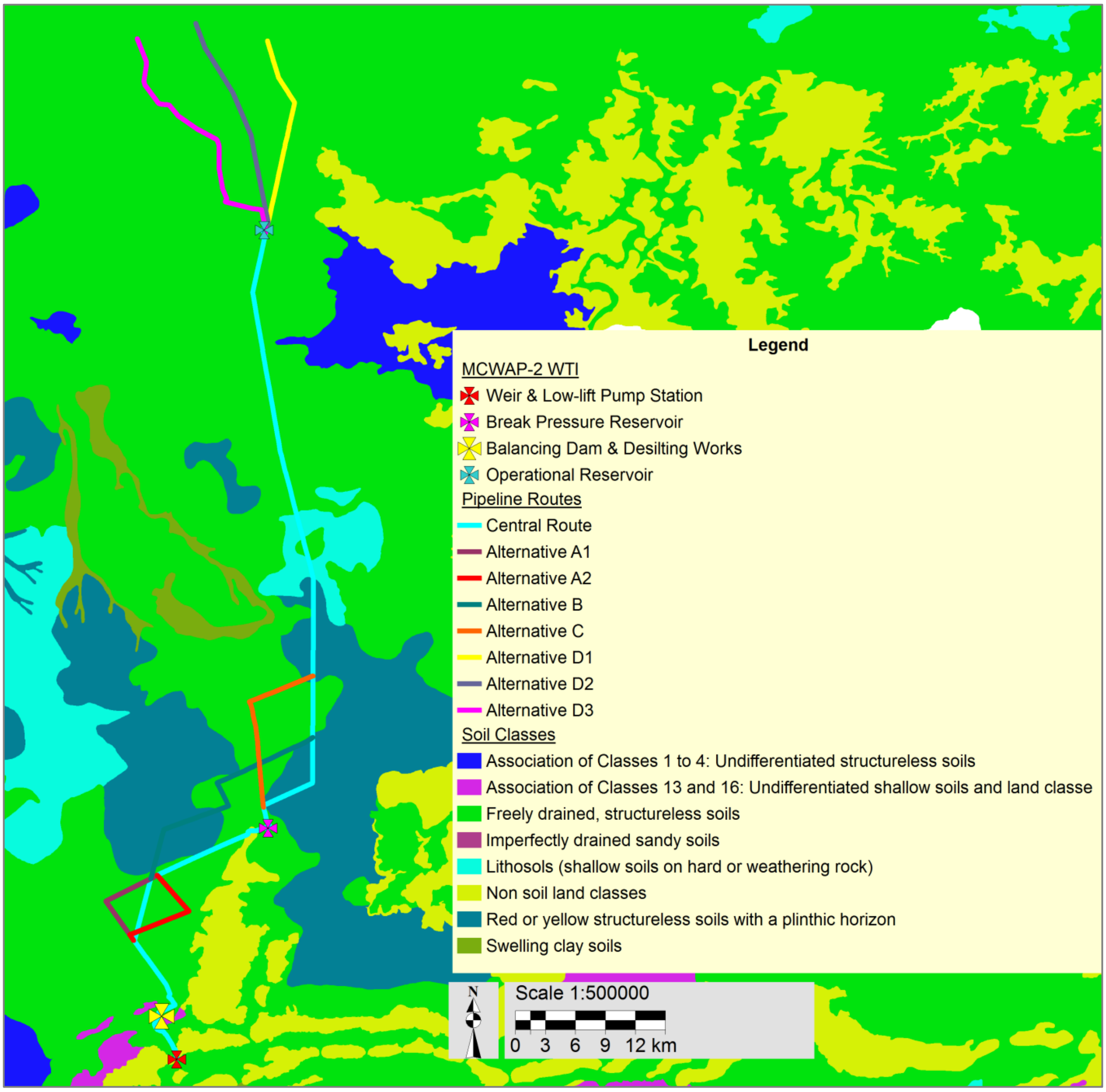


Figure 75: Soil classes

(Note: Pipeline Route Alternative B was discarded; gauging weirs and route Alternatives E & D4 not shown)

Further details on soil types and soil potential are contained in the Agricultural Impact Assessment (**Appendix I3**).

11.6 Geohydrology

11.6.1 General

Groundwater forms an important feature with regard to water resources in the Crocodile River (West) Catchment. An intergranular (alluvial) aquifer occurs along the Crocodile River (West), downstream of the Roodekopjes and Vaalkop Dams. A distinguishing feature of this aquifer is its hydraulic connection with the Crocodile River (West). The alluvial aquifer in the Crocodile River (West) sustains the current downstream irrigation use (Makoppa farmers), and is thus an important source. The aquifer is recharged from rainfall as well as river flow (DWA, 2004b).

Groundwater pollution in the catchment is caused by poor effluent disposal and waste management practices by municipalities, agricultural activities and mining. Of these, nitrates (from fertilizers and sewage) and acid mine drainage pose the biggest water quality threats (DWAF, 2006).

According to the Crocodile (West) River Reconciliation Strategy (DWS, 2015), a separate report on groundwater assessment was compiled as part of the Crocodile (West) Modelling Study. Water availability from groundwater was determined on a quaternary basis. No further groundwater sources were included as additional water availability in the Crocodile River catchment. Groundwater supply is considered in-directly in the water balance by reducing the volume of water required to be supplied by surface water resources.

11.6.2 Geotechnical Investigations

Some pertinent findings form the Feasibility Study Geotechnical Investigations (DWA, 2008) with regards to groundwater include:

- No water tables were recorded in any of the four boreholes drilled on the footprint of the balancing dam, desilting works and high-lift pumping station and it may be assumed that the water table occurs at depths greater than 10 m; and
- No seepage was encountered in any of the test pits dug along the pipeline route and it appears that this is unlikely, except in the vicinity of streams (and particularly on the south bank of the Matlabas River).

11.7 Topography

The primary terrain morphological units encountered in the project area are shown in **Figure 76.**

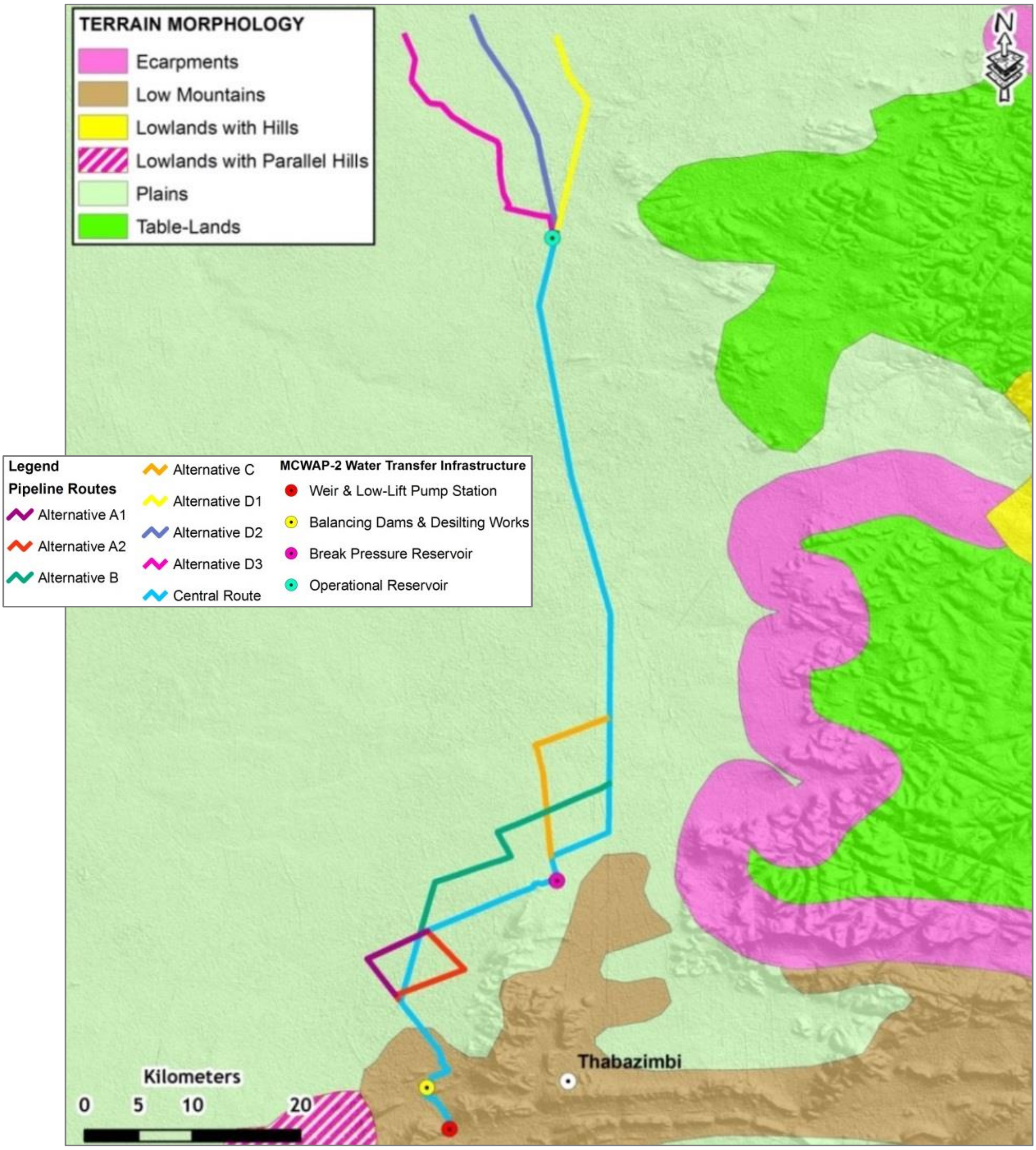


Figure 76: **Terrain morphology**

(Note: Pipeline Route Alternative B was discarded; gauging weirs and route Alternatives E & D4 not shown)

The terrain in the first section of the project footprint in the Vlieëpoort region (i.e. south-western part of project area) consists of low mountains. From there the terrain transforms to plains for the remainder of the project area, which comprises flat and undulating topography. Refer to **Figure 77** for the contours in the greater area.

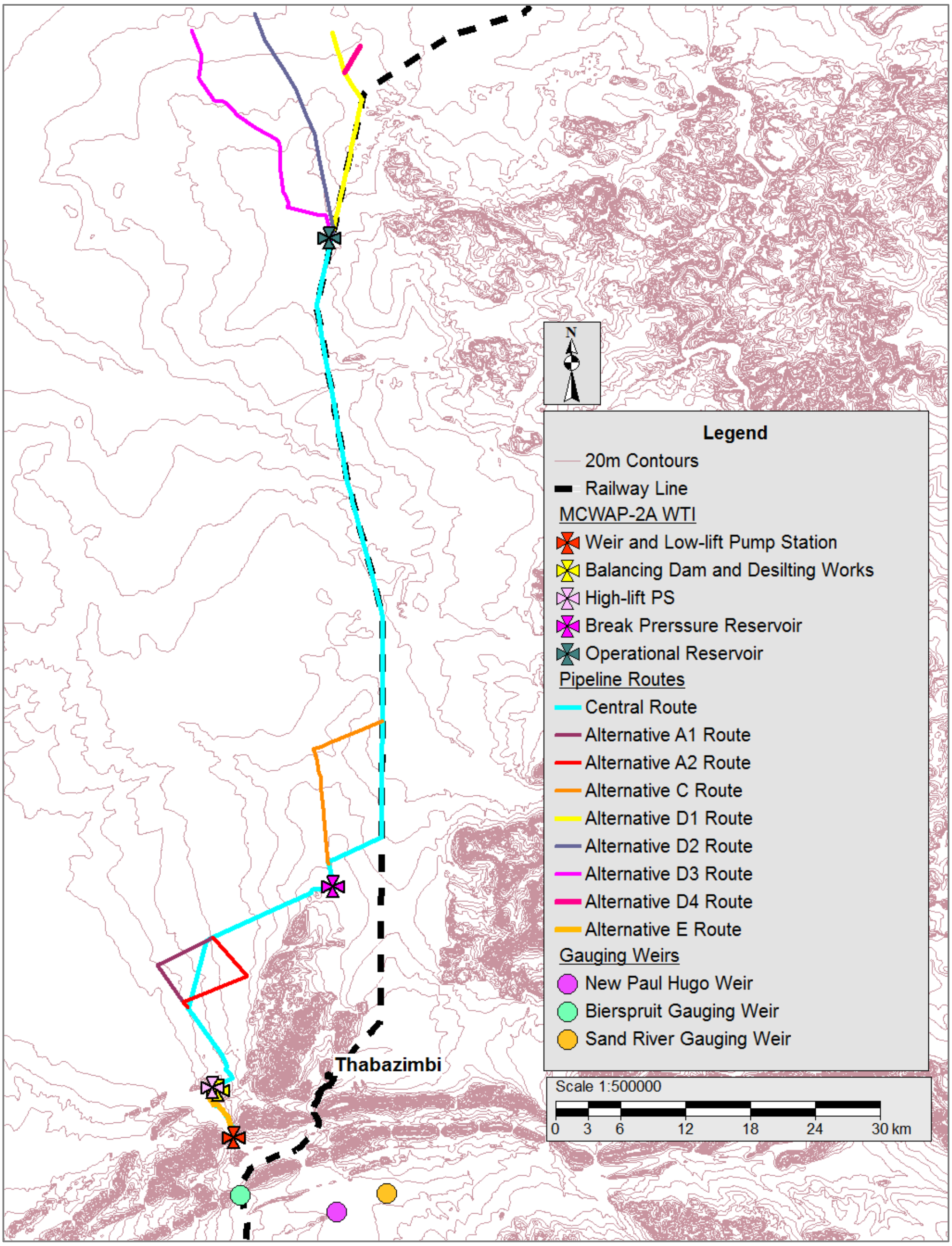


Figure 77: **20m Contours**

The site for the abstraction weir is located at a narrowing valley where the Crocodile River cuts through the Vlieëpoort mountains (see **Figure 78**). This mountain rises to elevations in excess of 1400 masl on either side of the river, where the elevation of the river bed is less than 900 masl (DWA, 2008). The site is characterised by a relatively wide river section, estimated in the order of 350m.

Figure 78: View of the Vlieëpoort abstraction weir site from left flank

A section of the Central Route follows the dirt road and passes a koppie approximately 1 km south-west of the BPR (see **Figure 79**).

Figure 79: View along dirt road followed by Central Route with koppie in background

11.8 Surface Water

A Baseline Aquatic and Impact Study was conducted (see **Appendix I1**) for the project. Refer to **Sections 12.3** and **13.8.6** for a synopsis of the study and a related impact assessment, respectively.

11.8.1 Hydrology

MCWAP-2A falls within the Limpopo Catchment as well as the Limpopo Water Management Area (WMA). The abstraction works, BPR and the first section of the pipeline in the south are situated in quaternary catchment A24J. The remaining pipeline route options and OR are located in quaternary catchments A41A, A41C, A41D, A41E and A41J. Refer to **Figure 80**. The Bierspruit gauging weir falls in quaternary catchment A24F, the Sand River gauging weir in quaternary catchment A24H and the new Paul Hugo gauging weir in quaternary catchments A24C and A24H.

The Crocodile River, which is a major tributary of the Limpopo River, is primarily fed by the Pienaars, Apies, Moretele, Hennops, Jukskei, Magalies and Elands Rivers. The total area of the Crocodile River Catchment is 29 400 km^2 (DWAF, 2004b). The major watercourses in the region are shown in **Figure 81**.

From the confluence of the Crocodile (West) and Marico rivers, the river is known as the Limpopo River, which forms the northern border of South Africa with Botswana and then with Zimbabwe, before flowing into Mozambique where it discharges into the Indian Ocean. South Africa has international agreements and obligations with each of these countries that need to be adhered to in terms of any new water resource developments within the catchment.

The Crocodile River system is regulated by the following 9 major dams:
- Rietvlei, Hartbeespoort and Roodekopjes Dams in the Crocodile River;
- Roodeplaat and Klipvoor Dams in the Apies/Pienaars River; and
- Olifantsnek, Bospoort, Lindleyspoort and Vaalkop Dams in the Elands River area.

The natural Mean Annual Runoff (MAR) of the Limpopo River is 5 067 million m^3 per annum, which mainly occurs during large floods. According to the WRC (2004), some key features of the Limpopo River catchment include the following:
- Parts of Johannesburg and Pretoria are situated in the upper reaches of the Crocodile River (in the Crocodile (West) Marico WMA) and are supplied with 650 million m^3 per annum of water transferred from Vaal Dam (in Upper Vaal WMA).
- Some 340 million m^3 per annum of this imported water is returned to the upper tributaries of the Crocodile River as treated but nutrient rich effluent, which has resulted in eutrophication of dams, whereas the natural runoffs of the Crocodile and Marico Rivers (in the Crocodile West/Marico WMA) together equal only 202 million m^3 per annum. Dolomitic aquifers supply 111 million m^3 per annum.
- The demand for water in all the South African tributaries of the Limpopo River is dominated by the irrigation requirements, followed by urban usage.

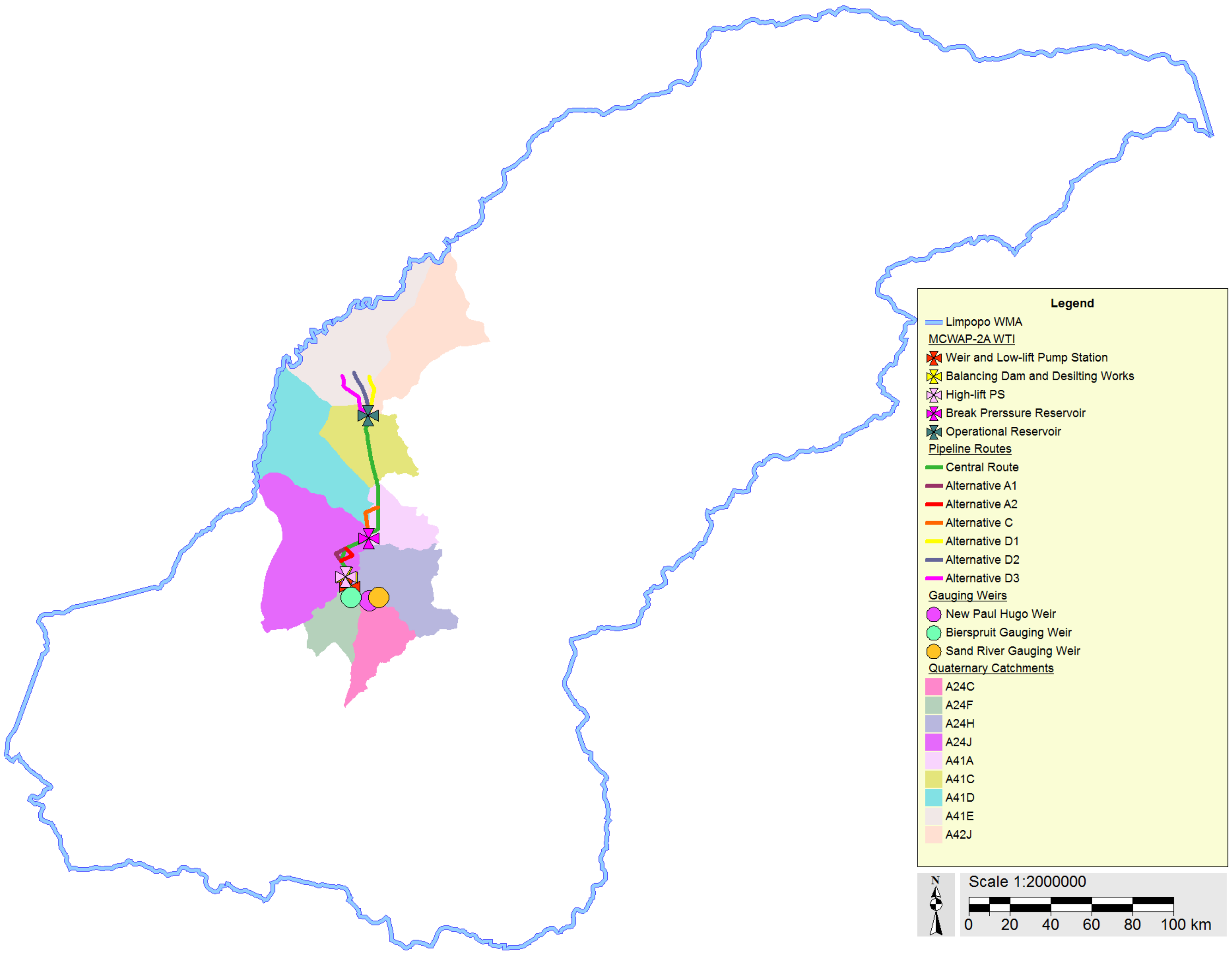


Figure 80: **WMAs and quaternary catchments**

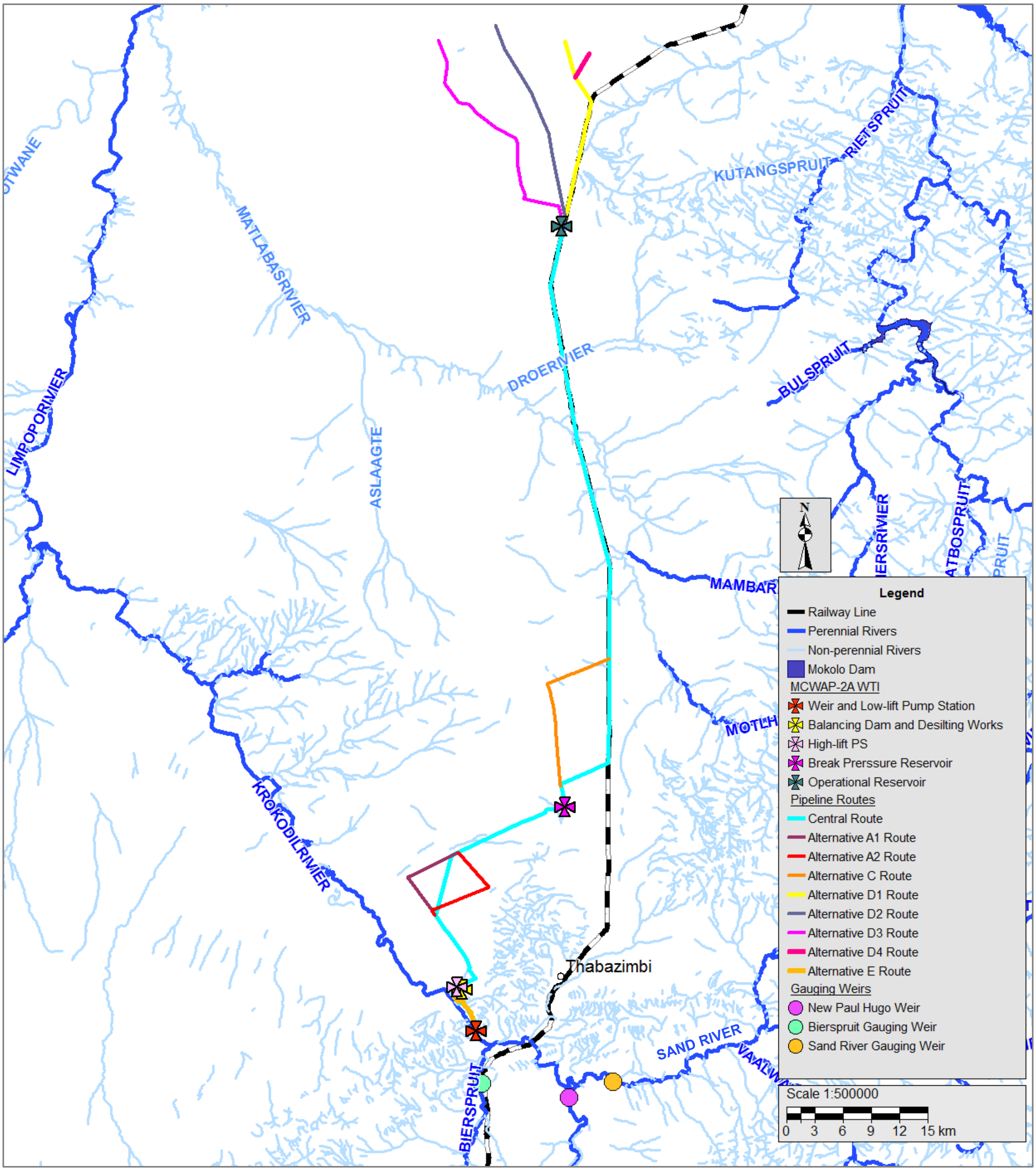


Figure 81: **Perennial and non-perennial rivers**

11.8.2 Affected Watercourses

11.8.2.1 Rivers and Streams

The following rivers and streams are directly affected by the MCWAP-2A infrastructure (refer to **Figure 81**):

- The Crocodile River (West) will be used for water conveyance for MCWAP-2A;

- Vlieëpoort abstraction weir will be located on the main stem of the Crocodile River (West) (see **Figure 82**) approximately 2 km downstream of the confluence of the Bierspruit;
- Gauging weirs will be located on the Bierspruit, Sand River and Crocodile River (West);
- Low-lift rising main crosses non-perennial tributaries of the Crocodile River (West);
- Drainage channel from desilting works crosses a non-perennial tributary of the Crocodile River (West) and will return sediment back to the main stem;
- Central Route crosses non-perennial tributaries of the Crocodile River (West);
- Central Route and Alternative C cross non-perennial tributaries of the Matlabas River;
- Central Route crosses the main stem of the Matlabas River (see **Figure 83**); and
- Alternative D1 crosses non-perennial tributaries of the Mokolo River.

Figure 82: Abstraction weir site on Crocodile River

The Matlabas River originates in the Marakele National Park. The river occupies secondary sub catchment A41 with a gross area of 6 014 km^2 and a Gross MAR of 48,7(10^{6}m^3) (Midgely *et. al*. 1994). The Mamba River is the only significant tributary to the Matlabas. The Matlabas has ephemeral flow, and hence the catchment is largely undeveloped with limited water resources and water use. There are no significant dams in this catchment and a significant portion of the water use is from groundwater due to the low assurance of the run-of-river yields (DWAF, 2004a).

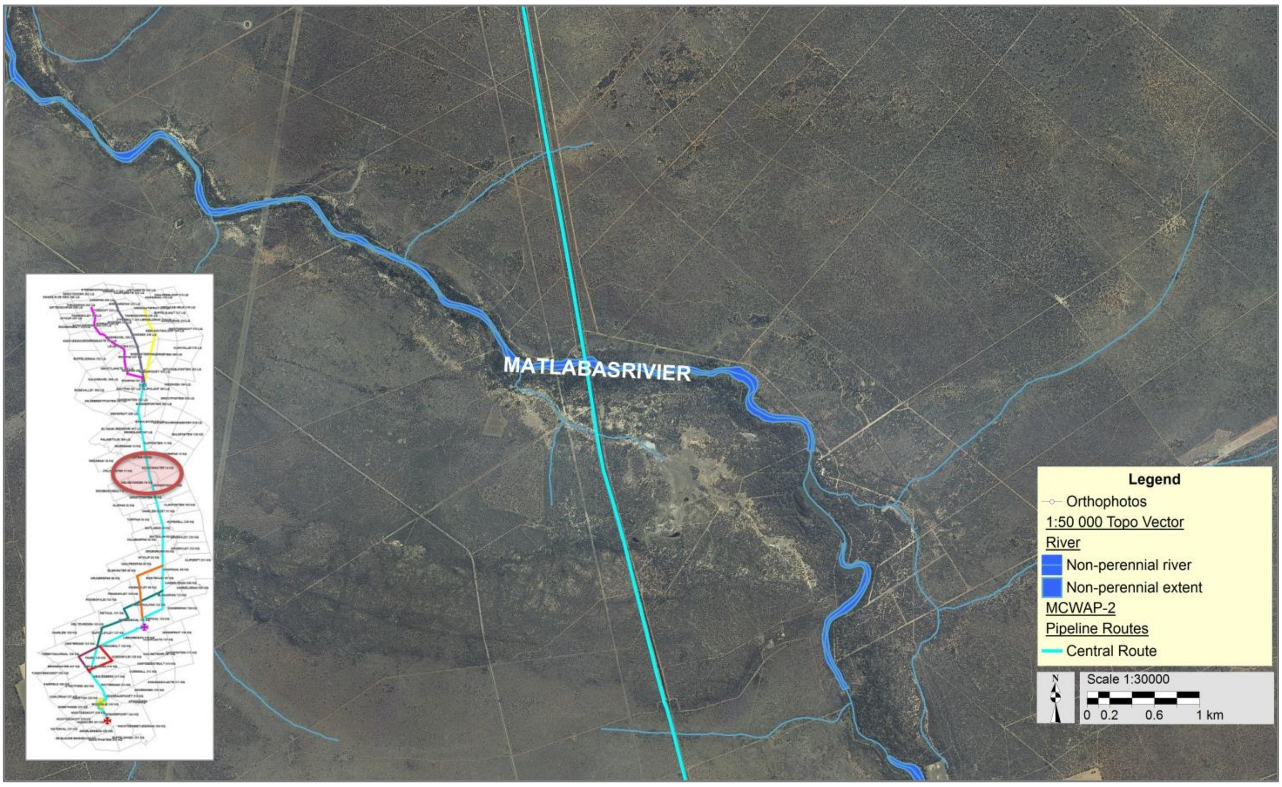


Figure 83: Crossing of Matlabas main stem and tributaries

11.8.2.2 Hartbeespoort Dam

Hartbeespoort Dam was constructed during the 1920's and completed in 1925. The dam, which lies in a valley to the south of the Magaliesberg mountain range and north of the Witwatersberg mountain range, was mainly built for irrigation purposes. Hartbeespoort Dam is very popular recreational area and also offers various tourism related activities. A number of residential developments occur around the dam.

The available storage in the Crocodile River (West) is not being used optimally at this stage due to the steady stream of return flows that has kept Hartbeespoort Dam spilling most of the time during the past decade and a half. This storage capacity will be better utilised once the transfer of water to the Lephalale area commences, if environmental authorisation is received. The operating level of the Hartbeespoort Dam will fluctuate as per seasonal rains, which may result in various impacts.

A Specialist Opinion was sought with regards to the potential impacts of MCWAP-2A on Hartbeespoort Dam (see **Appendix I8**). Refer to **Section 12.10** and **Section 13.8.7** for a synopsis of the study and a related impact assessment, respectively.

11.8.3 Sediment Regime

The sediment regime includes inputs and outputs of mobile sediment from a length of channel and storage of sediment within the channel and floodplain over a specified time interval.

The catchment area between the Klipvoor, Roodekopjes and Vaalkop Dams and Vlieëpoort is in Sediment Yield Region 1 with a medium sediment yield potential (DWA, 2010a). As part of the Feasibility Study, an analysis was undertaken to estimate the incremental yield benefit of additional storage at Vlieëpoort (e.g. constructing a dam). Based on the outcomes of the analysis, the following conclusions were drawn:

- Some additional yield from a dam at Vlieëpoort is possible, but the required dam gross storage capacity will have to be well in excess of 100 million m^3 before any additional exploitable yield could be possible;
- Reduction in gross yield due to the impacts of sedimentation, evaporation and EWR (the main components affecting net incremental yield) will not be easily made up by increasing dam size; and
- The MCWAP water requirements will not be met by a dam at Vlieëpoort alone.

Refer to **Section 9.3.4.2** and **Section 13.8.5** for discussions on sediment management.

11.8.4 Water Use

The main existing water users in the Crocodile River (West) catchment downstream of the Klipvoor, Roodekopjes and Vaalkop Dams comprise the following (DWAF, 2009):

- Irrigators downstream of the three dams (both upstream and downstream of Vlieëpoort) (see **Figure 84**);
- Platinum mines and associated settlements to the west of the Crocodile River (West);
- A number of rural towns and villages north and east of the Pilanesberg and also in the catchment of the Tolwane River (tributary of the lower Pienaars River) between the Klipvoor and Roodekopjes Dams;
- The users supplied from the small Zandriviersdrift and Bierspruit Dams on the Tolwane River and Bierspruit respectively; and
- Thabazimbi Local Municipality.

According to (DWAF, 2009), downstream of the Klipvoor, Roodekopjes and Vaalkop Dams the Crocodile River (West) is characterised by a very flat slope and a number of prominent meanders in flat alluvial plains. Preliminary desktop investigations indicate that these alluvial plains are underlain by relatively coarse lenticular alluvial deposits that are hydraulically connected to the Crocodile River (West) and that have created sedimentary aquifers that are recharged by rainfall and from the river. These aquifers are a major source of water for the irrigators who have drilled into them and are abstracting water from the boreholes on the basis that it was groundwater, whereas the water is mostly derived from the river (DWAF, 2009).

Further details pertaining to irrigation downstream of the Vlieëpoort abstraction weir, as obtained from the Agricultural Impact Assessment (contained in **Appendix I3**), are provided in **Section 12.7**.

Figure 84: **Indication of irrigation areas in the Crocodile River (west) (downstream of Hartbeespoort Dam)**

(Note: Pipeline Route Alternative B was discarded, gauging weirs and route Alternatives E & D4 not shown)

11.8.5 Ecological Status

The Reserve is central to water resource management and enjoys priority of use according to the NWA. The Reserve relates to the quantity and quality of water required to satisfy the following two elements:

- The Basic Human Needs Reserve, which provides for essential needs of individuals; and

❖ The Ecological Reserve, which relates to the water required to protect the functional integrity of aquatic ecosystems.

As part of a Reserve study, EWR sites are set at specific points on the river which are critical localities within a reach of the river. Factors that guide the selection of EWR sites include:

❖ The suitability of the site for accurate hydraulic modelling throughout the range of possible flows, especially low flows;
❖ Accessibility of the sites; and
❖ An area or site that could be critical for ecosystem functioning.

A comprehensive study was initiated in 2010 and completed in 2012 for the Crocodile (West) Marico WMA (DWA, 2012a). No Reserve study has been undertaken in the Matlabas catchment. **Table 30** shows the results from the Reserve Study in terms of the Present Ecological Status (PES), Ecological Importance and Sensitivity (EIS) and Recommended Ecological Category (REC) associated with each EWR site. The locations of the EWR sites are shown in **Figure 85**. EWR 8 (downstream of the confluence with the Bierspruit in Ben Alberts Nature Reserve) is of particular relevance in terms of the location of the abstraction weir.

Table 30: Summary of PES, EIS and REC per resource unit for the Crocodile (West) (DWA, 2012a)

EWR Site number	EWR site name	River	Resource unit	Quaternary catchment	PES	REC	EIS
EWR 1	Upstream of the Hartbeespoort Dam	Crocodile	MRU Crocodile 3	A21H	**D**	**D**	Moderate
EWR 2	Heron Bridge School	Juskei	MRU Crocodile 1	A21C	**E**	**D**	Moderate
EWR 3	Downstream of Hartbeespoort Dam in Mount Amanzi	Crocodile	MRU Crocodile 5	A21J	**C/D**	**C/D**	High
EWR 4	Downstream of Roodeplaat Dam	Pienaars	MRU Pienaars 5	A23B	**C**	**C**	High
EWR 5	Downstream of the Klipvoor Dam in Borakalalo National Park	Pienaars	MRU Pienaars 8	A23J	**D**	**D**	High
EWR 6	Upstream of Vaalkop Dam	Hex	MRU Hex 5	A22J	**D**	**D**	Moderate
EWR 7	Upstream of the confluence with the Bierspruit	Crocodile	MRU Crocodile 10	A24C	**D**	**D**	Moderate
EWR 8	Downstream of the confluence with the Bierspruit in Ben Alberts Nature Reserve	Crocodile	MRU Crocodile 11	A24H	**C**	**C**	Moderate

According to the River Health Programme (RHP) (2005), the drivers of change that adversely affect the ecological status of the Crocodile River (West) include:

❖ Extensive water use for agricultural purposes – abstraction for irrigation impacts on natural flow regime of the river;
❖ Dams and weirs act as barriers to flow and the migration of fauna; and
❖ Reduced water quality due to agricultural return flows.

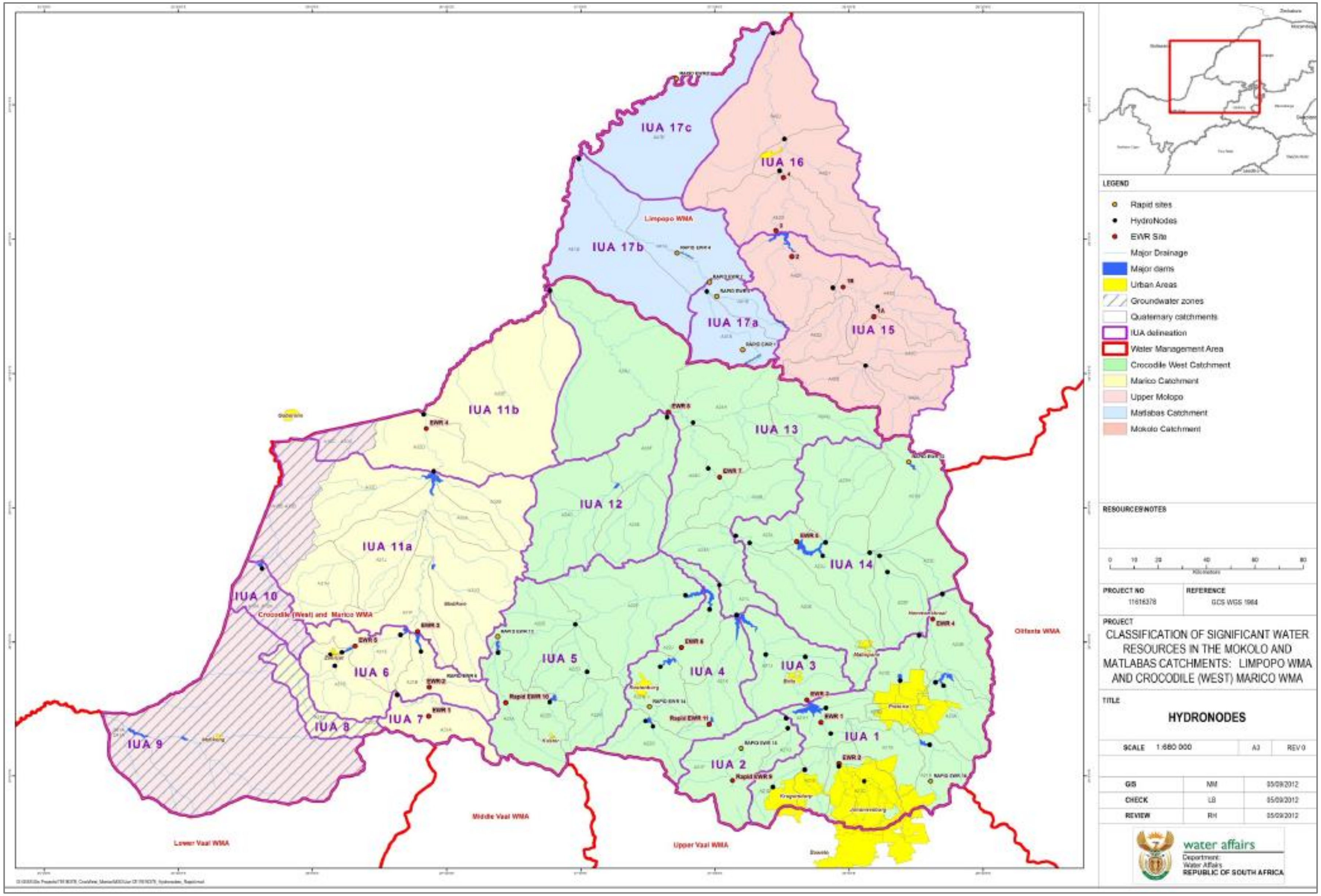


Figure 85: **Crocodile (West) Marico WMA and Mokolo and Matlabas catchments of the Limpopo WMA indicating *inter alia* EWR sites (DWA, 2012a)**

Results from the RHP (2008) indicate that the Matlabas catchment has a fair Ecostatus and moderate EIS, largely due to the fact that a substantial portion of the catchment falls in Marakele National Park, private nature reserves or game farms.

According to the RHP (2005), only hardy fish species are present in the lower Crocodile River, which can be ascribed to the loss of habitat and connectivity of the river. The Fish Assemblage Integrity was thus found to be poor. The Macro-invertebrate Integrity was also categorised as poor, with reduced water quality and diminished flows leading to dry sections and isolated pools. This reduction in suitable habitat has a severe impact on invertebrate diversity. Also the Instream Habitat Integrity was identified as poor due to extensive irrigation and multiple abstraction points along this reach of river which has a severe impact on river functioning. Due to the non-perennial nature of the Matlabas, the RHP (2008) found an absence of flow dependent and migratory fish species and low invertebrate biodiversity. **Table 31** contains a list of all the fish species historically recorded in the Crocodile West and Matlabas catchments.

Table 31: Fish species historically recorded in Crocodile West & Matlabas catchments (RHP, 2008)

Species	English Common Name	Crocodile (West)	Matlabas
Anguilla bengalensis labiata	African mottled eel	✓	
Anguilla mossambica	Longfin eel	✓	
Aplocheilichthys johnstoni	Johnston's topminnow	✓	
Barbus annectens	Broadstriped barb		✓
Barbus bifrenatus	Hyphen barb		✓
Barbus brevipinnis	Shortfin barb	✓	✓
Barbus marequensis	Largescale yellowfish		✓
Barbus mattozi	Papermouth	✓	
Barbus paludinosus	Straightfin barb	✓	✓
Barbus trimaculatus	Threespot barb	✓	✓
Barbus unitaeniatus	Longbeard barb	✓	✓
Barbus viviparus	Bowstripe barb	✓	✓
Chetia flaviventris	Canary Kurper	✓	
Chiloglanis paratus	Sawfin rock catlet	✓	
Chiloglanis pretoriae	Shortspine suckermouth	✓	
Clarias gariepinus	Sharptooth catfish	✓	✓
Labeo cylindricus	Redeye labeo	✓	✓
Labeo molybdinus	Leaden labeo	✓	✓
Labeo rosae	Rednose labeo	✓	✓
Labeo ruddi	Silver labeo		✓
Marcusenius macrolepidotus	Bulldog	✓	✓
Mesobola brevianalis	River sardine	✓	✓
Micralestes acutidens	Silver robber	✓	
Oreochromis mossambicus	Mozambique tilapia	✓	✓
Pseudocrenilabrus philander	Southern mouthbrooder	✓	✓
Schilbe intermedius	Silver catfish	✓	✓
Synodontis zambezensis	Brown squeaker		✓
Tilapia rendalli	Redbreast tilapia	✓	
Tilapia sparrmanii	Banded tilapia	✓	✓

Refer to **Section 12.3** for a discussion on the ecological status of the affected watercourses that was determined as part of the Baseline Aquatic and Impact Study.

11.8.6 Water Quality

DWS conducts an ongoing water quality monitoring programme on the Crocodile River. There are long term monitoring sites for the preliminary resource units and EWR sites identified during the Reserve determination. Some of the relevant monitoring sites are listed in **Table 32**. All the DWS long term monitoring sites include the monitoring of electrical conductivity (EC), pH, the major ions (Mg+, Na+, Ca+, K+, SO4- and Cl-), total alkalinity and nutrients (PO4-P, NH3, NO2, NO3) (DWA, 2012a).

Table 32: DWS water quality sites related to the Crocodile (West) EWR sites (DWA, 2012a)

WATER QUALITY SITE	QUARTENARY CATCHMENT	OTHER INFORMATION
A2H012 – Crocodile River at Kalkheuwel	A21H	Downstream of the confluences of the Jukskei, Hennops and Rietspruit Rivers with the Crocodile River, and upstream of Hartbeespoort Dam.
A2H023 – Jukskei River at Nietgedacht	A21C	Situated at the confluence of the Jukskei River with the Upper Crocodile River, and upstream of Hartbeespoort Dam.
A2H083 – Hartbeespoort Dam: downstream weir	A21J	Crocodile River immediately downstream of Hartbeespoort Dam
A2H006 – Pienaars River at Klipdrift	A23B	Weir is downstream of EWR site
A2H021 – Pienaars River at Buffelspoort	A23L	Weir is 21 km downstream of EWR site
A2H094 – Bospoort Dam: downstream weir	A22J	Weir is situated at Tweedepoort, 4 km downstream of EWR site
A2H060 - Crocodile River at Nooitgedacht	A24C	WQ site is 23 km upstream of the EWR
A2H116 – Paul Hugo Dam: downstream weir	A24F/H/J	Weir is situated at Haakdoorndrift

According to DWA (2012a), the Crocodile River is highly impacted in terms of water quality which is attributed to the following:

- The Lower Crocodile River water quality is deteriorating because of increased salts and nutrients. There are also increased levels of toxicants in the middle reaches of the river.
- Urbanisations, industrial diffuse sources and high agricultural return flows are the major impacting activities.
- Treated wastewater return flows from the Upper Vaal WMA play an important role downstream where the water is used in the Crocodile West catchment area.

Noteworthy point sources of pollution in the Crocodile River, and the watercourses into which they discharge their effluent, include the following:

- Northern Waste Water Treatment Works (WWTW) - Jukskei River;
- Driefontein WWTW - Muldersdrif-se-loop River;
- Sunderland Ridge WWTW - Hennops River;
- Baviaanspoort and Zeekoegat WWTW - Pienaars River;
- Daspoort, Rooiwal, Temba and Babelegie WWTW - Apies River;
- Sandspruit and Klipgat WWTW - Sand Spruit;
- Rietgat WWTW - Soutpan Spruit; and
- Brits WWTW - Crocodile River.

Organic pollution from point and diffuse pollution sources is a significant contributor to the poor water quality in the Crocodile River, which is evident in the highly eutrophic Hartbeespoort Dam.

According to DWAF (2004a), there are no reported water quality problems in the Matlabas Area, either surface or groundwater. Due to the low levels of development in this area, no water quality problems are anticipated.

Refer to **Section 12.3** for a discussion on the *in situ* water quality, as determined as part of the Baseline Aquatic and Impact Study.

11.8.7 Habitat

The riparian vegetation at the Vlieëpoort abstraction weir, as well as the three new gauging weir sites, is dominated by Dwaalboom Thornveld. At the Vlieëpoort site the riparian vegetation has retained much of its ecological integrity (see **Figure 86**) and the instream habitat is dominated by slow-flowing medium to deep channel. Prominent sand banks and marginal reedbeds are present.

Figure 86: Riparian vegetation at abstraction point on Crocodile River

The Matlabas River is dominated by sandy bed, sand banks and reedbeds (see **Figure 87**). The riparian vegetation mostly consists of Mixed Bushveld / Subtropical Alluvial Vegetation.

Refer to **Section 12.3** for a discussion on the riparian habitat, as assessed and delineated as part of the Baseline Aquatic and Impact Study.

Figure 87: Matlabas River

11.8.8 Pans and Wetlands

In terms of the NWA, a wetland means "*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*".

The wetland systems typically found in the Waterberg (Matlabas and Mokolo Catchments) include hillslope seeps, sheetrock wetlands and channelled and unhandled valley-bottom systems (DWA, 2012b). The main ecosystem services supplied by these systems include flood attenuation, water quality enhancement, streamflow augmentation and biodiversity maintenance.

According to a preliminary review of the National Wetlands Map II of the South African National Biodiversity Institute (SANBI), which was extracted from the National Land Cover 2000 dataset, no wetlands are directly affected by the project infrastructure. In addition, no NFEPA wetlands are directly affected. However, following preliminary site investigations during the Scoping phase and feedback from IAPs, pans are encountered along the Central Route and Alternatives D1, D2 and D3 (see **Figure 88**). Pans are endorheic wetlands (have no point of outflow and therefore gain water from rainfall and/or seepage and lose water mainly by evaporation), with a closed-drainage system. They are typical of poorly drained, relatively flat and dry regions, and the loss of water through evaporation sometimes results in saline conditions. The water depth within these pans is usually shallow (<3 m) and the pans vary in diameter (Barnes, 1998). Pans are recognized as being important for biodiversity support. Note that Route Alternatives D4 was identified to avoid a pan on the Farm Taaiboschpan 320 LQ. **Figure 89** shows the occurrence of wetlands adjacent to the Crocodile River (West) on the Farms Hampton 320 KQ, Stratford 462 KQ and Bridgewater 307 KQ, downstream of the abstraction point.

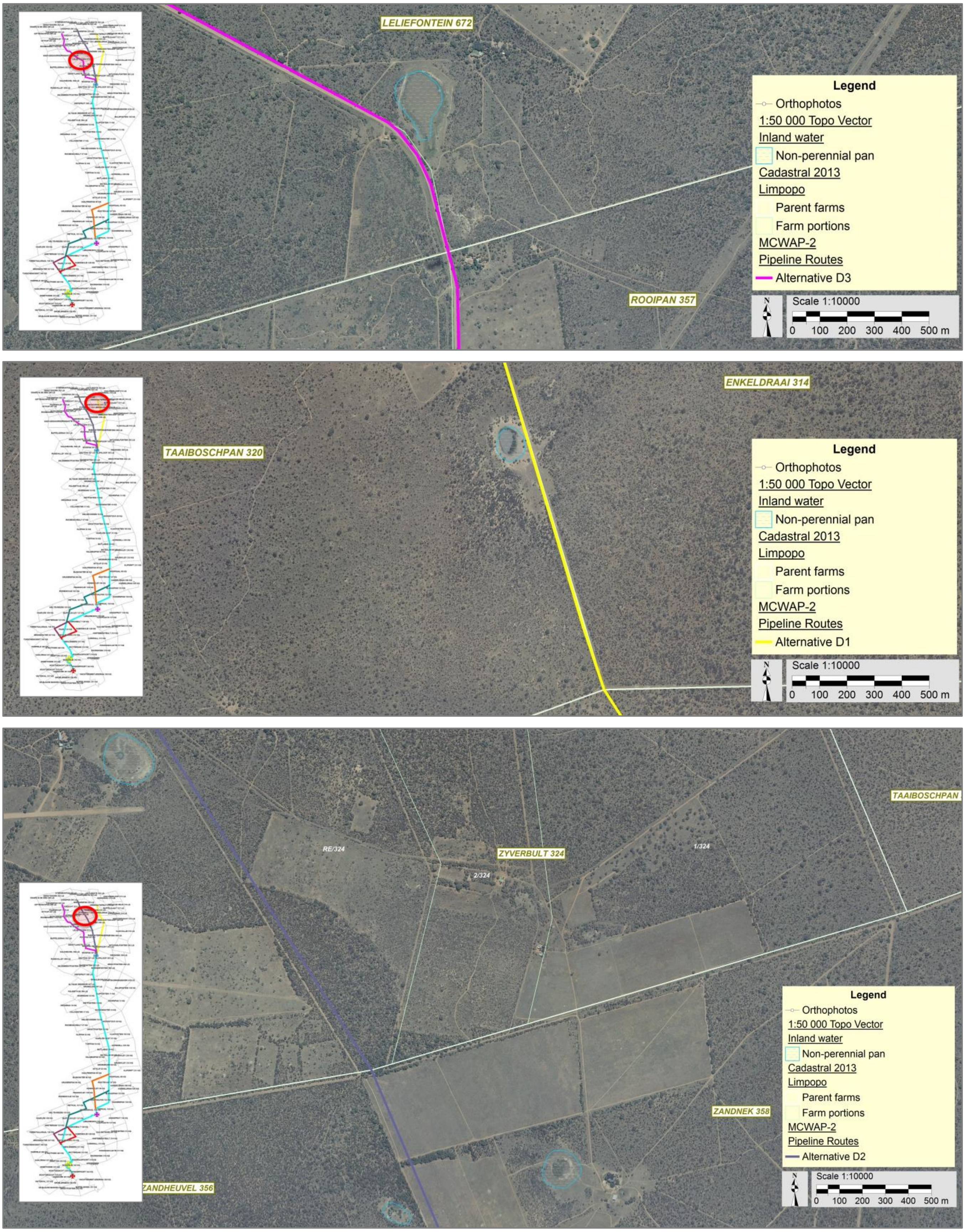


Figure 88: **Pans along Alternatives D1, D2 and D3 (not all pans shown)**

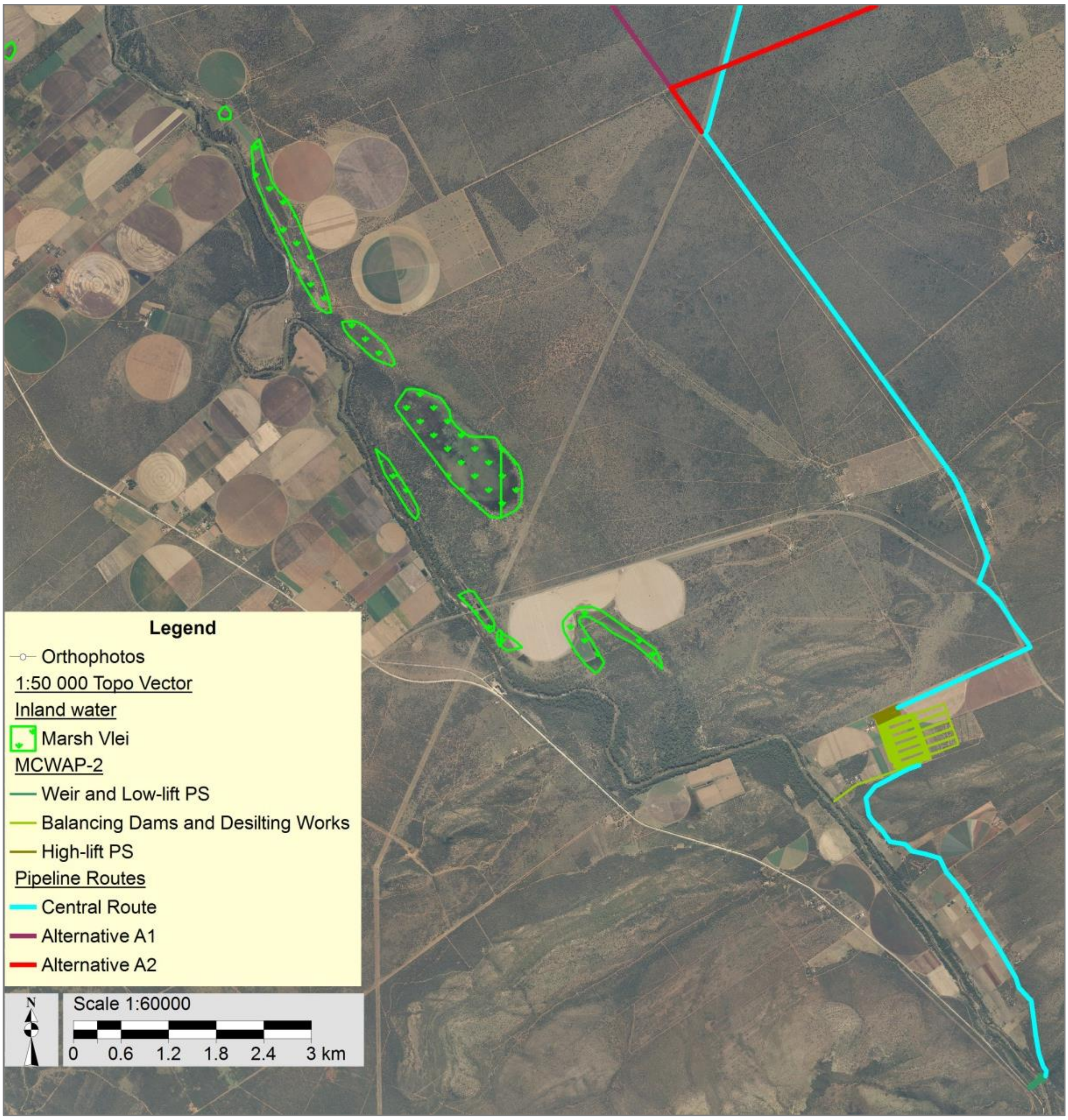


Figure 89: **Wetlands adjacent to the Crocodile River (West)**

A Wetland Impact Assessment (see **Appendix I5**) was conducted for the project. Refer to **Sections 12.4** and **13.9.4** for a synopsis of the study and a related impact assessment, respectively.

11.9 Flora

The information to follow was sourced from the Terrestrial Ecological Impact Assessment (see **Appendix I2**). Refer to **Sections 12.5** and **13.10** for a synopsis of the study and a related impact assessment, respectively.

11.9.1 Regional Vegetation

The proposed MCWAP-2A WTI falls within the Savanna Biome (SANBI, 2012) (**Figure 90**). However, a very small section of the Central Route and Alternative E, Balancing Dams and Desilting Works fall within the Azonal Vegetation Biome. The Savanna Biome is the largest in South Africa and it is characterized by a grassy ground layer and distinct upper layer of woody plants (Low and Rebelo, 1996).

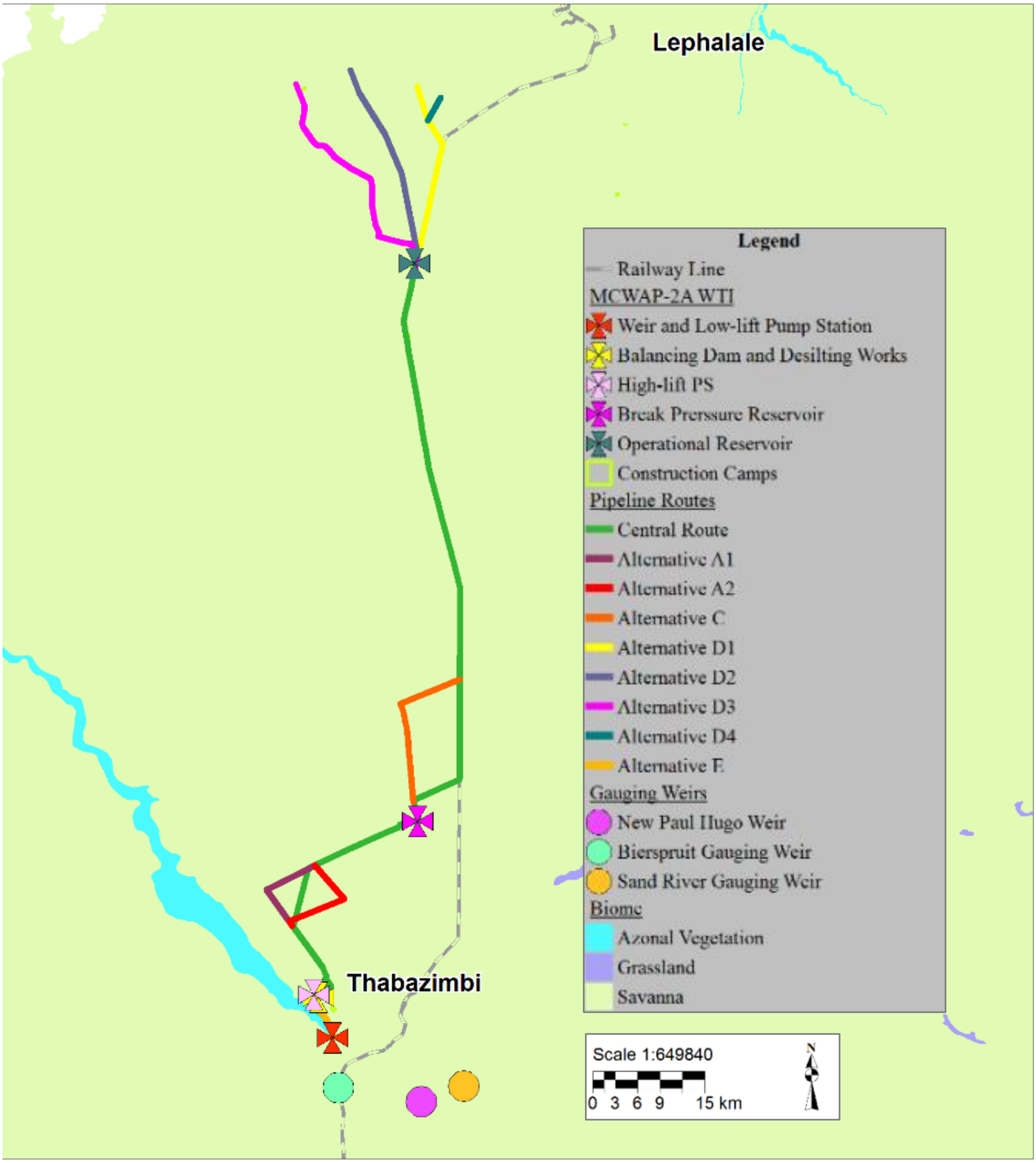


Figure 90: **Savanna Biome**

The study area traverses five (5) vegetation types-namely Limpopo Sweet Bushveld, Western Sandy Bushveld, Dwaalboom Thornveld, Waterberg Mountain Bushveld and Subtropical Alluvial Vegetation (**Figure 91**). A description of the vegetation types follows.

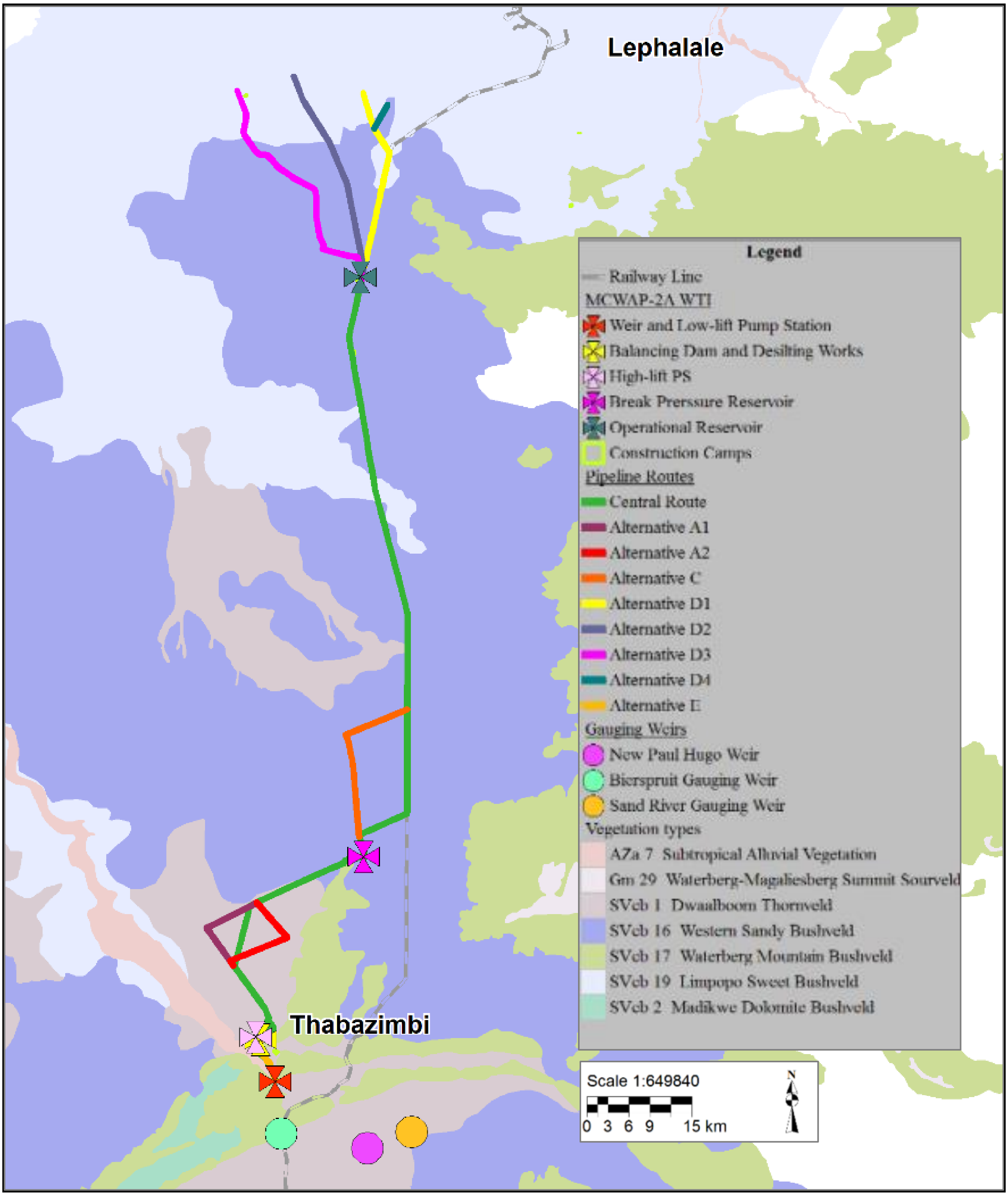


Figure 91: **Vegetation types**

Limpopo Sweet Bushveld

The Limpopo Sweet Bushveld is found in Limpopo Province. It extends from the lower reaches of the Crocodile and Marico Rivers around Makoppa and Derdepoort, respectively, down the Limpopo River Valley including Lephalale and into the tropics past Tom Burke to the Usutu border post and Taaiboschgroet area in the north. The unit also occurs on the Botswana side of the border (Mucina and Rutherford, 2006).

This vegetation type is listed as **Least threatened** with a national conservation target of 19%. Less than 1% is statutorily conserved and limited to reserves straddling the south-eastern limits of the unit, for example the D'Nyala Nature Reserve. Very little of this vegetation type is conserved in other reserves. About 5% is transformed, mainly by cultivation (Mucina and Rutherford, 2006).

Refer to **Figure 92** for a photograph taken in the study area of typical vegetation associated with Limpopo Sweet Bushveld.

Figure 92: Typical vegetation associated with Limpopo Sweet Bushveld

Western Sandy Bushveld

Western Sandy Bushveld vegetation type is found in Limpopo and North-West Provinces. It occurs on flats and undulating plains from Assen northwards past Thabazimbi and remaining west of the Waterberg Mountains towards Steenbokpan in the north. Some patches occur between the Crocodile and Marico Rivers to the west (Mucina and Rutherford, 2006).

This vegetation type is listed as **Least threatened** with a national conservation target of 19%. About 6% is statutorily conserved, just over half of which in the Marakele National Park. About 4% is transformed, mainly by cultivation (Mucina and Rutherford, 2006).

Refer to **Figure 93** for a photograph taken in the study area of typical vegetation associated with Western Sandy Bushveld.

Figure 93: Typical vegetation associated with Western Sandy Bushveld

Dwaalboom Thornveld

Dwaalboom Thornveld vegetation type is found in Limpopo and North-West Provinces. It flats north of the Dwarsberge and associated ridges mainly west of the Crocodile River in the Dwaalboom area but including a patch around Sentrum. South of the ridges, it extends eastwards from the Nietverdiend area, north of the Pilanesberg to the Northam area (Mucina and Rutherford, 2006).

This vegetation type is listed as **Least threatened** with a national conservation target of 19%. Some 6% is statutorily conserved, mostly within the Madikwe Game Reserve in the west. About 14% is transformed mainly by cultivation. Main use is extensive cattle grazing (Mucina and Rutherford, 2006).

Refer to **Figure 94** for a photograph taken in the study area of typical vegetation associated with Dwaalboom Thornveld.

Figure 94: Typical vegetation associated with Dwaalboom Thornveld

Waterberg Mountain Bushveld

Waterberg Mountain Bushveld vegetation type is found in Limpopo Province. It occurs in Waterberg Mountains, including the foothills, escarpment and tablelands south of the line between Lephalale and Marken and north of Bela-Bela and west of Mokopane and with outliers in the southwest such as the Boshofsberge and Vlieëpoortberge near Thabazimbi (Mucina and Rutherford, 2006).

This vegetation type is listed as Least threatened with a national conservation target of 24%. About 9% is statutorily conserved mainly in the Marakele National Park and Moepel Nature Reserve. More than 3% is transformed, mainly by cultivation (Mucina and Rutherford, 2006).

Refer to **Figure 95** for a photograph taken in the study area of typical vegetation associated with Waterberg Mountain Bushveld.

Figure 95: **Typical vegetation associated with Waterberg Mountain Bushveld on ridge**

Subtropical Alluvial Vegetation

Subtropical Alluvial vegetation unit is found in Limpopo, Mpumalanga and KwaZulu-Natal Provinces and in Swaziland. It occurs in broad river alluvia and around some river-fed pans in the subtropical regions of eastern South Africa, in particular in the Lowveld, Central Bushveld and in northern KwaZulu-Natal. The most important alluvia include the Limpopo, Luvubu, Olifants, Sabie, Crocodile, Phongolo, Usutu and Mkuze Rivers. This unit is fully embedded within the Savanna Biome (Mucina and Rutherford, 2006).

The conservation status of is **Least threatened** with a national conservation target of target of 31%. Much of the area has been transformed for cultivation, urban development and road building. Alien woody species commonly occurring in this vegetation type include *Melia azedarach, Chromolaena discolor etc* (Mucina and Rutherford, 2006).

Refer to **Figure 96** for a photograph taken in the study area of typical vegetation associated with Subtropical Alluvial Vegetation.

Figure 96: Typical vegetation associated with Subtropical Alluvial Vegetation (along river)

11.9.2 Terrestrial Threatened Ecosystems

According to the data sourced from SANBI, no terrestrial threatened ecosystems were recorded in the project area.

11.9.3 Limpopo Conservation Plan

Critical Biodiversity Areas (CBAs) within the bioregion are the portfolio of sites that are required to meet the region's biodiversity targets, and need to be maintained in the appropriate condition for their category (Desmet *et al*, 2013). An objective of the CBA map is to identify a network of areas, which if managed according to the land use guidelines would meet the pattern targets for all important biodiversity features, while at the same time ensuring the areas necessary for supporting necessary ecological processes remain functional.

The systematic conservation planning process resulted in 40% of the Limpopo Province being identified as CBAs (CBA 1 22% and CBA 2 18%). Ecological Support Areas (ESAs) cover a further 22% of the province, of which 16% are intact natural areas (ESA 1) and 7% are degraded or areas with no natural remaining which are nevertheless required as they potentially retain some value for supporting ecological processes (ESA 2) (Desmet *et al*, 2013).

A map indicating the Limpopo C Plan categories in relation to the project footprint is shown in **Figure 97**. The general description of CBA map categories and associated land management objectives are listed in **Table 33**.

The project footprint in relation to the Limpopo Conservation Plan is as follows:

- CBA 1 - Vlieëpoort abstraction weir, Bierspruit gauging weir, low-lift pumping station, OR and sections of the pipeline route options (Central Route, A1, C, D2, D3 and E);

- CBA 2 - balancing dam, desilting works, BPR, new Paul Hugo gauging weir, construction camps and sections of the pipeline route options (Central Route, A1, A2, C, D1, D2, D3 and E);
- ESA 1 - sections of the pipeline route options (Central Route, C and D2), as well as the Sand River gauging weir;
- ESA 2 - balancing dam and sections of the pipeline route options (Central Route, D3 and E);
- Other Natural Area - sections of the pipeline route options (Central Route, A1, A2, C, D1, D2, D3 and D4); and
- No Natural Remaining - balancing dam, high-lift pumping station and sections of the pipeline route options (Central Route, A1, A2, D2 and D3).

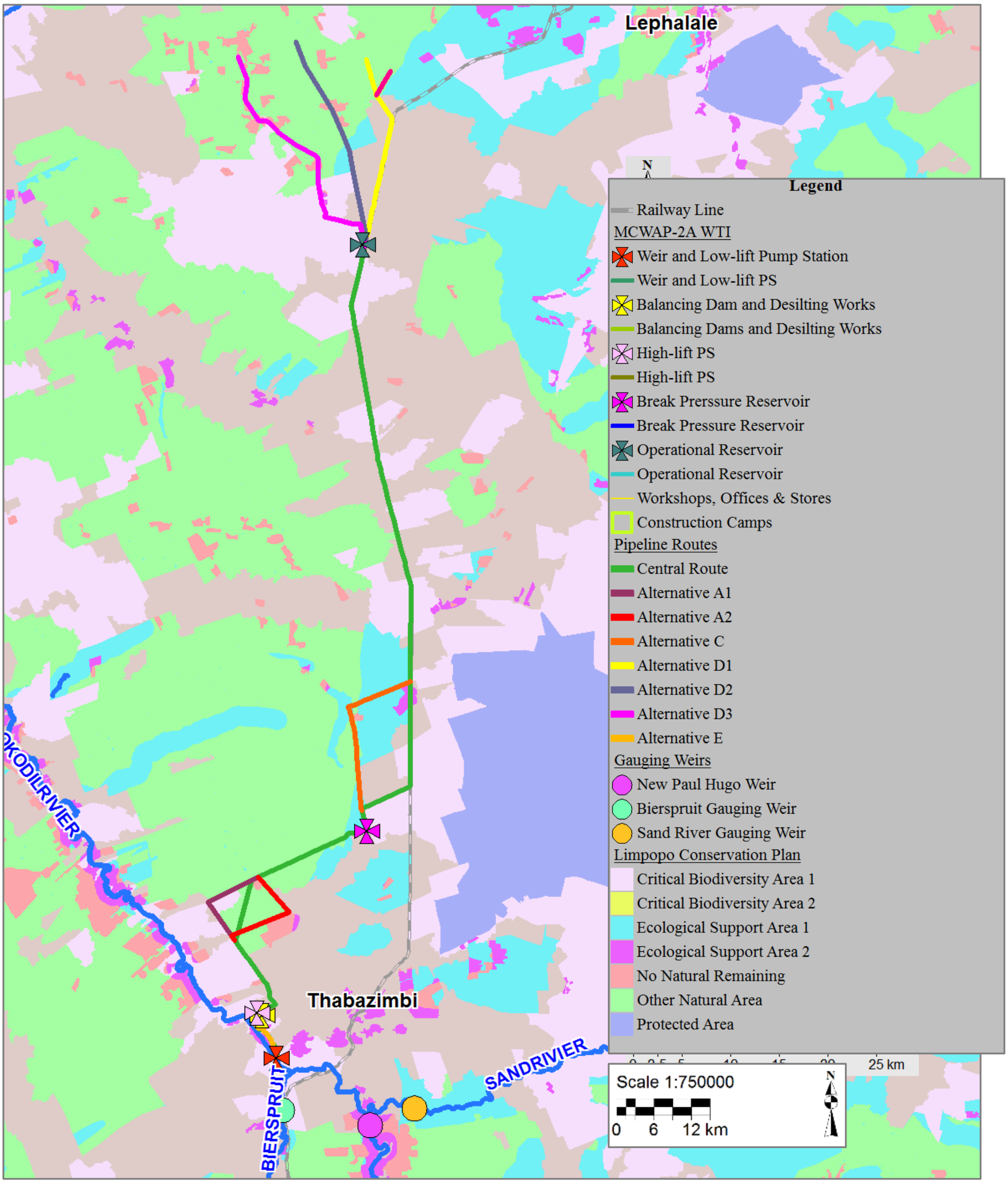


Figure 97: **Limpopo Conservation Plan (CBAs and ESAs)**

Table 33: General description of CBA Map categories and associated land management objectives

CBA Map Category	Description	Land Management Objective	Land Management Recommendations	Compatible Land-Use	Incompatible Land-Use
Protected Areas	Formal Protected Areas and Protected Areas pending declaration under NEM:PAA.	Maintain in a natural state with limited or no biodiversity loss. Rehabilitate degraded areas to a natural or near natural state, and manage for no further degradation. Development subject to Protected Area objectives and zoning in a NEM:PAA compliant and approved management plan.	Maintain or obtain formal conservation protection.	Conservation and associated activities (e.g. ecotourism operations), and required support infrastructure.	All other land-uses.
CBA 1	Irreplaceable Sites. Areas required to meet biodiversity pattern and/or ecological processes targets. No alternative sites are available to meet targets.	Maintain in a natural state with limited or no biodiversity loss. Rehabilitate degraded areas to a natural or near natural state, and manage for no further degradation.	Obtain formal conservation protection where possible. Implement appropriate zoning to avoid net loss of intact habitat or intensification of land use.	Conservation and associated activities. Extensive game farming and eco--- tourism operations with strict control on environmental impacts and carrying capacities, where the overall there is a net biodiversity gain. Extensive Livestock Production with strict control on environmental impacts and carrying capacities. Required support infrastructure for the above activities. Urban Open Space Systems	Urban land-uses including Residential (including golf estates, rural residential, resorts), Business, Mining & Industrial; Infrastructure (roads, power lines, pipelines). Intensive Animal Production (all types including dairy farming associated with confinement, imported foodstuffs, and improved/irrigated pastures). Arable Agriculture (forestry, dry land & irrigated cropping). Small holdings
CBA 2	Best Design Selected Sites. Areas selected to meet biodiversity pattern and/or ecological process targets. Alternative sites may be available to meet targets.	Maintain in a natural state with limited or no biodiversity loss. Maintain current agricultural activities. Ensure that land use is not intensified and that activities are managed to minimize impact on threatened species.	Avoid conversion of agricultural land to more intensive land uses, which may have a negative impact on threatened species or ecological processes.	Current agricultural practices including arable agriculture, intensive and extensive animal production, as well as game and ecotourism operations, so long as these are managed in a way to ensure populations of threatened species are maintained and the ecological processes which support them are not impacted. Any activities compatible with CBA1.	Urban land-uses including Residential (including golf estates, rural residential, resorts), Business, Mining & Industrial; Infrastructure (roads, power lines, pipelines). More intensive agricultural production than currently undertaken on site. Note: Certain elements of these activities could be allowed subject to detailed impact assessment to ensure that developments were designed to CBA2. Alternative areas may need to be identified to ensure the CBA network still meets the required

<table>
<tr><th>CBA Map Category</th><th>Description</th><th>Land Management Objective</th><th>Land Management Recommendations</th><th>Compatible Land-Use</th><th>Incompatible Land-Use</th></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td>targets.</td></tr>
<tr><td>ESA 1</td><td>Natural, near natural and degraded areas supporting CBAs by maintaining ecological processes.</td><td>Maintain ecosystem functionality and connectivity allowing for limited loss of biodiversity pattern.</td><td>Implement appropriate zoning and land management guidelines to avoid impacting ecological processes. Avoid intensification of land use. Avoid fragmentation of natural landscape.</td><td>Conservation and associated activities. Extensive game farming and eco-tourism operations. Extensive Livestock Production. Urban Open Space Systems. Low density rural residential, smallholdings or resorts where development design and overall development densities allow maintenance of ecological functioning.</td><td>Urban land-uses including Residential (including golf estates), Business, Mining & Industrial; Infrastructure (roads, power lines, pipelines). Intensive Animal Production (all types including dairy farming associated with confinement, imported foodstuffs, and improved/irrigated pastures). Arable Agriculture (forestry, dry land & irrigated cropping). Note: Certain elements of these activities could be allowed subject to detailed impact assessment to ensure that developments were designed to maintain overall ecological functioning of ESAs.</td></tr>
<tr><td>ESA 2</td><td>Areas with no natural habitat that is important for supporting ecological processes.</td><td>Avoid additional/ new impacts on ecological processes.</td><td>Maintain current land-use. Avoid intensification of land use, which may result in additional impact on ecological processes.</td><td>Existing activities (e.g. arable agriculture) should be maintained, but where possible a transition to less intensive land uses or ecological restoration should be favoured.</td><td>Any land use or activity that results in additional impacts on ecological functioning mostly associated with the intensification of land use in these areas (e.g. Change of floodplain from arable agriculture to an urban land use or from recreational fields and parks to urban).</td></tr>
<tr><td>Other Natural Areas</td><td>Natural and intact but not required to meet targets, or identified as CBA or ESA</td><td colspan="4" rowspan="2">No management objectives, land management recommendations or land-use guidelines are prescribed. These areas are nevertheless subject to all applicable town and regional planning guidelines and policy. Where possible existing Not Natural areas should be favoured for development before "Other natural areas" as before "Other natural areas" may later be required either due to the identification of previously unknown important biodiversity features on these sites, or alternatively where the loss of CBA has resulted in the need to identify alternative sites.</td></tr>
<tr><td>No natural habitat remaining</td><td>Areas with no significant direct biodiversity value. Not Natural or degraded natural areas that are not required as ESA, including intensive agriculture, urban, industry; and human infrastructure.</td></tr>
</table>

11.9.4 Protected Areas

The nearest protected areas, with a formal status in terms of the NEM:PAA, to the project footprint include the following (see **Figure 98**):

- Marakele National Park – located approximately 3,5 km to the east of the Central Route;
- Atherstone Nature Reserve – located approximately 40 km to the west of Alternative A1;
- Hans Strijdom Nature Reserve – located approximately 30 km to the east of the Central Route; and
- D'nyala Nature Reserve – located approximately 31 km to the east of Alternative D4.

The Ben Alberts Nature Reserve lies immediately south-east of the Vlieëpoort weir site. The reserve belongs to Kumba Iron Ore, Thabazimbi mine (currently undergoing closure).

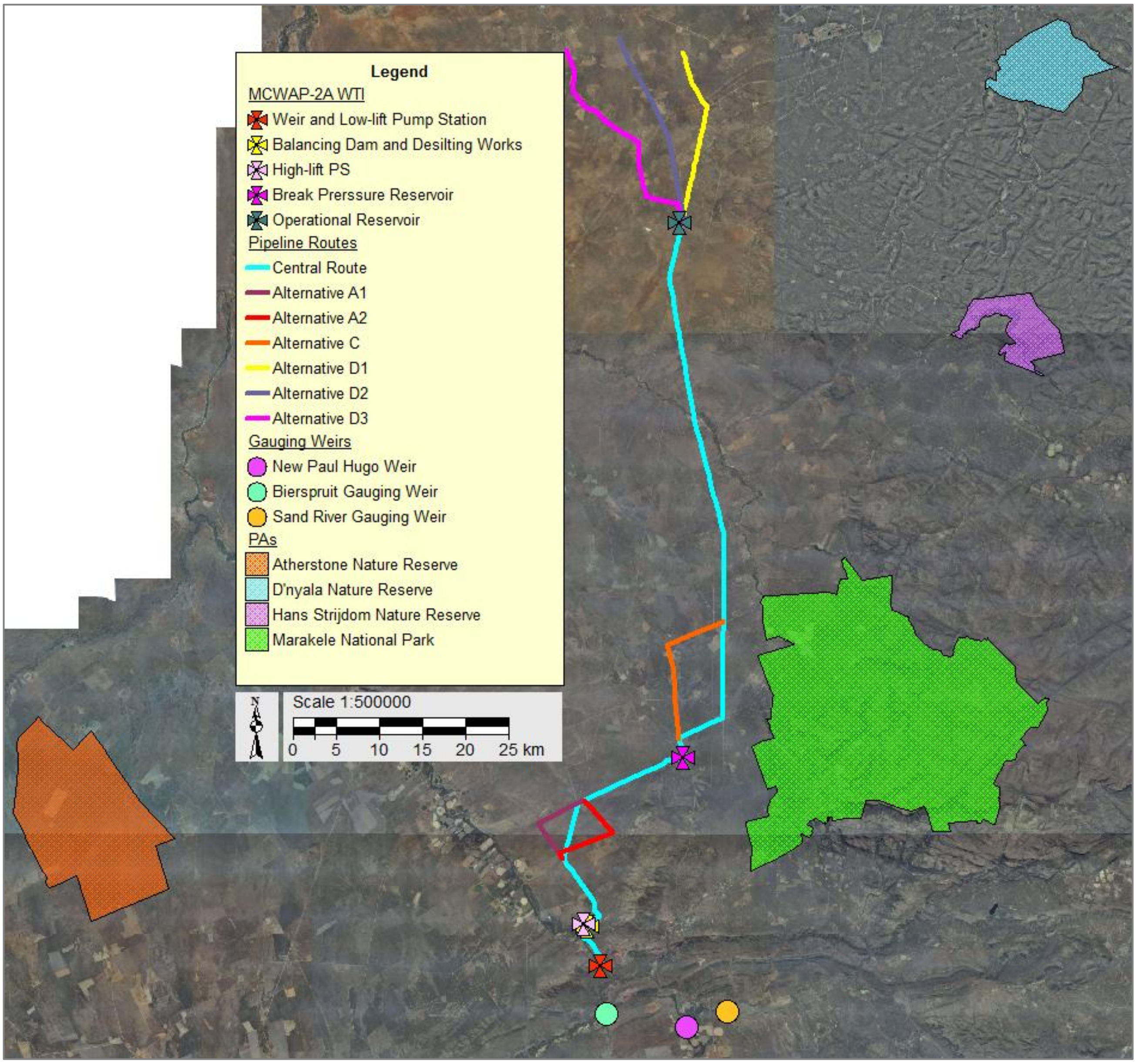


Figure 98: Protected areas

(Note: Pipeline route Alternatives E & D4 not shown)

The Waterberg Biosphere, which is located to the east of the project area (see **Figure 99**), represents a considerable area of savanna biome and contains a high level of biological diversity. It stretches from Marakele National Park in the south-west to Wonderkop Nature Reserve in the north-east with Vaalwater as the gateway town. According to UNESCO (2009), Biosphere reserves are areas of terrestrial and coastal marine ecosystems which are internationally recognized under UNESCO's Man and the Biosphere Programme. Biosphere Reserves are protected areas and they promote and demonstrate a balanced relationship between people and nature. Sections of the Central Route as well as Alternatives B and C encroach into the transition zone of the biosphere, which is a flexible area of co-operation, which may contain a variety of agricultural activities, settlements and other uses and in which local communities, management agencies, scientists, non-governmental organizations, cultural groups, economic interests and other stakeholders work together to manage and sustainably develop the area's resources (Waterberg DM, 2013).

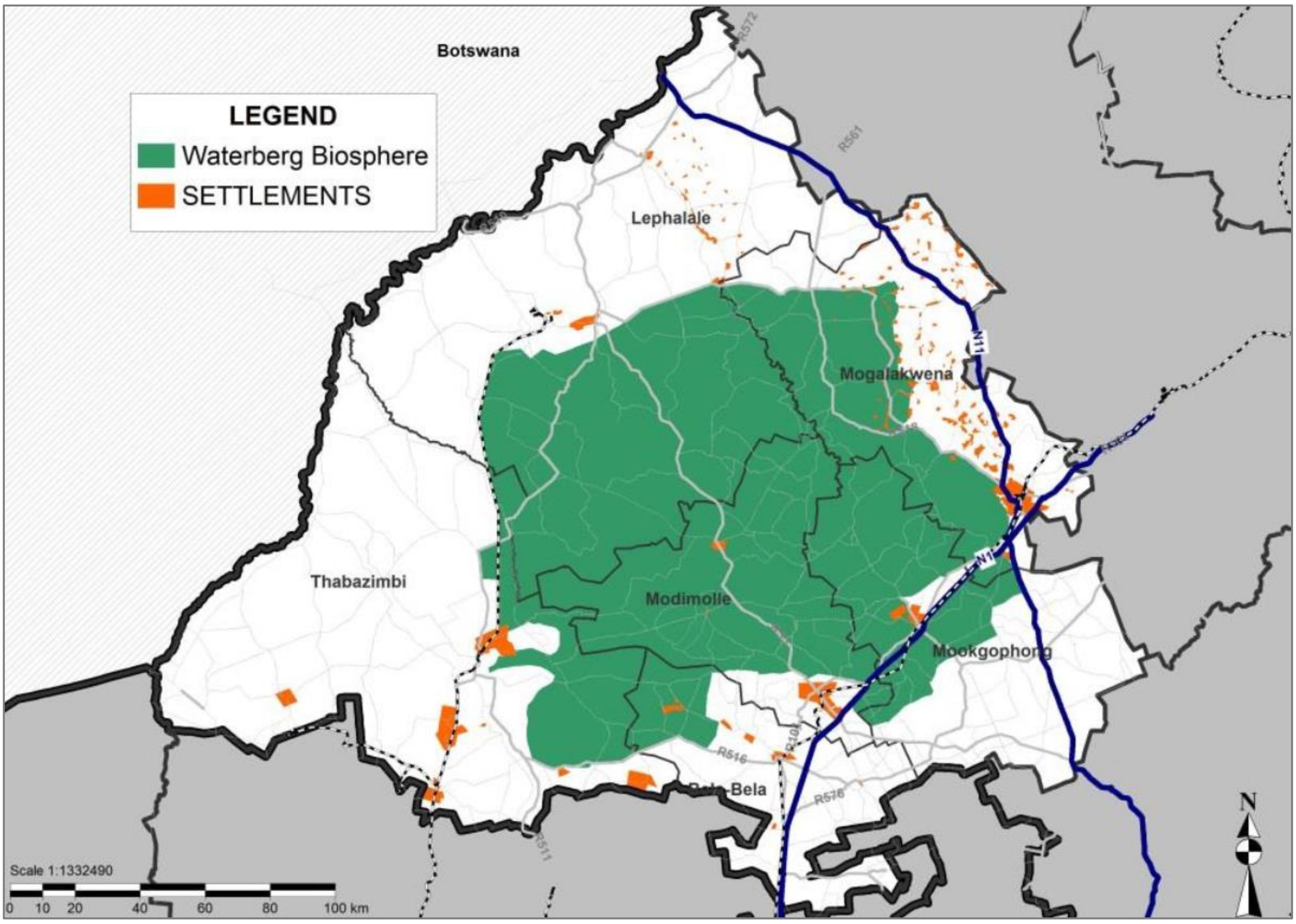


Figure 99: Waterberg Biosphere (Waterberg DM, 2013)

11.9.5 Flora Species

The study area is located within 2327CB, 2327CD, 2427AB, 2427AD and 2427CB quarter degree squares in terms of the 1:50 000 grid of South Africa. SANBI uses this grid system as a point of reference to determine any Red Data plant species or any species of conservation importance occurring in South Africa. **Table 34** provides details on the Red Data plant species which have been recorded in grid cells 2427AD and 2427CB (no Red Data plant species were recorded in grid cells 2327CB and 2327CD). The definitions of the conservation status are provided in **Table 35**.

Table 34: Threatened plant species recorded in grid cells 2427AD and 2427CB

Family	Species	Threat status	Growth forms
Scrophulariaceae	*Freylinia tropica* S.Moore	Rare	Shrub
Scrophulariaceae	*Jamesbrittenia bergae* P.Lemmer	VU	Dwarf shrub
Zamiaceae	*Encephalartos eugene-maraisii* I.Verd.	EN	Shrub, tree

Note: EN=Endangered, VU=Vulnerable

Table 35: Definitions of Red Data status (Raimondo *et. al*. 1999)

Symbol	Status	Description
EN	Endangered	A taxon is Endangered when the best available evidence indicates that it meets any of the five International Union for Conservation of Nature (IUCN) criteria for Endangered, and is therefore facing an extremely high risk of extinction in the wild.
VU	Vulnerable	A taxon is Vulnerable when the best available evidence indicates that it meets any of the five IUCN criteria for Vulnerable and it is therefore considered to be facing a high risk of extinction in the wild.
	Rare	A taxon is rare when it does not meet any of the four South African criteria for rarity, but is not exposed to any direct or plausible potential threat and does not qualify for a category of threat according to the five IUCN criteria.

Protected trees identified in the study area are include *Vachellia (Acacia) erioloba* (Camel Thorn), *Adansonia digitata* (Baobab), *Boscia albitrunca* (Shepherd's tree), *Combretum imberbe* (Leadwood) and *Sclerocarya birrea* subsp. *Africana* (Marula). There is only one plant species which falls within “protected plants” in terms of Limpopo Environmental Management Act (Act No. 7 of 2003) (LEMA) Schedule 12, namely *Spirostachys africana* (Tamboti).

The flora species recorded in the study area are listed in the Terrestrial Ecological Impact Assessment (Nemai Consulting, 2018b), which is contained in **Appendix I2**.

11.10 Fauna

The information to follow was sourced from the Terrestrial Ecological Impact Assessment (see **Appendix I2**). Refer to **Sections 12.5** and **13.10** for a synopsis of the study and a related impact assessment, respectively.

11.10.1 Mammals

The greater area was historically commonly used for cattle grazing. Game farms are now more common, with an associated high faunal biodiversity. Various mammal species (e.g. buffalo) have been introduced through this practice. Numerous farms also keep exotic game species. Proper conservation measures on game farms also afford protection to other species that naturally occur in the area, which include leopard, warthog, baboon and aardvark.

Known mammal distributions correlate well with biomes as defined by Acocks (1953), Low and Rebelo (1998), Knobel and Bredenkamp (2005) as well as Mucina and Rutherford (2006). However, the local occurrences of mammals are more closely dependent on broadly defined habitat types, in particular terrestrial, arboreal (treeliving), rupiculous (rock-dwelling) and wetland-associated vegetation cover. The riverine areas and ridges in the area are regarded as significant in terms of the habitat that they provide to fauna. Riparian zones also serve as important corridors to allow for animal migration.

A list of the Red Data mammal species that could potentially naturally occur in the project area that have been recorded in the grid cells 2327CB, 2327CD, 2427AB, 2427AD and 2427CB, as well as the mammal species that were recorded during the field survey, are listed in in the Terrestrial Ecological Impact Assessment (Nemai Consulting, 2018b) (**Appendix I2**).

Table 36 lists the Red Data mammal species which could potentially occur in the project area, as well as suitable habitats and probability of occurrence.

Table 36: Red Data mammal species that could potentially occur in the area, suitable habitat and probability of occurrence (Child et al., 2016)

Common Name	Red List category	Suitable Habitat	Probability of Occurrence
Roan Antelope	Endangered	They mostly inhabit lightly wooded savannah, open areas of medium sized grass, with easy access to surface water.	Medium
Sable Antelope	Vulnerable	Prefers open savannah woodlands or moist vleis, in which they select for medium height, good quality grass cover.	High
Cheetah	Vulnerable	Cheetahs occur in the Savanna biome and are habitat generalists which can survive where sufficient food is available and threats are tolerable	Low
Serval	Near Threatened	Found in most types of grasslands, the serval is most common in moist habitats such as reed beds and marshes.	Low
Brown Hyena	Near Threatened	The Brown Hyaena is widespread across southern Africa and is found in the desert areas with annual rainfall less than 100 m, semi-desert, open scrub and open woodland savannah with a maximum rainfall up to about 700 mm. It shows an ability to survive close to urban areas. It requires some type of cover in which to lie up during the day. For this it favours rocky, mountainous areas with bush cover in the bushveld areas of South Africa.	Medium
Ground Pangolin	Vulnerable	It is found in various woodland and savannah habitats, preferring arid and mesic savannah and semi-arid environments at lower altitudes, often with thick undergrowth, where average annual rainfall ranges between 250 and 1,400 mm. They also occur in floodplain grassland, rocky slopes and sandveld up to 1,700 m, but are absent from Karroid	Medium

Common Name	Red List category	Suitable Habitat	Probability of Occurrence
		regions, tropical and coastal forests, Highveld grassland and coastal regions.	
Short-eared Trident Bat	Endangered	Occurs in savannah and woodland areas where there is sufficient cover in the form of caves and mine tunnels for day roosting	High

A previous study undertaken by Rautenbach (2010) in the area found a bat cave situated in the Mooivallei area. The bats recorded from the cave are reported to be *Rhinolophus darlingi* and *Miniopterus schreibersii*, and are both ranked as 'Least Concern'.

11.10.2 Avifauna

According to Geyser (2012), the banks of the Crocodile River where the weir will be constructed are steep with reeds that grow in most areas followed by riparian vegetation that varies in density from place to place. The Matlabas River is a smaller river system with more or less the same vegetation that grows on its banks. These rivers are sensitive for bird species that depend on them for food, water and breeding purposes. Bird species such as herons, crakes, moorhens, bishops, weavers, cisticolas and warblers will breed in the reeds growing on the banks of the river systems and will also feed on insects that live within the reeds and semi-aquatic vegetation. Fish living in the water of these rivers will also attract birds such as kingfishers, cormorants and darters. Frogs and crabs also occur and will attract bird species that feed on them such as Hadeda, herons, hamerkop and kingfishers.

The vegetation within the riparian zone consists of large Acacia and broad-leafed trees, which are taller than those trees further away from the river due to the availability of water. This riparian vegetation will favour species typically associated with a bushveld habitat. These birds include a great variety of arboreal passerines such as drongos, warblers, flycatchers, shrikes, sunbirds, waxbills and weavers as well as arboreal nonpasserines such as doves, cuckoos and woodpeckers. Many of these species make use of the thorny nature of these trees to build their nests. Acacia trees generally attract many insects and in turn attract a good diversity of typical "Bushveld" bird species.

The bird species within the woodland habitat include a great variety of arboreal passerines such as drongos, warblers, flycatchers, shrikes, sunbirds, waxbills and weavers as well as arboreal non-passerines such as doves, cuckoos and woodpeckers. Many of these species make use of the thorny nature of these trees to build their nests. Acacia trees generally attract many insects and in turn attract a good diversity of typical Acacia savanna bird species. The ground cover between the trees consists of mainly short to long grass interspersed with shrubs.

Several, mainly seasonal, pans are found in the region. Not only are these pans important for Red Data species but also for many Palaearctic waders which visit southern Africa during the summer months. The pans will attract several water bird species such as lapwings, ducks, herons and egrets for foraging, breeding and roosting purposes. They will feed on prey species such as frogs and their tadpoles and fish that aestivate and hibernate in the mud during times when the pans are dry as well as aquatic insects and plants. The pans are also an important source of water for many woodland bird species such as waxbills, buntings, sparrows, weavers and doves especially during hot and dry periods.

The Important Bird & Biodiversity Area (IBA) programme of southern Africa (Barnes, 1998) identified 124 IBAs in South Africa. IBAs are places of international significance for the conservation of birds and other biodiversity and are sites that together form part of a wider, integrated approach to the conservation and sustainable use of the natural environment. The Waterberg System IBA occurs approximately 3.5 km to the east of the Central Route and the Northern Turf Thornveld IBA is situated approximately 2 km to the south of the abstraction weir (see **Figure 100**). The Paul Hugo and Bierspruit gauging weirs fall within the last mentioned IBA.

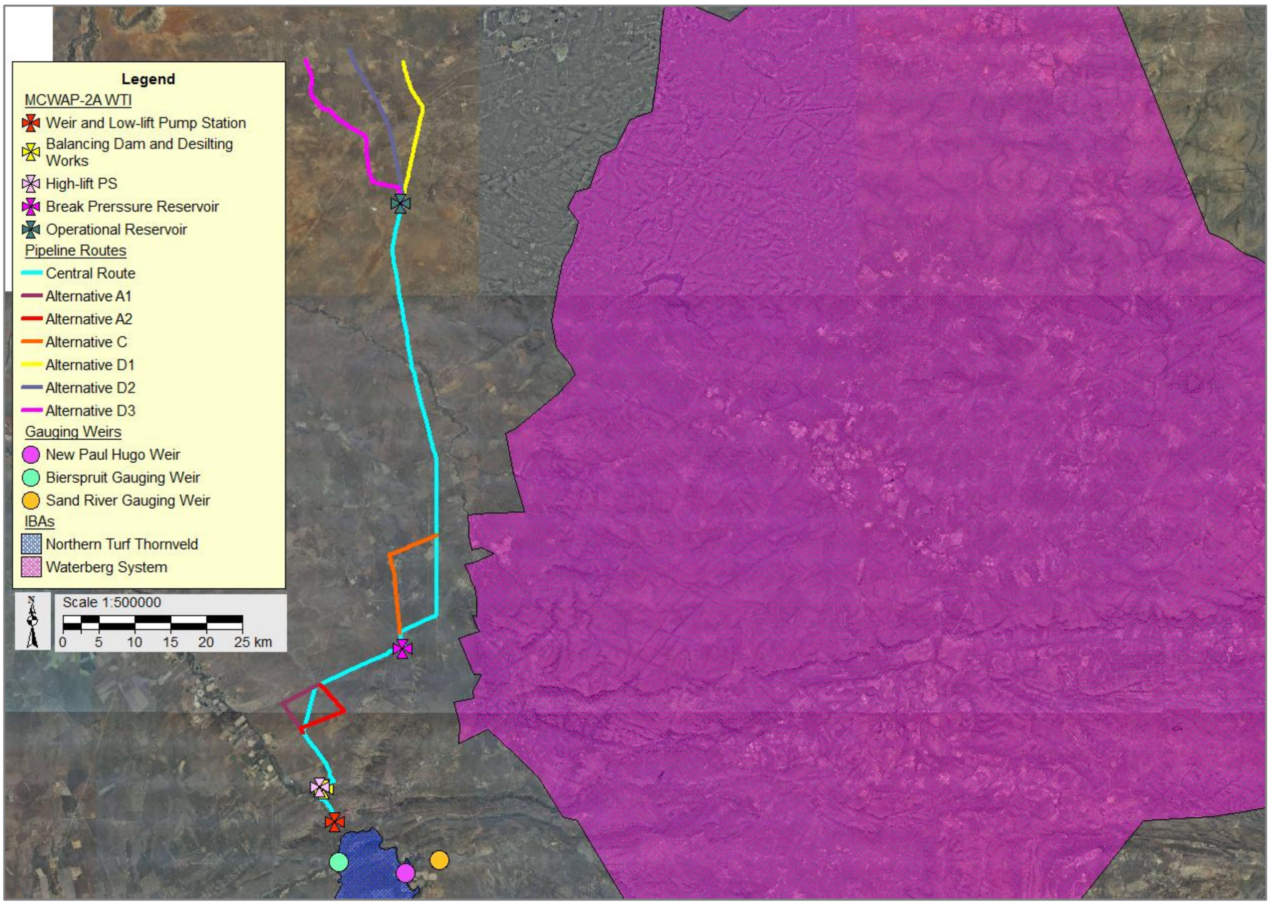


Figure 100: **IBAs**
(Note: Pipeline route Alternatives E & D4 not shown)

A list of the bird species that were recorded during the field survey is contained in the Terrestrial Ecological Impact Assessment (Nemai Consulting, 2018b) (**Appendix I2**).

Table 37 lists the Red Data bird species which could potentially occur in the project area, as well as suitable habitats and probability of occurrence.

Table 37: Red Data bird species recorded in the grid cells 2327CB, 2327CD, 2427AB, 2427AD and 2427CB (ADU, 2016), which could potentially occur within the project area

Common Name	Scientific Name	Conservation Status	Suitable Habitat	Probability of occurrence
Kori Bustard	*Ardeotis kori*	Near Threatened	In southern Africa it is locally common in Namibia, Botswana, Zimbabwe and west-central South Africa. It generally prefers dry, open savanna, Nama karoo, dwarf shrublands, occasionally moving into grassland and dense, closed-canopy woodland.	High
White-bellied Korhaan	*Eupodotis senegalensis*	Vulnerable	It generally prefers fairly tall, dense sour or mixed grassland, either open or lightly wooded, occasionally moving into cultivated or burnt land.	Low
Yellow-throated Sandgrouse	*Pterocles gutturalis*	Near Threatened	It generally prefers short, open grassy plains with moist clay-like soils, especially on or near seasonal rivers, swamps or flood plains, also occupying fallow fields and cultivated land	Medium
Greater Painted-snipe	*Rostratula benghalensis*	Vulnerable	It generally prefers dams, pans and marshy river flood plains, or any waterside habitat with mud and vegetation.	Low
Black-winged Pratincole	*Glareola nordmanni*	Near Threatened	It generally prefers open seasonally wet grassland, edges of pans and cultivated land.	Medium-High
White-backed Vulture	*Gyps africanus*	Endangered	It generally prefers arid savanna with scattered trees, such as Mopane (*Colosphermum mopane*), largely avoiding forests, deserts, treeless grassland and shrubland	Low
Cape Vulture	*Gyps coprotheres*	Endangered	It can occupy a variety of habitat types, although it especially favours subsistence farming communal grazing areas, where there is plenty of livestock to feed on.	Medium-High
Lappet-faced Vulture	*Aegypius tracheliotus*	Endangered	It generally prefers arid and semi-arid open woodland, especially with *Acacia*, Shepherds-tree (*Boscia albitrunca*), Purple-pod cluster-leaf (*Terminalia prunioides*) and Mopane (*Colosphermum mopane*).	Medium
Bateleur	*Terathopius ecaudatus*	Endangered	It generally prefers savanna and woodland habitats, such as arid *Acacia* savanna and miombo (*Brachystegia*) woodland and Mopane (*Colosphermum mopane*) woodland, especially with long grass. It may also move into drainage-line woodland in semi-desert shrubland.	Low
African Marsh-Harrier	*Circus ranivorus*	Endangered	It generally favours inland and coastal wetlands.	Low
Tawny Eagle	*Aquila rapax*	Endangered	It generally prefers lightly-wooded savanna, but it also occurs Nama Karoo and treeless grasslands, provided that there are pylons and alien trees to nest in.	High

Common Name	Scientific Name	Conservation Status	Suitable Habitat	Probability of occurrence
Martial Eagle	*Polemaetus bellicosus*	Endangered	It is found in open plains and semi-desert country, but not frequenting forest, although it occasionally breeds in forests on the edge of open country.	Medium-High
Secretarybird	*Sagittarius serpentarius*	Vulnerable	Prefers open grassland with scattered trees, shrubland, open *Acacia* and *Combretum* savannah. Restricted to large conservation areas in the region. Avoids densely wooded areas, rocky hills and mountainous areas.	Medium
Lanner Falcon	*Falco biarmicus*	Vulnerable	The species can be found in *Eucalyptus* stands in southern Africa and even in urban areas, as long as there are open or lightly wooded areas nearby for hunting, though it tends to avoid heavily forested or very wet areas.	Low-Medium
Yellow-billed Stork	*Mycteria ibis*	Endangered	It generally prefers wetlands, such as pans, flood plains, marshes, streams, flooded grassland and small pools, occasionally moving into mudflats and estuaries.	Low-Medium
Black Stork	*Ciconia nigra*	Vulnerable	It can occupy almost any type of wetland, such as pans, rivers, flood plains, ponds, lagoons, dams, swamp forests, mangrove swamps, estuaries, tidal mudflats and patches of short grass close to water	High
Marabou Stork	*Leptoptilos crumeniferus*	Near Threatened	It generally prefers open semi-arid habitats and wetlands, such as pans, dams and rivers.	Medium

11.10.3 Herpetofauna (Reptiles and Amphibians)

According to Haacke (2010), the habitat types affected by the project infrastructure are generally suitable for relatively high species diversity. The herpetofauna mainly consists of widespread, common Bushveld species with slight variation due to the presence of sandy substrate, stony to rocky terrain, water bodies, bush and trees.

Riparian habitats are ordinarily rich in reptile diversity and densities due to the habitat supporting a high abundance of prey species, such as frogs, birds and small mammals (Branch, 2001). Reptilian species are largely dependent on habitat unit structures and prey abundance, which, in turn, also depends on general habitat unit structure and condition. Many reptilian species, together with a large proportion of their prey species, have been shown to be broadly tolerant to a variety of habitat types. Vegetative cover is also greater within this habitat type. Species are also very often “ousted” into wetland and riparian zones due to transformation of lands for urban and agricultural purposes.

Amphibians are an important component of South Africa’s exceptional biodiversity and are such worthy of both research and conservation effort. This is made additionally relevant by international concern over globally declining amphibian populations, a phenomenon currently undergoing intensive investigation but is still poorly understood (Wyman, 1990 & Wake, 1991). This decline seems to have worsened over the past 25 years and amphibians are now more threatened than either mammals or birds, though comparisons with other taxa are confounded by a shortage of reliable data. Frogs are particularly restricted to aquatic habitats (wetlands and other surface water bodies) and, thus, impacts on these habitats (as a result of the clearing of the vegetation) are likely to negatively impact on amphibian species. Frogs also require terrestrial habitats adjoining aquatic habitats.

Frogs are useful environmental bio-monitors (bio-indicators) and may acts as an early warning system for the quality of the environment. Frogs and tadpoles are good species indicator on water quality, because they have permeable, exposed skins that readily absorb toxic substances. Tadpoles are aquatic and greatly exposed to aquatic pollutants (Blaustein, 2003). The presence of amphibians is also generally regarded as an indication of intact ecological functionality.

A list of the reptile and amphibian species that were recorded during the field survey is contained in the Terrestrial Ecological Impact Assessment (Nemai Consulting, 2018b) (**Appendix I2**).

The protected Southern African Python (*Python natalensis*) is known to occur in abundance in the project area, especially in the northern area. Habitat types that support protected Giant Bullfrog (*Pyxicephelus adspersus*) and African Bullfrog (*Pyxicephalus edulis*) are also present in the project area.

11.10.4 Invertebrates

Recorded spider species in grid cells 2327CB, 2327CD, 2427AB, 2427AC, 2427AD and 2427CB include:

- Green lynx spiders (*Peucetia* sp.)'
- Garden orb-web spiders (*Argiope* sp.)'
- Horned baboon spider (*Ceratogyrus darlingi*) and
- Golden brown baboon spider (*Idiothele nigrofulva*).

Baboon spider species belonging to the genus *Ceratogyrus* has a particular presence in the Limpopo Province. No burrows were identified, although it should be noted that these species are notoriously difficult to detect. Many species of baboon spiders live in burrows in open ground. The burrows can be easily recognised by their round entrance and silk lining. Horned Baboon Spiders (*Ceratogyrus* spp – All species) are listed in NEM:BA: Publication of lists of Critically Endangered, Endangered, Vulnerable and **Protected species** and also under Schedule 10 (Invertebrates to which section 61(1)(a) and (b) applies.

11.11 Socio-Economic Environment

11.11.1 General

A Socio-Economic Impact Assessment (see **Appendix I6**) was undertaken for the project. Refer to **Sections 12.8** and **13.12** for a synopsis of the study and a related impact assessment, respectively. An extract from the Socio-Economic Impact Assessment follows.

11.11.2 Overview of Affected Municipal Wards

The local study area comprises Ward 1 and Ward 9 of the Thabazimbi LM, as well as Ward 3 of the Lephalale LM. The analysis below uses data drawn from Census 2011, published by Statistics South Africa.

11.11.2.1 Language

Table 38 below provides an overview of the languages used in the area.

Table 38: Language in the Local Study Area

Language	Thabazimbi LM		Lephalale LM	Totals	% of Total
	Ward 1	Ward 9	Ward 3		
Setswana	4 261	9 468	2 919	16 648	49,8%
Sepedi	383	2 021	3 214	5 618	16,8%
Afrikaans	1 335	214	1 318	2 867	8,6%
Xitsonga	384	683	926	1 993	6,0%

Language	Thabazimbi LM		Lephalale LM	Totals	% of Total
	Ward 1	Ward 9	Ward 3		
English	264	434	398	1 096	3,3%
Other	379	296	2 364	3 039	9,1%
Totals:	7 006	13 116	11 139	31 261	100,0%

Setswana and Sepedi are the dominant languages in the local study area, becoming increasingly Sepedi the further north that one travels.

11.11.2.2 Gender

Figure 101, provides the gender balance in the local study area. The study area has a 56:44 split between male and female, a ratio that is most in keeping with that for the Limpopo Province than for the regional study area as a whole. This is since the mining and large industrial facilities that are present in the local municipalities do not fall within the local study area.

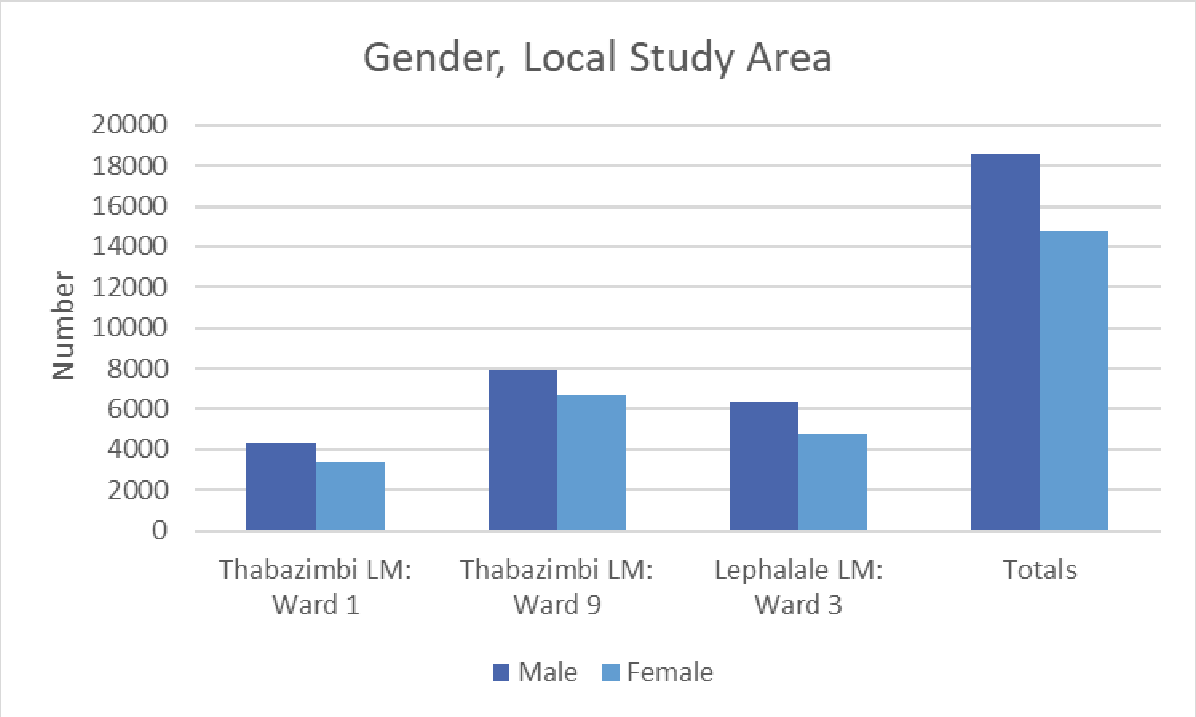


Figure 101: Gender in the Local Study Area

In this regard, the gender split in the local study area is more typically rural in nature than the regional study area as a whole.

11.11.2.3 Household Income

Annual household income is an indicator of the access to services and level of economy vulnerability that a house will face. **Table 39** provides data on the levels of annual household income in the local study area.

Table 39: Local Study Area Annual Household Income

Income Values	Thabazimbi LM		Lephalale LM	Totals	% of Totals
	Ward 1	Ward 9	Ward 3		
Very Low Income [R1 - R9 600 pa]	185	481	198	864	9,6%
Low Income [R9 601 to R38 200 pa]	1 285	1 484	1 639	4 408	49,0%
Middle Income [R38 201 to R614 400 pa]	669	1 867	894	3 430	38,2%
High Income [R614 60 and above pa]	139	65	83	287	3,2%
Totals:	2 278	3 897	2 814	8 989	100,0%
% of Totals:	25,3%	43,4%	31,3%	100,0%	

The table demonstrates that sixty percent of the households in the local stud area earn less than R38 200 per year, in 2011. Average household size across the local study area is 3.5. Thus, the degree of economic vulnerability to external shocks is high, with most households living a subsistence livelihood.

11.11.2.4 Education Level Attained

Table 40 provides detail on the education levels attained by residents of the local study area.

Table 40: Local Study Area Education Levels

Education Level Attained	Thabazimbi LM		Lephalale LM	Total	% of Total
	Ward 1	Ward 9	Ward 3		
No Schooling	999	1 171	1 251	3 421	10,2%
Some Primary School	1 826	3 431	2 564	7 821	23,4%
Primary School	506	789	876	2 171	6,5%
Some High School	2 025	4 667	3 331	10 023	30,0%
Matriculated	1 019	2 682	1 298	4 999	15,0%
Secondary Education	36	46	55	137	0,4%
Higher Degrees	225	125	300	650	1,9%
Other and Not Applicable	1 037	1 686	1 466	4 189	12,5%
Totals:	7 673	14 597	11 141	33 411	
% of Total:	23,0%	43,7%	33,3%	100,0%	

Education levels within the local study area reflect the low-income levels found in the previous section. Ten percent of the residents have no schooling, whilst a further thirty percent have completed up to primary school. An additional thirty percent have completed some high school but have not matriculated. The result is that sixty-nine percent of the residents of the area have not completed matric. Approximately two percent have gained an education level higher than matric.

These results reinforce the conclusion that the residents of the local study area are vulnerable to economic shocks.

11.11.2.5 Dwelling Type

Dwelling type is a livelihood indicator that provides insight into the socio-economic conditions in the local study area. The characteristics of the dwellings in which households live and their access to various services and facilities provide an important indication of the well-being of household members. It is widely recognised that shelter satisfies a basic human need for physical security and comfort.

According to the Statistics South Africa household classification, the following definitions apply to formal and informal housing:

- **Formal dwelling**, refers to a structure built according to approved plans, i.e. house on a separate stand, flat or apartment, townhouse, room in backyard, rooms or flat let elsewhere. Contrasted with informal dwelling and traditional dwelling; and
- **Informal dwelling**, is a makeshift structure not erected according to approved architectural plans, for example shacks or shanties in informal settlements or in backyards.

Table 41 provides data on the levels of annual household income in the local study area.

Table 41: Local Study Area Dwelling Type

Dwelling Type	Thabazimbi LM		Lephalale LM	Totals	% of Total
	Ward 1	Ward 9	Ward 3		
House, separate stand	64,1%	65,6%	48,7%	19 914	59,6%
Traditional Dwelling	3,5%	0,6%	1,9%	564	1,7%
Townhouses/Flats	0,8%	2,5%	1,1%	555	1,7%
Backyard Dwelling or Flatlet	1,1%	0,7%	4,6%	699	2,1%
Informal Dwelling	21,0%	24,8%	17,1%	7 134	21,4%
Not Applicable, Other and Unspecified	9,5%	5,8%	26,6%	4 530	13,6%

The analysis of dwelling type shows that sixty percent of the residents in the local study area live in brick houses located on separate stands. The next most common housing typology is an informal structure, which is home to twenty-one percent of residents.

These figures can be viewed alongside those for the labour force, using the working assumption that lower skilled and informal members of the workforce would be most likely to live in informal structures. Forty-five percent of the labour force is low skilled or part of the informal sector and yet twenty-one percent of the dwellings are informal. This disparity leads to the conclusion that housing typologies are not related to level of skill of the labour-force member. Hence, it is concluded that living in a separate brick structure should not be taken as an indicator of lower economic vulnerability when compared to those living in informal structures.

11.11.3 Summary of Impacts for Route Alternatives

Table 42 provides a breakdown of the number of impacts for the various route alternatives, as obtained from the Socio-Economic Impact Assessment (Bews and Chidley, 2018).

Table 42: Summary of Impacts Along Each Route Alternative

Nature of Impact	Route Alternative							
	Central	E	A1	A2	C	D1	D2	D3
Farm Dwellings*	1	2	1	2	7	3	4	14
Farm Buildings	7	4			2			
Orchards/Lands	2	2						
Irrigation Pivots	3							
Road Crossings	4				1			
Proximity to Road over Rail Bridge Crossing	6					1		
Proximity to Cattle/vehicle Rail Crossing	6							
Proximity to Rail level Crossing	1					2		
Rail Station	2							
Powerline Crossing	1		1			2	1	
Watering Point	1							
Totals	**39**	**8**	**2**	**2**	**10**	**8**	**1**	**14**

**Note: where uncertainty existing regarding whether a building is a dwelling or not, the building has been classified as a dwelling.*

11.11.4 Land Claims

The land claims in the district, based on the SDF (Waterberg DM, 2013) are shown in **Figure 102**. The project area around the Matlabas River seems to be the most affected by land claims. The status of land claims for the MCWAP-2A footprint will need to be confirmed as part of the land acquisition process.

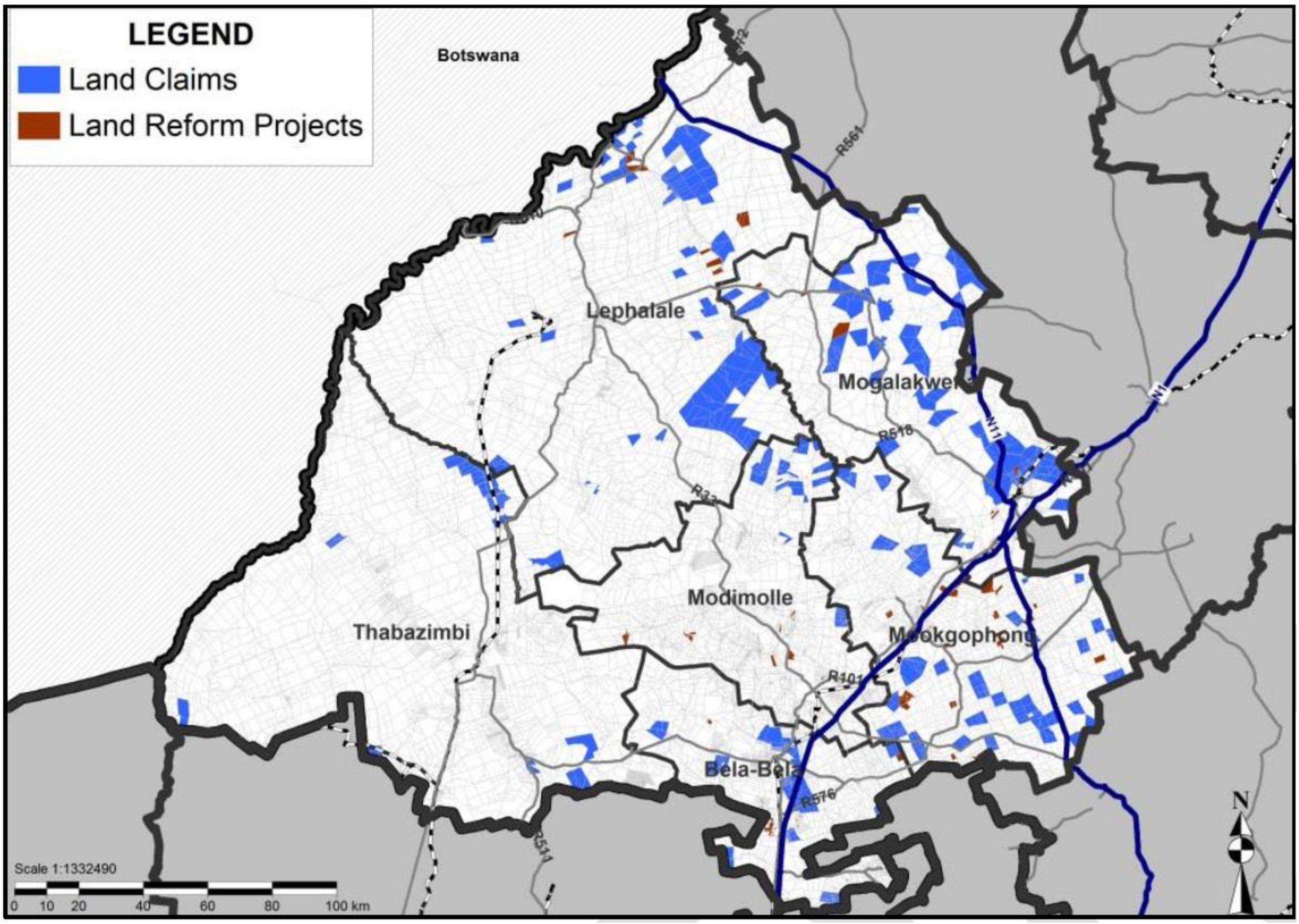


Figure 102: Land claims in district (Waterberg DM, 2013)

11.12 Agriculture

An Agricultural Impact Assessment (**Appendix I3**) was conducted for the project. Refer to the summary and impact assessment of this study contained in **Sections 12.7** and **13.13**, respectively.

11.12.1 Irrigation

In general the study area is regarded as arid, and irrigation is hence limited to major watercourses, as is evident immediately downstream of the proposed weir site (shown in **Figure 103**).

Formal agricultural groups in the study area include the following:

- Hartbeespoort Irrigation Board;
- Crocodile-West Irrigation Board;
- Makoppa Agriculture;
- Transvaal Agricultural Union-SA; and

❖ Agri-SA Lephalale.

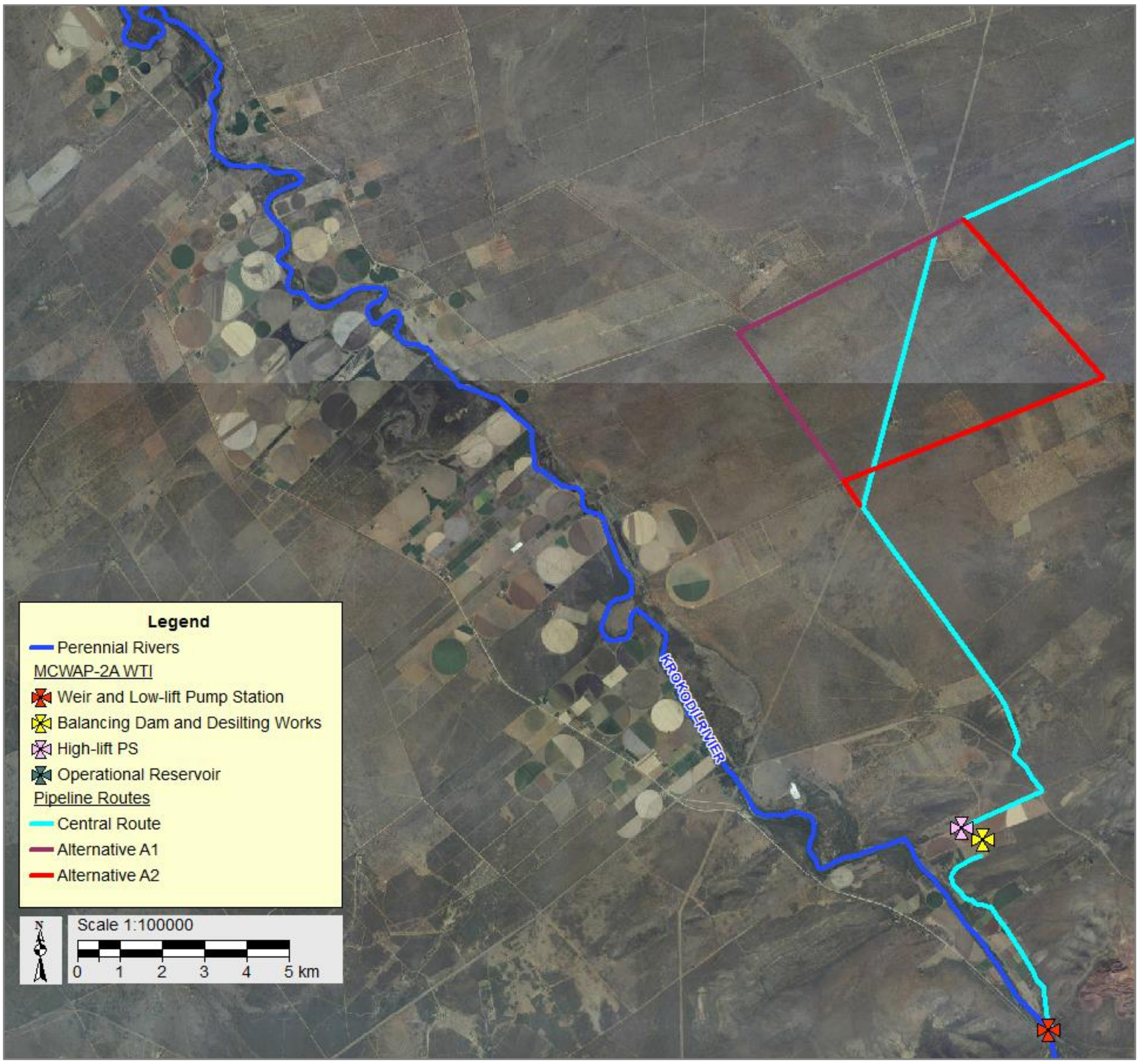


Figure 103: Agricultural practices alongside the Crocodile River, downstream of weir site

The location of the Hartbeespoort and Crocodile-West Irrigation Boards is shown in **Figure 84**. The Makoppa Farmers are downstream of the proposed abstraction weir in Vlieëpoort.

The Agricultural Impact Assessment (contained in **Appendix I3**) provides the details of agricultural land use (refer to **Section 12.7**) and irrigated land that is affected by the proposed project.

11.12.2 Land Capability

The following observations are made with regards to the land capability map in **Figure 104**:

❖ Moderate potential arable land is affected by the low-lift rising main, balancing dam, high-lift pumping station, BPR (Central Route) and sections of the Central Route;

- Marginal potential arable land is affected by the low-lift rising main and sections of the Central Route, as well as sections of Alternatives A1, A2, B, and C; and
- The remainder of the footprint affects non-arable land (grazing, woodland or wildlife).

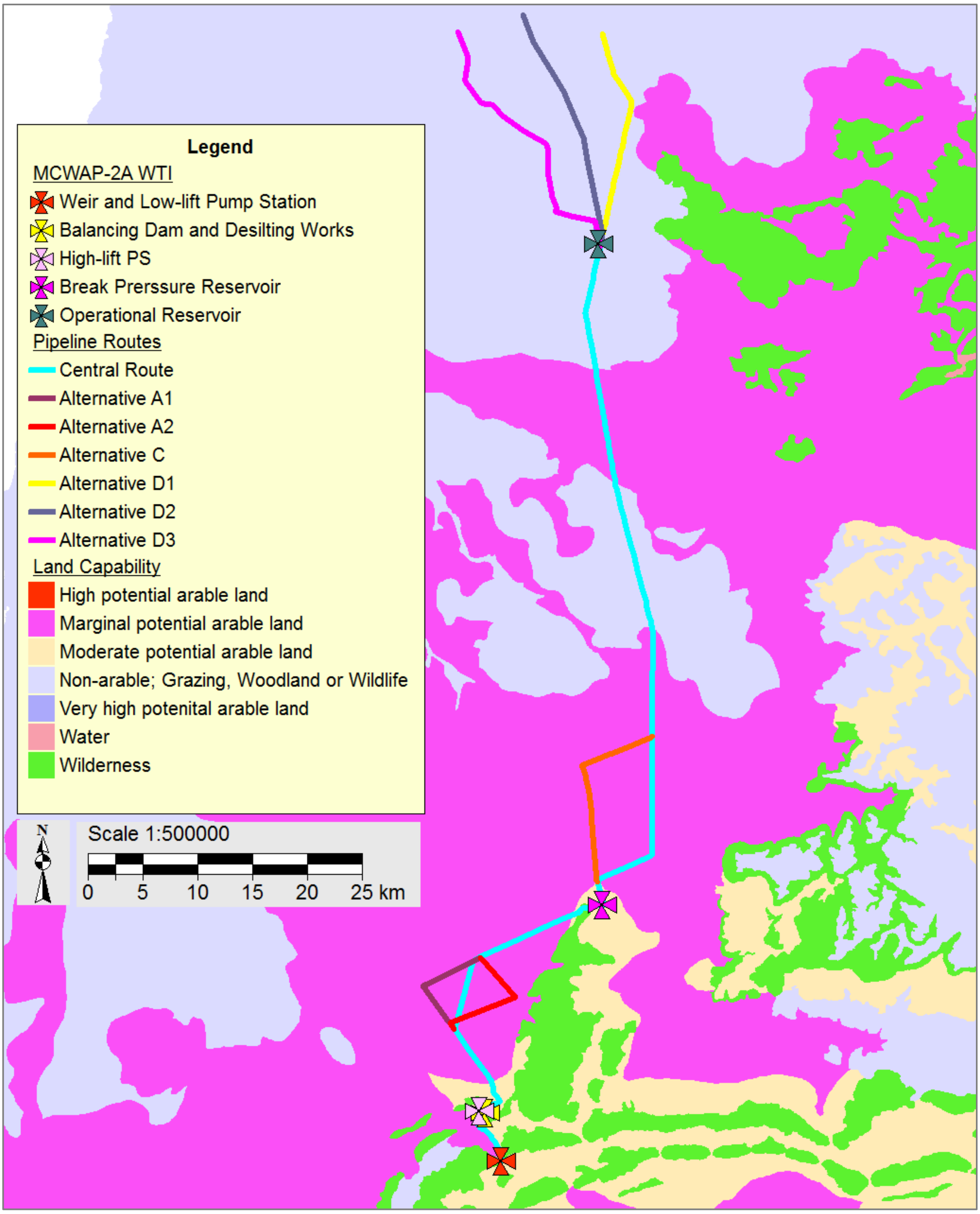


Figure 104: Land capability

(Note: Gauging weirs and pipeline route Alternatives E & D4 not shown)

Details regarding grazing capacity, as determined as part of the Agricultural Impact Assessment, as provided in **Section 12.7**.

11.12.3 *Existing Agricultural Activities*

According to the Crocodile (West) Marico Internal Strategic Perspective (ISP) (DWAF, 2004b), smallholding and commercial agricultural activities (limited formal irrigation) take place in the area to the north west of Johannesburg (south of the Magaliesberg northern range). The area between Rustenburg and Brits is known for its citrus farming activities, whereas irrigated cash crop farming takes place below the Hartbeespoort Dam and Brits. Irrigation also occurs along the main stem of the Crocodile River (West), the most significant areas being just south and north of the town of Thabazimbi. The rest of the area is used for dryland farming (limited), cattle grazing and game ranching (DWAF, 2004b). Generally, there has been a movement away from cattle farming towards game farming in the greater area.

The project footprint significantly affects the pivots and fields on Portions 1 and 2 of the Farm Mooivalei 342 KQ, which is earmarked for the proposed balancing dam, desilting works, high-lift pumping station, ancillary infrastructure and a section of the Central Route (see **Figure 105**). Cultivated areas occur along the south-western part of the low-lift rising main, where the potential impact depends on which side of the dirt road the pipeline will run, or which alternative is selected. Other cultivated areas also occur along other sections of the pipeline routes.

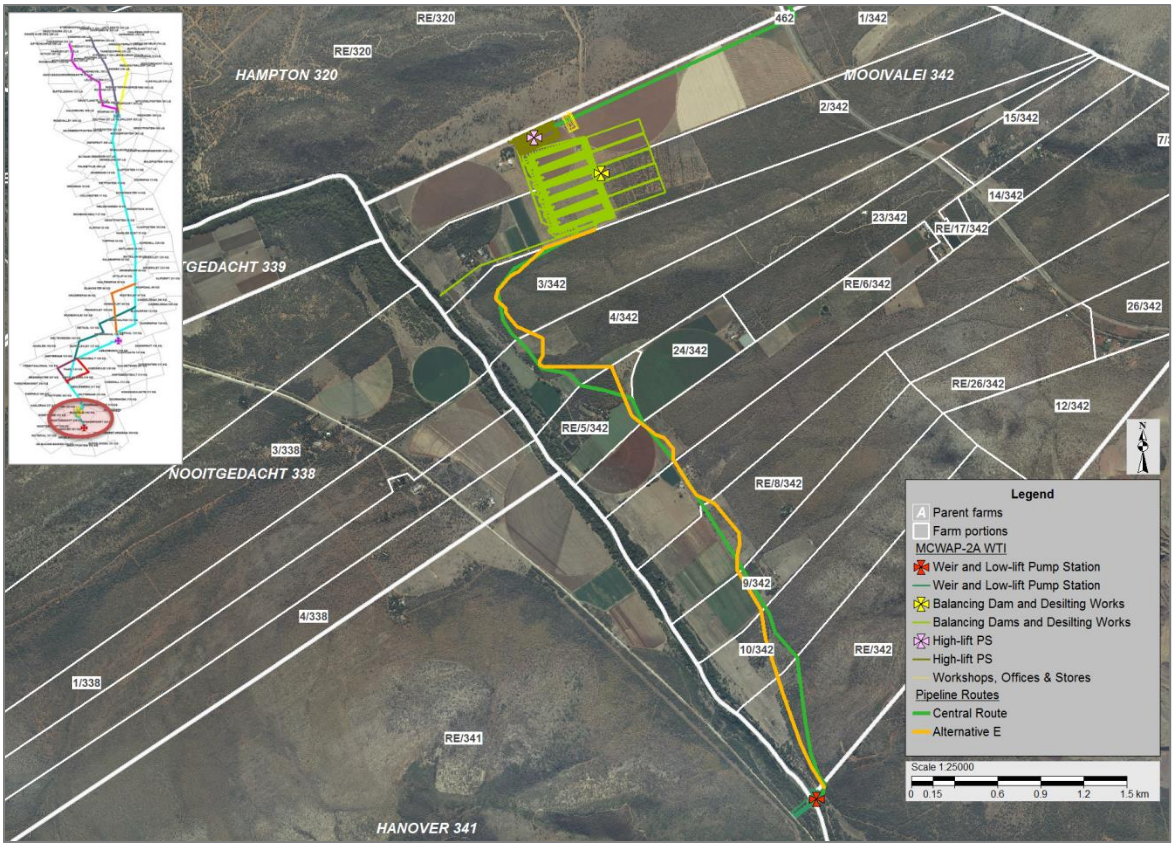


Figure 105: Agricultural activities affected in Mooivallei area

The Agricultural Impact Assessment (contained in **Appendix I3**) provides the details of agricultural land use (refer to **Section 12.7**) and irrigated land that is affected by the proposed project footprint.

11.13 Air quality

Due to the predominantly rural nature of the study area, the air quality is regarded to be good.

Obvious sources of air pollution in the greater region include the following:
- Grootegeluk coal mining operations;
- Dust from areas affected by the previous Thabazimbi iron ore mining operations
- Urban-related emissions from towns (notably Lephalale and Thabazimbi);
- Emissions from Matimba and Medupi power stations (stacks) and its associated ash dump;
- Dust from agricultural lands, bare areas and use of dirt roads;
- Tailpipe emissions from vehicles travelling along the road network;
- Burning of wood for household purposes in areas without electricity;
- Waste treatment and disposal;
- Burning of biomass (veld fires); and
- Veld fires.

11.14 Noise

The rural state of the study area affords it tranquillity.

Noise in the region emanates primarily from the following sources:
- Mining operations;
- Human settlements;
- Operations at the Matimba power station and ash dump;
- Farming operations (e.g. use of farming equipment);
- Vehicles on the road network;
- Trains utilising the railway line and
- Occasional overflying aircrafts.

The ridges in the southern part of the route serve as noise attenuation features, although the ambient noise levels are regarded as insignificant.

A Noise Study that was undertaken to assess the potential impacts from the proposed low-lift pumping station. Potential noise impacts are further discussed in **Section 13.15**.

11.15 Historical and Cultural Features

A Phase 1 Heritage Impact Assessment (see **Appendix I4**), as well as a paleontological desktop study, was undertaken for the project in accordance with the National Heritage Resources Act (Act No. 25 of 1999) (NHRA).

An archival and historical desktop study was undertaken as part of the Heritage Impact Assessment to provide a historic framework for the project area and surrounding landscape. This was augmented by a study of available historical and archival maps and an assessment of previous archaeological and heritage studies completed for the area. The desktop study revealed that the surroundings of the study area is characterised by a long and significant history, whereas previous archaeological and heritage studies from this area have revealed a number of archaeological and heritage sites. A total of 18 archaeological and heritage sites were identified during the fieldwork.

Refer to **Sections 12.6** for a synopsis of the Heritage Impact Assessment.

11.16 Planning

11.16.1 General

Waterberg DM covers an area of approximately 4 951 882 ha. It consists mainly of commercial farms, game farming, rural settlements and small towns. The district is geographically, the largest municipality in the Limpopo Province but has the smallest population compared to the other districts (Waterberg DM, 2017). It is located on the western part of the Province.

Thabazimbi LM is located in the south-western part of the Limpopo Province and Waterberg DM. The total area of the municipality is 10 882 km^2, which constitutes 21,97% of the overall DM. The project footprint is located in Wards 1 and 3 of the Thabazimbi LM (based on 2015 delimitation of wards).

Lephalale LM is located in the western part of the Limpopo Province and north-western part of the Waterberg DM. The total area of the municipality is 14 000 km^2, which constitutes 28,3% of the overall DM. The project footprint is located in Wards 3 and 5 of the Lephalale LM (based on 2015 delimitation of wards).

As mentioned, the project infrastructure is mostly located on privately-owned properties that are primarily used for agriculture, game farming and eco-tourism.

11.16.2 SDF

Limpopo Province SDF

The Limpopo SDF is dated September 2007 and indicates the following elements (Waterberg DM, 2013) (see **Figure 106**):

- Infrastructure;
- Nodes;
- Environmentally sensitive areas; and

❖ Corridors: Four corridors are identified as Strategic Development Initiatives. Two of these impact on the District, namely the Trans-Limpopo Corridor along the N1 and the east-west Corridor from Polokwane via Lephalale to Botswana.

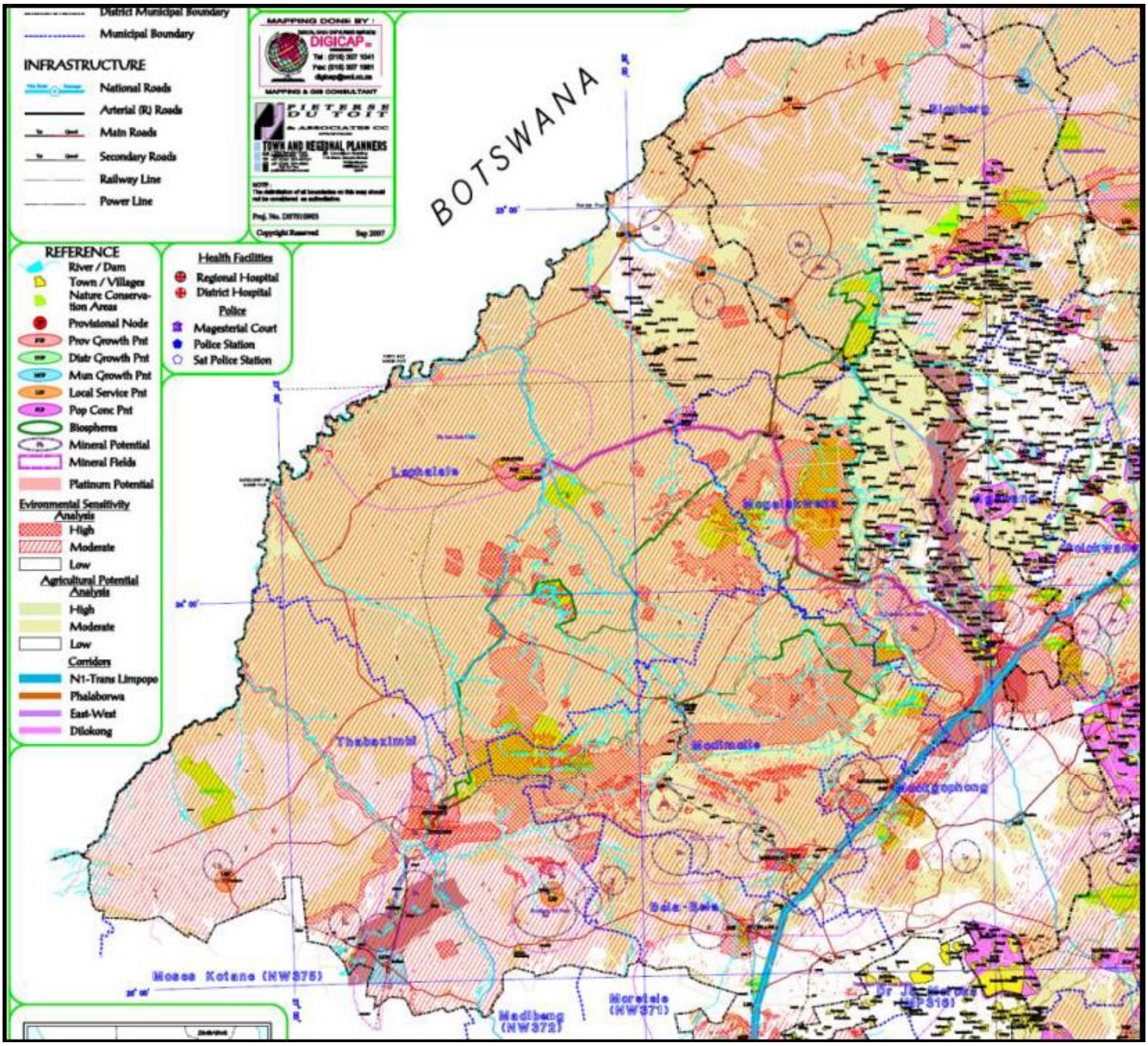


Figure 106 **Limpopo Province SDF**

Waterberg DM SDF

There is an existing SDF for the Waterberg District, which was approved in 2009, and indicates the following (Waterberg DM, 2013) (see **Figure 107**):

❖ Nodes;
❖ Networks;
❖ Conservation and Tourism;
❖ Mining; and
❖ Urban and Rural Development.

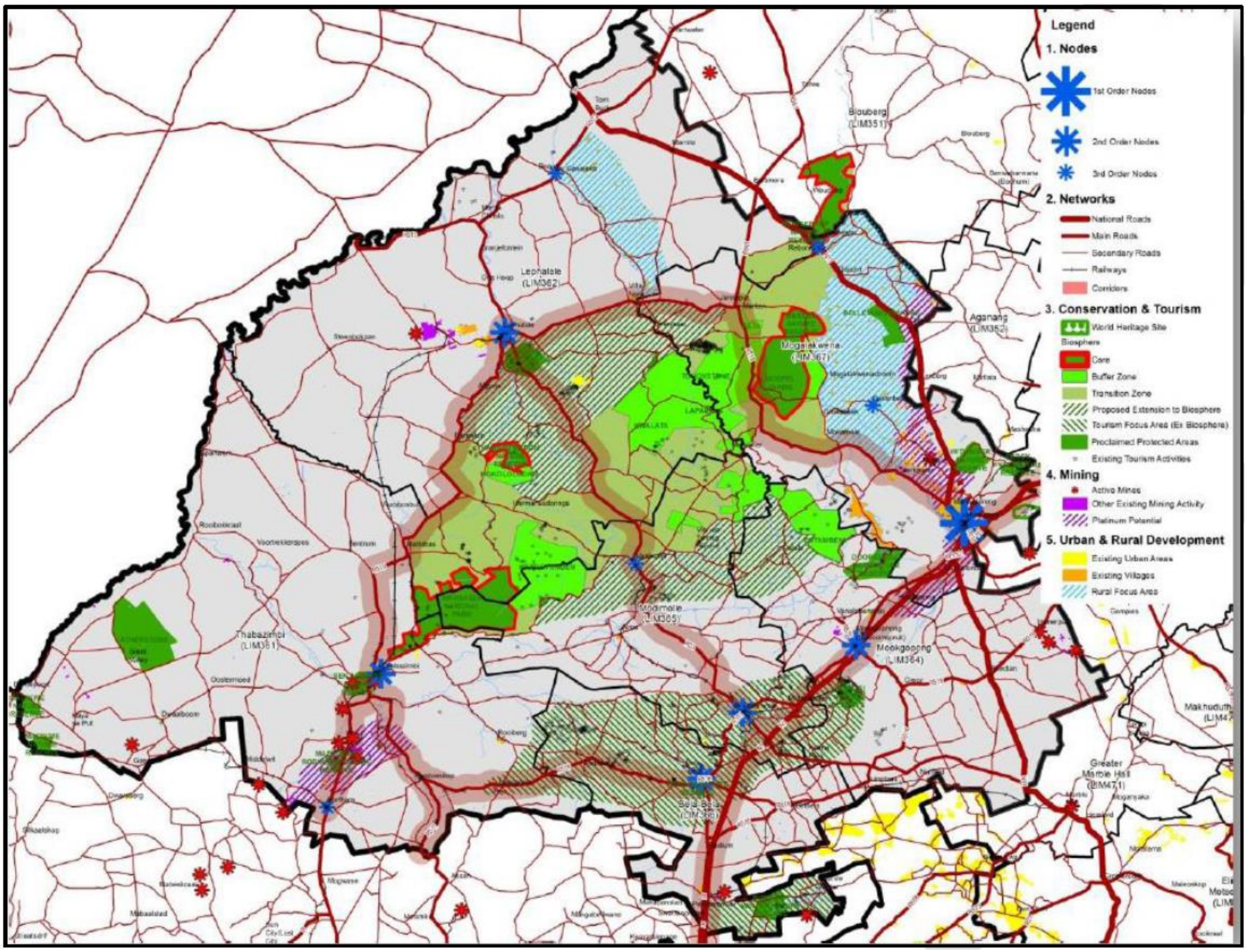


Figure 106: **Waterberg DM SDF**

Lephalale LM SDF

The Lephalale SDF is dated November 2012 and indicates the following (Waterberg DM, 2013) (see **Figure 108**):

- Development corridors and strategic roads;
- Nodal points;
- Human settlement and other zones and
- Long term vision and other features.

The IDP for the Lephalale LM (2016) acknowledges the need for MCWAP and specifically states the following: "It is imperative to note that the outcome of the MCWAP project need to be implemented to address expected water shortages before any development in node area 1 will be viable, as currently the area does not have sufficient water resources to sustain any new development". MCWAP-2A is also included as one of the strategic projects in terms of Key Performance Area 2: Basic Services and Infrastructure investment.

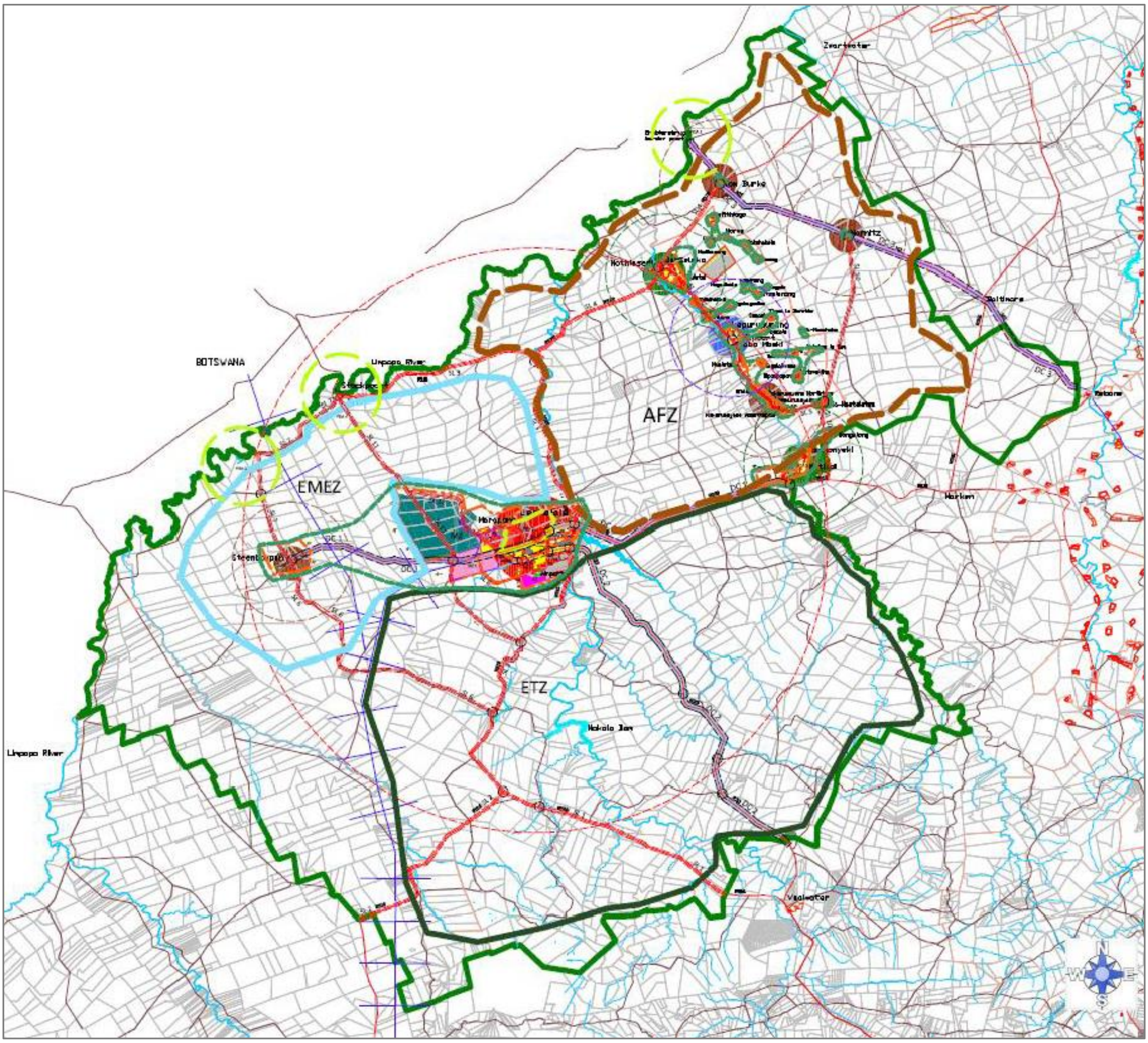


Figure 108: **Lephalale LM SDF**

Thabazimbi LM SDF

The Thabazimbi SDF is dated June 2008 and indicates the following (Waterberg DM, 2013) (see **Figure 109**):

- Growth points;
- Settlements;
- Corridors;
- Nodes;
- Waterberg Biosphere;
- Mines; and
- High-risk river areas.

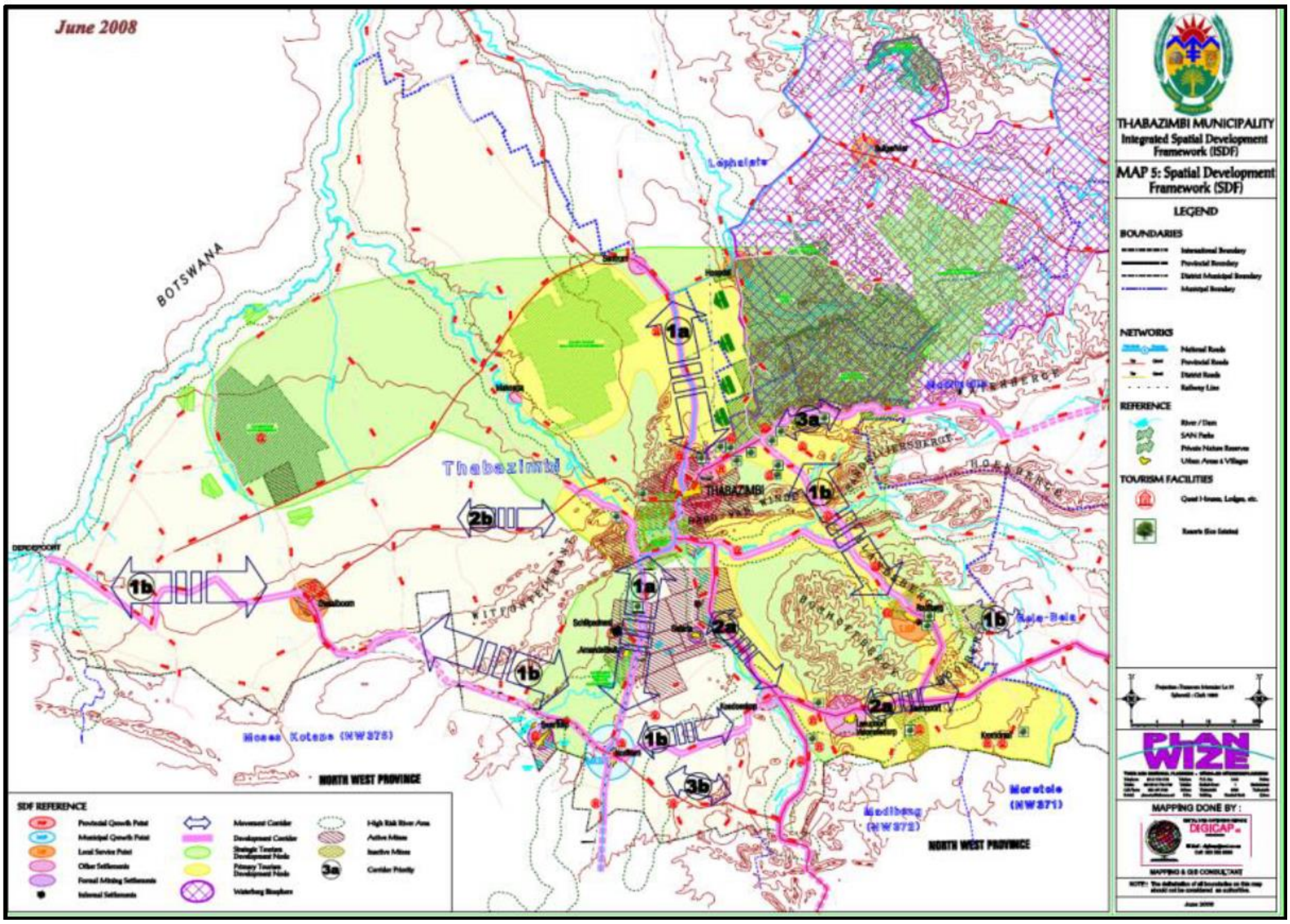


Figure 109: **Thabazimbi LM SDF**

It is noted that Thabazimbi LM's water supply is from Magalies Water. According to the spatial vision presented in the IDP for the Thabazimbi LM (2017), the proposed footprint of MCWAP-2A falls primarily within the activity and government corridor, which extends northwards from the town of Thabazimbi (similar to Zone 11 of the Waterberg DM EMF).

11.16.3 Environmental Management Framework

An EMF was developed for the Waterberg District with the following objectives (Environomics & NRM Consulting, 2010a):

- Encourage sustainable development;
- Establish development priorities;
- Identify strategic guidance and development management proposals;
- Identify the status quo, development pressures and trends in the area;
- Determine opportunities and constraints;
- Identify geographical areas in terms of NEMA;
- Specify additional activities within identified geographical areas that will require an EIA based on the environmental attributes of such areas;

- Specify currently listed activities that will be excluded from EIA within certain identified geographical areas based on the environmental attributes of such areas; and
- Develop a decision support system for development in the area to ensure that environmental attributes, issues and priorities are taken into account.

In terms of the EMF the project falls within the following Environmental Management Zones (refer to **Figure 110**):

- Zone 4: Game and cattle farming (including hunting) areas with commercial focus;
- Zone 5: Mining and industrial development focus areas;
- Zone 6: Restricted mining focus areas in aesthetic and/or ecological resource areas; and
- Zone 11: Major infrastructure corridors.

It is noted that Zone 11 facilitates the routing of bulk infrastructure, such as the pipeline associated with MCWAP-2A. The EIA will further assess whether MCWAP-2A is incompatible with the desired state established for the remaining zones.

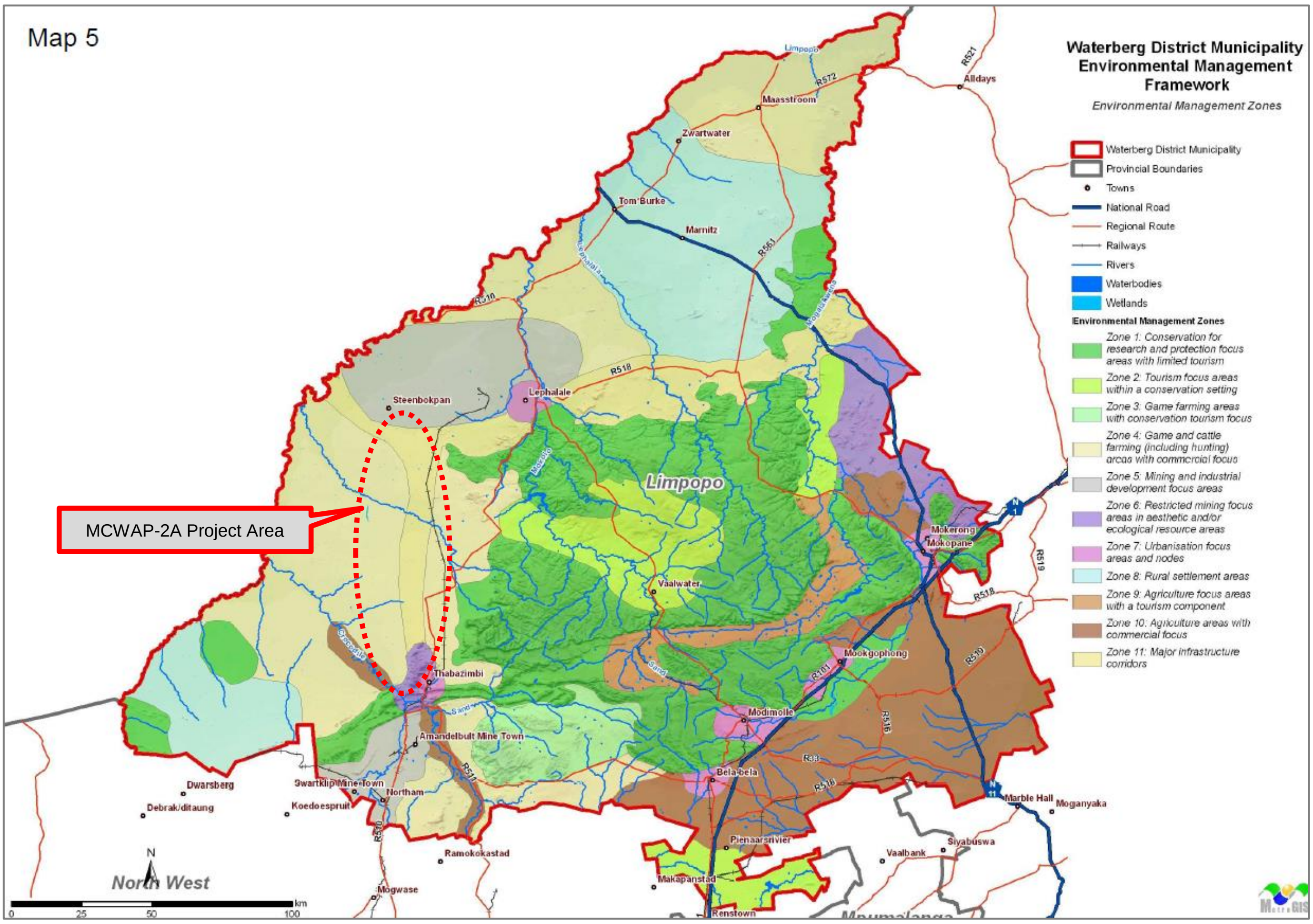


Figure 110: **Waterberg DM EMF (Environomics & NRM Consulting, 2010b)**

11.17 Existing Structures and Infrastructure

The alternative pipeline routes may affect the following physical features located in the project area (amongst others):

- Power lines (transmission, distribution and reticulation);
- Railway line (Central Route) (including bridges);
- Public and private roads (including bridges);
- Telephone lines;
- Access roads to private farms;
- Infrastructure associated with agricultural practices, such as irrigation pipelines, workshops, sheds, livestock enclosures, etc.;
- Private dams and boreholes;
- Fencing erected on the boundaries of private farms;
- Game camps;
- Farm houses and dwellings of farm labourers; and
- Churches and schools.

The balancing dam, desilting works and high-lift pumping station affect cultivated land (with associated infrastructure, and are also located near dwellings.

The backwater effect of the proposed abstraction weir will affect existing upstream infrastructure, specifically a low level mine haul road and railway bridge crossing the river some 7,5 km upstream. The future use of the haul road needs to be considered in light of the closure of the mine.

11.18 Transportation

The major transportation network in the region is shown in **Figure 111**.

Lephalale LM

Provincial roads in Lephalale, which serve as links between Thabazimbi, Vaalwater, Ellisras and Mokopane include the following:

- P84/1 (Vaalwater/Ellisras/Botswana);
- P19/2 (Ellisras/Marken) that links with (Mokopane); and
- P198/1 (Vaalwater/Ellisras).

The majority of the movement in the municipality occurs between the Mokerong-area and Lephalale where most of the business facilities are located, and along the road networks to Thabazimbi, Mokopane and Gauteng.

A number of District Roads link with the Main roads, and there are also a number of internal roads, which grant access to farms and settlements.

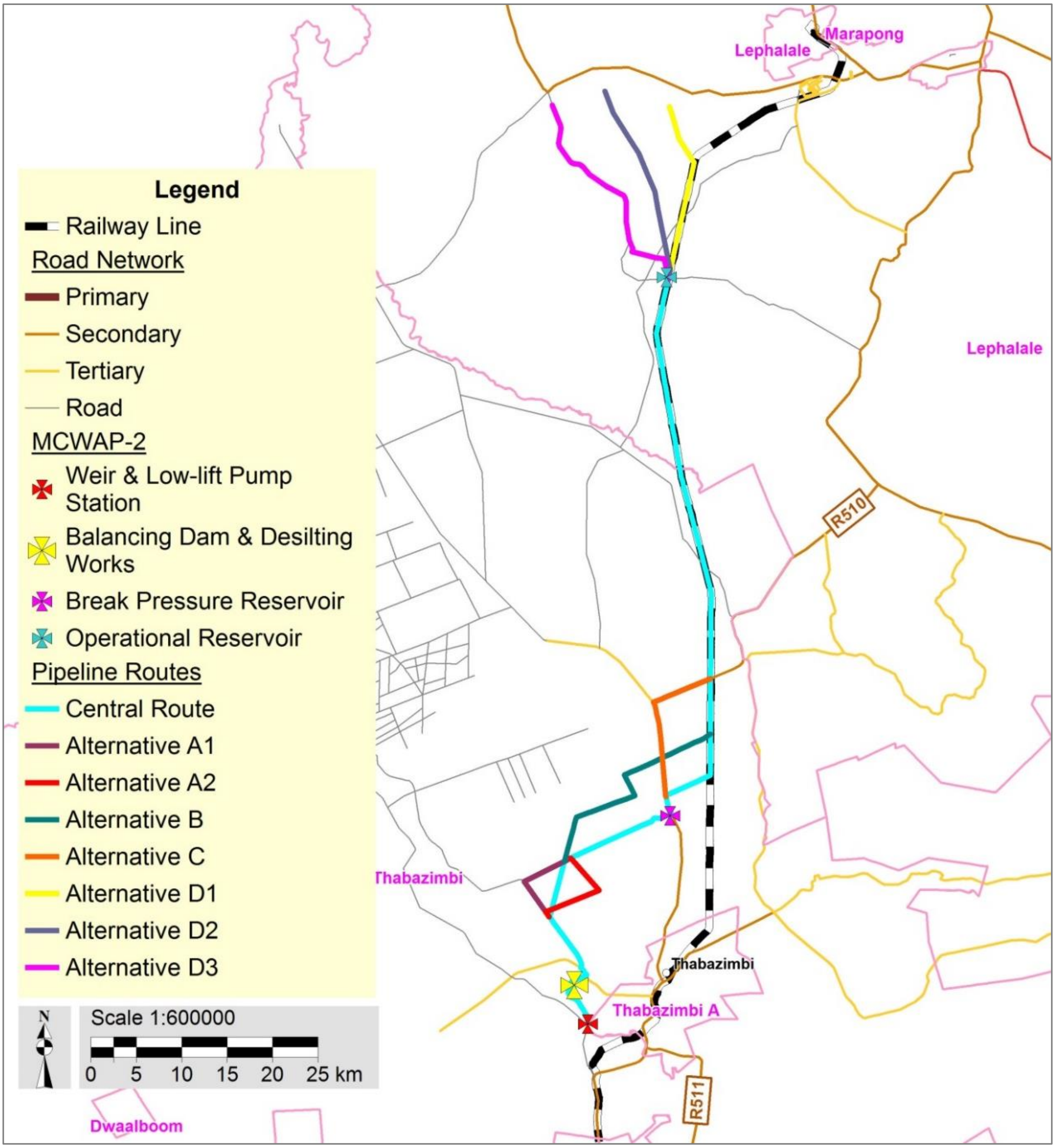


Figure 111: Major Transportation Network in Region
(Note: Pipeline Route Alternative B was discarded, gauging weirs and Alternatives E & D4 not shown)

Lephalale is serviced with a north/south railway line, which transports coal from Grootegeluk Mine. An airfield is also situated in Lephalale.

Thabazimbi Local Municipality

Important routes in Thabazimbi municipal area:

- P16/2 (link with the P84/1 situated in the Lephalale Local Municipality);
- P110/1 (north-south route; access route to the North West Province - Brits/Madibeng);
- P20-1 (east-west route; main access to Bela-Bela);
- P20-2 (east-west route; access to Koedoeskop/Northam);
- D928 (access road to Rooiberg from Thabazimbi); and
- D1649 (access road to Dwaalboom).

11.19 Waste Disposal Facilities

Lephalale LM has one permitted waste disposal facility. The life expectancy of the landfill is 5 years without waste minimization programmes but with such programmes the life expectancy can go as far as more than ten years (Lephalale LM, 2016). The Municipality has appointed a service provider to conduct the feasibility studies for the development of new landfill site.

According to the IDP (Thabazimbi LM, 2017), the waste disposal sites in Donkerpoort (Thabazimbi), Leeuwpoort and Northam have permits.

11.20 Aesthetic Qualities

The visual character of the landscape where the MCWAP-2A infrastructure is planned is typical of the bushveld. Private game farms are prevalent in the project area, which afford a high-level of aesthetic appeal to the region. The visual quality of the area is further enhanced by watercourses, undisturbed vegetation and the Vlieëpoort ridge to the south of the pipeline route (see **Figure 112**). The aesthetic quality of certain areas flanking the proposed route is partly degraded due to the existence of infrastructure such as roads, a railway line (see **Figure 113**) and a transmission line.

Hartbeespoort Dam offers aesthetic value to the surrounding residential and tourism-related developments.

Figure 112: View from Vlieëpoort ridge

Figure 113: View along railway line

11.21 Tourism

Tourism is a key economic sector within the study area. An abundance of tourism activities are available including hunting, game viewing, bird watching, fishing, horse riding, hiking, etc.

There has been a large-scale shift from cattle farming to ecotourism-based land use and hunting in the region, with numerous lodges, chalets and other forms of bush-accommodation also available.

The Waterberg Mountain Range, which stretches from Thabazimbi to Mokopane, is a popular tourist attraction in the region. Thabazimbi is also renowned for the numerous hunting opportunities afforded to tourists. Key tourist attractions in proximity to the MCWAP study area include (amongst others):

- The Marakele National Park lies to the east of the pipeline route (see **Figure 98**);
- Thaba Tholo, which is renowned for breeding threatened and endangered game species like Roan Antelope, Sable Antelope, Tssessbe and disease-free Buffalo, is situated to the west of the pipeline route;
- The Ben Alberts Nature Reserve lies immediately south-east of the Vlieëpoort weir site; and
- Private game reserves are located alongside the pipeline, or are traversed by the pipeline.

12 SUMMARY OF SPECIALIST STUDIES

12.1 Specialist Studies undertaken as part of the EIA

A crucial element of the Plan of Study for the EIA prepared during the Scoping phase was to provide the Terms of Reference for the requisite specialist studies triggered during Scoping. According to Münster (2005), a 'trigger' is "*a particular characteristic of either the receiving environment or the proposed project which indicates that there is likely to be an issue and/or potentially significant impact associated with that proposed development that may require specialist input*". The requisite specialist studies 'triggered' by the findings of the Scoping process, aimed at addressing the key issues and compliance with legal obligations, include:

1. Baseline Aquatic and Impact Study;
2. Terrestrial Ecological Impact Assessment;
3. Heritage Impact Assessment;
4. Agricultural Impact Assessment;
5. Wetland Impact Assessment;
6. Socio-Economic Impact Assessment;
7. Wildlife Impact Assessment; and
8. Hartbeespoort Dam Specialist Opinion.

In addition, the findings from the following specialist studies that were undertaken as part of the previous EIA for MCWAP-2 have been considered as part of the above studies and included in the EIA Report (as relevant):

- Ecological Study – Terrestrial;
- Ecological Study – Aquatic;
- Traffic Management Plan;
- Heritage Impact Assessment;
- Socio-Economic Study;
- Visual Impact Assessment;
- Social Impact Assessment; and
- Noise Study.

12.2 Incorporation of Findings from Specialist Studies

For the inclusion of the findings of the specialist studies into the EIA report, the following guideline will be used: *Guideline for the review of specialist input in EIA processes* (Keatimilwe & Ashton, 2005). Key considerations included the following:

- Ensuring that the specialists have adequately addressed IAPs' issues and specific requirements prescribed by environmental authorities;
- Ensuring that the specialists' input is relevant, appropriate and unambiguous; and

- Verifying that information regarding the receiving ecological, social and economic environment has been accurately reflected and considered.

The information obtained from the respective specialist studies was incorporated into the EIA report in the following manner:

1. The assumptions and limitations identified in each study were included in **Section 7**;
2. The information was used to complete the description of the receiving environment (**Section 11**) in a more detailed and site-specific manner;
3. A summary of each specialist study is contained in the sub-sections to follow (**Sections 12.3 – 12.10**), focusing on the approach to the study, key findings and conclusions drawn;
4. The specialists' impacts assessment, and the identified mitigation measures, were included in the overall project impact assessment contained in **Section 13**;
5. The evaluations performed by the specialists on the alternatives of the project components were included in the comparative analysis (**Section 14**) to identify the most favourable option;
6. Specialist input was obtained to address comments made by IAPs that related to specific environmental features pertaining to each specialist discipline; and
7. Salient recommendations made by the specialists were taken forward to the final EIA Conclusions and Recommendations (**Section 16**).

Refer to **Appendix I11** for declarations from the respective specialists.

12.3 Baseline Aquatic and Impact Study

A summary of the Baseline Aquatic and Impact Study (The Biodiversity Company, 2018), as contained in **Appendix I1**, follows. Refer to **Section 13.8.6** for an assessment of the associated impacts.

12.3.1 Details of the Specialist

The details of the specialist that undertook the Baseline Aquatic and Impact Study follow.

Organisation:	The Biodiversity Company
Name:	Christian Fry
Qualifications:	MSc – Aquatic Health
Affiliation (if applicable):	❖ Professional Natural Scientist (119082)

12.3.2 Objectives of the Study

The objectives of the Baseline Aquatic and Impact Study are as follows:

- Determine the baseline PES of the local river ecosystems;

- Evaluate the extent of site-related impacts;
- Undertake a risk assessment for the development; and
- Provide mitigation measures and recommendations (including monitoring programmes) for the identified risks.

12.3.3 Methodology

The following methodology was employed:

- Site Selection -
  - To determine the PES and potential impacts of each river system associated with the proposed development, site visits and sampling was conducted within each reach. Six aquatic sampling points were selected on the Crocodile River, a single site was assessed on the Sand River, two sites on the Bierspruit, two on the Matlabas River, and a single site on a tributary of the Matlabas system. A total of four comprehensive sites were conducted on the Crocodile River (CROC1, CROC2, CROC3, CROC5), and two visual assessments at CROC4 and CROC6. Due to the ephemeral nature of the Sand River, Bierspruit, and Matlabas River, sampling was limited to available surface water if any was present. No flow was present in all three systems.
- Water Quality -
  - Water quality was measured *in situ*. The constituents that were measured included pH, conductivity, temperature and Dissolved Oxygen (DO).
- Aquatic Habitat Integrity and Riparian Delineation -
  - The Intermediate Habitat Assessment Index (IHIA) was used to define the ecological status of the river reach;
  - The riparian habitat was delineated in accordance with the guideline: A practical field procedure for identification and delineation of wetlands and riparian areas (DWAF, 2005).
- Aquatic Macroinvertebrate Assessment -
  - The South African Scoring System version 5 (SASS5) was used to assess the status of riverine macroinvertebrates;
  - The Macroinvertebrate Response Assessment Index (MIRAI) was used to provide a habitat-based cause-and-effect foundation to interpret the deviation of the aquatic invertebrate community from the calculated reference conditions for the Sub-Quaternary Reach (SQR)
- Fish Community Assessment -
  - The Fish Response Assessment Index (FRAI) was used to determine the PES of the river based on the fish assemblage structures observed.

12.3.4 Key Findings of the Study

12.3.4.1 *In situ* Water Quality

In situ water quality analysis of the Crocodile River indicated elevated dissolved solids during the survey. The elevated dissolved solids are attributed to extensive anthropogenic activities upstream of these sites. These concentrations are above recommended levels, and would present adverse conditions to local aquatic biota, limiting diversity and abundances. The pH and DO levels within the Crocodile River fell within recommended Target Water Quality Range (TWQR) limits and would not present adverse conditions to local aquatic biota. The water temperature ranges in the Crocodile River fell within expected limits for the region and did not present any marked fluctuations between sites.

In situ water quality results of the Matlabas River indicated good water quality conditions within the reach and would not present adverse conditions to local aquatic biota. A marked increase in dissolved solids was observed between the upstream and downstream sites. Low water levels and agricultural activities within the reach are contributing to the increase in dissolved solid levels.

12.3.4.2 Intermediate Habitat Integrity Assessment and Riparian Assessment

The results of the IHIA assessment indicate that the instream and riparian habitat integrity of the Crocodile River are largely modified (class D), indicating a large loss of natural habitat, biota and basic ecosystem functions has occurred. Modifications to instream habitat are a result of flow modifications due to numerous instream weirs, extensive water abstraction throughout the reach, water quality modifications (eutrophication), and erosion which has resulted in sedimentation of instream habitat. Modifications to riparian habitat are a result of bank and channel modifications, flow modifications and water abstraction.

The results of the IHIA assessment indicate that the instream and riparian habitat integrity of the Matlabas River are moderately modified (class C), indicating a loss and change of natural habitat and biota have occurred but the basic ecosystem functions are still predominantly unchanged. Modifications to instream habitat include instream weirs, which have resulted in inundation, modifying bed, channel and banks within the reach. Agriculture activities and associated abstraction were observed along the reach.

Typical riparian habitat in the Crocodile River is illustrated in **Figure 114**. The defined lower zone was found to be dominated by *Phragmites australis* particularly in the river reach which is to be potentially inundated. The upper zone was composed of a mixture of several typical subtropical bushveld tree species such as *Combretum imberbe* and *Senegalia galpinii*. Alien riparian vegetation was also prominent during the survey and was dominated by *Amaranthis hybridus* and *Melia azedarach*. The riparian delineation for the upper zone of the Crocodile River is provided in **Figure 115**.

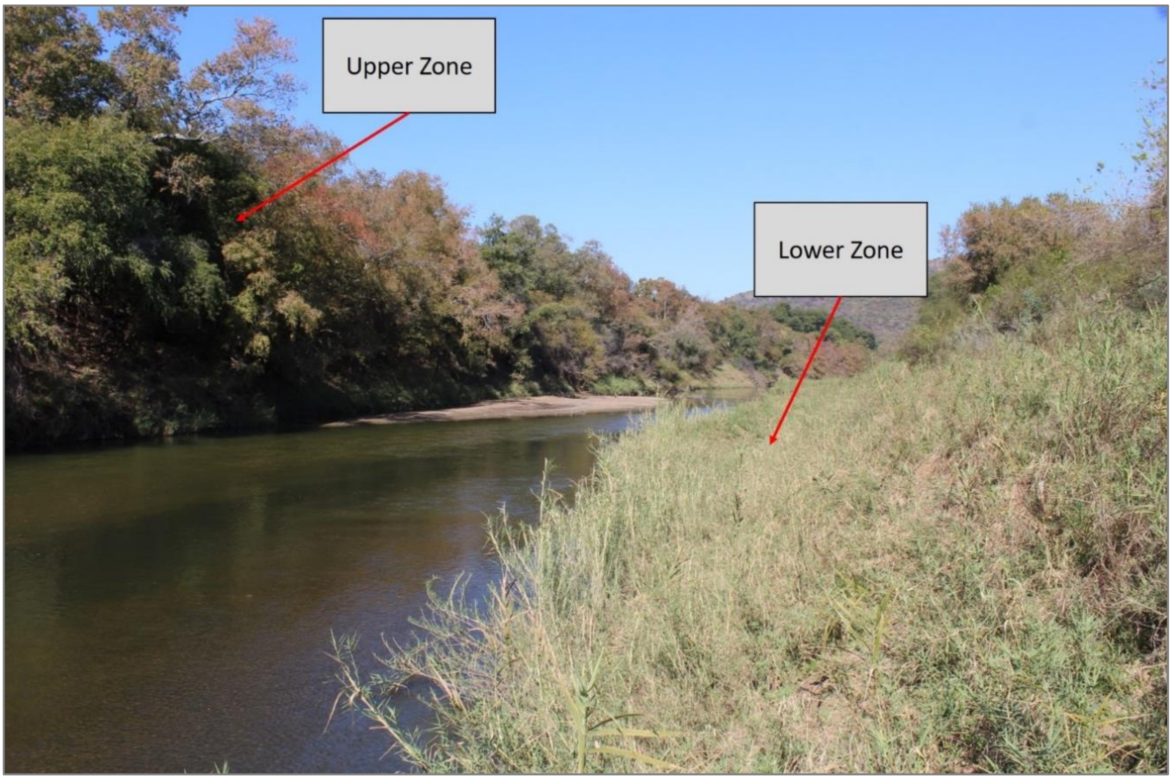


Figure 114: **Typical riparian vegetation in the Crocodile River at the proposed Vlieëpoort Abstraction Point (Biodiversity Company, 2018)**

Figure 115: **Upper Zone Riparian delineation for the Crocodile River in vicinity of the Vlieëpoort Abstraction Point (Biodiversity Company, 2018)**

12.3.4.3 Aquatic Macroinvertebrate Assessment

Macroinvertebrate Habitat

Habitat suitability ranged from class D at sites CROC1 and CROC2; to class F at site CROC3 and CROC5. The class D suitability was attributed to the low diversity of stones biotope within the systems and the decrease to class F at the lower sites was attributed to poor stones in and out of current diversity and abundance.

Habitat suitability within the Matlabas was rated as class F at both MAT1 and MAT2 sites. The poor habitat rating was attributed to low diversity of stones in and out of current, and low marginal and aquatic vegetation diversity. Furthermore, the low water levels within the system contributed to low biotope diversity.

The biotope results indicate that habitat availability would be a limiting factor to the macroinvertebrate assemblages within the Crocodile and Matlabas systems.

South African Scoring System

The SASS5 scores recorded in the Crocodile system during the low flow survey indicated a semi intolerant macroinvertebrate assemblage at CROC1 (5-10 sensitivity score) to a tolerant assemblage at CROC2 (<5 sensitivity score).

Ecological classes decreased from the upstream CROC1 site (largely natural, class B), to the downstream systems which were rated as moderately to largely modified (CROC2 to CROC5). This can be attributed to variations in habitat suitability between the sites. Water quality within the reach remained stable, with minor fluctuations observed in pH and DO and solid levels, further indicating habitat availability as the limiting factor.

The total sensitivity scores within the Matlabas River indicated predominantly tolerant taxa occurring within the reach (<5 sensitivity score). Water quality within the reach decrease from the upstream to downstream sites, with an increase in habitat suitability observed between the upstream and downstream sites. Therefore, habitat diversity within the reach is the limiting factor within the reach assessed. Ecological category increased from largely modified at MAT1, to largely natural at MAT2.

Macroinvertebrate Response Assessment Index

The results for the Crocodile River reach assessed indicated that the macroinvertebrate integrity is moderately modified. Scores indicate that all three drivers (flow, habitat and water quality modifications) are responsible for the modifications to the macroinvertebrate community.

The results for the Matlabas River assessment indicated that the macroinvertebrate integrity is largely natural, with flow modifications within the reach being the predominant driver for the modified assemblage.

12.3.4.4 Fish Assessment

The conservation status of the indigenous fish species was assessed in terms of the IUCN Red List of Threatened Species. Based on this assessment, a single species of special concern occur within the reach, namely *Oreochromis mossambicus*.

The results of the FRAI assessment indicate that the Crocodile River fish community was moderately modified during the survey. Several species were absent during the assessment; however, results are based on a single dry season survey. Should additional sampling be conducted within the reach, it is likely that additional species would be collected within the reach.

The results of the FRAI assessment for the Matlabas River fish community indicate a moderately modified fish assemblage. A total of nine of the expected 18 species were collected in the system, however, due to poor connectivity within the reach and low water levels, the fish community is expected to be modified. Should additional sampling be conducted during the high flow survey, more diverse cover features and velocity depth classes would be present, likely increasing the fish assemblage diversity.

The PES results indicate that the Crocodile River reach was in a moderately modified state during the survey. This is attributed to the modifications to instream habitat, connectivity, flows, water quality, and riparian zone, resulting in a modified biotic integrity. The Matlabas River system is in a moderately modified state. This is attributed to flow modifications within the reach, including weirs, as well as modifications to the riparian zone and instream habitat.

12.3.5 Impact Assessment

Refer to **Section 13.8.6** for the results from the impact assessment from this study.

12.3.6 Analysis of Alternatives

Refer to **Section 14.4** for the results from the analysis of the project alternatives .

12.3.7 Conclusions

The results from the aquatic baseline study indicates that the Crocodile River reach assessed in in a moderately modified state (class C), and the Matlabas River reach assessed in in a moderately modified state (class C). Due to the ephemeral nature of the Sand River and the Bierspruit, an ecological class for the reaches could not be determined. According to desktop data, the Crocodile River reach associated with the proposed development ranges from a largely modified state to a largely natural state. The Matlabas reach assessed ranged from largely modified to moderately modified, aligning with the results from the baseline survey.

The construction of the Vlieëpoort abstraction weir poses several moderate risks to the Crocodile River, with mitigation measures not being able to lower the risk status. This is due to the nature of the activity and proximity to sensitive areas. The physical construction of the weir poses the highest risk to the system, with additional moderate risks associated with river diversion, and clearing of the riparian areas for infrastructure. The flooding of the weir poses the highest initial risk to the Crocodile River, as this will inundate instream habitat, and modify downstream flows. Based on data provided to the specialist, an estimated 7,3 km of the Crocodile will be inundated, and an additional 1,5 km of the Bierspruit. This will result in permanent impacts to upstream areas of the weir. The construction of the Sand River and Bierspruit gauging weirs will pose a lower risk to the systems, as these systems are ephemeral, and should be constructed during the dry season.

The abstraction of water from the Crocodile River is rated as moderate. The moderate rating remains high due to the duration of the activity, however, due to the increase in expected runoff from upstream reaches, the flow modifications within the reach are expected to be improved and base flows within the lower reaches of the Crocodile be maintained.

The discharge of sediment into the Crocodile poses a moderate risk. This is due to the potential of altered sediment balance, modifications to downstream instream habitat, bank and channel erosion.

The construction of the central pipeline across the Matlabas River poses a moderate risk to the riparian and instream habitats. Furthermore, during the scouring of the pipeline into the system, risks were rated as moderate due to the potential modifications to water quality and instream habitat.

Overall, there will be a reduced PES of the aquatic ecosystems directly associated with the proposed project. The magnitude of the impact is considered moderate, as habitats will be altered but not completely lost. The scale of the anticipated impact will be limited to the immediate river reaches and is therefore considered a local impact. The impact is reversible should the weir structure be removed and rehabilitated. However, the impact will occur through the life of the project which is considered a long-term impact. Overall the cumulative impact of the proposed project was derived to be moderate.

A buffer zone of 30 m from the edge of the delineated riparian zone is recommended. Considering that the proposed project is for an instream barrier and a water pipeline crossing the buffer derived is only applicable for associated construction activities such as mixing areas, stockpiles and laydown yards. Based on the proposed development’s level of disturbance, a riverine buffer zone of 32 m from the delineated riparian zones, and NFEPA wetlands identified (Pans and floodplains) are recommended.

Furthermore, the ecological status of the Matlabas River needs to be determined during the high-flow period, prior to construction. This will determine the requirements for crossing the watercourse (i.e. open trench or trenchless), as well as for scouring (i.e. draining water from the pipeline, typically during maintenance).

It is the opinion of the specialist that according to the baseline conditions of the Crocodile and Matlabas Rivers, and the proposed activities for the MCWAP-2A, no fatal flaws have been identified for the project.

12.4 Wetland Impact Assessment

A summary of the Wetland Impact Assessment (Index, 2018b), as contained in **Appendix I5**, follows. Refer to **Section 13.9** for an assessment of the associated impacts.

12.4.1 Details of the Specialist

The details of the specialist that undertook the Wetland Impact Assessment follow.

Organisation:	Index
Name:	Dr Andries Gouws
Qualifications:	PhD Integrated Land Use Modelling
Affiliation (if applicable):	❖ Council of Natural Sciences.No:400036/93, Category: Agricultural sciences. ❖ Member of the Soil Science Society of South Africa

12.4.2 Objectives of the Study

The objectives of the Wetland Impact Assessment are as follows:

- Delineation all wetlands within 500 m of the study area;
- Undertake a risk assessment for all wetlands within 500 m of the entire study area;
- Assess the impacts in terms of their significance and suggest suitable mitigation measures;
- Assess the destabilisation of wetlands due to inadequate reinstatement and rehabilitation;
- Assess impacts to wetlands downstream of the abstraction point (surface-groundwater interactions).

12.4.3 Methodology

The approach to the delineation of the wetlands included the following:

- Evaluate aerial photography to determine possible wetlands;
- A corridor of 100 metres along the route was included in the survey (50 metres to each side of the proposed centre line) and 50 metres from the boundary of non-linear items, like the weir, construction camps, pumping stations, burrow pits, etc.;
- Undertake terrain unit study to determine where wetlands are most likely to occur;

- ❖ Identify hydromorphic (wetland) soils, soil form and wetness indicators; to establish permanent, seasonal, and temporary wetland zones;
- ❖ Classify soils in accordance with the Binomial Classification System for Southern Africa;
- ❖ Starting at the wetland edge, a probe is used to investigate the soil profile; should the soil show typical gleyed properties, it is classified as wetland. Moving progressively further away from the pan or watercourse and assigning the soil properties, the wetland boundary is determined;
- ❖ Matrix colours and mottle of the subsoil at a depth less than 500 mm are then measured against the criteria indicated above and the areas of *Permanently* and *Seasonal waterlogged* conditions mapped; and
- ❖ Positions of observation points are taken with GPS and placed on a base map; and combined with texture and colour on aerial photographs. The final boundary of the wetland is then delineated and placed on a GIS for incorporation in further planning.

12.4.4 Key Findings of the Study

12.4.4.1 Hydropedological Interpretation of Soils

Refer to **Figure 116** for the discussion to follow.

Crocodile River (West)

The soil on the higher laying portions to the north was classified as Hutton and Glenrosa and is on the old pediment of the Waterberg. This is on the terrestrial zone. These are deep sandy loam and loam soils that are classified as recharge soils. Because of the small size, it probably does not contribute much to the flow of the stream during the dry season.

The old alluvial plains that contain Rensburg, Oakleaf and Dundee soil forms and are classified as responsive soils. The drainage is normally as surface flow towards or parallel to the river.

The riparian zone has steep slopes on sandy loam soils. The stream banks are less than 8 metres wide and will therefore not play a significant role in water supply to the stream.

Matlabas River

The soil on the higher laying portions along the river was classified as Hutton and Glenrosa and is in the terrestrial zone. These are shallow sandy loam and loam soils that are classified as recharge soils. Because of the low rainfall and soil conditions it is unlikely that these contribute significantly to the flow of the river.

Northern Sandy Plains

The underlying rock is sandstone and mudstone of the Matlabas Subgroup, Waterberg Group. Soils on the sandy areas are single grained yellow and reddish brown with a high water infiltration rate. These are classified as recharge soils. Because of the low rainfall and soil conditions it is unlikely that it contributes significantly to the pans.

Pans are scattered throughout the plains. The dominant soils are duplex identified as Estcourt, Sepane, Valsrivier and Kroonstad. These are responsive soils.

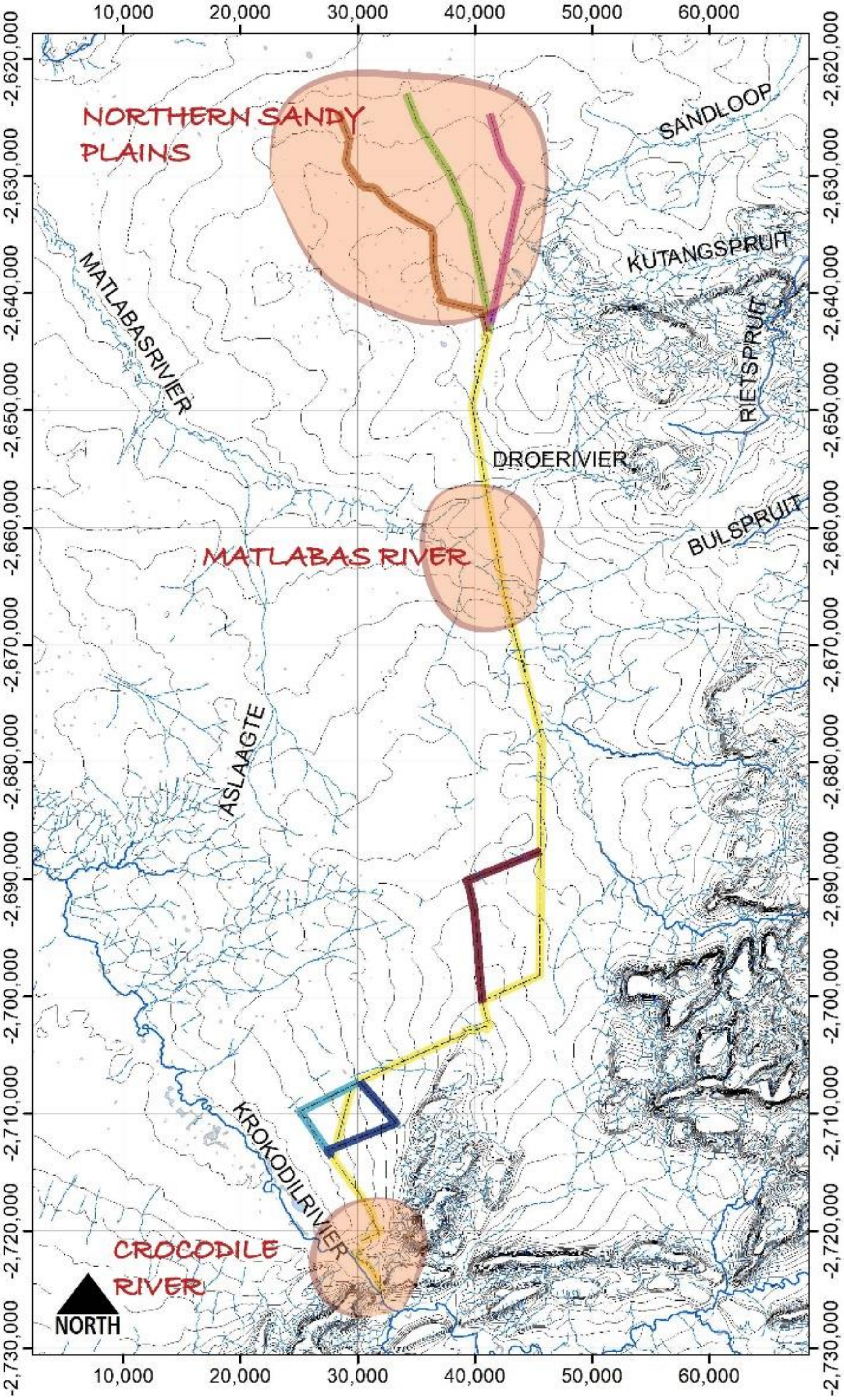


Figure 116: Hydropedology regions (Index, 2018b)

12.4.4.2 Wetland Delineation

Crocodile River (West)

The watercourse is classified as a River and as a stream wetland (the old floodplain). The outer edge of the old floodplain is the wetland boundary (refer to **Figure 117**).

The Vlieëpoort abstraction weir and low-lift pumping station impact on a stream wetland. Both the route alternatives from the pumping station to the balancing dam and desilting works are outside of the floodplain wetlands.

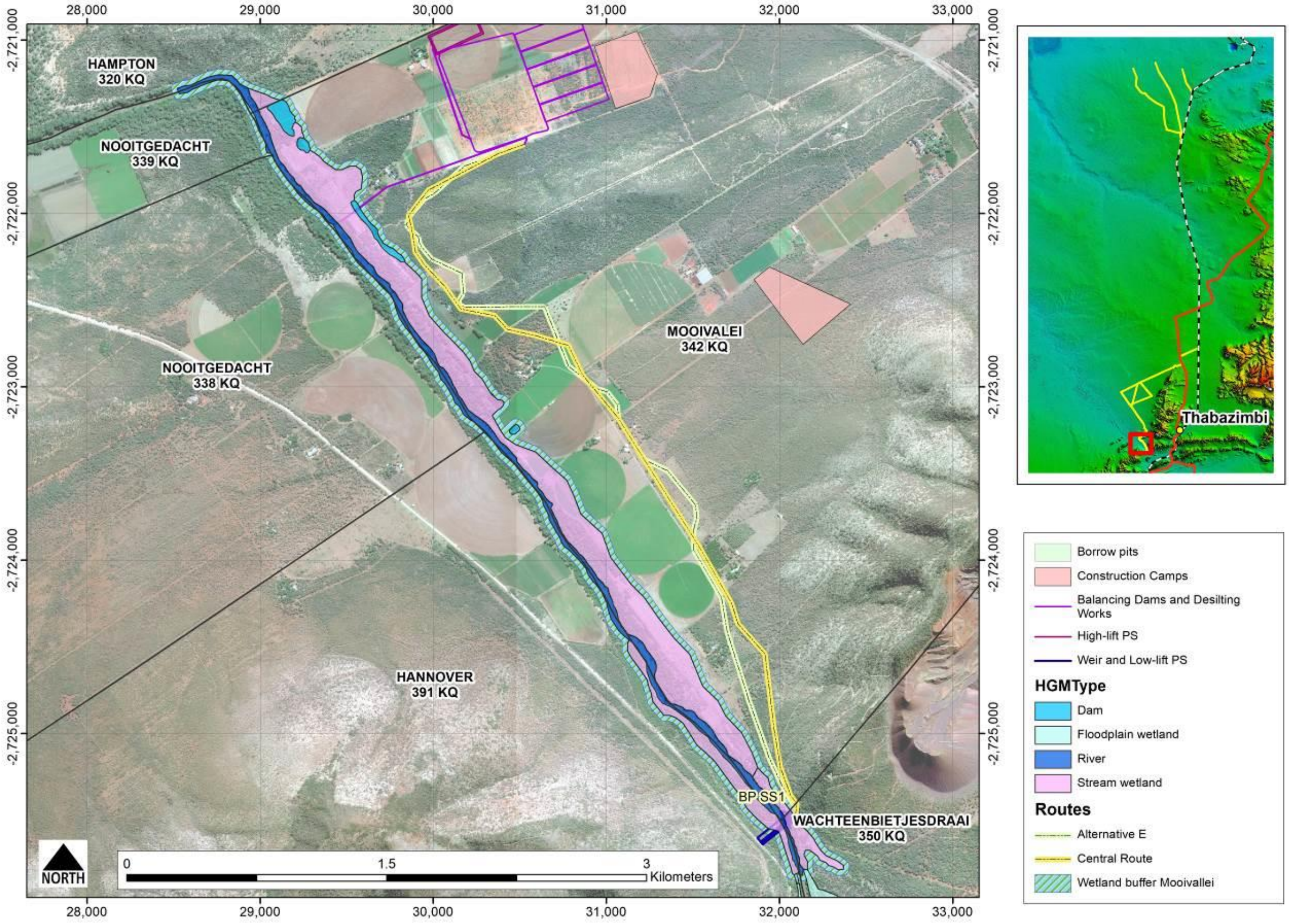


Figure 117: Abstraction weir site classification and wetlands delineation and buffer (Index, 2018b)

Matlabas River

Figure 118 shows hydro-geomorphic units within 500 metres of the route alignment. The only wetlands that were found in a 100 m corridor along the route are the river itself and the depression on the northern side on the river bank. The latter is an old excavation and does not play a role in silt trapping, water purification or retardation of storm water. There is an excavation approximately 500 metres south of the river, which is dry with no wetland properties. It was classified as a depression.

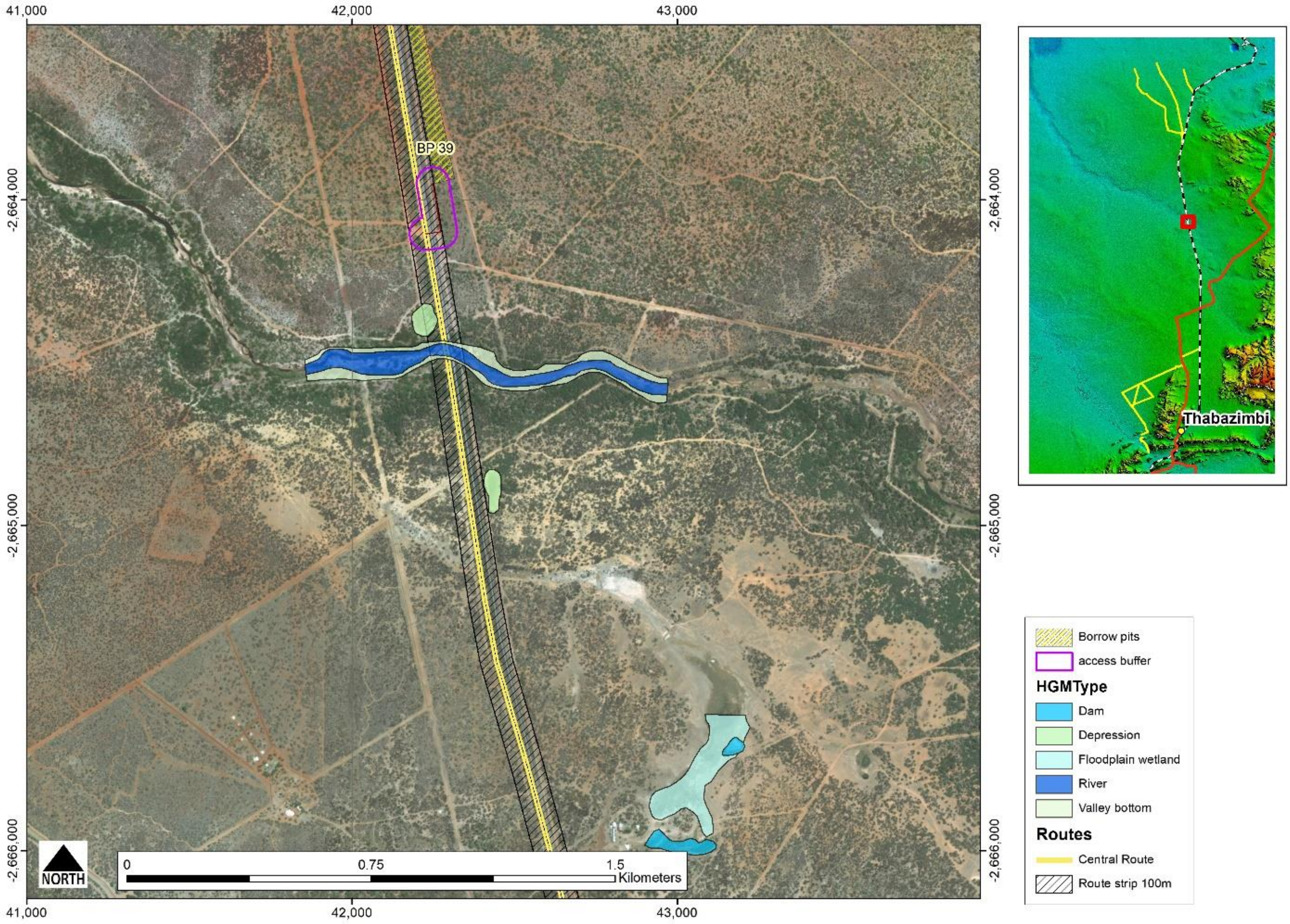


Figure 118: Wetlands classification of the Matlabas River section (Index, 2018b)

Northern Sandy Plains

Eleven depressions were found within 500 metres of the three route alignments. There are no rivers or streams in this section.

Five depressions were found with gleyed properties within the top 500 mm of the soils and that contain wetland plants. Historical Google images indicate that the size of the wetlands fluctuates during the season and over years. Wetlands within 500 metres with wetland properties are shown in **Figure 119**.

The Construction Camp at Rooipan 357 LQ is adjacent to the pan and within the buffer zone of 15 metres (refer to **Figure 120**). The location of the camp will have a negative impact on the functioning of the pan habitat. It is recommended that the camp be relocated further east of the present proposal.

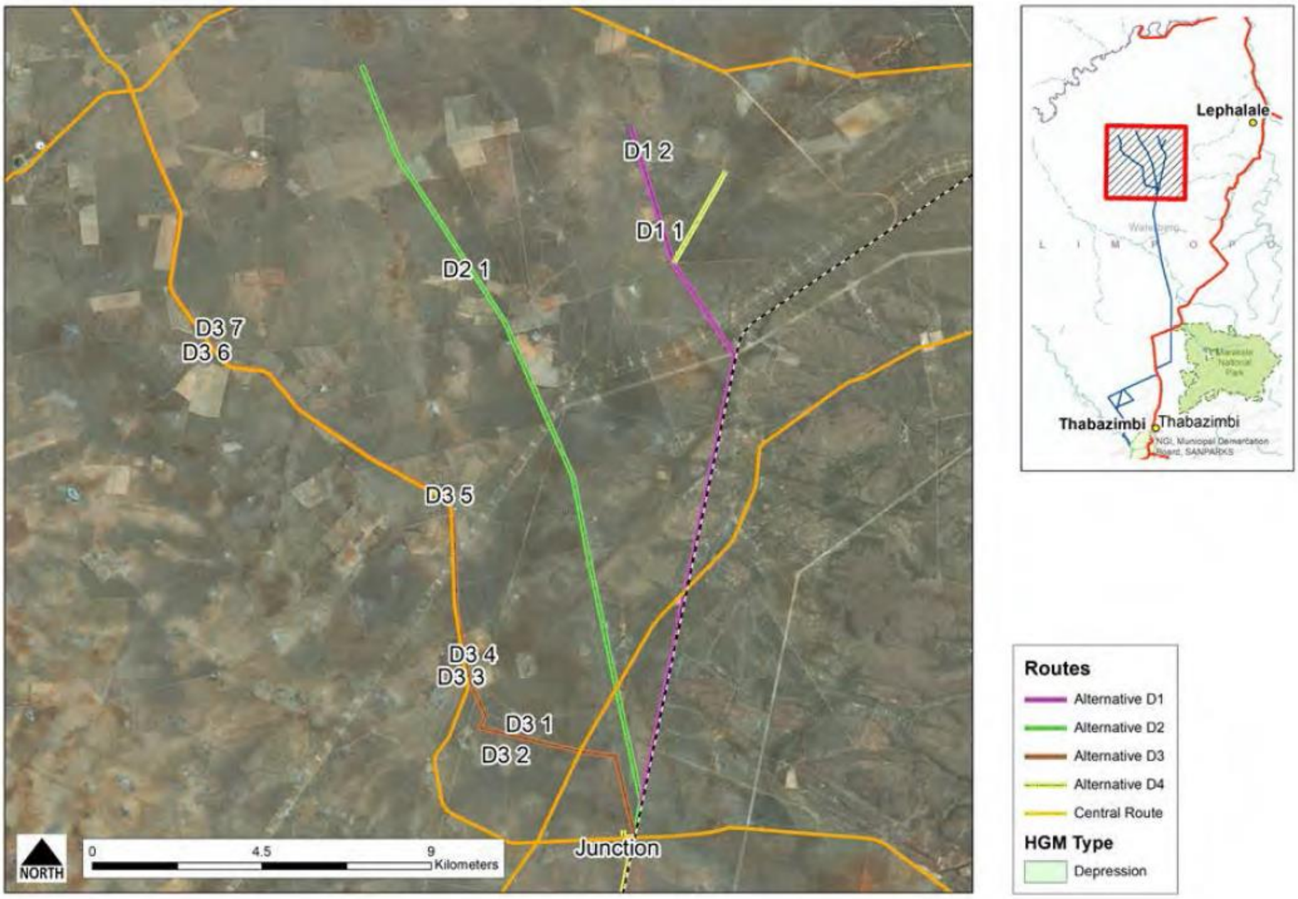


Figure 119: Positions of pans (depressions) within 500 m of Alternative D routes (Index, 2018b)

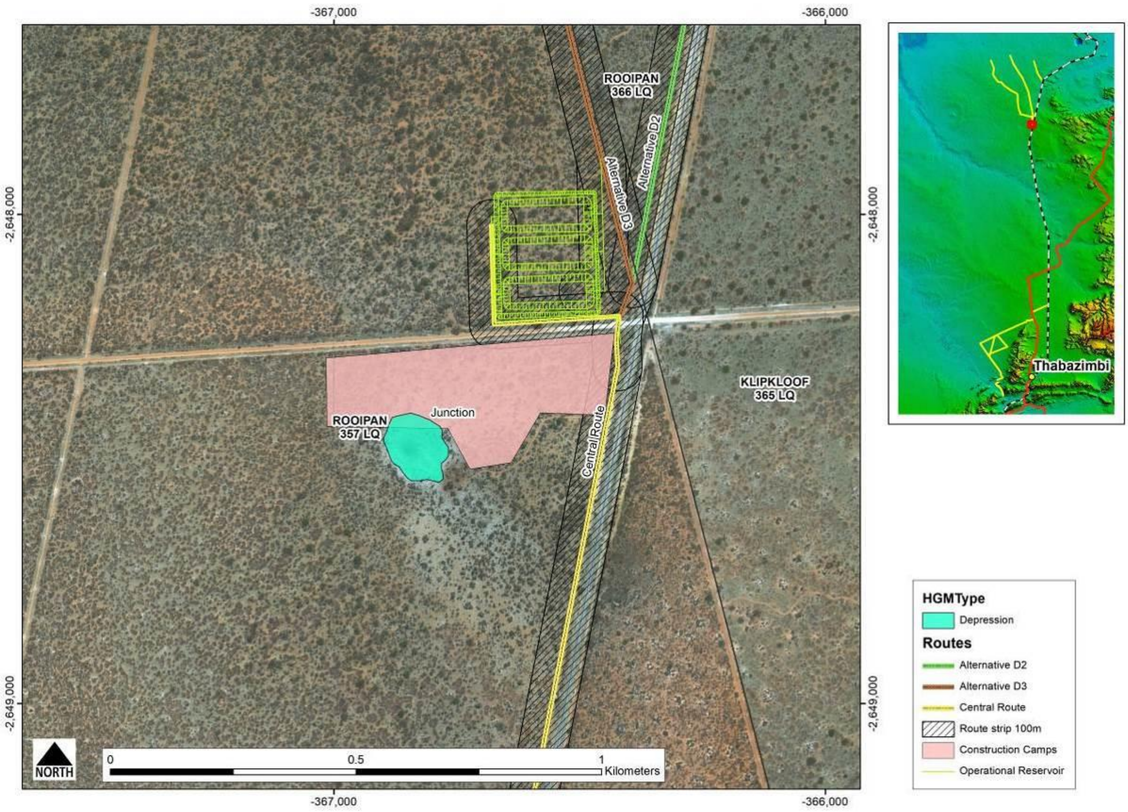


Figure 120: Wetland at Junction on the farm ROOIPAN 357 LQ (Index, 2018b)

12.4.4.3 Inundation Area above the Vlieëpoort Abstraction Weir

The Vlieëpoort abstraction weir is located just downstream of a floodplain where the river formed oxbow lakes and isolated temporary watercourses. The latter is locates bust behind natural levees that was formed through regular flooding and depositing of silt on the river banks. **Figure 121** shows the morphological components of the Crocodile River (West) just upstream of the weir.

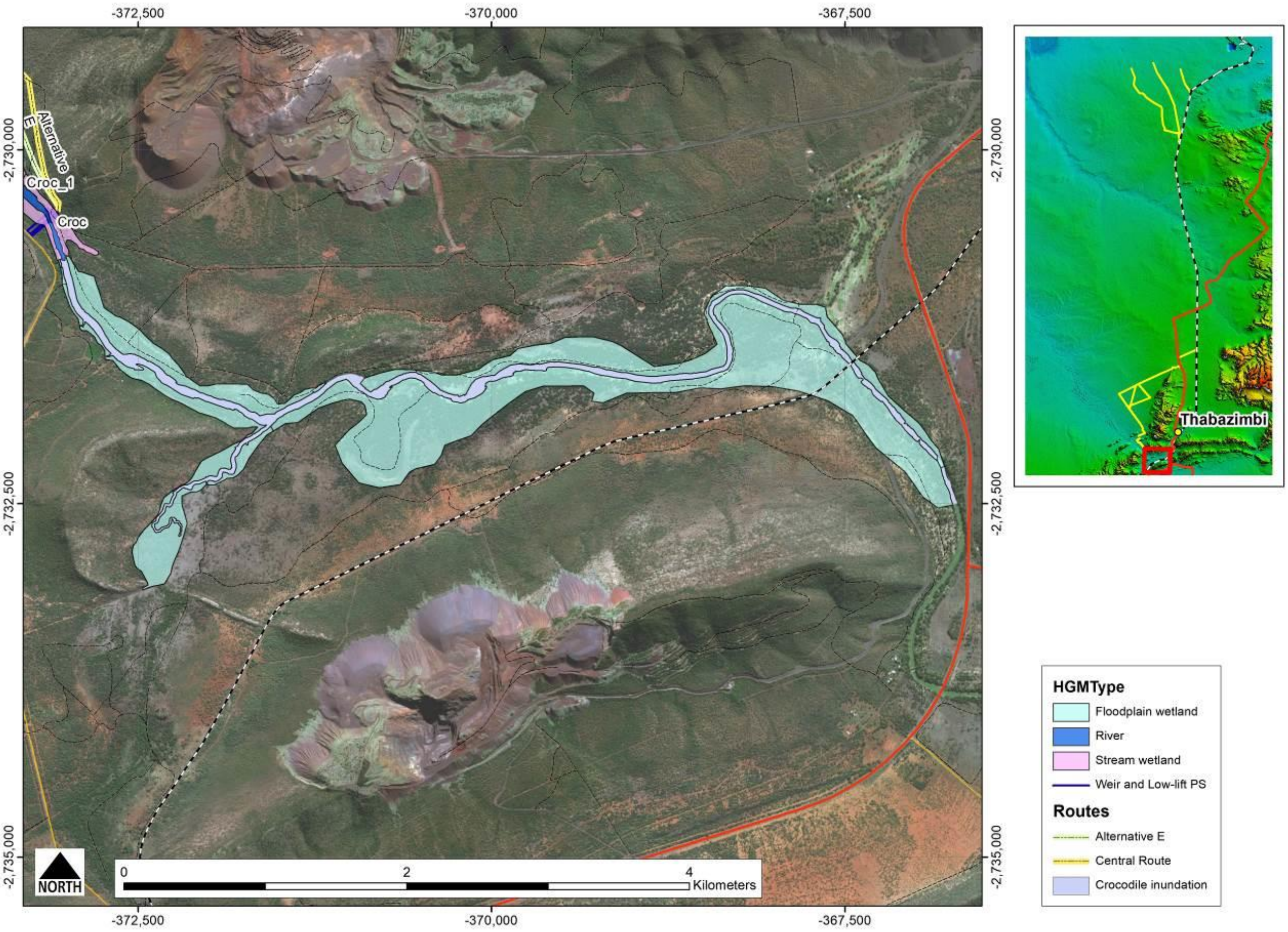


Figure 121: Depressions with wetland properties (indicated with yellow dots) (Index, 2018b)

The uneven topography of the floodplain is testament of periodic flooding. Although the soil is not gleyed throughout the floodplain, it warrants protection due to the riparian vegetation and the occurrence of the watercourses and the oxbow lakes.

A simulation run on the contours of the area that is expected to be inundated because of the weir's construction indicates that very little of the stream bank will be flooded and the loss of habitat is confined to the river itself. The higher water level caused by the construction of the weir may, however, increase the deposits of silt on the floodplain and also promote wetland plants to develop. The temporary watercourses outside of the river banks are already well established and are unlikely to be negatively influenced by the construction of the weir.

12.4.4.4 The Ecological Importance and Sensitivity

The ecological importance of a water resource provides an expression of its importance to the maintenance of ecological diversity and functioning at local and wider scales. The EIS assesses ecological importance and sensitivity, hydro-functional importance, and direct human benefits.

The findings from the Wetland Impact Assessment include the following:

- The Crocodile River (West) stream wetland is classified as Category A. It is considered ecologically important and sensitive on a national or even international level;
- The Matlabas River is a stream and is classified as Category B. It considered to be ecologically important and sensitive. The biodiversity of these systems may be sensitive to flow and habitat modifications; and
- The Depressions (pans) on the Northern Sandy Plains are classified as Category C and D. They are not ecologically important and sensitive at any scale. The biodiversity of these systems is ubiquitous and not sensitive to flow and habitat modifications.

12.4.4.5 Wetland Ecological State

The ecological integrity or PES of the hydro-geomorphic units within the study site were assessed for the current situation. The assessment of the wetland systems identified extensive modifications within the wetlands itself and also the surrounding land. The changes in integrity are mostly reflected across the three components, namely hydrology, geomorphology and vegetation.

The findings from the Wetland Impact Assessment include the following:

- The habitat of the Crocodile River (West) has seen few modifications. Further away from the river, much of the old terrace and floodplain is under cultivation and hence, totally modified and is classified as Category D. The construction of the pipeline, however would not impact on the wetland.
- The crossing of the Matlabas is on PES Category B. It is still in good condition with only little modifications due to construction of the railway bridge. It still contains wetland plants and is effective in impeding water flow during storms. The ecological status of the Matlabas River needs to be determined during the high-flow period, prior to construction. This will determine the requirements for crossing the watercourse (i.e. open trench or trenchless), as well as for scouring (i.e. draining water from the pipeline, typically during maintenance).
- There are three depressions on the Northern Sandy Plains, of which one is Category B, the other two are Category C. These pans are small and have no effect on stream flow or capturing silt or chemicals. However, they play a role in maintaining biodiversity and in support of wildlife and insects, in an otherwise arid environment.

12.4.4.6 Ecoservices

Floodplains up and downstream of the Vlieëpoort Weir provide high or moderately high services in maintenance of biodiversity and in supply of water to humans, animals and for irrigation. Their ability to trap sediments and ameliorate chemicals is intermediate or low.

The pans (or depressions) are inward draining and thus, has little ability in streamflow regulation. Most of the pans are temporary saturated after rain events. They provide environmental services at a low or moderately low level. Those that are seasonally or permanently saturated with water can provide moderate to high level of services to maintenance of biodiversity, water provision for animals, and can also support tourism at a moderately high level.

12.4.5 Impact Assessment

Refer to **Section 13.9** for the results from the impact assessment from this study.

12.4.6 Analysis of Alternatives

Refer to **Section 14.4** for the results from the analysis of the project alternatives.

12.4.7 Conclusions

Three areas will be affected:

- The stream wetland and riparian zone of the Crocodile River where the Vlieëpoort Weir and Low lift pump station will be constructed and also where the borrow pit (BP SS1) is located.
  - The habitat is now in PES category B. Construction of the weir complex will create a reservoir upstream that will lead to the loss of habitat. In general, the habitat functions effectively below the point where the weir is proposed. This is not expected to change following construction of the weir and pumping infrastructure.
  - The Risk Matrix classifies the Weir and Low lift pump station as a high risk activity.
- The Matlabas Stream Crossing
  - The river now has a PES rating of B. There is some degradation that has taken place, but the habitat is largely intact with minimal modification that has taken place.
  - The present proposal is that the pipeline be installed through horizontal drilling well below the surface; in which case construction will have little impact on the wetland. It is however an option to use trenching. Much of the catchment upstream is pristine because it is located in an area that focusses on nature-based tourism.
  - Construction is unlikely to have a long term influence on the flow characteristics or water quality of the Matlabas River.
  - Matlabas River Crossing has moderate risk because of the construction method that will be employed and the duration of construction.
- Pans along the different alternative D routes. They occur on the Northern Sandy Plains.

- This system is considered to be ecologically important in local context. The present PES status is B and C. This status will be maintained post construction. The depressions are important habitats for fauna because it provides water in an otherwise arid environment. It is poor in sediment trapping or controlling water quality.
- There are four alternative routes for the pipeline. D2 and D3 alignments each has one depression of significance that will be impacted on by the pipeline, while there are two pans in Route D1. Route alternative D4 diverts away from Route D1 where the route enters Enkeldraai and Taaiboschpan. This diversion results in the route effectively miss the two pans in Route D1.
- The construction of the pipeline along the Routes D1 to D3 poses low risk and will only influence the habitat for the duration of construction. A 100 m corridor along the route was allowed for in the impact assessment. In all cases the route is in proximity of the depression but does not enter the pan itself. However, it is still not total clarity of the regional hydrological functioning of the soils in proximity of the pans.
- The Construction Camp at Rooipan 357 LQ is adjacent to the pan and within the buffer zone of 15 metres. The location of the camp will have a negative impact on the functioning of the pan habitat. It is recommended that the camp be relocated further east of the present proposal.

12.5 Terrestrial Ecological Impact Assessment

A summary of the Terrestrial Ecological Impact Assessment (Nemai Consulting, 2018b), as contained in **Appendix I2**, follows. Refer to **Section 13.10** for an assessment of the associated impacts.

12.5.1 Details of the Specialist

The details of the specialist that undertook the Terrestrial Ecological Impact Assessment follow.

Organisation:	Nemai Consulting
Name:	Avhafarei Phamphe
Qualifications:	MSc – Botany
Affiliation (if applicable):	❖ Professional Natural Scientist-Ecological Science (400349/12) with South African Council for Natural Scientific Professions ❖ Professional member of South African Institute of Ecologists and Environmental Scientists ❖ Professional member of South African Association of Botanists

12.5.2 Objectives of the Study

The objectives of the Terrestrial Ecological Impact Assessment include the following:

❖ To apply relevant literature to determine the diversity and eco-status of the plants, mammals, avifauna, reptiles and amphibians in the study area;

- To carry out field survey to gain an understanding of the diversity of taxa and eco-status of ecosystems which these species inhabit, as well as the presence of unique habitats that might require further investigation or protection;
- To assess the current conservation status of plant and animal species in the study area;
- To comment on ecological sensitive species/areas;
- To assess the possible impact of the proposed project on these taxa and/or habitats;
- To list the species on site and to recommend necessary actions in case of occurrence of endangered, vulnerable or rare species or any species of conservation importance; and
- To provide management recommendations to mitigate negative and enhance positive impacts within the project area.

12.5.3 Methodology

The methodology used included a comprehensive desktop review, utilising available provincial ecological data, relevant literature, GIS databases, topographical maps and aerial photography. This was then supplemented through a ground-truthing phase, where pertinent areas associated with the project footprint were visited during field surveys undertaken during the late wet season. The survey focused on flora (vegetation) and fauna (mammals, avifauna, reptiles and amphibians). Habitat suitability was assessed during the field surveys.

12.5.4 Key Findings of the Study

12.5.4.1 Flora

During the field survey, no threatened plant species were observed within the project area. Only one (1) species of conservation concern (Orange Listed Plants) (listed as Declining) was found, namely *Vachellia erioloba* (= *Acacia erioloba*) (known as Camel Thorn). These plant species were recorded along the Central Route as well as the A2 and D2 routes.

Protected trees in the study area include *Vachellia* (*Acacia*) *erioloba* (Camel Thorn), *Adansonia digitata* (Baobab), *Boscia albitrunca* (Shepherd's tree), *Combretum imberbe* (Leadwood) and *Sclerocarya birrea* subsp. *africana* (Marula). According to Section 51(1) of the National Forests Act (Act No. 84 of 1998) (NFA), no person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a license granted by DAFF. There is only one plant species which falls within “protected plants” in terms of the LEMA, Schedule 12, namely *Spirostachys africana* (Tamboti). A permit from LDEDET is required before construction commences in order to cut, disturb, destroy or remove these trees noted within the project area.

12.5.4.2 Fauna

The greater area was historically commonly used for cattle grazing. Game farms are now more common, with an associated high faunal biodiversity. Local occurrences of mammal species are more closely dependent on broadly defined habitat types, in particular terrestrial, arboreal (tree-living), rupiculous (rock-dwelling) and wetland-associated vegetation cover. The riverine areas and ridges in the area are regarded as significant in terms of the habitat that they provide to fauna. Riparian zones also serve as important corridors to allow for animal migration.

The bats recorded from the caves situated in the Mooivallei area are reported to be *Rhinolophus darlingi* and *Miniopterus schreibersii.* Chapter 10 of LEMA deals with preservation of caves and caves-formation. It is recommended that a blasting expert and geologist assess the potential impact of blasting on the bat cave. The geotechnical investigations need to be taken into consideration during the design phase and the line can be shifted within the 100m corridor in order to avoid the cave and also to minimize impacts.

Three (3) Red Data bird species will be directly affected by the availability of water downstream from the proposed abstraction weir in the Crocodile River (West), namely Greater Painted-snipe, Yellow-billed Stork and Black Stork. It is therefore recommended that the requirements of the Ecological Reserve be satisfied.

A separate Wildlife Impact Assessment Study has been undertaken to assess the impact of the proposed development on wildlife.

The main potential impact of the proposed project on reptile species is linked to habitat loss or degradation. In order to protect the Southern African Python on site, should this species be encountered or exposed during the construction phase, they should be removed and relocated to natural areas in the vicinity. This remedial action requires the engagement of a herpetologist and or ecologist. If this species is found during winter period, when it is in hibernation, then a permit from LDEDET would be required in order to catch and release it to a safer environment.

Some areas within the project footprint offer suitable habitat for Giant Bullfrog and African Bullfrog. These species are protected in terms of the National Environmental Management: Biodiversity Act (Act No. 10 of 2004) (NEM:BA). Threatened or Protected Species Regulations and therefore any impacts on a specimen of these species or that may negatively affect the survival of the species would require a permit.

12.5.4.3 Invertebrates

Horned Baboon Spiders (*Ceratogyrus* spp – all species) are listed in NEM:BA: Publication of lists of Critically Endangered, Endangered, Vulnerable and **Protected** species and also under Schedule 10 (Invertebrates to which Section 61(1)(a) and (b) applies. It is therefore suggested that during the walk through survey, if any of these are found, a permit from LDEDET will be required before relocation can take place. The Contractor must ensure that no baboon spiders are illegally collected or intentionally destroyed throughout all stages of the project. Care should be taken when removing stumps, logs or rock material and any scorpions encountered on the site should be left alone and allowed free access away from the activity or safely removed from the area.

12.5.4.4 Limpopo Conservation Plan

A map indicating the Limpopo C Plan categories in relation to the project footprint is shown in **Figure 97**. The project footprint in relation to the Limpopo Conservation Plan is as follows:

- CBA 1 - Vlieëpoort abstraction weir, Bierspruit gauging weir, low-lift pumping station, OR and sections of the pipeline route options (Central Route, A1, C, D2, D3 and E);
- CBA 2 - balancing dam, desilting works, BPR, new Paul Hugo gauging weir, construction camps and sections of the pipeline route options (Central Route, A1, A2, C, D1, D2, D3 and E);
- ESA 1 - sections of the pipeline route options (Central Route, C and D2), as well as the Sand River gauging weir;
- ESA 2 - balancing dam and sections of the pipeline route options (Central Route, D3 and E);
- Other Natural Area - sections of the pipeline route options (Central Route, A1, A2, C, D1, D2, D3 and D4); and
- No Natural Remaining - balancing dam, high-lift pumping station and sections of the pipeline route options (Central Route, A1, A2, D2 and D3).

12.5.5 Impact Assessment

Refer to **Section 13.10** for the results from the impact assessment from this study.

12.5.6 Conclusions

It is recommended that a walk through survey of the approved route alternative be undertaken prior to the start of the construction activities in order to survey the area in detail for any Red Data Listed species. The survey should preferably be undertaken during summer season in order to have a higher probability of detecting species of special concern. This is relevant in the areas that have been labelled as ecologically sensitive. Habitat destruction should be limited to an absolute minimum as intact habitat would result in higher faunal and floral species diversity. It is therefore critical that construction activities be restricted to the construction servitude.

The Central Route either runs along servitudes of tar roads, gravel roads, farm roads, railway lines, or power lines and most of the areas directly linked to these servitudes are disturbed to a certain degree. It was therefore found that the proposed pipeline will not have a significant impact on the flora and fauna in the area, given that the servitude width will be kept to a minimum and that the mitigation measures proposed will be implemented. It is the opinion of the ecologist that the proposed development be considered favourable provided that the sensitivity map be considered during the planning and construction phases of the proposed development activities to aid in the conservation of ecology within the study area. Rehabilitation needs to take place to ensure that alien plant emergence and erosion do not occur.

12.6 Heritage Impact Assessment

A summary of the Heritage Impact Assessment (PGS Heritage, 2018), as contained in **Appendix I4**, follows. Refer to **Section 13.16** for an assessment of the associated impacts.

12.6.1 Details of the Specialist

The details of the specialist that undertook the Heritage Impact Assessment follow.

Organisation:	PGS Heritage (Pty) Ltd
Name:	Polke Birkholtz
Qualifications:	BA (Hons.) Archaeology
Affiliation (if applicable):	Association of Southern African Professional Archaeologists

12.6.2 Objectives of the Study

The aim of the study was to identify possible heritage sites and finds that may occur in the proposed project footprint. The Heritage Impact Assessment aims to inform the EIA to assist the developer in managing the discovered heritage resources in a responsible manner, in order to protect, preserve, and develop them within the framework provided by the NHRA.

12.6.3 Methodology

The Heritage Impact Assessment process consisted of the following three steps:

- Step I – Desktop Study: A detailed archaeological and historical overview of the study area and surroundings was undertaken. This work was augmented by an assessment of reports and data contained on SAHRIS. Additionally, an assessment was made of the available historic topographic maps. All these desktop study components were undertaken to support the fieldwork. Lastly, a palaeontological desktop study was also undertaken.
- Step II – Field Survey: The field assessment of the largest portion of the proposed pipeline routes were undertaken by driving along the adjacent and available roads, including the track running along the railway line. A concerted effort was made to conduct walkthroughs of those sections of the pipeline footprints not accessible by road. Furthermore, and whenever possible, all potential heritage sites identified during the assessment of the historic maps and

SAHRIS were also visited in the field. Additionally, with the exception of a few areas that were not covered, all the non-linear footprints were assessed by way of intensive walkthroughs.

- Step III – Report: The final step involved the recording and documentation of relevant heritage resources, as well as the assessment of resources regarding the Heritage Impact Assessment criteria and report writing, as well as mapping and recommendations.

12.6.4 Key Findings of the Study

12.6.4.1 Archaeological and Historical Overview

The Heritage Impact Assessment explains the study area and surroundings during the following periods:

- Stone Age;
- Iron Age;
- Late Iron Age and the early Historic Period;
- Mfecane;
- early Historical Period;
- South African War;
- Twentieth Century;

12.6.4.2 Previous Heritage Impact Assessment Reports

An assessment of SAHRIS was undertaken to establish whether any previous archaeological and Heritage Impact Assessments had revealed archaeological and heritage sites within, and in close proximity, to the present study area footprints.

This assessment has revealed that a number of previous reports had study areas which either incorporated sections of the present study area, or adjoined it. However, as part of these previous studies, no archaeological or heritage sites were identified within the present study area.

12.6.4.3 Archival and Historical Maps

An assessment of available archival and historical maps was undertaken as a way to identify potential heritage sites located within the study area and its immediate surroundings.

A total of 12 possible heritage sites were identified on these maps within the study area and its immediate surroundings. These possible heritage sites were visited in the field, and whenever a heritage site could be confirmed at any of these localities, it was recorded and included in the fieldwork results.

12.6.4.4 Fieldwork Findings

The fieldwork resulted in the identification of a total of eighteen (18) archaeological and heritage sites. Maps depicting the distribution of these identified heritage sites are shown in **Figures 122** to **125**. Photographs of selected sites are provided in **Figure 126**. Each of the heritage sites is described in the Heritage Impact Assessment Report in terms of GPS coordinates, site description, site extent, position of site relative to proposed development and site significance. The identified archaeological and heritage sites included the following:

- Five black homesteads where the potential risk for the presence of unmarked stillborn graves exist (map references: MCWAP Site 1, MCWAP Site 3, MCWAP Site 11, MCWAP Site 12 and MCWAP Site 16);
- Five sites containing confirmed graves and possible graves (map references: MCWAP Site 2, MCWAP Site 4, MCWAP Site 7, MCWAP Site 13 and MCWAP Site 14);
- Three historic farmsteads which are older than 60 years (map references: MCWAP Site 5, MCWAP Site 6 and MCWAP Site 15);
- Two Stone Age sites (map references: MCWAP Site 8 and MCWAP Site 18);
- Two metalworking sites associated with the Iron Age (map references: MCWAP Site 9 and MCWAP Site 10); and
- Memorial where cremated ash may have been placed (map references: MCWAP Site 17).

Figure 122: **General view of the southern end of the study area showing the distribution of heritage sites identified during the fieldwork (PGS Heritage, 2018)**

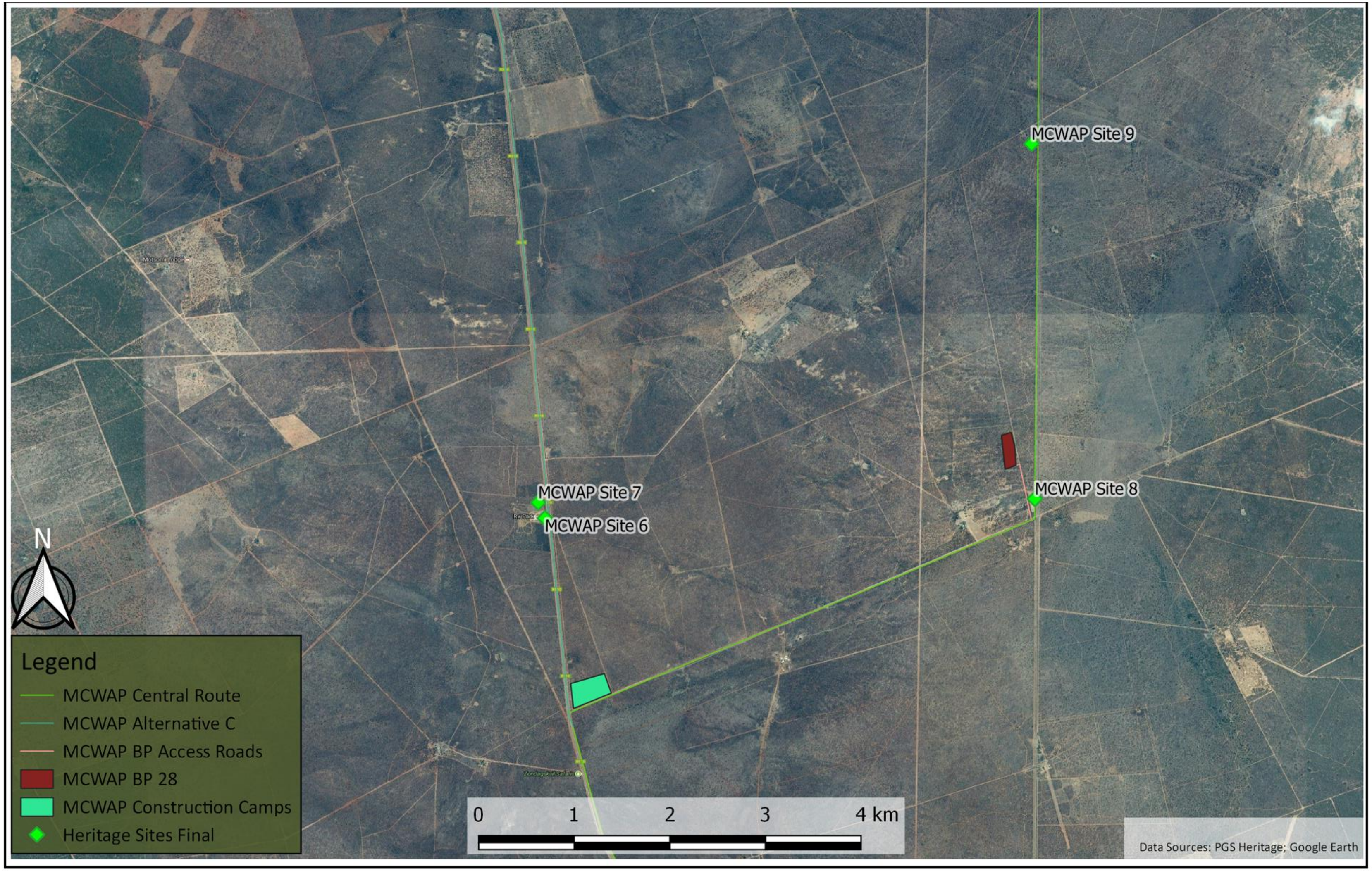


Figure 123: General view of the south-central section of the study area showing the distribution of heritage sites identified during the fieldwork (PGS Heritage, 2018)

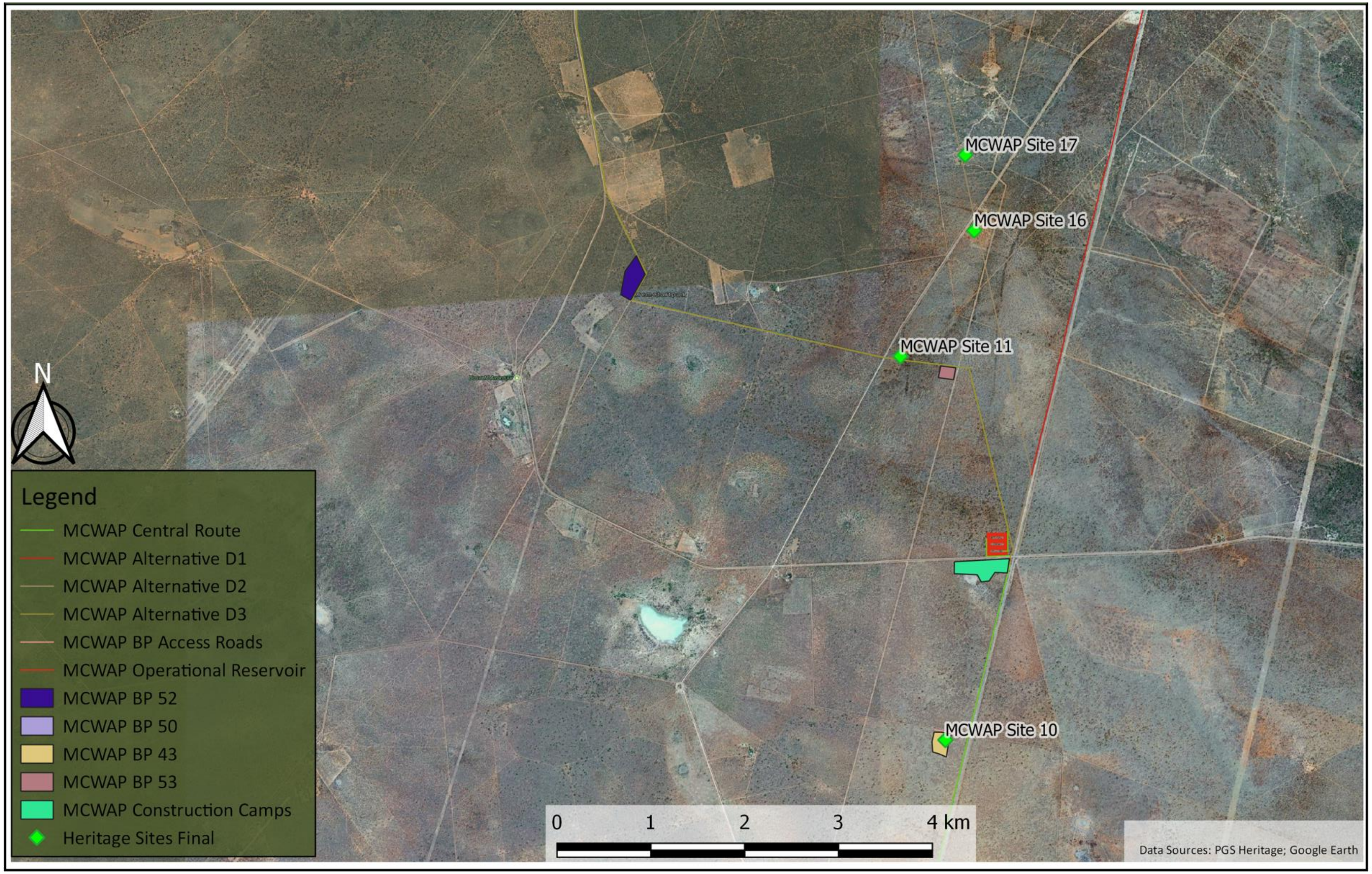


Figure 124: **General view of the north-central section of the study area showing the distribution of heritage sites identified during the fieldwork (PGS Heritage, 2018)**

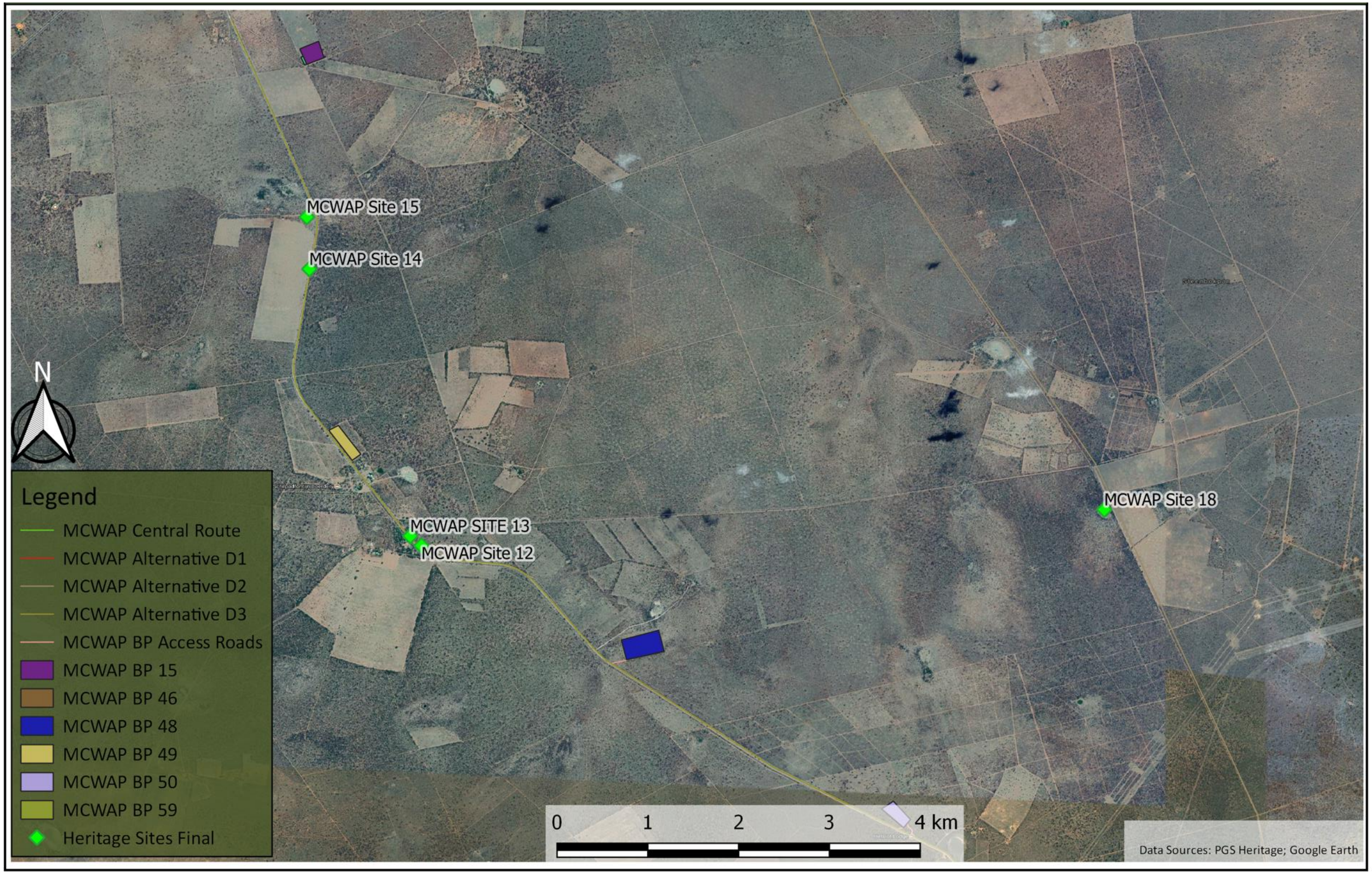


Figure 125: General view of the northern end of the study area showing the distribution of heritage sites identified during the fieldwork (PGS Heritage, 2018)

Sample of artefacts observed on the surface (MCWAP Site 1)

General view of the stone concentration (MCWAP Site 3)

Cemetery (MCWAP Site 4)

Farmhouse (MCWAP Site 5)

Sample of lithics identified (MCWAP Site 8)

Farmhouse (MCWAP Site 15)

Figure 126: Photographs of selected archaeological and heritage sites (PGS Heritage, 2018)

The identified archaeological and heritage sites included the following:

- Five black homesteads where the potential risk for the presence of unmarked stillborn graves exist (map references: MCWAP Site 1, MCWAP Site 3, MCWAP Site 11, MCWAP Site 12 and MCWAP Site 16);

- Five sites containing confirmed graves and possible graves (map references: MCWAP Site 2, MCWAP Site 4, MCWAP Site 7, MCWAP Site 13 and MCWAP Site 14);
- Three historic farmsteads which are older than 60 years (map references: MCWAP Site 5, MCWAP Site 6 and MCWAP Site 15);
- Two Stone Age sites (map references: MCWAP Site 8 and MCWAP Site 18);
- Two metalworking sites associated with the Iron Age (map references: MCWAP Site 9 and MCWAP Site 10); and
- Memorial where cremated ash may have been placed (map references: MCWAP Site 17).

12.6.4.5 Palaeontology

A paleontological desktop study was undertaken. **Table 43** indicates these geological sediments as well as their respective palaeontological sensitivities.

Table 43: Geological sediments underlying the project area (PGS Heritage, 2018)

Era	Supergroup/Sequence	Group	Subgroup	Formation	Sensitivity
Mokolien		Waterberg	Kransberg		Low
			Matlabas		
			Nylstroom		
Vaalian	Bushveld Complex; Lebowa Granite Suite				Zero
	Transvaal Supergroup	Pretoria		Black Reef	Moderate
		Chuniespoort	Malmani		High
Randian		Buffelsfontein			Moderate

But the Malmani Subgroup of the Chuniespoort Group (Transvaal Group) has a high Palaeontological sensitivity.

According to the SAHRIS PalaeoMap, it is recommended that no further palaeontological heritage studies, ground-truthing and/or specialist mitigation are required (pending the discovery of newly discovered fossils) in geological sediments with a low, very low and moderate Palaeontological Sensitivity. The majority of the proposed development footprint is thus deemed appropriate and feasible and will not lead to detrimental impacts on the palaeontological resources of the area. All route alternatives were found to be in the above mentioned geological sediments and therefore none of the routes were preferred above the other and none were a no-go option.

Should fossil remains be discovered during any phase of construction, either on the surface or exposed by fresh excavations, the Environmental Control Officer (ECO) should be alerted immediately. Such discoveries ought to be protected (preferably *in situ*) and the ECO should alert SAHRA so that appropriate mitigation (e.g. recording, sampling or collection) can be undertaken by a professional palaeontologist. The specialist involved would require a collection permit from SAHRA. Fossil material must be curated in an approved collection (e.g. museum or university collection) and all fieldwork and reports should meet the minimum standards for palaeontological impact studies developed by SAHRA.

But the Malmani Subgroup of the Chuniespoort Group (Transvaal Group) has a high palaeontological sensitivity, which is relevant to the Central Route. It is thus recommended that a Phase 1 palaeontology assessment be conducted to assess the value and prominence of fossils along the Central Route.

12.6.5 Impact Assessment

Refer to **Section 13.16** for the results of the impact assessment for the identified archaeological and heritage sites. General and well as site-specific mitigation measures are provided.

12.6.6 Analysis of Alternatives

Refer to **Section 14.4** for the results from the analysis of the project alternatives.

12.6.7 Conclusions

On the condition that the general recommendations are adhered to, and in cognisance of the assumptions and limitations, no heritage reasons can be given for the development not to continue.

12.7 Agricultural Impact Assessment

A summary of the Agricultural Impact Assessment (Index, 2018a), as contained in **Appendix I3**, follows.

12.7.1 Details of the Specialist

The details of the specialist that undertook the Agricultural Impact Assessment follow.

Organisation:	Index
Name:	Dr Andries Gouws
Qualifications:	PhD Integrated Land Use Modelling
Affiliation (if applicable):	❖ Council of Natural Sciences.No:400036/93, Category: Agricultural sciences. ❖ Member of the Soil Science Society of South Africa

12.7.2 *Objectives of the Study*

The objectives of the Agricultural Impact Assessment are to assess the following:

- Potential impacts during construction -
  - Loss of cultivated land and grazing land within the construction domain;
  - Loss of stock watering points within construction domain;
  - Disruptions to farming operations as a result of construction-related use of existing access roads; and
  - Loss of fertile soil through land clearance.
- Potential impacts during operational phase -
  - Potential impacts to water users (and associated agro-economic impact from reduced crop and food production) downstream of the abstraction works on the Crocodile River; and
  - Permanent loss of cultivated land due to physical infrastructure.

12.7.3 *Key Findings of the Study*

12.7.3.1 Agricultural Land Use

The agricultural land uses, as established as part of the Agricultural Impact Assessment, are listed in **Table 44** and shown in **Figures 127 - 130**.

Table 44: Agricultural Land uses in the survey area in ha (Index, 2018a)

Route	Fallow	Grazing	Irrigated	Old lands	Orchards	TOTAL
A1		104,6				104,6
A2		11,9				116,9
Central A		62,2				62,2
C		172,0			1,3	173,3
Central C		141,1				141,1
D1		196,9				196,9
D2		198,9		22,2		221,1
D3		253,2		8,7		261,9
E	3,3	38,7	11,5		0,7	54,2
Central E	1,8	40,5	9,0		1,4	52,7
Central		680,7	17,8	17,8		716,3
TOTAL		**2 005,7**	**38,3**	**48,7**	**3,4**	**2 101,2**

The predominant land use is animal production. Approximately 95% of the land is grazing. The land indicated as *fallow* has recently been cultivated and in some instances have been left to return to grazing.

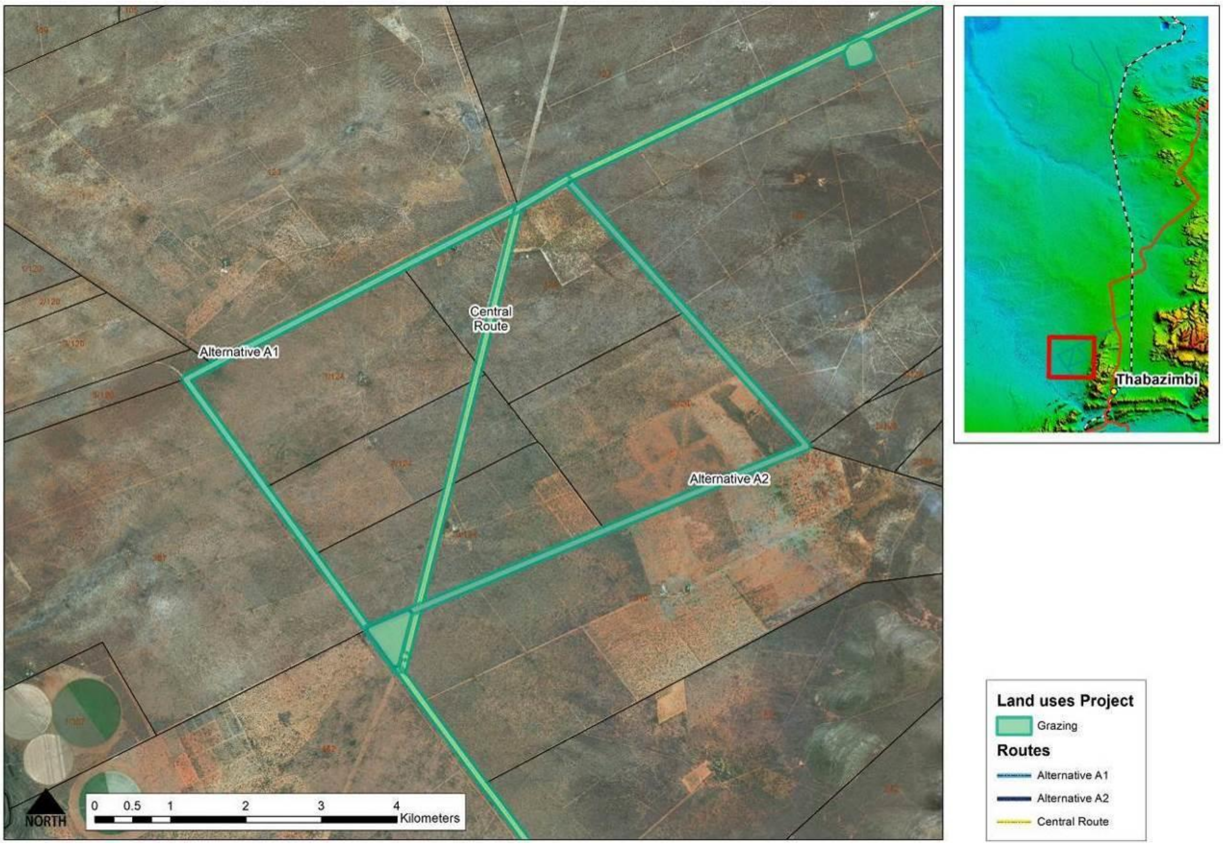


Figure 127: Land uses along Route Alternatives A1 and A2 (Index, 2018a)

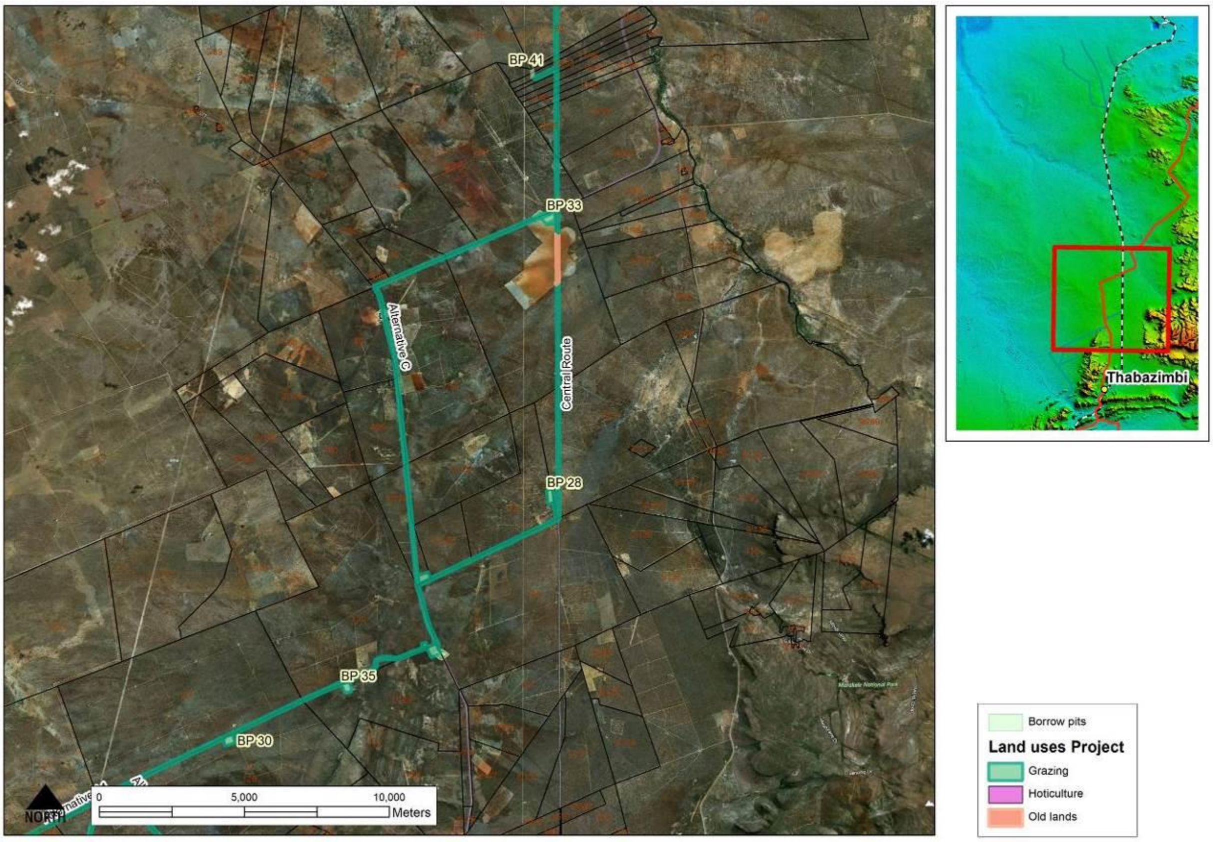


Figure 128: Land uses along Route Alternative C (Index, 2018a)

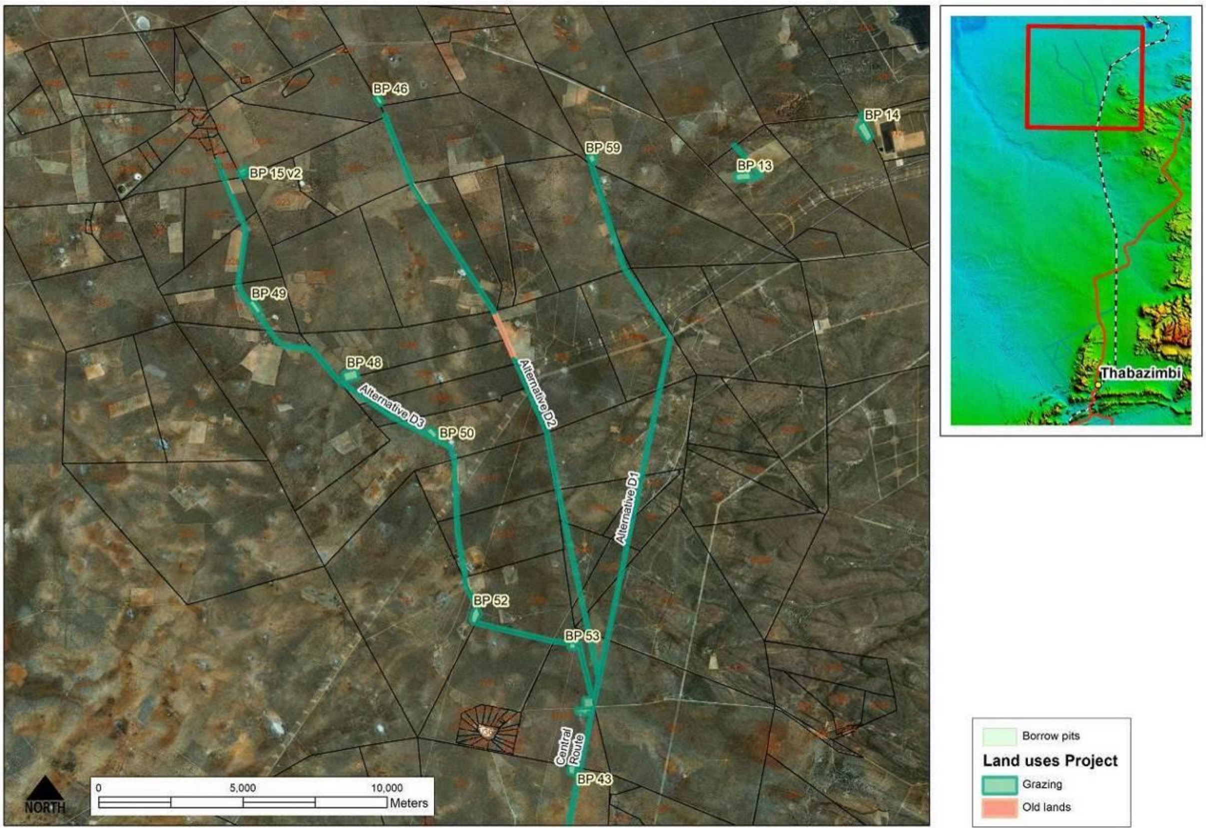


Figure 129: **Land uses along Route Alternatives D1, D2 and D3 (Index, 2018a)**

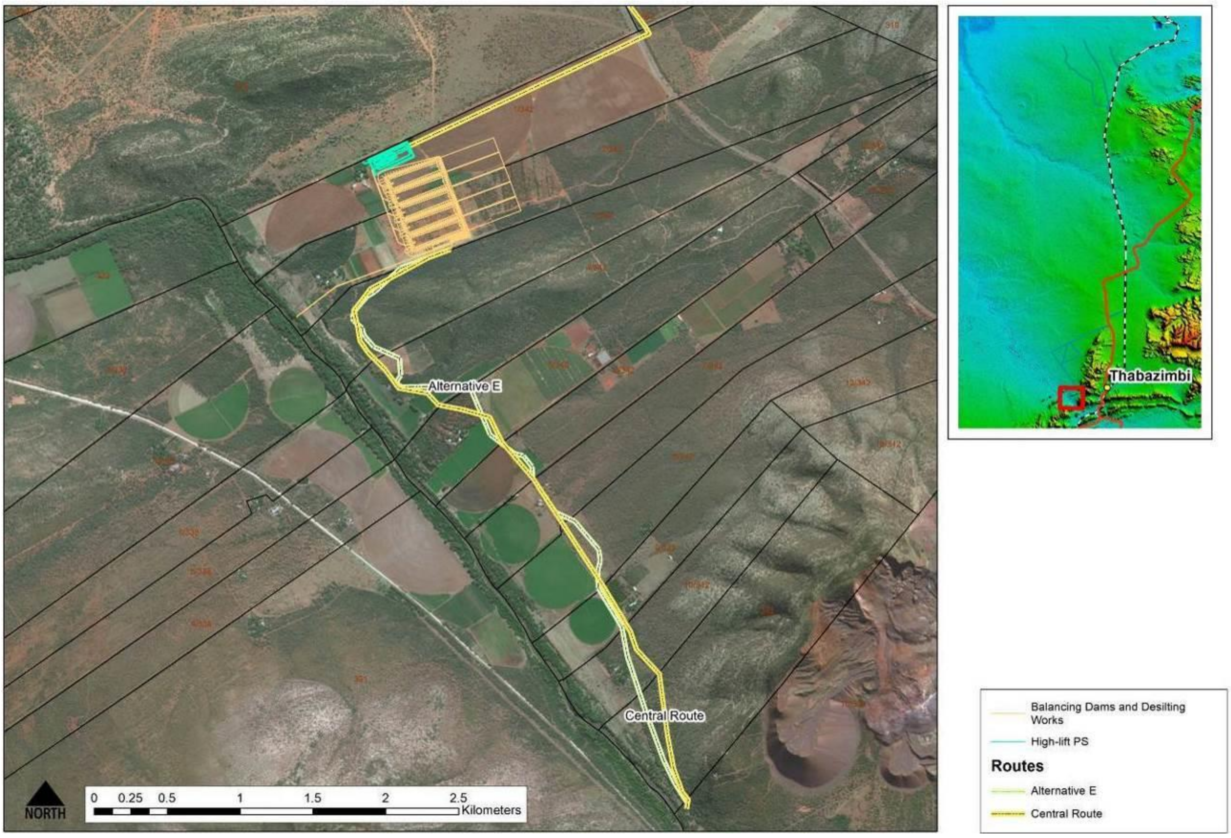


Figure 130: **Land uses along Route Alternative E (Index, 2018a)**

The following conclusions were drawn with regards to agricultural land use:

- Except for the properties listed in **Table 44**, no irrigated land nor cultivated land was identified;
- The main crops produced are lucerne, wheat, citrus and cotton;
- Livestock in combination with game or separately takes place on the largest part of the area;
- The bush density is very high in the southern part and some farmers are thinning out the vegetation to improve the grazing capacity of the veld; and
- Other farming activities identified are taxidermy, meat processing, hunting, guesthouses and tourism activities.

12.7.3.2 Grazing Capacity

The grazing capacity of natural veld, according to the Department of Agriculture, is estimated at 7 ha per large stock unit (LSU) for the southern portion close to Thabazimbi, gradually diminishing to 11 at Lephalale (refer to **Figure 131**). The browsing value of the Sandy Bushveld and Limpopo Sweet Bushveld trees and shrubs tend to favour browsing animals, hence, the large number of game farms or at least farmers that have both game and livestock.

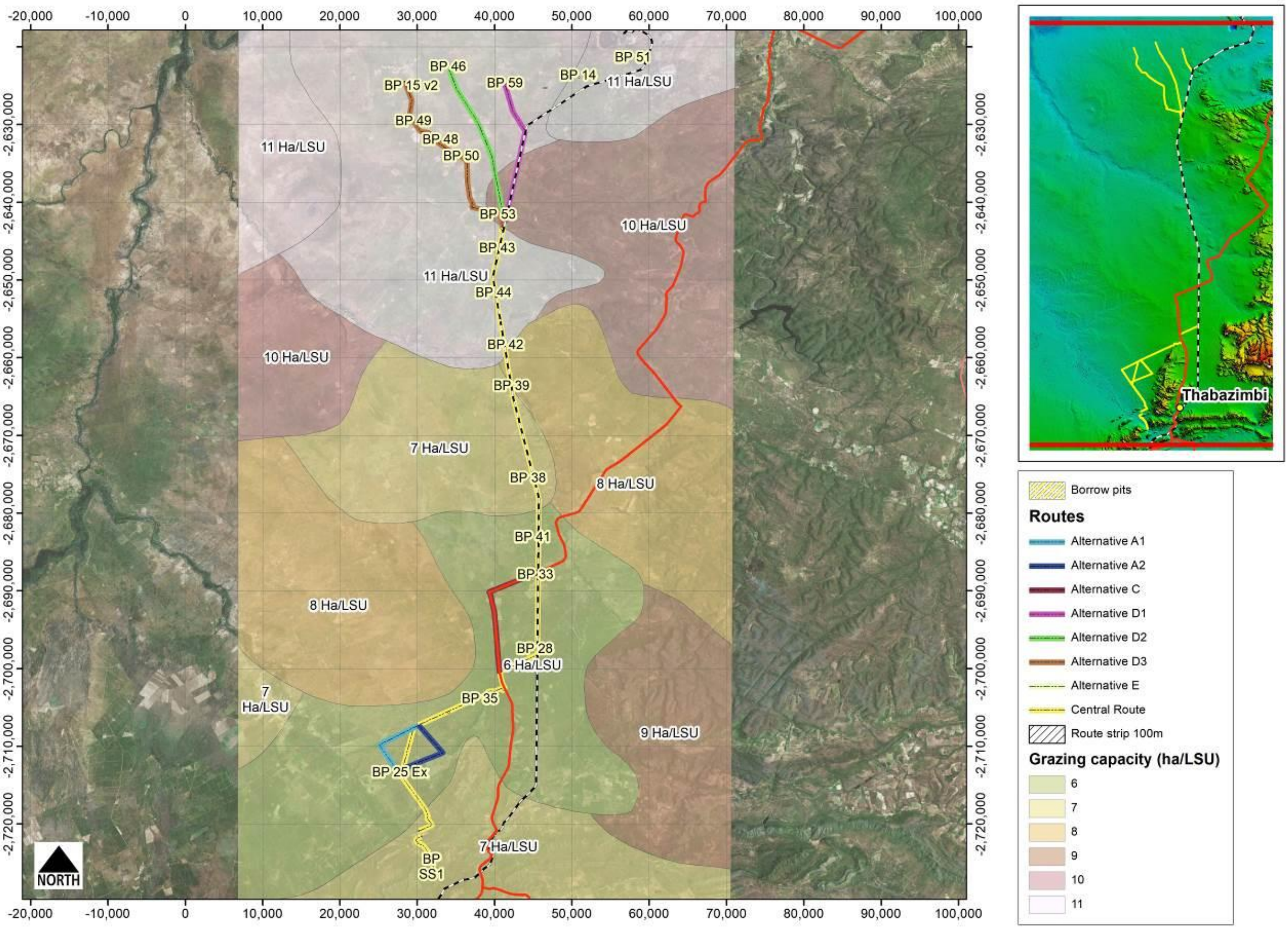


Figure 131: Grazing capacity in the project area (ha/LSU) (Index, 2018a)

12.7.3.3 Soil Potential & Dryland Crop Production Potential

The soil potential, which indicates the soil suitability of the various land types for various agricultural uses, is shown in **Figure 132**.

The climate and soils are the main environment factors that determine dryland crop potential on an area. The entire project area is not recognized as a rain fed cropping area, and the only crop production takes place where irrigation water is available.

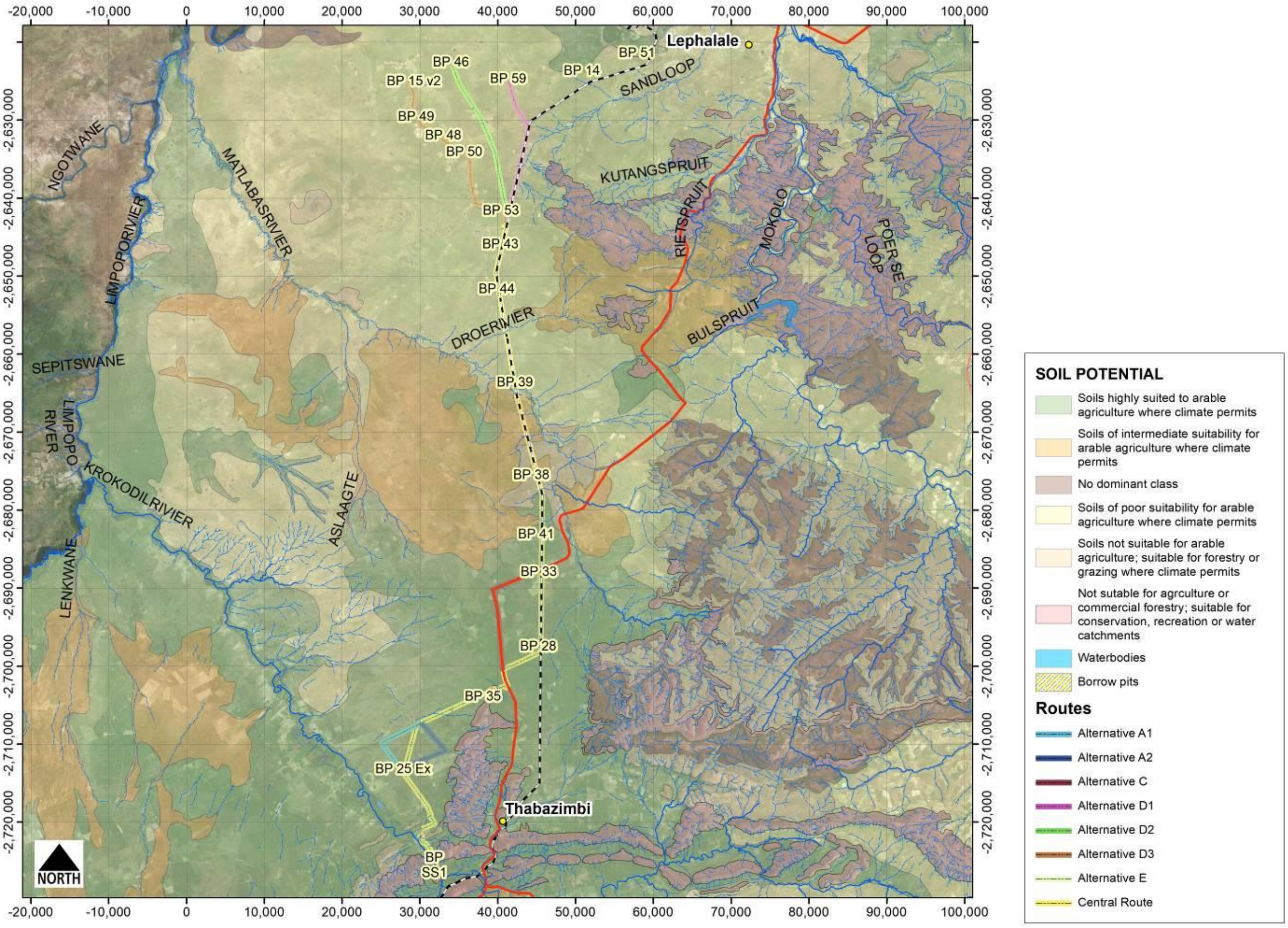


Figure 132: Soil potential in the project area (ha/LSU) (Index, 2018a)

12.7.4 *Impact Assessment*

Refer to **Section 13.13** for the results from the impact assessment from this study.

12.7.5 *Analysis of Alternatives*

Refer to **Section 14.4** for the results from the analysis of the project alternatives.

12.7.6 Conclusions

Permanent infrastructure on farms is critical in the production process and can have a major impact on farming income, especially in the case where pivot irrigation systems are used. Irrigation may cease during the period that the pipeline is constructed. In the case of permanent structures such as pumping infrastructure, balancing dam and the desilting works, the total pivot system will be permanently lost. Installing alternative irrigation systems is possible as mitigation on the remaining land, but it could lead to increase labour requirement for farming operations like shifting irrigation pipes and also place an additional burden on management.

There are a number of livestock or game watering or handling facilities that will have to be moved or replaced.

The temporary loss for grazing land will be for a strip of 50 metres from the boundary fence of the property. This width includes 40 metre within the construction servitude and 10 additional metres to allow for disturbances caused to the animals by construction vehicles and dust that may settle on the leaves of grass and trees. The period of the loss will be for the duration of construction and the time it will take for the grass to recover.

There are a number of houses in proximity of the routes that will impact on the farming operations, either permanently or at least for the duration of the construction.

The environmental impact on farming is as follows:

- Route alignments -
  - There will be a temporary loss of 38 ha irrigated land;
  - Temporary loss of 2 006 ha of grazing / browsing land; and
  - Fences and a small number of animal watering facilities will be permanently lost and must be replaced;
- Balancing dams, desilting works and high lift pumping station -
  - The largest impact of the development will be the permeant loss of 34,6 ha irrigated land and the grain, fodder and fibre it can produce; and
  - Portions 1 and 2 of the Farm Mooivalei 342 KQ may not remain economically viable at its reduced size;
- Construction camps, BPR and OR -
  - There will be no impact on high potential or rain fed arable land; and
  - Loss of grazing land includes a temporary loss of 58 ha and 23,7 ha permanent loss of grazing / browsing land.

Overall, there seems to be sufficient water for all the lawful users, including irrigation and for the environmental demand (EWR) downstream of the proposed Vlieëpoort abstraction weir. It is estimated that approximately 5 900 ha are irrigated at present. Most of the irrigation takes place within the first 25 to 30 km from the Vlieëpoort abstraction weir. The projected income of these farmers is R79,8 million annually and they employ around 1 353 people. It is the major economic activity downstream of the weir. While the Scoping Report assures lawful irrigators downstream of the weir a secure supply in line their present rights and entitlements, DWS cannot guarantee assurance of supply, which is in accordance with the NWA. This leaves the farmers unable to plan their production programme. In mitigation of this uncertainty of supply and inability of farmers to plan their production programme, the following is suggested:

- A management plan for their particular circumstances should be developed and then included in the suggested overall River Management System;
- Management procedures should be put in place to indicate the prevailing situation and to timeously inform farmers of potential water shortages;
- A flow gauge must be installed at the Vlieëpoort abstraction weir to inform farmers of the availability of water; and
- Unlawful water use needs to be curtailed, which would reduce the risk of inadequate supply of lawful users.

12.8 Socio-Economic Impact Assessment

A Socio-Economic Impact Assessment (Bews and Chidley, 2018) was undertaken for MCWAP-2A, which is contained in **Appendix I6**. A summary of the study follows.

12.8.1 Details of the Specialists

The details of the specialists that undertook the Socio-Economic Impact Assessment follow.

Organisation:	Nemai Consulting
Name:	Ciaran Chidley
Qualifications:	BA (Economics); BSc Eng (Civil); MBA
Affiliation (if applicable):	N/A

Organisation:	Dr Neville Bews & Associates
Name:	Neville Bews
Qualifications:	❖ BA (Hons) ❖ Henley Post-Graduate certificate in Management (United Kingdom) ❖ MA ❖ D. Litt et Phil
Affiliation (if applicable):	International Association of Impact Assessors South Africa IAIAsa

12.8.2 Objectives of the Study

The objectives of the Socio-Economic Impact Assessment include the following:

- To describe the socio-economic baseline conditions that may be affected by the project;
- To describe the approach proposed for assessing the potentially significant issues that should be addressed by the Socio-Economic Impact Assessment during the EIA phase;
- To determine the specific local socio-economic impacts of the project

- To Identify the potential socio-economic issues associated with the project;
- To suggest suitable mitigation measures to address the identified impacts; and
- To make recommendations on preferred options from a socio-economic perspective.

12.8.3 Situation Assessment

The land use in the area is predominantly agricultural, with grazing lands forming the bulk of the land use. There is irrigated agriculture in the south of the project in the Mooivallei area. Grazing land is used both for cattle rearing and for use by game on game farms. All land is privately owned in the project area.

The route options impact upon farm buildings and dwellings, irrigation pivots, road and powerline crossings and the pipeline routing is set to run along farm boundaries as a default. There are some cases where land portions are traversed.

The regional study area has a population of 201 000, living within 55 000 households. In general, the households in the regional study area are impoverished and have low access to services such as water and sanitation. Thabazimbi Local Municipality generates R28 billion of gross value added per year, a measure that is similar to geographic domestic product, but defined for a specific geographical area. The economy is highly skewed toward mining, with agriculture contributing R348 million of that value. The economy of Lephalale Local Municipality is smaller, at R9 billion gross value added, with agriculture contributing R370 million of that total. The labour force is both municipalities is mainly comprised of semi-skilled and unskilled workers with a substantial minority of the workforce being engaged in the informal sector.

The local study area has 58% of households who earned less that R38 000 per year in 2011, this for an average household size of 3.5. Education outcomes reveal that sixty-nine percent of the residents of the area have not completed matric. Approximately two percent have gained an education level higher than matric. 33% have not completed primary school.

12.8.4 Impact Assessment

Stakeholder engagement was carried out using the public participation process during the EIA. Stakeholders involved in the engagement were landowners, community groups and other interested groups. During this engagement the following social and economic issues were identified: noise; dust; land acquisition and land rights concerns; security and access issues; loss of business productivity; land use; and direct local economic benefits derived from the project.

Refer to **Section 13.12** for the results from the impact assessment from this study.

12.8.5 Analysis of Alternatives

Refer to **Section 14.4** for the results from the analysis of the project alternatives.

12.8.6 Conclusions

The study assessed the social and potential economic impacts of the proposed project. As expected of any construction project, there were several positive and negative social as well as economic impacts identified. The identified negative impacts can be successfully mitigated and the positive impacts will bring economic and socio-economic benefit to the area, they therefore do not require any mitigation.

12.9 Wildlife Impact Assessment

In acknowledgement of the sensitivity of the receiving environment in terms of sensitive game species and the dominant land use, a Wildlife Impact Assessment was undertaken. A summary of the Wildlife Impact Assessment (NABRO Ecological Analysts, 2018), as contained in **Appendix I7**, follows.

12.9.1 Details of the Specialist

The details of the specialist that undertook the Wildlife Impact Assessment follow.

Organisation:	NABRO Ecological Analysts
Name:	Ben Orbán
Qualifications:	MSc - Wildlife Management
Affiliation (if applicable):	Professional Natural Scientist(400061/96) with South African Council for Natural Scientific Professions

12.9.2 Objectives of the Study

The objectives of the Wildlife Impact Assessment include the following:

- Assess the wildlife industry and preferred land-use options applied within the project area;
- Identify the potential impacts on wildlife and wildlife enterprises;
- Provide an assessment of impacts with potential mitigations measures; and
- Provide an independent report stating conclusions.

12.9.3 Key Findings of the Study

12.9.3.1 General

The approaches in wildlife breeding are based on extensive breeding systems (wildlife ranches with no internal fences) where habitat and stocking rates are manipulated to simulate the cascade effect, or intensive breeding systems (wildlife farms with separately fenced enclosures) where wildlife species are relegated to separate camps. The land-use options have separate spin-offs, where wildlife ranches are generally dependant on eco-tourism and hunting on generating revenue, while wildlife farms are dependent on live sales of wildlife. However, often both approaches are implemented on the same property to ensure optimum financial gain.

Eco-tourism, generally has high initial investment cost in establishing suitable facilities to comply with international tourism requirements, but once established ensure a steady stream of dependable income throughout the year. Hunting generally requires less investment capital in developing facilities and is, most often, only conducted in the winter months (May to October) with a peak in June, July and August.

The wildlife ranches/farms are currently stocked with black rhinoceros (*Diceros bicornis*), white rhinoceros (*Ceratotherium simum*), buffalo (*Syncerus caffer*), giraffe (*Giraffa camelopardalis*), roan antelope (*Hippotragus equines*), the sable antelope (*Hippotragus niger niger*), greater kudu (*Tragelaphus strepsiceros*), waterbuck (*Kobus ellipsiprymnus*); common impala (*Aepyceros melampus melampus*); gemsbok (*Oryx gazelle*), blue wildebeest (*Connochaetes taurinus*), red hartebeest (*Alcelaphus buselaphus*); plain's zebra (*Equus quagga*), eland (*Taurotragus oryx*), nyala (*Tragelaphus angasii*); bushbuck (*Tragelaphus scriptus*) and warthog (*Phacochoerus africanus*)*;* while mountain reedbuck (*Redunca fulvorufula*) and klipspringer (*Oreotragus oreotragus*) occur in the mountainous areas of some properties. Steenbok (*Raphicerus campestris*) and common duiker (*Sylvicapra grimmia*) are some of the smaller wild ungulates that occur.

12.9.3.2 Study Area

The properties highlighted in blue (**Figure 133** and **134**) are ranches and farms where the proposed MCWAP-2A will significantly influence current land-use practices and mitigation measures will be required to reduce the perceived impact on wildlife.

The preferred land-use options applied on Louma Boerdery (Hampton 320) are eco-tourism and hunting; Thaba Tholo (Startford 309, Bridgewater 307, Tarentaalkraal 120 and Amsterdam 123) is predominantly wildlife farming; Buffelsvley 127 and Karoobult 126 are wildlife farming and hunting enterprises.

Many wildlife ranches and hunting enterprises are present along the proposed MCWAP-2A pipeline route next to the railway line. Cheetah Safaris (Rietfontein 15, Inkermann 10 and Groenland 397), predominantly a wildlife ranch with a few wildlife breeding facilities, is particularly sensitive to disruption due to their emphasis on international hunting activities. Mabulskop 406 is predominantly a wildlife ranch, however, a number of wildlife breeding camps are located along the railway line and some wildlife may need to be relocated. Rooipan 357 is a recently developed wildlife ranch with emphasis on eco-tourism. Land-use on Rooipan 357 will be affected by the proposed MCWAP-2A and financial losses can occur.

Kuche Safaris (Schuldpadfontein 328) and its associated infrastructure are located next to the road, with another residence directly opposite the entrance. Due to the relatively small size (400 ha) and the location of infrastructure on this property, economic viability of the enterprise will be seriously compromised by the proposed project.

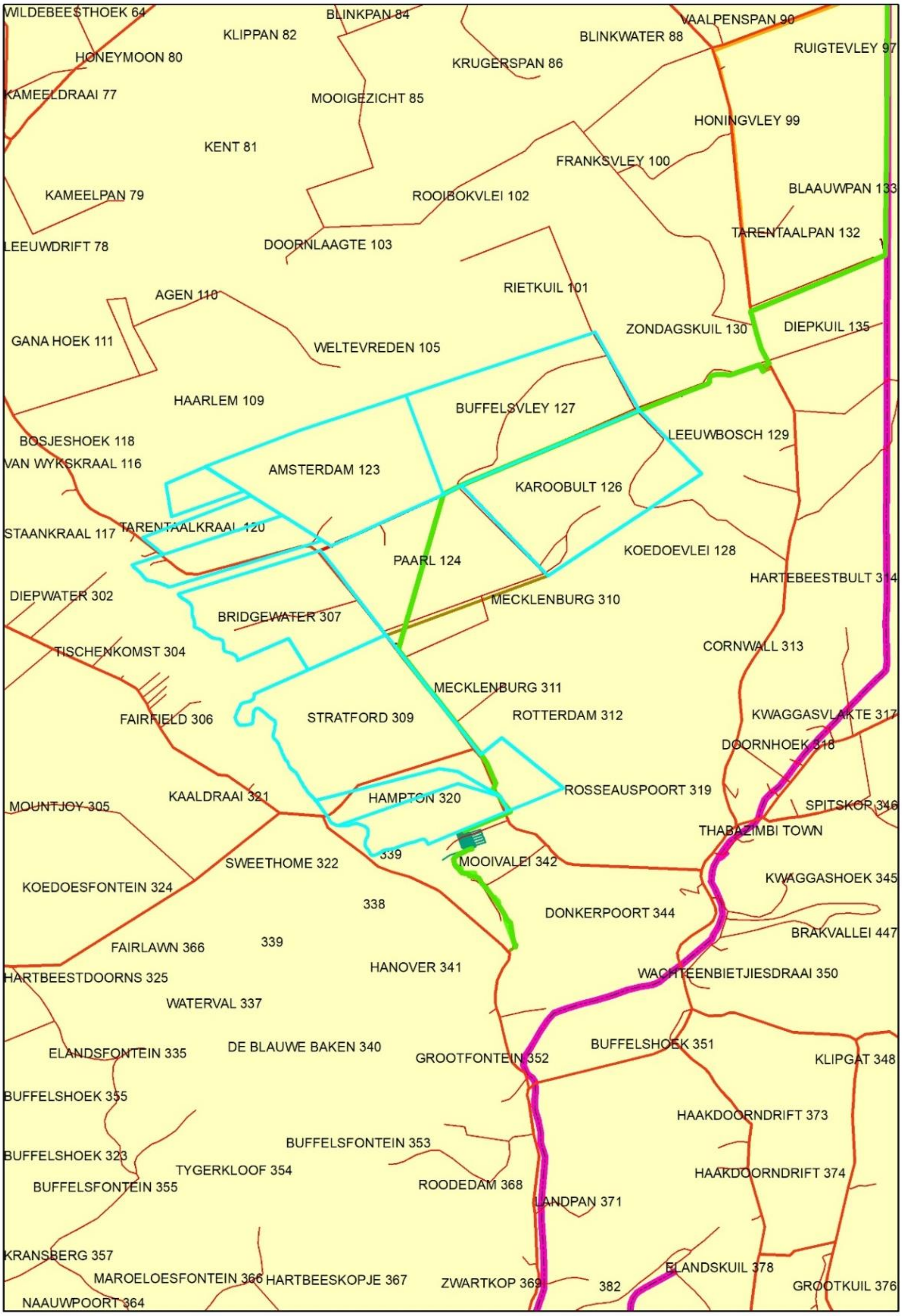


Figure 133: Highlighted ranches and farms (blue boundaries) where breeding camps may have to be moved and/or rare and endangered wildlife relocated to more secure areas (NABRO Ecological Analysts, 2018)

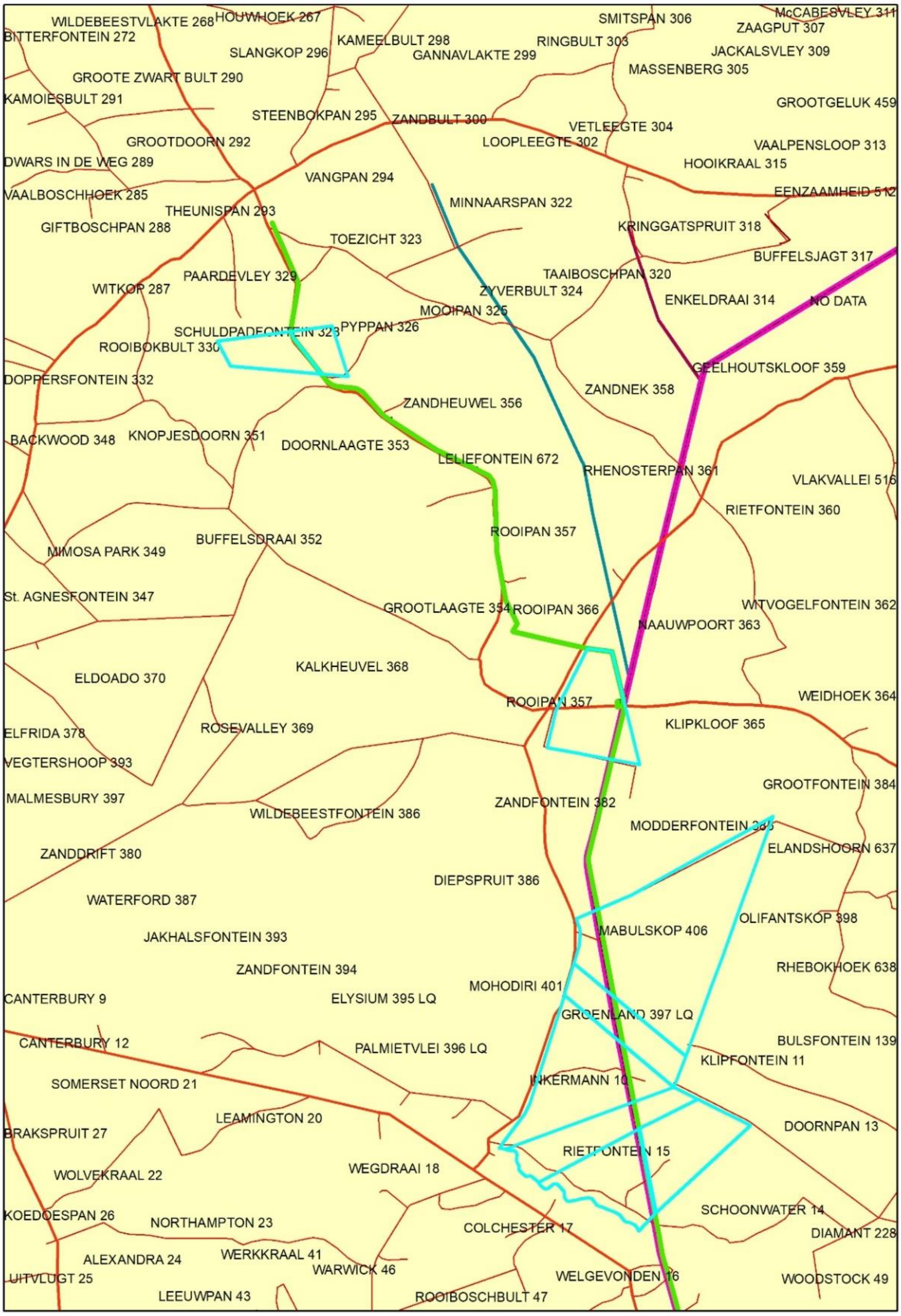


Figure 134: **Highlighted ranches, farms and infrastructure (blue boundaries) where breeding camps may have to be moved and/or rare and endangered wildlife relocated to more secure areas. Economic viability of some wildlife enterprises may also be compromised (NABRO Ecological Analysts, 2018)**

12.9.3.3 Expected Wildlife Impacts from MCWAP-2A

Habitat Loss

The linear configuration of the proposed MCWAP-2A will invariably result in current habitat loss, a reduction in the availability of natural resources, less wildlife that can be sustained and ultimately a reduction in revenue generated from the preferred land-use option applied. The pipeline's construction servitude will result in complete habitat modification where all woody species are removed, making the habitat unsuitable for species dependant on this resource. However, after construction and rehabilitation of the construction zone the newly modified habitat will become more suitable to a number of plains game, potentially increasing species diversity. Resource availability may need to be recalculated; optimum stocking rates adjusted and applied management principles re-evaluated within the constraints of the land-use options available. Further infrastructural development may also be required to ensure that the remaining wildlife has access to sufficient basic resources such as open water.

Habitat Fragmentation

Habitat fragmentation is generally a concern where an ecosystem's ability to sustain wildlife is negatively affected due to a reduction in feeding, breeding, nesting and resting requirements of wildlife species. However, the inadvertent creation of ecotones can also be beneficial since many smaller wildlife species are attracted, thus potentially increasing species diversity. The proposed MCWAP-2A design endeavoured to reduce habitat fragmentation by following existing infrastructure such as roads, railway lines and property boundary fence lines. However, where the boundary fence between two properties has been removed to create a larger conservation area, the construction corridor will bisect the properties for duration of the construction and rehabilitation phases.

Wildlife Dispersal and Migration

Natural migration of most wildlife species has been effectively curbed by the erection of property fence lines and internal camp systems and is seldom observed in South Africa; however, natural migrations of wildlife can still be seen in neighbouring African countries. Where the proposed MCWAP-2A affects properties, wildlife movement and access to resources will be temporarily arrested but can continue unabated after rehabilitation, with due consideration of habitat modification. The modified habitat in the construction zone will need to be re-evaluated to quantify the natural resources available before optimum stocking rates can be applied. Failure to do so can lead to sub-optimal resource use or habitat degradation and failure of rehabilitation measures applied in the construction zone.

Wildlife Diversity

Construction of the MCWAP-2A pipeline will result in the loss of habitat and thus indirectly a reduction in wildlife diversity, where animals will move to alternative areas where their requirements for feeding, breeding, nesting and resting are met. Concomitantly, other wildlife species will invariably move into the degraded/modified environment created during the construction of the MCWAP-2A pipeline. After cessation of construction and implementation of the proposed rehabilitation measures the modified habitat can contribute to species diversity due to the effective creation of a grassland habitat more suited to plains game.

Land Use

During the construction phase of the MCWAP-2A the currently preferred land-use practices applied by property owners will be negatively influenced by increased noise levels and dust released from excavations. Wildlife will exhibit avoidance behaviour where possible; however, any breeding camp system in close proximity to these activities will negate any efforts in moving away from the disturbance. Increased noise levels will also negatively affect wildlife enterprises dependant on eco-tourism and hunting where visitor experience will be tainted by undesirable environmental stimulation. This may have further indirect consequences since much of the marketing occurs from personal referral and returns to the same enterprise/hunting operator.

Noise Impact on Animals

Most work on the effects of noise on animals has focused on behavioural responses of animals and the effects on animal physiology, development, neural function and genetic effects. Although there are many natural sources of noise the effects of anthropogenic noise are becoming increasingly more prevalent with studies on how acoustic stimuli contribute to stress and impact on physiology and development.

The impacts of noise on reproduction and development can be observed already in embryonic stage where excessive environmental noise (<85 dB) has been correlated to premature birth and growth abnormalities due to disruption of calcium regulation. Noise stress appears most often to be particularly damaging to females.

Animals susceptible to increased noise levels generally increase vigilance, hide or retreat thus spending less time foraging. If it is considered that anthropogenic noise is often accompanied by environmental constraints that can decrease food availability, this could cause decrease weight and condition loss over an extended period of time.

During stress reactions, the heart contracts more rapidly with vasoconstriction occurring throughout much of the body so that blood can deliver oxygen needed for flight or fight responses. However, frequent or long-term expression of these may have adverse effects on the health of the animal.

Chronic noise exposure, often accompanied by excess light, has been associated with depression and aggression. It is thus expected that exposure to chronic noise levels could alter behavioural interactions and population dynamics. The immune system can also be affected with reduced immunoglobin levels, decreased number of T-cells and a decrease in phagocytic activity. Environmental noise is known to impact expression of several genes, especially in the brain, where the release of free radicals from cochlear reactive oxygen species cause damage to the Dynamic Neuromuscular Stabilization system, proteins and lipids. However, it is important to note that many animals may habituate to stressors over time and that some types and levels of noise may enhance or play an important part in development.

Dust Impact on Animals

The effects of dust are difficult to determine since dust composition can vary tremendously and the composition will determine if it is potentially harmful. Furthermore, most studies have been conducted in controlled environments on domestic livestock. However, the effect of dust and airborne microorganisms on the health of man and animals cannot be separated allowing for deductions to be made. It is accepted that the diameter of particles determines how deeply they can penetrate the respiratory tract. The impacts can be described as mechanical, chemical, infectious allergic and toxic. Dust in the air can add significant burden to the respiratory tract of animals and must be considered in context of known respiratory disease patterns. However, inhalation of dust generally causes an overloading of clearance mechanisms in the respiratory passages which facilitates the beginning of infections. High dust concentrations have a general performance-reducing effect.

Environmental Pollution

It is expected that the influx of contractors and associated labour will be accompanied by urban behaviour where disposal and packaging products will be discarded without consequence to the environment. Furthermore, it is anticipated that other human waste and debris can be harmful to wildlife. Ingestion of especially plastic products will be extremely harmful to some species that is not as selective in their feeding behaviour. On-site waste and sanitary management measures stipulated in the EMPr will need to be implemented.

Veld Fires

Undesirable fires will be a matter of concern since these can have a devastating effect on any wildlife ranch or farm where not only will resources be destroyed, requiring supplementary feeding, but animals can also die. Run-away fires will not only have a regional affect but may have far reaching consequences on a broader scale.

Security

Poaching of wildlife, especially rare and endangered wildlife species will be a matter of concern. Security measures will be required on-site and security efforts implemented by wildlife ranchers and farmers may need to be intensified during the MCWAP-2A construction phase. Operation and management inspections will only be conducted by prior arrangement with the property owners after completion of construction and rehabilitation of the servitude area. All personnel must wear clearly identifiable identification and be in possession of legal documentation stating objectives for entering a property. It is furthermore recommended that all vehicles display decals for easy identification.

12.9.4 Impact Assessment

Refer to **Section 13.11**for the results from the impact assessment from this study.

12.9.5 Analysis of Alternatives

Refer to **Section 14.4** for the results from the analysis of the project alternatives.

12.9.6 Conclusions

Based on consultation with IAPs and observations in the field, the main concerns regarding the proposed MCWAP-2A is the effects on wildlife such as the loss of habitat, re-planning of a management strategy, moving camp breeding systems, translocation of game, reduced stocking rates and the requirement for supplementary feeding. Wildlife ranches dependant on eco-tourism and hunting in generating income will also be adversely affected by the construction due to high noise levels from earth moving excavations, blasting and other construction activities. Infrastructural losses and economic viability of some wildlife enterprises will also be severely compromised. Furthermore, wildlife and property security will need to be improved in an attempt to curb poaching activities and losses of rare and expensive wildlife species.

In implementing some of the mitigation measures contained in the Wildlife Impact Assessment Report it is evident that compensation to and close collaboration with property owners will be required to achieve the desired mitigation required for successful implementation the proposed MCWAP-2A.

Evaluation of the proposed MCWAP-2A WTI indicated that the noise generated by construction of the balancing dam, desilting works and high-lift pumping station close to Thabazimbi will adversely affect the land-use options applied on Hampton 320 KQ, where eco-tourism and hunting are the main revenue generators. It is recommended that affected parties be informed in writing of construction progress and that they be warned well in advance (require 12 months' notice) of impending disruption. Pre-emptive action can then be taken by the affected parties by re-scheduling activities or cancelling bookings.

Least impact is expected following the Central Route from the balancing dam all the way to the railway line since Alternative A1 and A2 are more disruptive to wildlife farms and ranches located adjacent to these routes. Least impact is expected following the existing powerlines across Paarl

124 KQ. The Central Route from Paarl 124 KQ follows a servitude road that can be exploited in reducing the impact on affected properties. However, both Buffelsvley 127 KQ and Karoobult 126 KQ are wildlife farms that will require that internal fence-lines on the properties be moved to achieve the desired buffer zone from construction activities. Limited hunting is conducted on these two properties. Reduced impact is also observed on Zondagskuil 130 KQ and Diepkuil 135 KQ, both wildlife ranches with limited hunting operations. Alternative C is also considered as a viable option in reaching the railway line corridor with little additional impact on wildlife.

Following the Central Route along the railway line is considered least impact on wildlife and wildlife enterprises. Although some wildlife farming (breeding camps) are located adjacent to the railway line and will invariably be impacted by the proposed pipeline construction, and the recommended mitigation measures will reduced the perceived impacts.

Rietfontein 820 KQ, Inkerman 10 KQ, and Groenland 397 KQ will be affected since revenue is mainly generated from international hunting. Where it is not possible to implement phase development and avoidance measures during the peak hunting seasons, compensation for loss of income due to cancellation of bookings may be the only alternative. Mabulskop 406 LQ is a wildlife farm with infrastructure located adjacent to the railway line. The existing breeding camps may have to be moved or the animals relocated to facilities further away from the proposed MCWAP-2A construction site. Camps systems may require re-design and translocation of wildlife to areas were impacts will be reduced. The farm Rooipan 357 LQ is a newly developed eco-tourism and hunting concern that will be adversely affected by the proposed MCWAP-2A. The proposed Alternative D3 also impacts on the farm, potentially exacerbating the situation and effecting economic viability of the enterprise. Further consideration of the Alternative D3 pipeline route is not recommended since any development along this road is associated with complications. Not only will infrastructural development be affected (main road to Steenbokpan), but a number of structures will have to be demolished. Furthermore, not only is a wetland is present on Leliefontein 672 LQ but Eskom pylons are erected on both sides of the road, less than 50 m from the boundary fence on Zandheuvel 356 LQ, requiring deviation from the proposed route. The presence of the Kuche Safaris hunting operation, with associated structures on Schuldpadfontein 326 LQ will require that the running concern be bought out, since economic viability will be severely compromised. All infrastructural development on Kuche Safaris is adjacent to the road and current delineation of the proposed pipeline will require that most structures be demolished. The property is too small (approximately 400 ha) for further development. Moving the pipeline corridor to the other side of the road is also not considered a suitable alternative since another homestead is also located directly next to the road. The Alternative D1 (and D4) and D2 routes are considered more viable with fewer challenges for the proposed MCWAP-2A.

12.10 Hartbeespoort Dam Specialist Opinion

A summary of the Hartbeespoort Dam Specialist Opinion (Horizon Environmental Consulting, 2018a), as contained in **Appendix I8**, follows.

12.10.1 Details of the Specialist

The details of the specialist that undertook the Hartbeespoort Dam Specialist Opinion follow.

Organisation:	Horizon Environmental Consulting
Name:	Mike Howard
Qualifications:	BSc (Honours)
Affiliation (if applicable):	International Association of Impact Assessments, South Africa

12.10.2 Objectives of the Study

The focus of this study is the impact of the implementation of the MCWAP-2A on the limnology of Hartbeespoort Dam and specifically potential consequences of the impoundment having variable water levels during certain parts of the year.

12.10.3 Methodology

The approach used was based on an assessment of the current status of Hartbeespoort Dam, identification of the type of impacts that can occur and thereafter an evaluation of the possible impacts of the MCWAP-2A on the impoundment.

12.10.4 Key Findings of the Study

Hartbeespoort Dam lies at the confluence of the Crocodile and Magalies Rivers. The full supply capacity is 195 million m^3, and covers an area of 20 km^2. The maximum depth of the impoundment is 32,6 m and the average depth is 9,6 m. The catchment area of the dam is 4 100 km^2 and drains the predominantly urban areas of Johannesburg, Pretoria and Krugersdorp

Hartbeespoort Dam is a warm hypertrophic, monomictic impoundment. It is prone to periodic massive blooms of cyanobacteria which forms dense scums on the surface of the impoundment. At times the impoundment is covered by dense stands of Water Hyacinth (*Eichornia crassipes*). The primary reason for the hypertrophic conditions in the impoundment is the influx of nutrients from WWTWs in its catchment, raw sewage and agricultural runoff.

The following aspects of Hartbeespoort Dam were assessed with regards to the potential impact of MCWAP-2A and the predicted fluctuating water levels:
1. Overall water balance and morphometry;
2. Water Quality;
3. Primary Production; and

4. Macrophytes.

The findings of the impact assessment are presented in **Section 13.8.7**.

12.10.5 Conclusions

While there were no specific measures identified to mitigate the impacts of MCWAP-2A on Hartbeespoort Dam, general catchment measures were recommended.

13 IMPACT ASSESSMENT

13.1 Overview

13.1.1 General

This section focuses on the pertinent environmental impacts that could potentially be caused by the proposed MCWAP-2A WTI infrastructure during the pre-construction, construction and operational phases of the project.

Note that an 'impact' refers to the change to the environment resulting from an environmental aspect (or activity), whether desirable or undesirable. An impact may be the direct or indirect consequence of an activity.

Impacts were identified as follows:

- An appraisal of the project activities and components;
- Impacts associated with listed activities contained in GN No. R. 983, R. 984 and R. 985 of 4 December 2014, as amended, for which authorisation has been applied for;
- An assessment of the receiving biophysical, social, economic and built environment;
- Findings from specialist studies;
- Issues highlighted by environmental authorities; and
- Comments received during public participation from IAPs.

13.1.2 Impacts associated with Listed Activities

As mentioned, the project requires authorisation for certain activities listed in the 2014 EIA Regulations (as amended), which serve as triggers for the environmental assessment process. The potential impacts associated with the key listed activities are broadly stated in **Table 45**.

Table 45: Potential Impacts associated with the key listed activities

Listed Activities	Potential Impact Overview
GN No. R. 983 of 4 December 2014 (Listing Notice 1)	
GN No. R.983 – Activity no. 9: *The development of infrastructure exceeding 1000 metres 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;* *excluding where-* *(a) such infrastructure is for bulk transportation of water or storm water or storm water drainage inside a road reserve; or* *(b) where such development will occur within an urban area.*	• Impacts associated with the footprint of the physical infrastructure (proposed water pipeline). • Effects to resource quality (i.e. flow, in-stream and riparian habitat, aquatic biota and water quality) associated with traversing or working in close proximity to watercourses. • Potential loss of sensitive environmental features (e.g. heritage resources, sensitive fauna and flora species). • Visual and socio-economic impacts during construction. • Traffic disruptions (road crossings,

Listed Activities	Potential Impact Overview
	construction traffic). • Land acquisition - securing of servitude.
GN No. R.983 – Activity no. 12: *The development of -* *(i) dams or weirs, where the dam or weir, including infrastructure and water surface area, exceeds 100 square metres; or* *(ii) infrastructure or structures with a physical footprint of 100 square metres or more;* *where such development occurs -* *(a) within a watercourse;* *(b) in front of a development setback; or* *(c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse; -* *Excluding -* *(aa) the development of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour;* *(bb) where such development activities are related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies;* *(cc) activities listed in activity 14 in Listing Notice 2 of 2014 or activity 14 in Listing Notice 3 of 2014, in which case that activity applies;* *(dd) where such development occurs within an urban area;* *(ee) where such development occurs within existing roads, road reserves or railway line reserves; or* *(ff) the development of temporary infrastructure or structures where such infrastructure or structures will be removed within 6 weeks of the commencement of development and where indigenous vegetation will not be cleared.*	• Impacts associated with the footprint of the physical infrastructure within 32 m of a watercourse – abstraction weir, gauging weirs, access roads and pipeline. • Adverse effects to resource quality (i.e. flow, in-stream and riparian habitat, aquatic biota and water quality) associated with working in-stream and alongside watercourses. • Inundation of instream habitat as a result of the abstraction weir's backwater effect. • Loss of riparian and instream vegetation within construction domain. • Alteration of flow regime by the weir structures. • The abstraction weir and gauging weirs will act as instream barriers that will prevent the migration of aquatic biota. • The abstraction weir will serve as a morphological modification and the backwater created by the structure will change the affected upstream river reach from a lotic to more of a lentic ecosystem. This will result in changes to the aquatic community structure and remove certain habitats from potential utilisation; • Destabilisation of affected watercourses. • Potential loss of sensitive environmental features (e.g. heritage resources, sensitive fauna and flora species). • Visual impacts. • Reduction in water quality of receiving watercourses due to improper management of storm water, hazardous material and sanitation.
GN No. R.983 – Activity no. 13: *The development of facilities or infrastructure for the off-stream storage of water, including dams and reservoirs, with a combined capacity of 50000 cubic metres or more, unless such storage falls within the ambit of activity 16 in Listing Notice 2 of 2014.*	• Impacts linked to the footprint of the balancing dam, BPR and OR. • Findings of geotechnical investigations to be considered and recommendations to be implemented. • Management of spoil material to be created by earthworks. • Socio-economic impacts associated with construction activities.
GN No. R.983 – Activity no. 14: *The development of facilities or infrastructure, for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 cubic metres or more but not exceeding 500 cubic metres.*	• Pollution of bio-physical environment and risks posed to human health through poor practices associated with onsite storage of dangerous goods during construction phase.
GN No. R.983 – Activity no. 19: *The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse;* *but excluding where such infilling, depositing, dredging, excavation, removal or moving -* *(a) will occur behind a development setback;* *(b) is for maintenance purposes undertaken in accordance with a maintenance management plan;* *(c) falls within the ambit of activity 21 in this Notice, in which case that activity applies;* *(d) occurs within existing ports or harbours that will not increase the development footprint of the port or harbour; or* *(e) where such development is related to the development of a port or*	• Construction activities (including bulk earthworks) to be undertaken within watercourses for physical infrastructure – abstraction weir, gauging weirs, access roads and pipeline. • Adverse effects to resource quality (i.e. flow, in-stream and riparian habitat, aquatic biota and water quality) associated with working in-stream and alongside the watercourse. • Destabilisation of affected watercourses.

Listed Activities	Potential Impact Overview
harbour, in which case activity 26 in Listing Notice 2 of 2014 applies.	
GN No. R.983 – Activity no. 24: *The development of a road -* *(i) for which an environmental authorisation was obtained for the route determination in terms of activity 5 in Government Notice 387 of 2006 or activity 18 in Government Notice 545 of 2010; or* *(ii) with a reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 metres;* *but excluding a road -* *(a) which is identified and included in activity 27 in Listing Notice 2 of 2014;* *(b) where the entire road falls within an urban area; or* *(c) which is 1 kilometre or shorter.*	• Impacts associated with access roads to the various sites (abstraction works, balancing dam, desilting works, pumping stations, BPR, OR and other various work fronts along pipeline, etc.). • Potential loss of sensitive environmental features (e.g. heritage resources, sensitive fauna and flora species). • Traffic disruptions during construction. • Impacts to watercourses at crossings.
GN No. R.983 – Activity no. 27: *The clearance of an area of 1 hectares or more, but less than 20 hectares of indigenous vegetation, except where such clearance of indigenous vegetation is required for-* *(i) the undertaking of a linear activity; or* *(ii) maintenance purposes undertaken in accordance with a maintenance management plan.*	• Clearance of large areas associated with the construction footprint of the Balancing Dam, BPR, OR, laydown areas and general site establishment. • Potential loss of sensitive environmental features (e.g. heritage resources, sensitive fauna and flora species). • Visual impacts. • Soil destabilisation and subsequent erosion. • Proliferation of alien and invasive species. • Loss of agricultural land. • Socio-economic impacts associated with construction activities.
GN No. R.983 – Activity no. 28: *Residential, mixed, retail, commercial, industrial or institutional developments where* *such land was used for agriculture, game farming, equestrian purposes or afforestation on or after 01 April 1998 and where such development:* *(i) will occur inside an urban area, where the total land to be developed is bigger than 5 hectares; or* *(ii) <u>will occur outside an urban area, where the total land to be developed is bigger than 1 hectare</u>;* *excluding where such land has already been developed for residential, mixed, retail, commercial, industrial or institutional purposes.*	
GN No. R.983 – Activity no. 30: *Any process or activity identified in terms of section 53(1) of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004).*	Potential loss of sensitive fauna and flora species.
GN No. R.983 – Activity no. 56: *The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre-* *(i) where the existing reserve is wider than 13,5 meters; or* *(ii) where no reserve exists, where the existing road is wider than 8 metres;* *excluding where widening or lengthening occur inside urban areas.*	• Impacts associated with the widening or lengthening of existing roads to create access roads. • Potential loss of sensitive environmental features (e.g. heritage resources, sensitive fauna and flora species). • Traffic disruptions. • Impacts to watercourses at crossings.
GN No. R.983 – Activity no. 67: *Phased activities for all activities -* *(i) listed in this Notice, which commenced on or after the effective date of this Notice or similarly listed in any of the previous NEMA notices, which commenced on or after the effective date of such previous NEMA Notices;* *excluding the following activities listed in this Notice-* *17(i)(a-d);* *17(ii)(a-d);* *17(iii)(a-d);* *17(iv)(a-d);* *17(v)(a-d);* *20;* *21;* *22;* *24(i);* *29;* *30;* *31;* *32;*	• Impacts associated with phased activities. • Cumulative impacts.

Listed Activities	Potential Impact Overview
34; 54(i)(a-d); 54(ii)(a-d); 54(iii)(a-d); 54(iv)(a-d); 54(v)(a-d); 55; 61; 64; and 65; or (ii) listed as activities 5, 7, 8(ii), 11, 13, 16, 27(i) or 27(ii) in Listing Notice 2 of 2014 or similarly listed in any of the previous NEMA notices, which commenced on or after the effective date of such previous NEMA Notices; where any phase of the activity was below a threshold but where a combination of the phases, including expansions or extensions, will exceed a specified threshold	
GN No. R. 984 of 4 December 2014 (Listing Notice 2)	
GN No. R.984 – Activity no. 4: 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 more than 500 cubic metres.	Pollution of bio-physical environment and risks posed to human health through poor practices associated with onsite storage of dangerous goods during construction phase.
GN No. R.984 – Activity no. 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, excluding - (i) activities which are identified and included in Listing Notice 1 of 2014; (ii) activities which are included in the list of waste management activities published in terms of section 19 of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) in which case the National Environmental Management: Waste Act, 2008 applies; (iii) the development of facilities or infrastructure for the treatment of effluent, polluted water, wastewater or sewage where such facilities have a daily throughput capacity of 2 000 cubic metres or less; or (iv) where the development is directly related to aquaculture facilities or infrastructure where the wastewater discharge capacity will not exceed 50 cubic metres per day.	Impacts associated with the scouring of sediment back to the Crocodile River from the desilting works in terms of the NWA.
GN No. R.984 – Activity no. 11: The development of facilities or infrastructure for the transfer of 50 000 cubic metres or more water per day, from and to or between any combination of the following - (i) water catchments; (ii) water treatment works; or (iii) impoundments; excluding treatment works where water is to be treated for drinking purposes.	• Impacts associated with constructing new infrastructure to allow for transfer of water from the Crocodile River (West) to Lephalale. • Reduction in volume of water available in the Crocodile River (West) system. • Impacts to water users (including aquatic environment) downstream of the abstraction weir. • Impacts associated with the release of the raw water conveyed and stored within the system, which is water of poor quality from the Crocodile River, into the Matlabas River and other watercourses from scour valves during the maintenance of the pipeline and reservoirs. • Impacts to hydrological and sediment regimes of the Crocodile River (West).
GN No. R.984 – Activity no. 15: The clearance of an area of 20 hectares or more of indigenous vegetation, excluding where such clearance of indigenous vegetation is required for- (i) the undertaking of a linear activity; or (ii) maintenance purposes undertaken in accordance with a maintenance management plan.	• Clearance of large areas associated with the construction footprint of the Balancing Dam, BPR, OR, laydown areas and general site establishment. • Potential loss of sensitive environmental features (e.g. heritage resources, sensitive fauna and flora species).

Listed Activities	Potential Impact Overview
	• Visual impacts. • Soil destabilisation and subsequent erosion. • Proliferation of alien and invasive species. • Loss of agricultural land. • Socio-economic impacts associated with construction activities.
GN No. R.984 – Activity no. 16: *The development of a dam where the highest part of the dam wall, as measured from the outside toe of the wall to the highest part of the wall, is 5 metres or higher or where the highwater mark of the dam covers an area of 10 hectares or more.*	• Impacts to water users (including aquatic environment) downstream of the abstraction weir. • Impacts to hydrological and sediment regimes of the Crocodile River (West). • Alteration of current biophysical functioning of the Crocodile River (West). • Interruptions to river continuum. • Impacts to migration of aquatic biota. • Impacts to low level mine haul road and railway bridge crossing upstream of the abstraction weir.
<u>GN No. R. 985 of 4 December 2014 (Listing Notice 3)</u>	
GN No. R.985 – Activity no. 2(e)(ii): *The development of reservoirs, excluding dams, with a capacity of more than 250 cubic metres.*	Possible occurrence of sensitive biodiversity features at affected areas. The area earmarked for the Balancing Dam has been disturbed agriculture.
GN No. R.985 – Activity no. 4(e)(i): *The development of a road wider than 4 metres with a reserve less than 13,5 metres.*	Impacts associated with building access roads through sensitive, threatened or protected ecosystems.
GN No. R.985 – Activity no. 10(e)(i): *The development and related operation of facilities or infrastructure for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of 30 but not exceeding 80 cubic metres.*	Pollution of sensitive, threatened or protected ecosystems through poor practices associated with onsite storage of dangerous goods.
GN No. R.985 – Activity no. 12(e)(i – ii): *The clearance of an area of 300 square metres or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan.*	• The clearance of large tracts of indigenous vegetation. • Potential loss of sensitive fauna and flora species.
GN No. R.985 – Activity no. 14(e)(i): *The development of—* *(i) dams or <u>weirs</u>, where the dam or weir, including infrastructure and water surface area exceeds 10 square metres; or* *(ii) infrastructure or structures with a physical footprint of 10 square metres or more;* *where such development occurs—* *(a) within a watercourse;* *(b) in front of a development setback; or* *(c) if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse;* *excluding the development of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour.*	Impacts to sensitive, threatened or protected ecosystems associated with infrastructure within watercourses / within 32 m from watercourses, including abstraction weir, gauging weirs, access roads and pipeline. Effects to resource quality (i.e. flow, in-stream and riparian habitat, aquatic biota and water quality) associated with working in-stream and alongside the watercourses.
GN No. R.985 – Activity no. 18(e)(i): *The widening of a road by more than 4 metres, or the lengthening of a road by more than 1 kilometre.*	Impacts to sensitive, threatened or protected ecosystems associated with access roads to the various sites (construction and operational phases).
GN No. R.985 – Activity no. 23(e)(i): *The expansion of -* *(i) dams or weirs where the dam or weir is expanded by 10 square metres or more; or* *(ii) infrastructure or structures where the physical footprint is expanded by 10 square metres or more;* *where such expansion occurs -* *(a) within a watercourse;* *(b) in front of a development setback adopted in the prescribed manner; or* *(c) if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse;*	Impacts to sensitive, threatened or protected ecosystems associated with upgrade of existing bridge(s) along access road(s). Effects to resource quality (i.e. flow, in-stream and riparian habitat, aquatic biota and water quality) associated with working in-stream and alongside the watercourses.

Listed Activities	Potential Impact Overview
excluding the expansion of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour.	
GN No. R.985 – Activity no. 26: *Phased activities for all activities -* *i. listed in this Notice and as it applies to a specific geographical area, which commenced on or after the effective date of this Notice; or* *ii. similarly listed in any of the previous NEMA notices, and as it applies to a specific geographical area, which commenced on or after the effective date of such previous NEMA Notices -* *where any phase of the activity was below a threshold but where a combination of the phases, including expansions or extensions, will exceed a specified threshold; -* *excluding the following activities listed in this Notice—* *7;* *8;* *11;* *13;* *20;* *21; and* *24.*	• Impacts associated with phased activities. • Cumulative impacts.

13.1.3 Issues raised by Environmental Authorities and IAPs

The issues raised by authorities (both regulatory and commenting) and IAPs during meetings and contained in correspondence received to date during the execution of the EIA are captured and addressed in the Comments and Responses Report (refer to **Appendix M**).

The consolidated issues raised by IAPs during the Announcement and Scoping phases of the project, as contained in the Comments and Response Report (**Appendix M**), have been succinctly grouped into the following main categories (*Note: please refer to the Comments and Response Report for a comprehensive and accurate representation of the issues raised by IAPs*):

- Alternatives-
  - Alternatives to the weir option (e.g. location of the Vlieëpoort weir);
  - Realignment of the pipeline from the dam to Lephalale;
  - Motivation for the Vlieëpoort weir;
- Water use –
  - Impacts to existing water users;
  - Increase in cost of water;
  - Impacts to existing extraction points and weirs;
  - Water allocation process;
  - Institutional arrangements;
- Socio-economic impacts –
  - Benefits to local suppliers of construction material (e.g. local quarry site);
  - The project may be a catalyst for development of Lephalale area;
  - Land acquisition process;
  - Municipal revenue generation;
  - Compensation;

- Tourism potential of the dam;
- Agriculture –
  - Loss of agricultural land;
  - Impacts to existing farming operations;
  - Impacts to agricultural infrastructure (e.g. furrows);
  - Impacts to viability of existing farms;
  - Compensation;
  - Movement of livestock;
- Terrestrial ecology –
  - Impacts to sensitive species;
  - Relocation of sensitive species;
  - Rehabilitation of affected areas;
- Freshwater and estuarine ecology –
  - Consideration of EWR;
- Proposed Irrigation Scheme –
  - Timing;
  - EIA process and lead authority;
  - Institutional arrangements;
  - Benefits to emerging farmers;
  - Cumulative impacts;
- Traffic, road network and access –
  - Impacts to existing roads used by local community;
  - Air pollution of vehicles and traffic;
- Existing infrastructure –
  - Impacts to existing infrastructure (power line, telephone line, roads, pipelines and pumps);
- Historical and Cultural Features –
  - Recording of graves;
- Public participation –
  - Involvement of the local community; and
  - Suggestions for additional venue to be used for review period of EIA.
- Electrical requirements –
  - Electrical requirements of project; and

These issues received further attention during the investigations in the EIA phase, including the environmental and technical specialist studies.

13.1.4 Environmental Activities

In order to understand the impacts related to the project it is necessary to unpack the activities associated with the project life-cycle, as done in the sub-sections to follow.

13.1.4.1 Project Phase: Pre-construction

The main project activities as well as high-level environmental activities undertaken in the pre-construction phase are listed in **Table 46**.

Table 46: Simplified List of Activities associated with Pre-construction Phase

Project Phase: Pre-construction
Project Activities
• Negotiations and agreements with the affected landowners, tenants, occupiers of land, stakeholders and authorities
• Initiate legal process required for land acquisition
• Detailed engineering design
• Detailed geotechnical investigations, including geophysical investigations
• Survey and mark construction servitude
• Survey and map topography for determination of post-construction landscape, rehabilitation and shaping (where necessary)
• Possible removal of trees within construction servitude
• Procurement process for Contractors
• Review Contractor's method statements (as relevant)
• Selective improvements of access roads to facilitate the delivery of construction plant and materials
• Arrangements for accommodation of construction workers (off site)
• The building of a site office and ablution facilities
• Confirmation of arrangements with individual landowners / tenants / occupiers of land for managing and mitigating issues such as fencing and gate dimensions for traversing servitude, traversing patterns of livestock / game over servitude, access to livestock / game drinking points, security, opening and closing of gates and access to private property
• Confirmation of the location and condition of all buildings, assets and structures within the servitude
• Determining and documenting the road conditions for all identified haul roads
• Fencing of construction servitude
• Conduct detailed hydraulic analysis to determine the optimum positioning of the scour valves
High Level Environmental Activities
• Diligent compliance monitoring of the EMPr, Environmental Authorisation and other relevant environmental legislation
• Search, rescue and relocation of red data, protected and endangered species, heritage resources and graves (based on area of influence of the construction activities). Develop Search, Rescue and Relocation Management Plan, based on findings of walk through survey
• Develop Environmental Monitoring Programme (air quality, water quality, noise, traffic, social)
• Conduct further baseline environmental studies for Environmental Monitoring Programme
• Barricading of sensitive environmental features (e.g. graves)
• Obtain permits for impacts to species of conservation concern
• Obtain permits if heritage resources are to be impacted on and for the relocation of graves
• Establish Environmental Monitoring Committee (EMC)
• On-going consultation with IAPs
• Other activities as per EMPr

13.1.4.2 Project Phase: Construction

The main project activities as well as high-level environmental activities undertaken in the construction phase are listed in **Table 47**.

Table 47: Simplified List of Activities associated with Construction Phase

Project Phase: Construction
Project Activities
• Site establishment
• Relocation of existing structures and infrastructure
• Prepare access roads
• Establish construction laydown areas
• Bulk fuel storage
• Delivery of construction material
• Transportation of equipment, materials and personnel
• Storage and handling of material
• Construction employment
• Site clearing (as necessary)
• Excavation
• Blasting
• Establishment and operation of crusher
• Establishment and operation of batching plant
• Establishment and operation of materials testing laboratory
• Concrete Works
• Steel works
• Mechanical and Electrical Works
• Temporary river diversions for abstraction weir, gauging weirs and pipeline crossings
• Electrical supply
• Pipe delivery, offloading and stringing
• Construction of pipeline
• Construct air and scour valves
• Construct access chambers
• Install final Cathodic Protection measures and AC mitigation measures
• Install pipeline markers
• Construction of abstraction weir and low-lift pumping station
• Construction of balancing dam, sedimentation works and high-lift pumping station
• Construction of BPR
• Construction of OR
• Construction of gauging weirs
• Cut and cover activities
• Stockpiling (sand, crushed stone, aggregate, etc.)
• Waste and wastewater management
High Level Environmental Activities
• Diligent compliance monitoring of the EMPr, Environmental Authorisation and other relevant environmental legislation
• Ongoing search, rescue and relocation of red data, protected and endangered species, medicinal plants, heritage resources and graves (based on area of influence of the construction activities) – permits to be in place
• Implement Environmental Monitoring Programme (air quality, water quality, noise, traffic, social)
• Reinstatement and rehabilitation of construction domain (as necessary)
• Convene EMC Meetings
• On-going consultation with IAPs

Project Phase: Construction
• Other activities as per EMPr

13.1.4.3 Project Phase: Operation

The main project activities as well as high-level environmental activities undertaken in the operational phase are listed in **Table 48**.

Table 48: Simplified List of Activities associated with Operational Phase

Project Phase: Operation
Project Activities
• Maintenance of infrastructure
• Comply with Operation and Maintenance Manual
• Adhere to Operating Rule
• Operation of scheme
• Implement and sustain the River Management System
• Abstraction weir - o Low flows over the stepped overspill crest of the weir will be measured and become part of the data informing the River Management System. This will allow for the monitoring of the flow downstream thereby allowing verification that the minimum downstream water requirements are met.
• Low-lift pumping station - o Monitoring of river releases and flows o Monitoring of the water level over the abstraction weir o Monitoring of the "general health" of all the mechanical & electrical equipment o Monitoring of all security and control access o Monitoring of the flow out of the low-lift pumping station o Control of gravel trap radial gate and pump bay sluice gates o Control of automatic trash rack cleaning system o On/Off control of individual submersible pumps in various configurations to deliver a specific total abstraction rate
• Desilting Works - o Monitoring of silt levels o Monitoring of the "general health" of all the mechanical & electrical equipment o Control of inlet manifold valves o Control of outlet sluice gates/valves o Control of flushing sluice gates/valves o Systematic removal or discharge of silt from infrastructure
• Balancing Dam - o Monitoring of flow into reservoir o Monitoring of flow out of reservoir o Monitoring of water levels in all compartments o Monitoring of leakage detection system o Monitoring of all security and control access o Monitoring of the "general health" of all the mechanical & electrical equipment o Control of inlet manifold valves o Control of outlet valves o Control of silt flushing valves

Project Phase: Operation
• Bulk Water Pipeline - o Create maintenance access track along pipeline servitude o Conduct routine maintenance inspections of the project infrastructure o Monitor cathodic protection system o Scouring of pipeline, where the water conveyed and stored within this system will be released into the receiving watercourses along the alignment from scour valves o Undertake maintenance and repair works, where necessary
• On-going consultation with directly affected parties
High Level Environmental Activities
• Satisfy requirements in terms of EWR and Existing Lawful Users
• Implement and sustain the River Management System
• On-going consultation with IAPs
• Other activities as per EMPr for Operational Phase

13.1.5 Environmental Aspects

Environmental aspects are regarded as *those components of an organisation's activities, products and services that are likely to interact with the environment and cause an impact*.

The environmental aspects that have been identified for the proposed MCWAP-2A WTI, which are linked to the project activities, are provided in **Table 49**. Note that only high level aspects are provided.

Table 49: Environmental Aspects associated with Project Life-Cycle

Project Phase: Pre-construction
Environmental Aspects
• Inadequate consultation with landowners / tenants / occupiers of land
• Inadequate environmental and compliance monitoring
• Poor construction site planning and layout
• Land occupancy by temporary buildings, provisional on-site facilities and storage areas
• Inaccurate pre-construction environmental walk through survey (including search and rescue)
• Absence of relevant permits (e.g. for protected trees, heritage resources)
• Lack of barricading of sensitive environmental features
• Poor waste management
• Absence of ablution facilities

Project Phase: Construction
Environmental Aspects
• Inadequate consultation with landowners / tenants / occupiers of land
• Inadequate environmental and compliance monitoring
• Lack of environmental awareness creation
• Indiscriminate site clearing
• Poor site establishment
• Poor management of access and use of access roads

Project Phase: Construction
• Inadequate provisions for working on steep slopes
• Poor transportation practices
• Poor fencing arrangements
• Erosion
• Disruptions to existing services
• Disturbance of topsoil
• Poor management of excavations
• Inadequate storage and handling of material
• Inadequate storage and handling of hazardous material
• Poor maintenance of equipment and plant
• Poor management of labour force
• Pollution from ablution facilities
• Inadequate management of construction camp
• Poor waste management practices – hazardous and general solid, liquid
• Wastage of water
• Disturbance to landowners / tenants / occupiers of land
• Poor management of pollution generation potential
• Damage to significant flora (if encountered)
• Damage to significant fauna (if encountered)
• Influence to resource quality of the Crocodile River (West) and its tributaries from river diversions, in-stream works and activities in the riparian zones
• Environmental damage where drainage lines are crossed
• Environmental damage of sensitive areas
• Disruption of archaeological and cultural features (if encountered)
• Poor reinstatement and rehabilitation

Project Phase: Operation
Environmental Aspects
• Inadequate consultation with landowners / tenants / occupiers of land
• Inadequate environmental and compliance monitoring
• Inadequate monitoring and management of abstractions from, and the river flow in, the Crocodile River (West) between Hartbeespoort Dam and Vlieëpoort Weir, the Moretele River from Klipvoor Dam to the confluence with the Crocodile River (West), the stretch of Elands River from Vaalkop Dam to Crocodile confluence, and also the required flow past Vlieëpoort
• Inadequate management of access, routine maintenance and maintenance works
• Inadequate management of vegetation
• Not satisfying the requirements in terms of EWR and Existing Lawful Users
• Scouring of poor quality sediment from desilting works back to the Crocodile River (West)
• Poor scouring practices for bulk water pipeline
• Inadequate management of light pollution and noise from pumping stations
• Failure to comply with health, safety and environmental specifications
• Downstream erosion

13.1.6 *Potential Significant Environmental Impacts*

Note that it is not the intention of the impact assessment to evaluate all potential environmental impacts associated by the project's environmental aspects, but rather to focus on the potentially **significant** direct and indirect impacts identified during the Scoping phase and any additional issues uncovered during the EIA stage.

The potential significant environmental impacts associated with the project, as listed in **Table 50**, were identified through an appraisal of the following:

- The possible impacts identified and assessed as part of the Technical Feasibility Study;
- Project-related components and infrastructure (see **Section 9.2 – 9.7**);
- Operation of the system (see **Section 9.3.8**);
- Activities associated with the project life-cycle (i.e. pre-construction, construction, operation and decommissioning);
- Proposed alternatives to project components (see **Section 10**);
- Nature and profile of the receiving environment and potential sensitive environmental features and attributes (see **Section 11**);
- Findings from specialist studies (see **Section 12**);
- Understanding of direct and indirect effects of the project as a whole (see **Section 13**);
- Input received during public participation from authorities and IAPs (see **Section 15**); and
- Legal and policy context (see **Section 5**).

Table 50: Potentially Significant Environmental Impacts

Environmental Factor	Construction Phase Potential Issues / Impacts	Operational Phase Potential Issues / Impacts
Land Use	• Temporary loss of land used for agriculture and game farming within pipeline servitude. • Permanent loss of land at abstraction works, low-lift pumping station, balancing dam, desilting works, high-lift pumping station, BPR, OR and chambers. • Servitude restrictions. • Disturbances on game farms.	• Permanent loss of land at abstraction works, low-lift pumping station, balancing dam, desilting works, high-lift pumping station, BPR, OR and chambers. • Servitude restrictions and inspections. • Operation and maintenance functions. • Impacts to land use surrounding Hartbeespoort Dam due to fluctuating water levels.
Climate	• Emission of greenhouse gases during construction.	• Impacts of climate change on the yield and operation of the scheme.
Geology	• Blasting related impacts. • Sourcing of construction aggregate and associated impacts (e.g. borrow pits, haul roads). • Disposal of spoil material. • Unsuitable geological conditions – risks to structural integrity of infrastructure.	-

Environmental Factor	Construction Phase Potential Issues / Impacts	Operational Phase Potential Issues / Impacts
	• Significant work will be required to prepare the foundation for the abstraction weir.	
Geohydrology	• Potential disturbance of the aquifer from blasting. • Contamination of groundwater primary aquifer with water from more saline secondary aquifer as a result of blasting. • Potential contamination of groundwater during the construction stage. • Possible influence to groundwater flow as a result of trenching during construction.	• Possible pollution of the aquifer with water during the maintenance of the infrastructure. • Impacts to the recharge of the alluvial aquifer downstream of the abstraction weir, due to surface water and groundwater interactions.
Soil	• Soil erosion (e.g. steep terrain and instream works). • Soil contamination through poor construction practices and inadequate management of dangerous goods (e.g. fuel).	• Soil erosion (e.g. steep terrain and instream works).
Hydrology	• Temporary impacts to flow during the instream works associated with the construction of the weir and pipeline crossings.	• Alteration of flow regime by the weir structure. • Impact of the proposed Abstraction Works on flood levels and on infrastructure up- and downstream of the weir. • Reduction in the average levels of the upstream impoundments during the operation of the scheme.
Water Quality	• Sedimentation from instream works. • Water quality impacts due to spillages and poor construction practices.	• During the maintenance of the pipeline and reservoirs the raw water conveyed and stored within this system, which is water of poor quality from the Crocodile River, will be released into the Matlabas River and other watercourses from scour valves.
River Morphology	• The weir structure in the Crocodile River and the pipeline crossings at watercourses may lead to the alteration of the morphology of the watercourse (e.g. destabilisation of bed and banks of watercourses).	• Destabilisation of river structure due to inadequate reinstatement and rehabilitation.
Riparian Habitat	• Encroachment of construction activities into riparian zones / wetlands. • Inundation of instream habitat as a result of the weir's backwater effect. • Loss of riparian and instream vegetation within construction domain.	• Disturbances of riparian vegetation may lead to erosion and encroachment of exotic vegetation.
Wetlands and Pans	• Crossing of wetlands and pans by the pipeline and access roads • Inundation of wetlands as a result of the weir's backwater effect	• Destabilisation of wetlands due to inadequate reinstatement and rehabilitation. • Impacts to wetlands downstream of the abstraction point (surface-groundwater interactions).

Environmental Factor	Construction Phase Potential Issues / Impacts	Operational Phase Potential Issues / Impacts
Water Use	• Impacts to existing water users (e.g. sedimentation)	• Impact of the abstraction from the Crocodile River (West) and of the management of the system on the existing agricultural water users. • Water availability in the Crocodile River (West). • Impacts to recreational use at Hartbeespoort Dam due to fluctuating water levels.
Aquatic Ecology	• Disruptions to aquatic biota community due to water contamination, temporary alteration of flow and disturbance to habitat during construction (instream works).	• The abstraction weir and gauging weirs will act as instream barriers that will prevent the migration of aquatic biota. • The abstraction weir will serve as a morphological modification and the backwater created by the structure will change the affected upstream river reach from a lotic to more of a lentic ecosystem. This will result in changes to the aquatic community structure and remove certain habitats from potential utilisation. • Impairment of ecosystem functioning in Hartbeespoort Dam due to fluctuations in water levels.
Sediment Regime	• Sedimentation from instream works.	• Management of sediment at abstraction works to be stored and returned to the Crocodile River (West) during operational phase
Terrestrial Ecology - Flora	• Encroachment into CBAs and ESAs, which are important in terms of biodiversity, ecosystem functionality and ecological processes. • Vegetation will primarily be lost in areas that are to be cleared for the project infrastructure. The potential loss of significant flora species may occur. • Clearing of vegetation for construction purposes may result in the proliferation of exotic vegetation, which could spread beyond the construction domain.	• The establishment of trees within the pipeline servitude will not be allowed as roots may compromise the stability of the pipeline.
Terrestrial Ecology - Fauna	• Ecosystem disruption may occur where clearing is undertaken to allow for the construction of the project infrastructure. • Sections of the alternative pipeline routes traverse or pass in close proximity to enclosures where sensitive game is kept. • Fauna could be adversely affected through construction-related activities (noise, dust, light pollution, illegal poaching, and habitat loss). This is especially relevant to sensitive game species (including exotic game). • The construction servitude will	• Disruptions to game farms during operation and maintenance activities.

Environmental Factor	Construction Phase Potential Issues / Impacts	Operational Phase Potential Issues / Impacts
	minimise animal movement. This is particularly significant on smaller game farms or in instances where access to watering points will be affected. • Possible disturbance to the bat cave that is situated in the Mooivallei area during construction.	
Socio-economic Environment	• Loss of land (including structures and cultivated areas) through project infrastructure. • Loss of agricultural production. • Risk to game and livestock as a result of construction related hazards. • Loss of income in eco-tourism sector (hunting and game farming). • Potential damage to property (e.g. gates, fences, structures). • Servitude restrictions; • Use of local road network. • Safety and security. • Impact to visual quality and sense of place. • Nuisance from dust and noise. • Light pollution. • Influx of people seeking employment and associated impacts (e.g. foreign workforce, cultural conflicts, squatting, demographic changes, anti-social behaviour, and incidence of HIV/AIDS). • Reduction in property value. • If the projected development materialise the population and specifically the urban population of Lephalale will grow substantially.	• Use of local road network for operation and maintenance purposes. • Impact to visual quality and sense of place. • Provision of light at infrastructure may cause light pollution. • Inundation of a low level bridge due to the weir's backwater effect. • The pumping stations will be operating continuously and may cause noise pollution. • Cumulative impacts to properties that are already affected by existing linear infrastructure. • Impacts to smaller properties, where the servitude may affect the critical mass required to continue with the current land use. • The operating level of the Hartbeespoort Dam will fluctuate as per seasonal rains, with associated impacts to the surrounding recreational water users (active and passive).
Agriculture	• Loss of cultivated land within construction domain. • Loss of grazing land within construction domain. • Loss of stock watering points within construction domain. • Disruptions to farming operations as a result of construction-related use of existing access roads. • Loss of fertile soil through land clearance.	• Potential impacts to water users (and associated agro-economic impact from reduced crop and food production) downstream of the abstraction works on the Crocodile River. • Permanent loss of cultivated land due to physical infrastructure.
Historical and Cultural Features	• Heritage and cultural resources could be destroyed or damaged through construction activities.	-
Existing Structures & Infrastructure	• Risk of damaging existing services, infrastructure and structures during construction. • Disruptions to traffic on local road network during construction. This is associated with road crossings, where the pipeline route follows existing road alignments and as a result of general use of the roads by construction	• Impact of the proposed Abstraction Works on flood levels and on infrastructure up- and downstream of the weir. • Servitude restrictions.

Environmental Factor	Construction Phase Potential Issues / Impacts	Operational Phase Potential Issues / Impacts
	vehicles.	
Transportation	• Increase in traffic on the local road networks. • Develop temporary access and haul roads. • Risks to road users.	• Permanent access along the pipeline servitude will be required after construction.
Solid Waste	• Waste generated from site preparations (e.g. plant material). • Domestic waste. • Surplus and used building material. • Hazardous waste (e.g. chemicals, oils, soil contaminated by spillages, diesel rags). • Wastewater (sanitation facilities, washing of plant, operations at the batching plant, etc.). • Disposal of excess spoil material (soil and rock) generated as part of the bulk earthworks.	-
Aesthetics	• Visual quality and sense of place to be adversely affected by construction activities.	• High visibility of permanent infrastructure. • Loss of “sense of place”. • Section of cleared vegetation along access road. • Provision of light at infrastructure may cause light pollution. • Inadequate reinstatement and rehabilitation of construction footprint. • Visual impacts of lowered water levels at Hartbeespoort Dam.

The cumulative impacts are discussed in **Section 13.22**.

The findings of the specialists are of particular importance in terms of understanding the impacts of the project and managing these during the project life-cycle, as these studies focused on the significant environmental issues identified during the execution of the EIA. As can be seen from the various impact assessments performed by the specialists (see **Section 13**), there are a host of cross-cutting impacts that are addressed in a number of these studies, with particular reference to the land use, terrestrial ecology, wildlife and socio-economic effects of the project. The mitigation measures proposed by the specialists for these similar types of impacts are regarded as complementary and they are aligned with best practices and principles.

13.1.7 Impact Assessment Methodology

The impacts and the proposed management thereof are first discussed on a qualitative level and thereafter quantitatively assessed by evaluating the nature, extent, magnitude, duration, probability and ultimately the significance of the impacts (refer to methodology provided in **Table**

51). Where applicable, the impact assessments and significance ratings provided by the respective specialists are included.

The assessment considers impacts before and after mitigation, where in the latter instance the residual impact following the application of the mitigation measures is evaluated.

Table 51: Quantitative Impact Assessment Methodology

Nature (/Status)	The project could have the following impacts to the environment: • Positive; • Negative; or • Neutral.
Extent	• Local - extend to the site and its immediate surroundings. • Regional - impact on the region but within the province. • National - impact on an interprovincial scale. • International - impact outside of South Africa.
Magnitude	Degree to which impact may cause irreplaceable loss of resources. • Low - natural and social functions and processes are not affected or minimally affected. • Medium - affected environment is notably altered; natural and social functions and processes continue albeit in a modified way. • High - natural or social functions or processes could be substantially affected or altered to the extent that they could temporarily or permanently cease.
Duration	• Short term - 0-5 years. • Medium term - 5-11 years. • Long term - impact ceases after the operational life cycle of the activity either because of natural processes or by human intervention. • Permanent - mitigation either by natural process or by human intervention will not occur in such a way or in such a time span that the impact can be considered transient.
Probability	• Almost certain - the event is expected to occur in most circumstances. • Likely - the event will probably occur in most circumstances. • Moderate - the event should occur at some time. • Unlikely - the event could occur at some time. • Rare/Remote - the event may occur only in exceptional circumstances.
Significance	Provides an overall impression of an impact's importance, and the degree to which it can be mitigated. The range for significance ratings is as follows- 0 - Impact will not affect the environment. No mitigation necessary. 1 - No impact after mitigation. 2 - Residual impact after mitigation / some loss of populations and habitats of non-threatened species. 3 - Impact cannot be mitigated / exceeds legal or regulatory standard / increases level of risk to public health / extinction of biological species, loss of genetic diversity, rare or endangered species, critical habitat.

In the case of the specialist studies, some of the impact assessment methodologies deviated from the approach shown in **Table 51**. However, the quantitative basis for these specialist evaluations of the impacts to specific environmental features still satisfied the intention of the EIA.

13.1.8 Impact Mitigation

13.1.8.1 Mitigation Hierarchy

Impacts are to be managed by assigning suitable mitigation measures. According to DEAT (2006), the objectives of mitigation are to:

- Find more environmentally sound ways of executing an activity;
- Enhance the environmental benefits of a proposed activity;
- Avoid, minimise or remedy negative impacts; and
- Ensure that residual negative impacts are within acceptable levels.

Mitigation should strive to abide by the following hierarchy – (1) prevent; (2) reduce; (3) rehabilitate (or remediate); and/or (4) compensate for the environmental impacts.

The proposed mitigation of the impacts associated with the project includes specific measures identified by the technical team (including engineering solutions) and environmental specialists, stipulations of environmental authorities and environmental best practices.

Note that the mitigation measures in the subsequent sections are not intended to be exhaustive, but rather focus on the potentially significant impacts identified.

The EMPr (contained in **Appendix K**) provides a comprehensive list of mitigation measures for specific elements of the project, which extends beyond the impacts evaluated in the body of the EIA Report.

13.1.8.2 EMPr Framework

An EMPr represents a detailed plan of action prepared to ensure that recommendations for enhancing positive impacts and/or limiting or preventing negative environmental impacts are implemented during the life-cycle of a project.

Box 2:	**Overview of an EMPr**
The EMPr aims to satisfy the requirements stipulated in Section 24N of NEMA and Appendix 4 of GN No. R982 (4 December 2014) as amended. The scope of the MCWAP-2A WTI EMPr, is as follows: • Establish management objectives during the project life-cycle in order to enhance benefits and minimise adverse environmental impacts; • Provide targets for management objectives, in terms of desired performance; • Describe actions required to achieve management objectives; • Outline institutional structures and roles required to implement the EMPr; • Provide legislative framework; and • Describe the requirements for record keeping, reporting, review, auditing and updating of the EMPr. All liability for the implementation of the EMPr (as well as the EIA findings and Environmental Authorisation) lies with the project proponent (i.e. DWS).	

The following considerations and assumptions accompany the compilation of the EMPr:

- The EMPr is guided by the following principles, based on Lochner (2005) -
  - **Continuous improvement -** The project proponent (or implementing organisation) should be committed to review and to continually improve environmental management, with the objective of improving overall environmental performance;
  - **Broad level of commitment -** A broad level of commitment is required from all levels of management as well as the workforce in order for the implementation of the EMPr to be successful and effective; and
  - **Flexible and responsive -** The implementation of the EMPr needs to be responsive to new and changing circumstances. The EMPr report is a dynamic "living" document that will need to be updated regularly throughout the duration of the project life-cycle.
- Compliance with the EMPr must be audited in terms of Regulation 34 of GN No. R 982 of 4 December 2014 (as amended).
- The EMPr provides the framework for the overarching environmental management requirements for the project life-cycle. Following detailed design and planning, the EMPr may need to be revised to render the management actions more explicit and accurate to the final project specifications.
- Any amendments to the EMPr must be undertaken in accordance with Regulations 35 – 37 of GN No. R. 982 of 4 December 2014 (as amended).
- The EMPr will be linked to the project's overall Environmental Management System (EMS) (if applicable), where the EMS constitutes an iterative process that aims achieve continuous improvement and enhanced environmental performance.
- Although every effort has been made to ensure that the scope and level of detail of the EMPr are tailored to the level of environmental risk (i.e. type and scale of activity and the sensitivity of the affected environment) and the project- and site-specific conditions, certain of the environmental management requirements within the EMPr may be regarded as generic to make provision for activities that may take place as part of the overall project.

13.2 Land Use & Land Cover

13.2.1 Impact Description

The dominant land use and land cover in the areas earmarked for the project infrastructure is presented in **Section 11.2**. The proposed infrastructure is mostly located on privately-owned properties that are primarily used for agricultural practices and game-farming.

To minimise impacts to the receiving environment and current land uses, the proposed pipeline route attempts to remain alongside existing linear-type infrastructure, such as roads (main roads and dirt roads), the railway line (i.e. section of approximately 56 km), transmission lines, industrial corridors and farm boundaries.

Land is required for constructing the selected scheme. In addition, servitudes are required for operation and maintenance purposes. The following will be required:

- The River Management System includes a perpetual servitude-of-aqueduct in terms of the NWA over such stretches of the rivers, enabling the Minister to utilise such stretches as part of the government waterworks;
- Permanent servitudes for the new pipeline and accesses need to be acquired and registered in terms of the NWA. A permanent servitude of aqueduct (25 m minimum width) will accommodate the new pipelines. The defined area will not be fenced off following construction (unless requested by the landowner) and no improvements may be erected or established within such area. The defined area may only be used for grazing purposes or for the cultivation of crops with a weak (shallow) root system. Access to pipeline servitudes will not be controlled, but restrictions will be placed on activities inside the servitudes. Existing fencing will be reinstated and gates installed where these fences cross the servitude-of-aqueduct. A permanent right-of-way servitude to accommodate the permanent accesses, need to be acquired and registered. A service road (to basic standards) will be provided along the servitude for maintenance purposes and will be patrolled on a regular basis. Servitudes need to be marked with concrete servitude markers;
- A servitude-of-abutment where gauging facilities are implemented will be needed and also a right-of-way servitude to enable access to such facilities, and
- Land to accommodate the Vlieëpoort Abstraction Weir (including the basin), low-lift pumping station, desilting works, balancing dam, high-lift pumping station, BPR, OR as well as the ancillary structures will need to be acquired (purchased).

The land acquisition process is explained in **Section 9.13**. Negotiations with the landowners to acquire and register the relevant land rights (servitudes and purchases) will be undertaken by TCTA, as the project's implementing agent. TCTA's land rights acquisition strategy will adhere to all statutory requirements prevailing at the time.

Impacts associated with land use were assessed as part of the Agricultural Impact Assessment (see **Section 13.13**), Wildlife Impact Assessment (see **Section 13.11**) as well as the Socio-Economic Impact Assessment (see **Section 13.12**).

13.2.2 *Impact Assessment*

Environmental Feature	**1. Land Use**
Relevant Alternatives & Activities	**All physical infrastructure and ancillary structures that form part of MCWAP-2A**
Project life-cycle	**Construction & operational phases**
Potential Aspects & Impacts	**Proposed Management Objectives / Mitigation Measures**
Land acquisition and servitude restrictions.	1.1. Compensation to be determined by an independent valuer, in accordance with the principle set out in Section 25 of the Constitution concurrent with Section 12 of the Expropriation Act. 1.2. Optimisation of final pipeline route to be considered in the design phase to avoid existing structures and buildings, as well as other sensitive features (where possible). Should the realignment of the route be found to be unfavourable, the existing infrastructure can be relocated to an agreed position or compensation for the market value can be offered upon undertaking of a valuation.

	+/- Impacts	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**
Before Mitigation	-	local	high	permanent	almost certain	2
After Mitigation	-	local	low	permanent	almost certain	1

Environmental Feature	**2. Land Use**
Relevant Alternatives & Activities	**All physical infrastructure and ancillary structures that form part of MCWAP-2A**
Project life-cycle	**Construction phase**
Potential Aspects & Impacts	**Proposed Management Objectives / Mitigation Measures**
Disruptions to existing land use.	2.1. Construction will only commence following completion of land acquisition process. 2.2. Construction activities to be restricted to construction servitude. 2.3. Compensation based on legitimate claims for losses as a result of project-related activities.

	+/- Impacts	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**
Before Mitigation	-	local	high	short-term	almost certain	3
After Mitigation	-	local	low	short-term	moderate	1

13.3 Climate

13.3.1 *Impact Description*

Considerations in terms of climate change from DWS' draft National Water and Sanitation Master Plan (NW&SMP): Volume 2 (March 2018):

- This NW&SMP gives effect to the mandate given to the water sector through the Constitution, the White Paper on a National Water Policy for South Africa (1997), the Strategic Framework for Water Services (2002), the National Sanitation Policy (2017), the NWA and the Water Services Act. In addition, it takes into account other relevant policy and legislation such as the Industrial Policy Action Plan, the Irrigation Strategy, the National Climate Change Response

White Paper, NEMA, the Public Finance Management Act, the Municipal Finance Management Act, and the Municipal Structures and Systems Acts.

- A number of important strategies and operational policies have been compiled since the enactment of the national policy and water acts in order to flesh out and implement the legislation and policy. This includes a Water and Sanitation Sector Policy on Climate Change (2017).
- The study on Future Climates in South Africa concluded that climate change will have a limited impact on water supply at a national level but could be quite significant at regional level under particularly drier futures. The greatest concern regarding climate change, are the isolated water resource systems that are dependent on a single resource or small geographical area with limited hydrological variability, including small farm dams in headwater catchments and water supply schemes for rural towns. Systems with greater integration and diversification have greater resilience to climate change uncertainty, such as the Integrated Vaal River System. Also, more variability due to climate change, including more flush floods, may require more storage to provide the required yield of a system.
- Although climate change brings an added uncertainty to water resources, the impacts can and should be mitigated. The relatively gradual nature of climate change allows time for well-considered adaptation and mitigation measures. However, there is growing concern that the decreasing monitoring through rainfall and flow gauging networks are no longer sufficient to accurately detect these trends to ensure mitigation measures are planned and put in place timeously. (*Insert: this emphasises the need to for the proposed River Management System for the MCWAP-2A*).
- The impact of climate change on resource availability and water requirements should be taken into account in all future planning, including Reconciliation Strategy studies. Mitigation measures can then be introduced as their necessity becomes evident, but then adequate data is essential to support the decisions to be made. Therefore, it is vital that the monitoring of rainfall, evaporation and runoff be continued rigorously, and the hydrological monitoring network improved to ensure that the actual effects of climate change are measured accurately and brought as quickly as possible into the analysis of resources.

Studies conducted where various global climate models were used to estimate the likely implication on water availability (yield) of system showed widely varying results and found that either increases or decreases will occur in water availability as a result of Climate Change. Due to these observations it has been acknowledge that Climate Change adds another layer of uncertainty to water resource assessment and planning.

Considering the recent advances made in developing methods of assessing uncertainty in water resource analysis there are proposals under consideration by the DWS and other funding organisations to expand the uncertainty assessment methodology by also incorporating the effects of Climate Change. The key in achieving this is by integrating available research products of Climate Change and uncertainty. This will require developing procedures (including software systems) and establishing analytical techniques that can be used in studies such as these.

The water balance was considered as part of the technical studies and derived from sophisticated risk analysis simulation techniques. These methods simulate the complete Crocodile River System on a monthly time step, which accounts for the observed characteristics of rainfall and runoff.

The risk analyses are conducted for 1 000 plausible streamflow and rainfall stochastic sequences. These sequences cater for a range of extremes, where the wettest sequence is wetter than the wettest period experienced historically and the driest sequence drier than the worst drought experienced historically. The variability of the stochastic analysis is thus catered to a certain degree for potential changes within these extremes.

Due to the small surface area of the inundation area behind the abstraction weir, in terms of global climate change factors, no noticeable impact on the climate of the region is anticipated.

Infrastructure will be designed to be sufficiently robust to withstand severe rainfall events. Other factors that will affect the flow in the river at the weir such as rainfall, evaporation from the river water surface, evapo-transpiration from the riverine vegetation, tributary and diffuse inflows and diffuse seepage outflows from the river, will be considered as part of the overall River Management System.

The EMPr includes measures to control and minimize greenhouse gas (GHG) emissions by optimizing the utilisation of construction resources.

According to the Assessment of Greenhouse Gas Emissions Study (Horizon Environmental Consulting, 2018b), which is contained in **Appendix I9**, the proposed Vlieëpoort weir on the Crocodile River (West) is a small structure with a small footprint and as such is below the scale applicable for all processes within the GHG Reservoir Tool, except construction impacts. **Table 52** presents the estimated construction data for the total MCWAP-2A. Results from G-Res estimate that some 1 034 tons CO2 equivalents per annum will be emitted during construction of MCWAP-2A.

For Hartbeespoort Dam, while the impoundment is hypereutrophic, it may not necessarily be actively contributing significantly to climate change. It is expected that the introduction of MCWAP-2A on Hartbeespoort dam is likely to have a limited effect on primary production in winter under the 50th percentile scenario when the impoundment is dominated by diatoms. During summer, when the hypereutrophic conditions are at their worst, the potential changes to primary production as a result of MCWAP-2A are expected to be limited. This means that Hartbeespoort Dam will continue to be a GHG emitter.

Table 52: Construction details for the proposed MCWAP-2A (Horizon Environmental Consulting, 2018b)

Item	Earthworks (m^3)	Concrete (m^3)	Steel (expressed as 127 kg/m for steel pipe)
Abstraction Weir		500	
Low lift pumping station		1 750	
Low lift rising main (2 pipes)			1 102 360
Sedimentation works			12 000
Balancing works	272 800		
High lift pumping station		36 000	
High lift rising main to Break Pressure Reservoir			3 683 000
Break Pressure Reservoir		9 000	
Gravity Pipelines to Operating reservoir			8 096 250
Operating reservoir		9 000	
Gravity pipeline from Operating reservoir to Medupi Tee-off (km)			7 494 270
Roads and borrow pits	1 500 000		
Total	**1 772 800**	**56 250**	**20 387.88**

13.3.2 *Impact Assessment*

Environmental Feature	**3. Climate**
Relevant Alternatives & Activities	**All construction activities that emit GHG**
Project life-cycle	**Construction phase**
Potential Aspects & Impacts	**Proposed Management Objectives / Mitigation Measures**
Greenhouse gas emissions. Contributions to global warming.	3.1. Materials with a high recycled content should be used where possible and the re-use of site materials should be considered. 3.2. The operational performance of accommodation facilities on site should be considered so to maximise the efficient use of energy and water. 3.3. Suitable training should be provided to operators to ensure that they maximise the efficiency of the plant and idling is reduced. 3.4. In terms of transportation of workers and staff, collective transportation arrangements should be made to reduce individual car journeys. 3.5. All vehicles used during the project should be properly maintained and in good working order.

	+/- Impacts	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	-	regional	unknown	short-term	likely	unknown
After Mitigation	-	regional	unknown	short-term	likely	unknown

13.4 Geology

13.4.1 Impact Description

Published seismic hazard maps of southern Africa indicate PGAs in the order of 0,1 g to 0,04 g within the study area, becoming progressively lower towards the north. These accelerations might be considered to represent a moderate to low level of seismic hazard.

Significant work will be required to prepare the foundation for the abstraction weir. Foundation work must be deep enough to prevent seepage and piping underneath the weir.

A first order assessment of the anticipated geotechnical conditions along the conveyance routes was done in order to inform the pre-feasibility decision making process (DWAF, 2008d). According to this assessment, no adverse geological conditions are expected that would prohibit the construction of the pipelines along any of the alternative route options investigated.

Further geotechnical investigations will be undertaken during the design phase. This investigation would result in more information to evaluate the geological conditions. In addition, dolomite stability investigations are required at the site for the balancing dam, desilting works and high-lift pumping station (DWA, 2008). Depending on the level of inherent risk it may be possible to construct the reservoir at this site, provided appropriate designs are adopted and strict water precautionary measures are adopted. Should limited areas of high risk for sinkhole and doline development be identified, then it might further be possible to optimise the site layout in order to minimise exposure to this risk.

Blasting will be required, based on geotechnical conditions encountered. All blasting will comply with the relevant legislation and SANS stipulations. Specific mitigation measures are contained in the EMPr, including the use of blast mats to safeguard against fly-rock, and the protection of property and accompanying monitoring practices.

Construction material will need to be sourced from approximately 30 borrow pits that will be located at 5km intervals along the project footprint. Such extraction could result in a variety of environmental impacts including visual impacts, loss of habitat, noise and dust to local communities and wildlife. As mentioned, a separate application will be submitted to DMR to seek approval for the borrow pits.

Other important considerations from a geological perspective include *inter alia* blasting and spoil material that will need to be disposed of during the installation of the pipeline through filling of borrow pits or other suitable environmental practices. The spoil sites will only be operational for the construction period of MCWAP-2A and will be rehabilitated afterwards through shaping, application of topsoil and planting of indigenous vegetation.

13.4.2 *Impact Assessment*

Consider findings from geotechnical investigations and dolomite stability investigations during project design phase and incorporate mitigation measures (as relevant).

13.5 Soils

13.5.1 *Impact Description*

During the construction phase large areas will be cleared of vegetation, which may lead to soil erosion. Where construction activities will take place in terrain that is characterised by steeper gradient as well as at instream works, erosion could take place in the absence of suitable storm water management and stabilisation of the cut and fill areas. The EMPr includes suitable storm water management measures to prevent the occurrence of erosion.

Soil may be polluted by poor storage of construction material, spillages and inadequate housekeeping practices. Specific mitigation measures are contained in the EMPr, where the primary objective is the effective and safe management of materials on site, in order to minimise the impact of these materials on the biophysical environment. The same objective applies to the correct management and handling of hazardous substances (e.g. fuel).

13.5.2 *Impact Assessment*

Consider findings from geotechnical investigations during project design phase and incorporate mitigation measures (as relevant).

Environmental Feature	**4. Soils**
Relevant Alternatives & Activities	**All construction activities on steep slopes**
Project life-cycle	**Construction & operational phases**
Potential Aspects & Impacts	**Proposed Management Objectives / Mitigation Measures**
Soil erosion on steep slopes.	4.1. Stabilisation of cleared areas to prevent and control erosion. The method chosen (e.g. watering, planting, retaining structures, commercial anti-erosion compounds) will be selected according to the site-specific conditions. Drainage management should also be implemented to ensure the minimization of potential erosion. 4.2. Acceptable reinstatement and rehabilitation of disturbed areas to prevent erosion during operation phase. 4.3. Install suitable buttressing to prevent future erosion of the structures of the watercourses affected by construction, if required. 4.4. Monitoring to be conducted to detect erosion (e.g. steep sections along access roads and pipeline, crossing of drainage lines, tie-ins at river banks, etc.).

	+/- Impacts	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**
Before Mitigation	-	local	medium-high	short-long	likely	2
After Mitigation	-	local	low	short-term	unlikely	1

13.6 Geohydrology

13.6.1 Impact Description

Some pertinent findings form the Feasibility Study Geotechnical Investigations (DWA, 2008) with regards to groundwater include:

- No water tables were recorded in any of the four boreholes drilled on the footprint of the balancing dam, desilting works and high-lift pumping station and it may be assumed that the water table occurs at depths greater than 10 m; and
- No seepage was encountered in any of the test pits dug along the pipeline route and it appears that this is unlikely, except in the vicinity of streams (and particularly on the south bank of the Matlabas River).

The alluvial deposits of the Crocodile River constitute the primary aquifer in terms of ground water utilisation. The construction of a weir in this aquifer may impact on the equilibrium of sub surface flow conditions. This is discussed further in **Section 13.8.5**.

Based on the initial geophysical and geotechnical studies the presence of a fault zone was identified at the Vlieëpoort weir site. Monitoring boreholes were drilled (see **Figure 135**) and a two year monitoring programme was initiated to conduct water level monitoring, which started in July 2011 and ended in July 2013. Groundwater levels were measured and samples taken in eight monitoring boreholes drilled at the perimeter of the weir site. Samples were taken in April 2013 for chemical and stable isotope analysis to study the link between the river and monitoring boreholes. Based on the data obtained from water level monitoring and the sampling for chemical and isotope analysis of boreholes, the following conclusions were made (Aurecon, 2013):

- The water levels showed a seasonal trend that could be linked to the annual rainfall, river flow or both;
- The fluctuations in rainfall definitely correlated with the water levels trends with some delay in water level response;
- The river flow which is dependent on both rainfall and dam releases correlated well with both the rainfall and water levels trends;
- All the borehole samples show similarity to the surface water indicating a possible link between river and groundwater;
- The stable isotope analysis showed the extent of evaporation between samples and all the samples fall on the same evaporation line that could indicate a possible link between surface and groundwater; and
- It is concluded that a link between surface and groundwater exists and once the weir is constructed monitoring of water levels and chemistry will confirm this.

The following recommendations are made as part of the above study (Aurecon, 2013):

- Once the weir is constructed monitoring of the ground-, and surface water levels as well as chemistry should be done to confirm the link between surface and groundwater;

- ❖ Digital real-time water level loggers should be installed in the boreholes to ensure accurate water level data;
- ❖ A digital rain gauge should be installed at the weir site or site specific rainfall data should be obtained; and
- ❖ Monitoring boreholes must be properly demarcated to avoid damage from heavy machinery/vehicles during construction and to increase visibility.

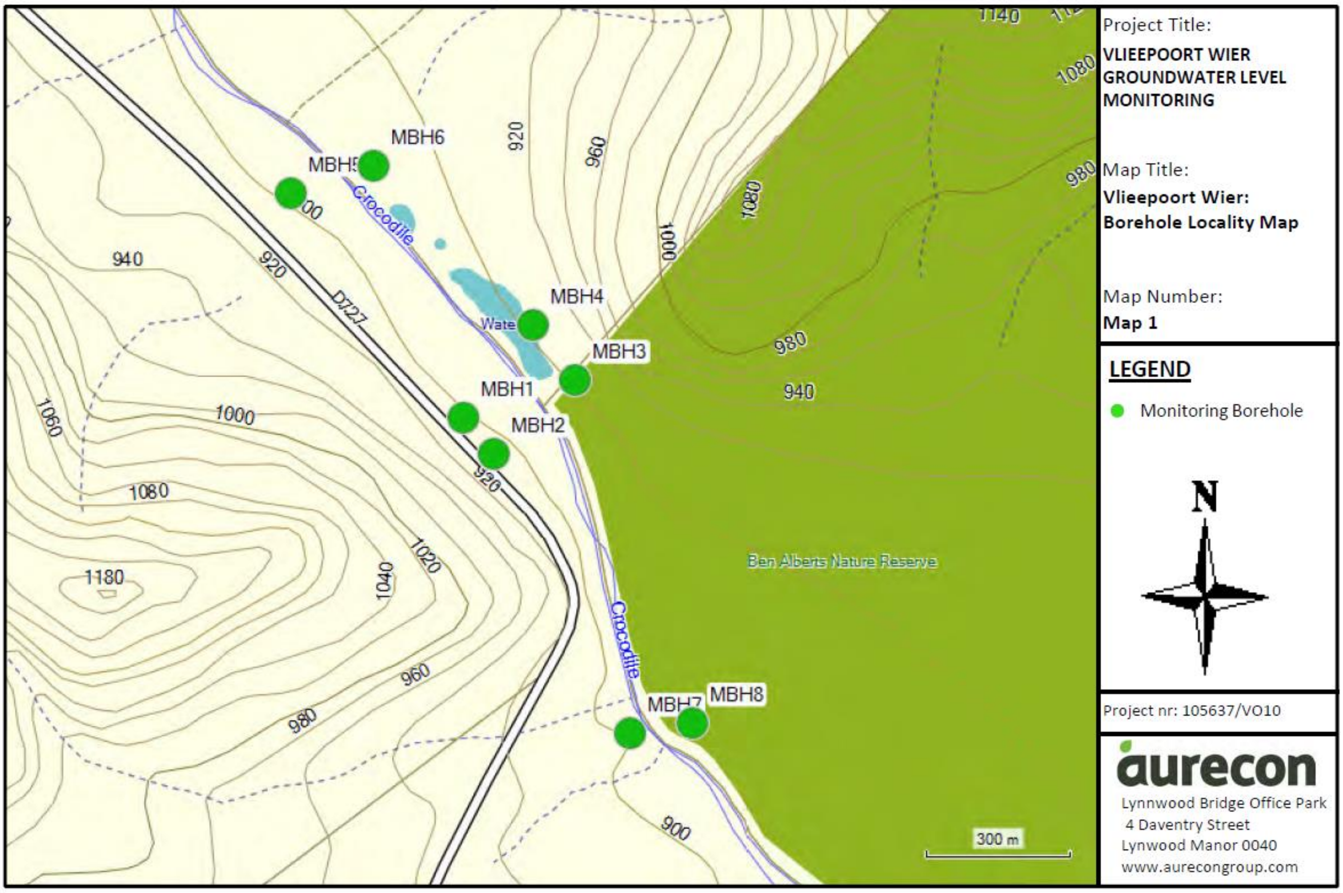


Figure 135: Borehole Locality Map (Aurecon, 2013)

Groundwater may further be impacted by the project as follows:

- ❖ Potential disturbance of the aquifer from blasting;
- ❖ Possible influence to groundwater flow as a result of trenching during construction. Confirmation is required whether aquifers will be intersected by the pipeline trench;
- ❖ Potential contamination of groundwater during the construction stage;
- ❖ Contamination of groundwater primary aquifer with water from more saline secondary aquifer as a result of blasting; and
- ❖ Appropriate management required of shallow groundwater at river crossings and waterlogged areas, which will include the suitable dewatering of excavations.

According to Davis (2017), Hartbeespoort Dam is underlain by shales and diabase (that weathers to a dense clay). Both rock types are very impervious and groundwater found in them (if any) will not be linked to the dam itself. The only place where interaction occurs is along the three fault lines. The wall is built on one of these fault lines and groundwater below the wall is definitely fed by the dam (Wentzel pers. comm., 2018). It is thus not expected that lowering the water level in the dam will affect groundwater, except along the fault lines, where the groundwater level is far below the lowest level of the dam.

13.6.2 Impact Assessment

Consider findings from geotechnical investigations during project design phase and incorporate mitigation measures (as relevant).

Environmental Feature	**5. Geohydrology**
Relevant Alternatives & Activities	**All infrastructure and activities that may affect groundwater**
Project life-cycle	**Construction phase**
Potential Aspects & Impacts	**Proposed Management Objectives / Mitigation Measures**
Contamination of groundwater by poor construction practices.	5.1. Suitable protection of groundwater during excavations. Implement mitigation measures suggested as part of the geotechnical investigations for managing groundwater. 5.2. All storage tanks containing hazardous materials must be placed in bunded containment areas with impermeable surfaces. The bunded area must be able to contain 110% of the total volume of the stored hazardous material. 5.3. Reduce sediment loads in water from dewatering operations. All dewatering should be done through temporary sediment traps (e.g. constructed out of geo-textiles and hay bales). 5.4. Groundwater monitoring programme (refer to EMPr).
Disturbances to aquifer from blasting.	5.5. Suitable protection of aquifer during blasting. Implement mitigation measures suggested as part of the geotechnical investigations for managing groundwater

	+/- Impacts	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**
Before Mitigation	-	local - regional	high	long-term	moderate	3
After Mitigation	-	local - regional	low	short-term	unlikely	1

Environmental Feature	**6. Geohydrology**
Relevant Alternatives & Activities	**Vlieëpoort abstraction weir**
Project life-cycle	**Operational phase**
Potential Aspects & Impacts	**Proposed Management Objectives / Mitigation Measures**
Disturbance to surface water and groundwater interactions (sand aquifers).	6.1. Monitoring of the ground- and surface water levels, as well as chemistry, to be done to confirm the link between surface and groundwater. Appropriate measures to be identified to address disturbances, as necessary.

	+/- Impacts	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**
Before Mitigation	-	local - regional	high	long-term	likely	3
After Mitigation	Neutral *	-	-	-	-	-

** Assumed status of impact following adoption of suitable mitigation.*

13.7 Topography

13.7.1 Impact Description

Significant topographical features in the project area include the following:

- Low mountains are encountered in the first section of the project footprint, in the Vlieëpoort region (i.e. south-western part of project area) (see **Figure 136**);
- A section of the Central Route follows the dirt road and passes a koppie approximately 1 km south-west of the BPR (see **Figure 137**); and
- A section of Alternative D1 traverses Portion 4 of the Farm Rhenosterpan 361 LQ, where there are two koppies.

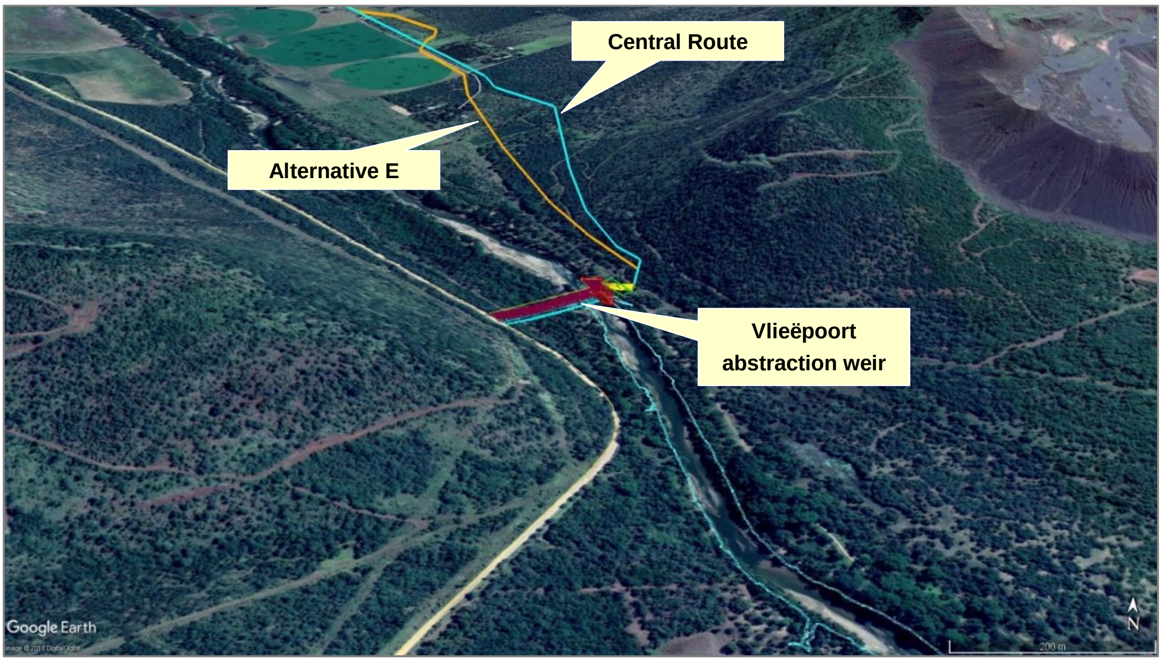


Figure 136: View of Vlieëpoort abstraction weir

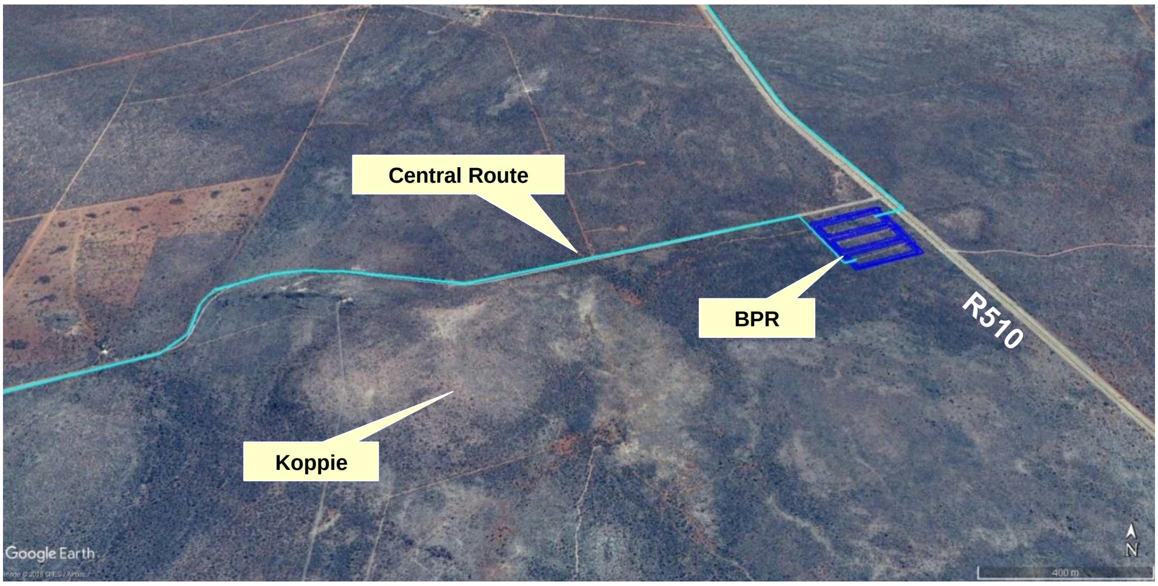


Figure 137: View of koppie along Central Route

13.7.2 *Impact Assessment*

Environmental Feature	7. Topography
Relevant Alternatives & Activities	**All steep sections of the project footprint and where koppies are encountered (Alternative D1 and Alternative E)**
Project life-cycle	**Construction phase**
Potential Aspects & Impacts	**Proposed Management Objectives / Mitigation Measures**
Erosion on steep slopes.	7.1. Suitable erosion protective measures are to be implemented where the pipeline traverses steep terrain. 7.2. Undertake rehabilitation of the construction area to minimise visual impacts. 7.3. Although the use of indigenous vegetation is promoted, where there is a risk of soil erosion (e.g. steep slopes) a suitable specialist must be consulted to determine the most appropriate stabilisation measures.
Damage to koppies.	7.4. Align the pipeline within the 100m corridor, which was assessed as part of the EIA and specialist studies, to avoid koppies (as feasible).

	+/- Impacts	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	-	local	high	long-term	likely	3
After Mitigation	-	local	medium	long-term	unlikely	1

Environmental Feature	8. Topography
Relevant Alternatives & Activities	**All steep sections of the project footprint**
Project life-cycle	**Operational phase**
Potential Aspects & Impacts	**Proposed Management Objectives / Mitigation Measures**
Erosion on steep slopes.	8.1. Pipeline inspections to include checking for signs of erosion. Corrective measures to be implemented where erosion is encountered.

	+/- Impacts	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	-	local	high	long-term	likely	3
After Mitigation	-	local	medium	long-term	unlikely	1

13.8 Surface Water

13.8.1 *General*

The following definitions apply for the discussion to follow:

- "Watercourses" are considered as rivers, streams, natural channels (perennial and seasonal), wetlands and dams, as defined in the NWA.
- Activities linked with the construction and operational phases can cause significant adverse impacts to the "resource quality" of the affected watercourses, which is defined by the NWA as the following -
  - Quantity, pattern, timing, water level and assurance of in-stream **flow**;
  - **Water quality**, including physical, chemical and biological characteristics of the water;
  - Character and condition of the in-stream and riparian **habitat**; and
  - Characteristics, condition and distribution of the **aquatic biota**.

- The "regulated area of a watercourse" for Section 21(c) or (i) of the NWA water uses (Notice 509 of 2016) is as follows -
  - The outer edge of the 1 in 100 year flood line and /or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake or dam;
  - In the absence of a determined 1 in 100 year flood line or riparian area the area within 100 m from the edge of a watercourse where the edge of the watercourse is the first identifiable annual bank fill flood bench (subject to compliance to Section 144 of the NWA); or
  - A 500 m radius from the delineated boundary (extent) of any wetland or pan.

13.8.2 Water Use

13.8.2.1 Impact Description

The need for MCWAP-2A stems from satisfying the water requirements of the following (including strategic water users):

- Power generation in Waterberg;
- Coal for power generation in the Waterberg;
- Coal to support power stations in Mpumalanga;
- Industrial/mining for other purposes; and
- Urban use by Lephalale Municipality.

The water uses associated with the project are discussed in **Section 5.1.5**. Water Use Authorisation will be required for the aforementioned activities in terms of Section 21 of the NWA. In accordance with Section 27 of this Act, the following factors need to be taken into consideration by DWS before an authorisation may be issued:

1. Existing Lawful Water Uses;
2. The need to redress the results of past racial and gender discrimination;
3. Efficient and beneficial use of water in the public interest;
4. The socio-economic impact of the water use or uses if authorised; or of the failure to authorise the water use or uses;
5. Any catchment management strategy applicable to the relevant water resource;
6. The likely effect of the water use to be authorised on the water resource and on other water users;
7. The class and the resource quality objectives of the water resource;
8. Investments already made and to be made by the water user in respect of the water use in question;
9. The strategic importance of the water use to be authorised;
10. The quality of water in the water resource which may be required for the Reserve and for meeting international obligations; and

11. The probable duration of any undertaking for which a water use is to be authorised.

The Reconciliation Strategy for the Crocodile (West) Water Supply system was first developed in 2008, revised in 2012, and continues to be reviewed and updated by the DWS in cooperation with institutions and stakeholders in the water sector. The first Reconciliation Strategy for the Crocodile (West) Water Supply System was developed and published in 2008 by the then Department: Water Affairs (DWA) to ensure sufficient water can be made available to supply the current and future water requirements of the urban, industrial, mining and irrigations users in the system. The Strategy primarily focused on the quantitative reconciliation of the water requirements with the available resources and also considered water quality where it impacts on the water balance. The objectives of the Reconciliation Strategy 2015 include the following (DWS, 2015):

- To maintain a positive water balance in future and reconcile growing water requirements and availability;
- To identify, plan and monitor necessary interventions needed;
- To integrate planning between the different Water Service Authorities / Water Service Providers; and
- In the unique case of the Crocodile (West) River system, to identify the optimal use of the growing water availability due to increasing return flows. This resource is a limited asset to be best used from a regional perspective, i.e. supply within the catchment and transfers to Lephalale and other neighbouring catchments.

The impact of the abstraction from the Crocodile River (West) and of the management of the system on the existing agricultural water users is regarded as a key environmental issue associated with the project, and has been raised as a concern by many IAPs during public participation. The availability of water for the proposed transfer of water as part of MCWAP-2A was modelled during the Reconciliation Study 2015 (DWS, 2015), which took into consideration the Existing Lawful Water Uses, including the Hartbeespoort Irrigation Board, Crocodile River (West) Irrigation Board and the Makoppa Agriculture Area. The return flows from growing urban areas that feed into the Hartbeespoort Dam provide surplus water that is available and targeted for the proposed water transfer, which is more than the natural yield of the Crocodile River (West). DWS however does not guarantee the assurance of supply in accordance with the NWA.

As mentioned in **Section 5.4**, the Crocodile River (West) and Mokolo River catchments form part of the Limpopo River Basin, which is shared by Botswana, Mozambique, South Africa and Zimbabwe. Notifications in terms Article 4(1)(a) of the SADC Revised Protocol of the RSA’s intention to proceed with implementation of the MCWAP, were given to the co-basin states.

13.8.2.2 Impact Assessment

Environmental Feature	9. Surface Water - Water Use
Relevant Alternatives & Activities	Vlieëpoort Abstraction
Project life-cycle	Construction & operational phases
Potential Aspects & Impacts	Proposed Management Objectives / Mitigation Measures
Impacts to Existing Lawful Water Users.	9.1. Manage water quality during construction. 9.2. Establish operating rules for the Lower Crocodile (West) system with MCWAP-2A releases to make provision for (amongst others) multiple users along the river stretch (irrigation, transfer and Ecological Reserve), with varying assurance of supply criteria. 9.3. Implement and sustain the River Management System to monitor, control and manage the releases into the river, the flows in the river and abstractions from the river. This will also allow for the monitoring of the flow downstream, thereby allowing verification that the minimum downstream water requirements are met.

	+/- Impacts	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	-	regional - international	medium-high	permanent	almost certain	3
After Mitigation	neutral	-	-	-	-	-

13.8.3 Hydrology

13.8.3.1 Impact Description

A HEC-RAS model of the Crocodile River (West) was set up to determine the flood levels in the Crocodile River. The model was also used to determine and check the impact of the proposed Abstraction Works on flood levels and on infrastructure up- and downstream of the Works. The model was also used to determine the impact of the proposed abstraction weir on existing upstream infrastructure, specifically a low level mine haul road and railway bridge crossing the river some 7,5 km upstream of the proposed weir (see **Figure 138**).

The baseline model shows that the existing haul road bridge currently overtops at flow rates exceeding 130 m³/s. The proposed weir has the effect of reducing the flow rate to 90 m³/s at which the bridge will overtop. This is a significant effect and will increase the frequency at which the road is not usable. The haul road belongs to Kumba Iron Ore's Thabazimbi mine, which is currently undergoing closure. At the stage when the EIA Report was compiled, it could not be conclusively determined whether there will be future need for the continued use of the haul road in question. The effect on the railway bridge is insignificant. The model indicated that the railway bridge will overtop between 4 000 and 4 100 m³/s with or without the proposed weir. These and other matters within the weir basin will be dealt with when the land is acquired in terms of the Expropriation Act and standing Treasury Guidelines governing the sharing of cost for the construction of the abstraction weir including the impoundment up to the 1:100 year flood level and a buffer zone in accordance with DWS policy.

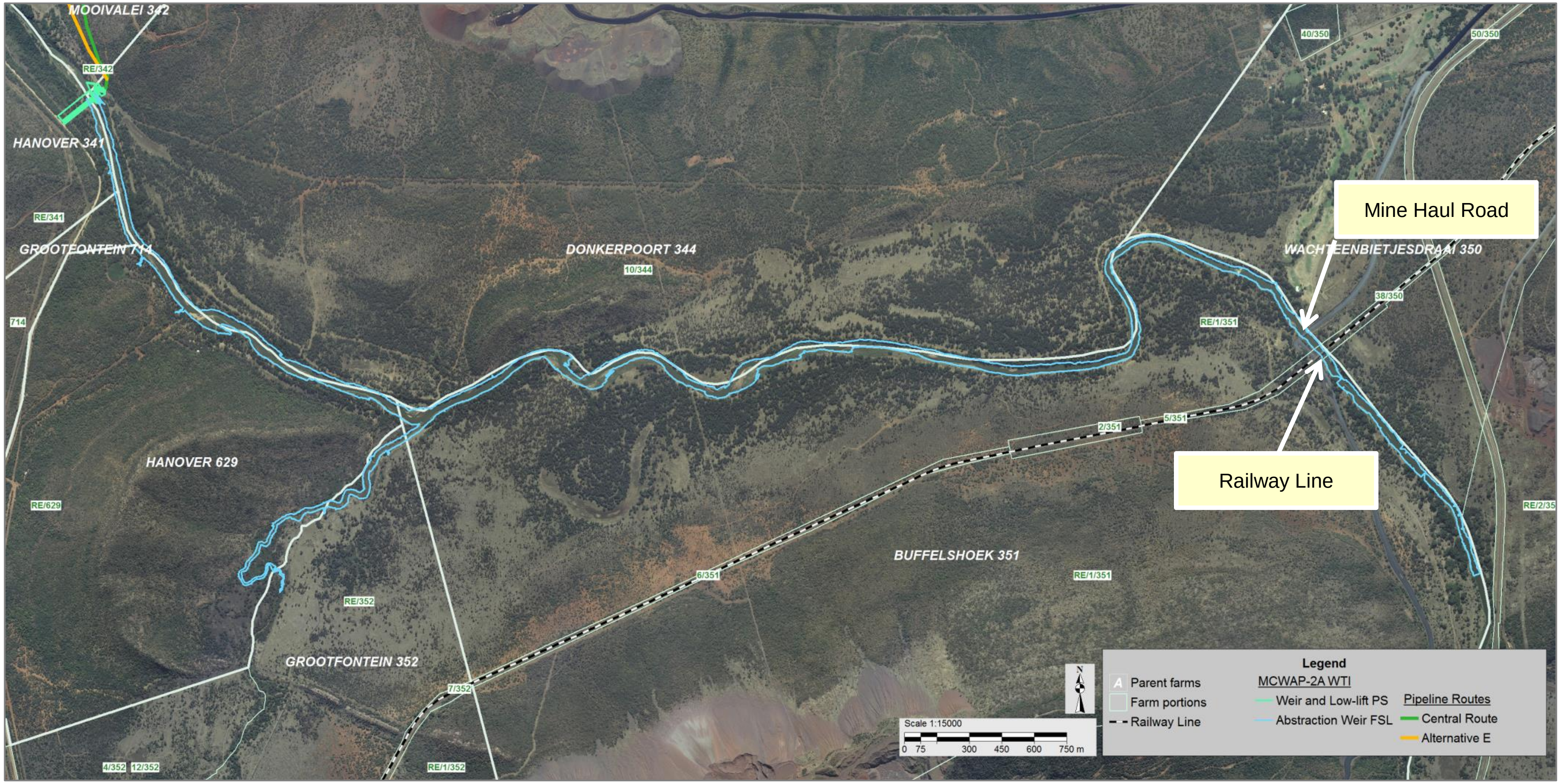


Figure 138: Upstream Structures affected by Vlieëpoort Weir Full Supply Level

The Vlieëpoort abstraction weir is not designed for storage and it is assumed it will silt up. The areas immediately upstream and downstream of the weir will be cleared and suitable erosion protection measures such as grassing and rip-rap will be applied. The existing gravel road (D727) on the left bank will need to be raised or realigned locally at/around the weir.

The following rivers and streams are directly affected by the MCWAP-2A infrastructure:

- The Vlieëpoort abstraction weir will be located on the main stem of the Crocodile River (West), approximately 2 km downstream of the confluence of the Bierspruit;
- Gauging weirs will be located on the Bierspruit, Sand River and Crocodile River (West);
- Low-lift rising main crosses non-perennial tributaries of the Crocodile River (West);
- Drainage channel from desilting works crosses a non-perennial tributary of the Crocodile River (West) and will return sediment back to the main stem;
- Central Route crosses non-perennial tributaries of the Crocodile River (West);
- Central Route and Alternative C cross non-perennial tributaries of the Matlabas River;
- Central Route crosses the main stem of the Matlabas River; and
- Alternative D1 crosses non-perennial tributaries of the Mokolo River.

The Contractor will prepare detailed method statements on how the river diversions will be undertaken to accommodate the construction of the above-mentioned project infrastructure, as relevant. The environmental objective will be to minimise the influence to the downstream flow regime when diverting and impeding flow for cofferdams, temporary river crossings or for any other purposes Best practices to manage the flow of the rivers to be affected by the construction of the project infrastructure are included in the EMPr. Provision is also made in the EMPr for the reinstatement of the affected watercourses.

13.8.3.2 Impact Assessment

Environmental Feature	**10. Surface Water - Hydrology**
Relevant Alternatives & Activities	**All infrastructure that will affect watercourses**
Project life-cycle	**Construction phase**
Potential Aspects & Impacts	**Proposed Management Objectives / Mitigation Measures**
Impacts to watercourses from temporary diversions.	10.1. Minimise influence to downstream flow regime when diverting and impeding flow for cofferdams, temporary river crossings or for any other purposes. 10.2. Prevent possible erosion caused by temporary in-stream diversion. Install suitable buttressing / stabilisation structures to prevent future erosion, if required. 10.3. Select most appropriate crossing point based on geotechnical conditions, sensitivity of riparian habitat (e.g. protected trees, large trees that afford bank stabilisation) and in-stream habitat, depending on technical feasibility. 10.4. Adequate rehabilitation and reinstatements of affected watercourses.

	+/- Impacts	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	-	local	high	short-term	almost certain	2
After Mitigation	-	local	low	short-term	moderate	1

Environmental Feature	**11. Surface Water - Hydrology**
Relevant Alternatives & Activities	**Vlieëpoort Abstraction Weir**
Project life-cycle	**Operational phase**
Potential Aspects & Impacts	**Proposed Management Objectives / Mitigation Measures**
Impacts to upstream infrastructure in the Crocodile River (West) as a result of the abstraction weir's backwater effect.	11.1. Continued engagement with the custodians of the affected infrastructure, including Transnet and Kumba Iron Ore's Thabazimbi mine. If required, make provision for the raising/realignment and protection of the haul road, depending on the future plans for continued use of the road. 11.2. Consider further as part of land acquisition process for the abstraction weir's impoundment up to the 1:100 year flood level and buffer zone.

	+/- Impacts	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	-	regional	high	short-term	almost certain	3
After Mitigation	-	regional	medium	short-term	moderate	1

13.8.4 Water Quality

13.8.4.1 Impact Description

During the construction phase, potential contamination of surface water could occur through:

- Sedimentation from working within and alongside the watercourse;
- Diffuse pollution from spillages, silt-laden runoff from disturbed areas, and improper practices (e.g. poor management of waste water, inadequate storage and housekeeping practices, and inadequate disposal of solid waste); and
- Dewatering without filtering of sediments.

The water quality impacts during the construction phase will be managed by employing environmental best practises that will be contained in the EMPr.

During the maintenance of the pipeline and reservoirs the raw water conveyed and stored within this system, which is water of poor quality from the Crocodile River (West), will be released into the Matlabas River and other watercourses from scour valves.

The CSIR (Dabrowski & Ashton, 2016) undertook a screening study to understand the potential changes in water quality that may arise as a result of scour valve discharges of water from the MCWAP-2A pipeline (abstracted from the Crocodile River) into the Matlabas River. The following conclusions were drawn from this study:

- Water discharged from the MCWAP pipeline is of a poorer quality than the receiving Matlabas River and scour valve discharge will result in short term increases in Total Dissolved Solids (TDS), nutrients and Chemical Oxygen Demand (COD).
- Median daily flows in the Crocodile and Matlabas rivers are highest during the wet summer months, particularly January and February.
- Water quality in the Crocodile and Matlabas rivers is generally better during the summer months, particularly January and February.
- The months of January and February therefore provide the most favourable conditions for the Matlabas River to assimilate and dilute poorer water quality discharged from the MCWAP pipeline.
- Performing scour valve discharge operations at lower flow rates for a longer period of time will have further benefit through reducing peak concentrations of water quality variables (and associated potential acute toxic effects) that could occur in the Matlabas River.
- The most serious effects on aquatic ecosystem health are likely to be related to decreased Dissolved Oxygen concentrations in the Matlabas River as a result of elevated COD concentrations associated with biofilm scoured from the pipeline.

Based on these conclusions, the following recommendations were made (Dabrowski & Ashton, 2016):

- Scour valve discharge operations should preferably take place during January and February when high flows are most likely to occur in the Matlabas River. As a general guideline, scour valve operations should take place when flows in the Matlabas River exceed 0.8 m^3/s.
- Scour valve discharge operations should be avoided during low flow periods in the Matlabas River (particularly during the winter and spring months).
- A Low scour discharge scenario (e.g., 0.35 m^3/s over 8 hours) is recommended over that of a High discharge scenario (e.g., 1.14 m^3/s over 2 hours).
- A High scour discharge scenario should only be considered when COD concentrations in the scour discharge are likely to result in severe anoxic conditions (0 mg/L Dissolved Oxygen) for the Low scenario (i.e., > 5 mm under the current

modelled scenarios). This would keep the duration of these adverse anoxic conditions as short as possible.

- Monitoring of COD concentrations in scour discharge should be performed so as to gain a better understanding of potential effects on Dissolved Oxygen in the Matlabas River. Depending on the magnitude of measured / observed COD concentrations, alternative scour valve operations could be considered (for example, if measured COD levels are similar to what is predicted in this study, then more frequent scouring of the pipeline could be considered so as to prevent greater accumulations of biofilm).

Refer to **Section 13.8.5** for a discussion on sediment management, including the scouring of sediment back to the Crocodile River (West) from the desilting works.

13.8.4.2 Impact Assessment

Environmental Feature	**12. Surface Water - Water Quality**
Relevant Alternatives & Activities	**All components and associated infrastructure; activities undertaken in-stream, alongside watercourses and within construction domain**
Project life-cycle	**Construction phase**
Potential Aspects & Impacts	**Proposed Management Objectives / Mitigation Measures**
Contamination of surface water through sedimentation from in-stream works, silt-laden runoff from disturbed areas, and improper practices (e.g. poor management of waste water and disposal of solid waste).	12.1. Conduct water quality monitoring (baseline and during construction) at suitable up- and downstream sites on – ○ Crocodile River (West) (abstraction weir and gauging weir); ○ Bierspruit and Sand River (gauging weirs); ○ Major watercourses affected by project infrastructure (e.g. pipeline and access roads' crossings, etc.). 12.2. All diffuse pollution sources to be managed to prevent pollution of the watercourses in the project area. 12.3. Storage area and ablution facilities to be located 50 m from edge of riparian habitat. 12.4. Where necessary, install in-stream silt traps during construction within the watercourse channel and along the riparian habitat. The style of silt trap will depend on materials used and the water movement patterns. 12.5. Implement suitable storm water measures during construction to manage ingress of runoff into watercourses. 12.6. Ensure proper storage of material (including fuel, paint) that could cause water pollution. Ensure proper storage and careful handling of hazardous substances with spill prevention materials at hand. 12.7. Reduce sediment loads in water from dewatering operations. All dewatering should be done through temporary sediment traps (e.g. constructed out of geo-textiles and hay bales).

	+/- Impacts	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**
Before Mitigation	-	local	medium-high	short-term	likely	3
After Mitigation	-	local	low	short-term	moderate	1

Environmental Feature	13. Surface Water – Water Quality
Relevant Alternatives & Activities	Scouring into the Matlabas River
Project life-cycle	Operational phase
Potential Aspects & Impacts	Proposed Management Objectives / Mitigation Measures
Reduction in water quality of the Matlabas River with poorer quality water from the Crocodile River (West).	13.1. Prevent water quality impacts to the Matlabas River as a result of scouring. Determine the ecological status of the Matlabas River during the high-flow period, prior to construction, to determine specific requirements for scouring, as necessary.
Destabilisation of watercourses and erosion as a result of scouring.	13.2. Ensure that the scouring does not cause erosion.

	+/- Impacts	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	-	local	medium-high	short-term	likely	3
After Mitigation	-	local	low	short-term	moderate	1

13.8.5 Sediment Regime

13.8.5.1 Impact Description

The Crocodile River (West) system is regarded to have a medium sediment yield potential. The bulk water transfer process requires careful management of the dynamic sediment load conditions in the Crocodile (West) river system. It is explained in **Section 9.3.4.2** that the abstracted suspended sediment is less than 4% of total average annual sediment load in the river and that only up to 2% is planned to be returned (scoured back to the river from the desilting works). In addition, it is understood that the chemical characteristics of sediment in river are the same as for the sediment to be returned.

The following reports pertaining to sediment management are provided in **Appendix J**:

1. Interim Sediment Quality Report; and
2. MCWAP Technical Information: Summary of proposed sediment management in the Crocodile River at Vlieëpoort.

The abstraction weir is required to be located on an outside bend in the river. This allows the intakes to the Low-lift Pumping station to be placed on the outside of the bend in order to minimise sedimentation at the intakes. The weir is not designed for storage and it is assumed that it will silt up (and, because of its low height, should be scoured clear during most large flood events). The particular design that was adopted will, however, minimise the effects of sedimentation on the operation of the Works.

The alluvial deposits of the Crocodile River constitute the primary aquifer in terms of ground water utilisation. The construction of a weir in this aquifer may impact on the equilibrium of sub surface flow conditions. The proposed low level abstraction weir will cause an increase in the upstream river bed levels due to sedimentation. The impact is estimated to extent approximately 12 km upstream in the Crocodile River and 2 km upstream in the Bierspruit. The expected increase in sediment levels should improve the aquifer storage capacity but could cause local drainage problems on farms.

The sedimentation levels at the proposed inlet works will be locally managed by means of a large scour facility introduced at the proposed low level weir. Flushing of the local area in front of the intakes will be carried out from time to time during floods and for short durations. The reservoir created by the proposed weir will silt up and a new equilibrium bed will be formed. It is not the intension to flush the sediment from this reservoir.

The proposed weir is earmarked to be constructed in a well-defined section of the alluvial aquifer in the Crocodile River (West). The weir will be designed to dissipate erosive energy immediate downstream of the structure. This will mitigate the potential reduction of the depth of the aquifer at this point.

The increased water levels and sedimentation of the relative small reservoir or storage volume upstream of the low level weir will increase the hydraulic energy in the alluvial aquifer identified at Vlieëpoort. This will cause an increase in the flow rate in the aquifer from upstream to downstream of the proposed low level weir. This would cause a significant seepage potential underneath the weir. It is proposed to introduce a cut off wall below the weir to prevent seepage. The downstream section of the aquifer will thus be recharged from flow over the weir. Flow and suspended solids will be measured and trends monitored at the proposed new weir.

Boreholes will be established upstream and downstream of the proposed weir site to define a groundwater level baseline prior to the construction of the weir. The bulk of the sediment load reaching Vlieëpoort is expected to pass the weir. There should be more than sufficient sediment to sustain the existing levels of the alluvial aquifer downstream of the proposed weir. The actual situation regarding sediment conveyance will be monitored against the established baseline for sediment in suspension downstream of the proposed weir.

The proposed management of the abstracted sediment is based on the following:

1. The abstracted sediment load is approximately 3% of the total annual sediment load in the river; and
2. The abstracted sediment load is a natural product of the river system.

It is estimated that in the initial phases of MCWAP-2A between 19000t and 26000t of sediment will annually be abstracted at Vlieëpoort. The management of the abstracted suspended solids is critical as the potential cumulative impact can be substantial. It is further estimated that between 2300t and 3200t of the sediment load (Clay fraction) will be annually pumped to the end users.

The options to dispose of the remaining abstracted sediment volumes are the following:

- Partial storage and discharge back to the river (current preferred option) -
  - Annually deposit temporarily between 4 000m^3 and 5 400m^3 of sediment during floods and flush at the end of the same floods back to river. Flushing is not allowed during low flow conditions in the river. Permanent storage required for accumulation of sediment between floods of up to 2900m^3 per annum. It is assumed that the balancing dam would provide the permanent silt storage volume. This scenario layout was conveyed during the Feasibility Study. DEA confirmed in writing on 12 April 2016 (refer to letter contained in **Appendix F**) that there is no need for a Waste Management Licence for the scouring of the sediment back to the river.
- Complete storage -
  - In the event that the project is not permitted to discharge silt back to the river, between 6 000 m^3 and 9 000 m^3 per annum will have to be permanently stored, Over 50 years this is estimated to require a sediment storage volume of 450 000 m^3 and an additional footprint of up to 10 ha.

13.8.5.2 Impact Assessment

Environmental Feature	**14. Surface Water – Sediment Regime**
Relevant Alternatives & Activities	**All components and associated infrastructure; activities undertaken in-stream, alongside watercourses and within construction domain**
Project life-cycle	**Construction phase**
Potential Aspects & Impacts	**Proposed Management Objectives / Mitigation Measures**
Siltation of the affected watercourses from in-stream works and silt-laden runoff from disturbed areas.	14.1. Refer to mitigation measures related to managing sedimentation under **Section 13.8.4.2**.

	+/- Impacts	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**
Before Mitigation	-	local	medium-high	short-term	likely	3
After Mitigation	-	local	low	short-term	moderate	1

Environmental Feature	**15. Surface Water - Sediment Regime**
Relevant Alternatives & Activities	**Scouring of sediment back to Crocodile River (West) from the desilting works**
Project life-cycle	**Operational phase**
Potential Aspects & Impacts	**Proposed Management Objectives / Mitigation Measures**
Excessive sedimentation with deleterious impacts to aquatic environment and downstream water users.	15.1. Return sediment during floods and flush at the end of the same floods back to river. Flushing is not allowed during low flow conditions in the river. 15.2. Monitoring of the sediment levels in the Crocodile River (West) before and after flushing, as necessary, to determine impacts. 15.3. Periodic monitoring of chemical characteristics of sediment to confirm storage requirements and that scouring is acceptable.

	+/- Impacts	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	-	local	medium-high	short-term	likely	3
After Mitigation	-	local	low	short-term	moderate	1

Environmental Feature	**16. Surface Water - Sediment Regime**
Relevant Alternatives & Activities	**Vlieëpoort abstraction weir**
Project life-cycle	**Operational phase**
Potential Aspects & Impacts	**Proposed Management Objectives / Mitigation Measures**
Impact to sediment regime.	16.1. Establish boreholes upstream and downstream of the proposed weir site to define a groundwater level baseline prior to the construction of the weir. Monitor the actual situation regarding sediment conveyance against the established baseline for sediment in suspension downstream of the proposed weir.

	+/- Impacts	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	-	local - regional	high	long-term	likely	3
After Mitigation	neutral	-	-	-	-	-

** Assumed status of impact following adoption of suitable mitigation.*

13.8.6 <u>Ecological Status</u>

13.8.6.1 Impact Description

The findings from the Baseline Aquatic and Impact Study (see **Appendix I1**) follow.

According to the proposed activities associated with the MCWAP-2A and the current state of the local aquatic systems assessed, numerous potential impacts are expected for the project. The most direct impact expected to the Crocodile system is during the construction and operation of the Vlieëpoort abstraction weir and the new Paul Hugo Weir. As these structures entail instream construction, direct impacts to water quality, flows, instream habitat and aquatic biota are expected.

Furthermore, the inundation of the Crocodile River (West) during the operational phase will impact instream and riparian habitat, and is likely to modify aquatic biota due to modifications to flow regimes, from largely lotic system to lentic. Several fish and macroinvertebrate species with a high preference for well oxygenated fast flowing waters are likely to avoid the inundation zone. Furthermore, the potential for alien invasive species to proliferate is high, including fish species (*Micropterus salmoides* and *Cyprinus carpio*) which are likely to have adverse effects on indigenous aquatic biota and habitat; and alien invasive vegetation (e.g. *Eichhornia crassipes* (Water hyacinth)).

The instream connectivity of the Crocodile River (West) is further to be fragmented due to the construction of the two proposed weirs, adversely affecting fish migration. A single true migratory species is expected within the region, *Anguilla mossambica*. The presence of the species in upstream reaches indicates the ability of the species to circumnavigate low levels weirs. However, fish species found within the region have local migratory habits (< 5km). It is thus proposed that provision is made for a fishway for the Vlieëpoort abstraction weir.

The potential impacts during the construction and operational phases for the Bierspruit and Sand River gauging weirs are expected to be minor should adequate mitigation measures be implemented. Both systems are ephemeral, allowing construction to take place during the dry season.

Potential impacts to the Matlabas River during the construction of the pipeline crossing include modifications to the riparian zone, instream habitat, water quality, and modifications to local aquatic biota. *Insert: note that ecological status of the Matlabas River needs to be determined during the high-flow period, prior to construction. This will determine the requirements for inter alia crossing the watercourse (i.e. open trench or trenchless).*

A buffer zone of 30 m from the edge of the riparian zone is recommended. Apart from instream structures and activities, all other proposed construction activities should adhere to the recommended buffer. It is also recommended that the footprint of the construction servitude be reduced proximate to the Matlabas River.

Scouring of the pipeline at the Matlabas River crossing has the potential to modify water quality and erode banks and instream habitat and modify the sediment balance within the system.

The potential impacts arising from the abovementioned activities are listed in **Table 53**.

Table 53: Activity and Impact table for the proposed project (The Biodiversity Company, 2018)

Phase	Activity	Aspect	Impact
Construction	Construction of road and pipeline crossing	Site clearing and compaction	The activity would result in the deterioration of water and habitat quality within the downstream river reaches
		Storage of construction materials	
		Alteration of catchment drainage	
	Weir construction and associated infrastructure	Physical construction of the structure including the excavation of the streambed and removal of bank vegetation	Direct instream habitat loss and up and downstream habitat deterioration. Water quality impacts may also be anticipated through increased nutrients, suspended and dissolved solids
		Diversion of river for construction activities	
		Temporary infrastructure including mixing areas and ablutions	
		Spills and leaks of hydrocarbons and the operation of machinery	
Operation	Operation of the weir	Initial flooding of the impoundment	The flooding of upstream aquatic

Phase	Activity	Aspect	Impact
			habitat and loss of water quantity downstream
		Maintenance of the impoundment and presence of barrier	The barrier will alter the hydrology of the river system resulting in negative effects to the ecology of the river system. The barrier will serve to sever connectivity between up and downstream river reaches
		Physical abstraction of water	Loss of flow and floodplains in downstream sacrifice zone
	Operation of the roads and pipeline infrastructure	Runoff of contaminants and alteration of catchment hydrology	Water and habitat quality impacts to downstream river reaches
	Sediment return	Discharge of sediment into Crocodile River	Water and habitat quality impacts to downstream river reaches
	Scouring Pipeline in Matlabas	Release of water and sediment into the Matlabas	Water and habitat quality impacts to downstream river reaches

13.8.6.1 Impact Assessment

13.8.6.2 Risk Matrix

The risk assessment from the Baseline Aquatic and Impact Study (see **Appendix I1**) is presented in **Table 55**. The risk assessment was conducted in accordance with the DWS risk-based Water Use Authorisation approach and delegation guidelines. The matrix assesses impacts in terms of consequence and likelihood.

Consequence is calculated based on the following formula:

Consequence = Severity + Spatial Scale + Duration

Likelihood is calculated as:

Likelihood=Frequency of Activity + Frequency of Incident +Legal Issues + Detection

Significance is calculated as:

Significance\Risk= Consequence x Likelihood

The significance of the impact is calculated according to **Table 54**.

Table 54: Significance ratings matrix

Rating	Class	Management Description
1 – 55	(L) Low Risk	Acceptable as is or consider requirement for mitigation. Impact to watercourses and resource quality small and easily mitigated. Wetlands may be excluded.
56 – 169	M) Moderate Risk	Risk and impact on watercourses are notably and require mitigation measures on a higher level, which costs more and require specialist input. Wetlands are excluded.
170 – 300	(H) High Risk	Always involves wetlands. Watercourse(s) impacts by the activity are such that they impose a long-term threat on a large scale and lowering of the Reserve.

Table 55: Risk Impact Matrix for the proposed project (The Biodiversity Company, 2018)

Aspect	Flow Regime	Water Quality	Habitat	Biota	Severity	Spatial scale	Duration	Consequence
Construction Phase								
Construction of new infrastructure	1	1	1	1	1	1	2	4
Storage and use of hydrocarbons in proximity to the watercourse	0	2	0	2	1	2	2	5
Staff ablutions	0	2	0	2	1	2	2	5
Stockpile runoff and seepage and hydrocarbon contamination	1	2	2	3	2	2	2	6
Operational Phase								
Storage and use of hydrocarbons in proximity to the watercourse	0	2	1	2	1.2	2	2	5.2
Staff ablutions	0	2	1	1	1	2	2	5
The removal of sediments	3	1	3	3	2,5	3	2	7,5
Operation of machinery and equipment	2	2	2	2	2	2	2	6
Stockpile runoff and seepage and hydrocarbon contamination	2	2	2	2	2	2	2	6

Table 55: (continued)

Aspect	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Sig.	Without Mitigation	With Mitigation
Construction Phase								
Construction of new infrastructure	3	2	1	3	9	36	**Low**	**Low**
Storage and use of hydrocarbons in proximity to the watercourse	3	2	5	3	13	65	**Moderate***	**Low**
Staff ablutions	3	2	1	3	9	45	**Low**	**Low**
Stockpile runoff and seepage and hydrocarbon contamination	3	3	1	3	10	60	**Moderate***	**Low**
Operational Phase								
Storage and use of hydrocarbons in proximity to the watercourse	3	3	5	3	14	73	**Moderate***	**Low**
Staff ablutions	3	3	1	3	10	50	**Low**	**Low**
The removal of sediments	2	4	5	2	13	97,5	**Moderate**	**Moderate**
Operation of machinery and equipment	3	3	1	3	10	60	**Moderate***	**Low**
Stockpile runoff and seepage and hydrocarbon contamination	3	3	1	3	10	60	**Moderate***	**Low**
(*) denotes-In accordance with General Notice 509 “Risk is determined after considering all listed control / mitigation measures. Borderline moderate risk scores can be manually adapted downwards up to a maximum of 25 points (from a score of 80).								

The construction of the Vlieëpoort abstraction weir poses several moderate risks to the Crocodile River (West), with mitigation measures not being able to lower the risk status. This is due to the nature of the activity and proximity to sensitive areas. The physical construction of the weir poses the highest risk to the system, with additional moderate risks associated with river diversion, and clearing of the riparian areas for infrastructure. The initial flooding of the weir post construction poses the highest initial risk to the Crocodile River (West), as this will inundate instream habitat, and modify downstream flows. Based on data provided to the specialist, an estimated 7,3 km of the Crocodile will be inundated, and an additional 1,5 km of the Bierspruit. This will result in permanent impacts to upstream areas of the weir. The construction of the Sand River and Bierspruit gauging weirs will pose a lower risk to the systems, as these systems are ephemeral, and should be constructed during the dry season.

The abstraction of water from the Crocodile River is rated as moderate. The moderate rating remains high due to the duration of the activity, however, due to the increase in expected runoff from upstream reaches, the flow modifications within the reach are expected to be improved and base flows within the lower reaches of the Crocodile be maintained. The discharge of sediment into the Crocodile poses a moderate risk. This is due to the potential of altered sediment balance, modifications to downstream instream habitat, bank and channel erosion.

The construction of the central pipeline across the Matlabas River poses a moderate risk to the riparian and instream habitats. Furthermore, during the scouring of the pipeline into the system, risks were rated as moderate due to the potential modifications to water quality and instream habitat.

13.8.6.3 Mitigation Measures

The mitigation measures proposed as part of the Baseline Aquatic and Impact Study are as follows:

- ❖ Buffer Zones -
  - The recommended buffer zones should be strictly adhered to during the construction phase of the project, with exception of the activities and structures required to traverse a watercourse. This includes structures such as culverts for drainage lines and the weir structure itself. Any supporting aspects and activities, such as laydown and mixing yards, not required to be within the buffer area should adhere to the buffer zone.
- ❖ Weir Construction -
  - A water bar (e.g. Earth Berm Water Bars) diverts water flowing down a surface (e.g. road) to one side. This reduces the volume of water that flows down the surface and the subsequent erosion that occurs;

- During the excavation of watercourses, flows should be diverted around active work areas where required. Water diversion must be temporary and re-directed flow must not be diverted towards any stream banks that could cause erosion;
- Construction areas should be demarcated and watercourses marked as "restricted" in order to prevent the unnecessary impact too and loss of these systems;
- Storm water channels and preferential flow paths should be filled with aggregate and/or logs (branches included) to dissipate and slow flows limiting erosion;
- Prevent uncontrolled access of vehicles through the wetlands that can cause a significant adverse impact on the hydrology and alluvial soil structure of these areas;
- All removed soil and material must not be stockpiled within the system. Stockpiling should take place outside of the water resources. All stockpiles must be protected from erosion, stored on flat areas where run-off will be minimised, and be surrounded by bunds; and
- Any exposed earth should be rehabilitated promptly by planting suitable vegetation (vigorous indigenous grasses) to protect the exposed soil.

❖ Altered Hydrology -

- The minimum flows for the EWR stipulated in the "Preliminary Reserve Determination and Ecological Categorisation for selected Rivers and Wetlands in the Crocodile (West) Catchment (A20)" is recommended for implementation through the operational phase of the proposed project.

❖ Water Quality -

- Same mitigation measures above for weir construction above, as relevant.
- Laydown yards, camps and storage areas must be beyond the water resource areas and associated buffers where applicable;
- During construction contractors used for the project must have spill kits available to ensure that any fuel or oil spills are clean-up and discarded correctly;
- As much material must be pre-fabricated and then transported to site to avoid the risks of contamination associated with mixing, pouring and the storage of chemicals and compounds on site;
- All contractors and employees should undergo induction which is to include a component of environmental awareness. The induction is to include aspects such as the need to avoid littering, the reporting and cleaning of spills and leaks and general good "housekeeping";
- All chemicals and toxicants during construction must be stored in bunded areas;
- All machinery and equipment should be inspected regularly for faults and possible leaks, these should be serviced off-site;
- Cofferdams are temporary structures used to displace water and provide dry access to usually submerged areas (such instream construction and

maintenance of bridges etc.). They can also be built to prevent water coming into contact with high impact zones (e.g. construction sites) and reduce the amount of sedimentation and pollution;

- Adequate sanitary facilities and ablutions on the servitude must be provided for all personnel throughout the project area. Use of these facilities must be enforced (these facilities must be kept clean so that they are a desired alternative to the surrounding vegetation);
- Have action plans on site, and training for contactors and employees in the event of spills, leaks and other impacts to the aquatic systems;
- No dumping of construction material on-site may take place; and
- All waste generated on-site during construction must be adequately managed. Separation and recycling of different waste materials should be supported.

❖ Erosion and Sedimentation -

- Same mitigation measures above for weir construction and water quality, as relevant.
- The placement of culverts in drainage lines should not encourage erosion through increasing water velocity. Energy dissipation must be installed downstream of culverts in drainage lines.
- Temporary and permanent erosion control methods may include silt fences, flotation silt curtains, retention basins, detention ponds, interceptor ditches, seeding and sodding, riprap of exposed embankments, erosion mats, and mulching;
- Riverine sediment management must occur in a manner which replicates natural sediment movements.

❖ Pipeline Trench Rehabilitation -

- Trench must be side dug (where possible) from the access routes, or already disturbed areas;
- Trenches must be dug on-line (where applicable) creating narrower trenches;
- Where trench breakers are required, these must be imported appropriately and installed by the backfill crew, ahead of backfilling;
- Careful separation of soil types / strata as identified;
- The soils must be removed in such a way that they can be easily reinstated in the reverse order;
- To ensure correct backfilling, the soil that is removed from the trench at its deepest point must be laid closest to the trench. The first layer of topsoil must be laid furthest away from the trench;
- Excess spoil must be temporarily windrowed over the trench to permit natural settling of the material prior to the reinstatement phase;
- Stripping must be demarcated to avoid unnecessary removals (survey pegs). Keep stripping areas to a minimum footprint area;

- Trenches within watercourses must be in excess of 1m to enable interflow within the system;
- Vegetation should be stripped / removed in a phased manner. Where possible, store vegetation for re-planting. Impacted areas can be re-vegetated using sods from removed vegetation;
- To avoid compaction of the backfilled trench, ripping should be done to a maximum depth of 300 mm in two directions at right angles;
- Ripping should be conducted during the drier period;
- After construction, compacted topsoil should be ripped and vegetation re-planted or seeds dispersed; and
- Should project timeline allow, the construction of the weir and pipeline should be undertaken in the dry season.

❖ Alien Invasive Plants -

- Quarterly vegetation rehabilitation surveys need to be conducted of the vegetation within the project footprint; and
- An alien invasive plant management plan needs to be compiled and implemented prior to construction to control and prevent the spread of invasive aliens.

❖ Maintenance of Connectivity -

- The loss of connectivity between areas up- and downstream of the weir is anticipated to have the largest ecological impact, especially when considering the listed Near Threatened species. It is anticipated that the weir will act as a barrier. Therefore, to facilitate the movement of fish species, a fish ladder is recommended as the mitigation action. A fish ladder has been included in the initial proposed weir design options. However, the option considered from an aquatic ecology perspective should pose the least risk to fish migration.
- Detailed fish ladder designs should implement the established protocols found in WRC report No 1270/2/04 and WRC report No 1310/1/05. Essentially, four types of fishways should be considered namely: Pool and weir, vertical-slot, pool and slot, and natural by-pass channels.
- Considering this literature, the following fishway concepts should be adhered to in the preferred option:
    - The fishway should have water passing through it during both high flows and low flows to encourage fish to make use of the fishway no matter the flow levels;
    - The fishway should cater for both rheophilic (fastmoving water) and anti-rheophilic (slow moving water) fish species. This can be achieved through having several different flow velocity areas across the fishway;
    - It is recommended that a rough stone surface be cast into the fishway channel floor to cater for climbing and crawling species;

- Rocks used for the fishway should have flat sides with rounded edges (typical of quarried rock) rather than rounded rocks, as they provide a variety of water velocity and depths that easy for fish to navigate;
- Pools or depressions of varying sizes and depths should be created at random throughout the length and width of the fishway and should be placed behind large rocks to create lower velocity resting areas (eddies) for fish. The more pools incorporated in the design, the more successful the fishway will be; and
- Additional guidelines for fishway design are also provided in the Baseline Aquatic and Impact Study.

❖ Monitoring Programme -

- Considering the potential negative impacts to aquatic ecology arising from the proposed project, an aquatic monitoring programme has been recommended.

13.8.7 Hartbeespoort Dam

13.8.7.1 Impact Description

The findings from the Hartbeespoort Dam Specialist Opinion (see **Appendix I8**) are presented in **Table 56**.

Table 56: Wetland Impact Assessment (qualitative) (Horizon Environmental Consulting, 2018)

Aspect Considered	Summary	Mitigation
Stratification	It is not anticipated that there will be a significant change to the stratification and hypolimnion in Hartbeespoort Dam.	-
Primary Production	MCWAP-2A is unlikely to influence primary production in Hartbeespoort Dam. The physical parameters controlling problem aquatic algae won't change during the winter, as colder conditions currently limit production.	Mitigation measures to address in-lake primary production need to address inflow water quality and any residual nutrients accumulated in the dam.
Nitrates	The potential impacts on Hartbeespoort Dam can be divided into winter and summer impacts. During winter, with the implementation of MCWAP-2A, impoundment levels are expected to drop by up to 6 m. However, based on the area capacity curve and area volume map, the impoundment surface area will only reduce by 800 ha. This reduction in area by 40% is unlikely to have a significant effect in winter, as primary production is limited by temperature and light during this period. During summer, high concentrations of nitrates are suitable for blooms of algae. With the advent of MCWAP-2A, these high concentrations are expected to continue and thus blooms of algae will continue to occur.	While there are no specific measures identified as a result of MCWAP-2A implementation, general catchment mitigation measures could include measures such as: • Reduction at source – reduce nutrient loading by maintaining upgrading point source water treatment works and diffuse source breakdown of water reticulation systems; • Pre-impoundment treatment – installation of a pre-lake or wetland to assist with the removal of nutrients before they enter the impoundment; and • In-lake treatment – building from the now defunct Hartbeespoort Dam Management Plan for a longer period of time and a on a

Aspect Considered	Summary	Mitigation
		continuous basis.
Phosphates	During winter the load to the impoundment remains constant as the dominant flow remains the Crocodile River. However, the lowered water level will expose a certain portion of the sediments and through desiccation and physical action by wind, phosphates can be released when the impoundments starts to fill. The scale of this release is difficult to assess because the bulk of the sediment lies within the deeper basin which will not be influenced by the lower winter levels. There is however, a portion of the sediments deposited in the Crocodile River basin in the impoundment and a portion of these could be exposed during low water levels. It is for this reason that there is a possibility that the primary production in the impoundment will increase during the early spring and summer period when temperature and solar radiation becomes favourable for algal growth.	While there are no specific measures identified as a result of MCWAP-2A implementation, general catchment mitigation: • Reduction at source – reduce nutrient loading by maintaining upgrading point source water treatment works and diffuse source breakdown of water reticulation systems; • Pre-impoundment treatment – installation of a pre-lake or wetland to assist with the removal of nutrients before they enter the impoundment; and • In-lake treatment – Dredging of sediments during winter when the lower impoundment water levels provides greater surface area for mechanical removal.
Salinity	The nature of changing water quality in a large number of South African rivers is increasing salinity. An increase in salinity can impact on a number of in-lake processes: • Biodiversity; and • In-lake chemical processes. The current concentrations of Dissolved Mineral Salts in the impoundment are not a cause for concern, but incremental changes over time may impact of the ecological nature of the impoundment.	-
Water Hyacinth	Water hyacinth die back in the winter periods. It's minimum temperature tolerance is 12 degrees C. The leaves are prone to frost. The impact of the MCWAP-2A in winter (when the lowest water levels are expected) is unlikely to affect the current status of hyacinth in the impoundment. As the temperature rises in spring, the hyacinth begin to recover and once temperatures reach the mid 20's, hyacinth is at its most productive. Hyacinth are prolific growers and can double in mat size within 2 weeks. Hyacinth reproduces with runners but seed production can be many thousand per plant and can survive for over 20 years. During this period it is expected that the impoundment will be 2 m shallower than the recent past. As per the area capacity curve, the reduction in area is relatively small and thus there is unlikely to be any significant change to the prolific growth of hyacinth on Hartbeespoort Dam.	The containment and harvesting of hyacinth in specific areas and conversion to fertiliser, could remove significant amounts of nutrients from the impoundment and provide sustainable opportunities.

13.9 Wetlands

13.9.1 Impact Description

The findings from the Wetland Impact Assessment (see **Appendix I5**) follow.

Table 57: Wetland Impact Assessment (qualitative) (Index, 2018b)

Feature	Description	Discussion
1. Construction of the Vlieëpoort abstraction weir and low-lift pumping station		
PES	• The habitat is currently in PES category B. Construction of the weir complex will create a reservoir upstream that will lead to the loss of habitat. • The river banks are covered by alien invasive species. • In general the habitat functions effectively below the point where the weir is proposed. This is not expected to change after construction of the weir and pumping infrastructure, unless flow diminishes.	Watercourse characteristics: • Hydraulic regime ○ The basal cover is sufficient to retard flow and protect the bed against erosion. • Water quality ○ Water quality is a given and fluctuates with water levels. • Geomorphology and sediment balance ○ The flow velocity of the river will not change upstream of the weir but will diminish downstream. It is unlikely to impact on stream bank and stream bed incision and erosion downstream. • Habitat and biota ○ Proliferation of alien and invasive floral species has occurred over time. ○ Many of the plants identified are invasive and should be eradicated.
Eco services	• Despite the slight decreased ecological integrity, functioning remains at an intermediate level, particularly in terms of eco- services such as flood attenuation, sediment trapping, toxicant assimilation, and erosion control. Socio-cultural service provision is deemed to be low because of restricted access to the river, reducing the opportunity to provide services such as water for tourism and recreation and to maintain biodiversity. • The Crocodile River (West) is a major source of irrigation water. This supply is regulated through an existing lawful use (Section 35 of the NWA) and will be dealt with in accordance with this Act.	
EIS	• This system is considered to be ecologically important at the location of the affected site.	
REC	• The Crocodile River Stream Wetland is largely modified due to farming activities. • Irrigation already takes place on the old riparian zone and will likely remain so.	
2. Construction of pipeline at Matlabas River crossing		
PES	• The river now has a PES rating of B. There is some degradation that has taken place; but the habitat is largely intact with minimal modification. • The impact of the pipeline will depend on the construction method employed; if buried, it will affect the PES temporarily.	Watercourse characteristics: • Hydraulic regime ○ Much of the catchment upstream is pristine as it is located in an area that focusses on nature-based tourism. ○ Construction is unlikely to influence to flow characteristics of the Matlabas River. • Water quality ○ Water in this section of the
Eco services	• The river functions at a high level, particularly in terms of eco-services such as flood attenuation, sediment trapping, toxicant assimilation, and	

Feature	Description	Discussion

	erosion control.
	• Socio-cultural service provision is deemed to be high, largely as a result of the surrounding tourism development. However, access to the services are limited because of its *Private Game Reserve* status.
		tributary was not tested for quality. Construction will not change the water quality.
		• Geomorphology and sediment balance
		  ○ The flow velocity of the river will not change. Construction is unlikely to impact the Matlabas River. (*Insert: note the ecological status of the Matlabas River needs to be determined during the high-flow period, prior to construction. This will determine the requirements for crossing the watercourse (i.e. open trench or trenchless), as well as for scouring (i.e. draining water from the pipeline, typically during maintenance)*.
		• Habitat and biota
		  ○ Proliferation of alien and invasive floral species has occurred over time.
		  ○ Many of the plants identified are invasive and should be eradicated.

EIS	• This system is considered to be ecologically important at the location of the affected site.	
REC	• Construction in this sensitive habitat is likely to introduce silt and dust. The EMPr for the construction phase should include measures to minimise the impact of construction and eradicate invasive plants and to improve and maintain the riparian vegetation.	
3. Installation of pipeline at depressions in the Northern Sandy Plains		

PES	• The present PES status is B and C. This status will be maintained post construction.	Watercourse characteristics:
		• Hydraulic regime
		  ○ Not applicable
		• Water quality
		  ○ Not applicable
		• Geomorphology and sediment balance
		  ○ Construction will not impact on the pan.
		• Habitat and biota
		  ○ Construction should not impact on the pan (if avoided).

Eco services	• The depressions are important habitats for fauna because it provides water in an otherwise arid environment. It is poor in sediment trapping or controlling water quality.	
EIS	• This system is not considered to be ecologically important.	
REC	• The system is largely unmodified and should remain in its present state after construction.	

13.9.2 <u>Impact Assessment</u>

13.9.2.1 Risk Matrix

The risk matrix from the Wetland Impact Assessment (see **Appendix I5**) is presented in **Table 58**.

Table 58: Risk Matrix (Index, 2018b)

Activity	Aspect	Impact	Flow Regime	Physical & Chemical (Water Quality)	Habitat (Geomorphology and Vegetation)	Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance
WEIR AND LOW-LIFT PUMPING STATION															
Divert water to construct weir	Clear vegetation of the land where the new weir will be built. Build a the temporary canal to divert the water during construction of the weir.	Impeding or Diverting the Flow of Water in a Watercourse [Section 21(c)].	The river is perennial. Flows increase during rainfall events.	The site is moderately transformed with a small probability of capturing solids or chemicals. No additional pollutants are expected from the diversion .	The stream integrity is intact below the weir. The stream diversion will have a large impact for the distance of the diversion.	2	1	3	**8**	1	1	5	1	**8**	**64**
Construct and commission	Excavate existing watercourse. Build retaining structure. Re-divert water to new reservoir (weir).	Altering the Bed, Banks, Course or Characteristics of a Watercourse [Section 21(i)].				4	3	4	**11**	1	3	5	1	**10**	**110**
MATLABAS RIVER CROSSING															
Construct portal	Clear vegetation of the land where the portals will be built.	Impeding or Diverting the Flow of Water in a Watercourse [Section 21(c)]	The river is perennial but the pipeline will be constructed by horizontal drilling * and will not impact on the flow of the river.	No impact is foreseen due to the construction method.	No impact is foreseen due to the construction method.	1	1	1	**3**	1	5	5	1	**12**	**36**
Construct and commission	The pipeline will be constructed by horizontal drilling or by excavation.*	Altering the Bed, Banks, Course or Characteristics of a Watercourse [Section 21(i)].				3	1	4	**8**	1	1	5	1	**12**	**96**
CONSTRUCT PIPELINE ON DEPRESSIONS (OPTION 1) - worst case scenario															
Construct berm to retain water	Clear vegetation where the pipeline and berm will be constructed.	Impeding or Diverting the Flow of Water in a Watercourse [Section 21(c)]	The wetland is a depression with no flow. Construction will not impact on the flow regime.	The wetland is a depression with no flow. Construction will not impact on wetland water quality.	The impact on the vegetation will be for the duration of construction and the period for the vegetation to recover.	2	1	1	**4**	1	1	5	1	**8**	**32**
Construct and commission	Excavate the trench, install and backfill.	Altering the Bed, Banks, Course or Characteristics of a Watercourse [Section 21(i)]				2	1	2	**5**	1	1	5	1	**8**	**40**
CONSTRUCT PIPELINE ON DEPRESSIONS (OPTION 2) - preferred placement of the route															
Construct and commission	Move the pipe alignment to the other side of the fence but still within the 100 m corridor.	No impact	No impact	Dust from construction may impact on water quality, but can be mitigated.	Dust from the construction may impact on water quality.	-	-	-	**0**	-	-	-	-	**0**	**0**

**: Insert: Ecological status of the Matlabas River needs to be determined during the high-flow period, prior to construction, to determine the requirements for crossing.*

The Wetland Impact Assessment used a risk matrix, based on the ratings shown in **Table 54**, to determine the risks posed by MCWAP-2A on the water resources after mitigation measures have been implemented. Refer to the findings provided in **Table 59**.

Table 59: Overall Risk Ratings (Index, 2018b)

Impacted Wetland / Activity	Impact Score	Impact Rating
Weir and Low-Lift Pumping station	174	High
Matlabas River crossing	130	Moderate
Construct Pipeline on Depressions (Option 1) - Worst case scenario	72	Moderate without further mitigation
Construct Pipeline on Depressions (Option 2) - Preferred placement of the route	0	Low

13.9.2.2 Mitigation Measures

The Wetland Impact Assessment proposed the following mitigation measures:

- Vlieëpoort abstraction weir and low-lift pumping station -
  - *Exotic vegetation* - Removal and subsequent management of these species is very important in maintaining the biodiversity value and integrity of the stream and wetland. Exotic shrubs and creepers can be treated chemically. The alien and invasive species were listed in the Government Gazette of 29 July 2016 published in terms of the NEM:BA. These procedures will apply to all sections where aliens and exotics need to be eradicated. Although the abundance of exotic species is currently relatively low, control and management will ensure they don't proliferate and negatively affect the system;
  - *Insert – provision is made in the EMPr to safeguard the resource quality of the affected watercourses during construction*.
- Construct Pipeline at the Matlabas Crossing -
  - The ecological status of the Matlabas River needs to be determined during the high-flow period, prior to construction. This will determine the requirements for crossing the watercourse as well as for scouring.
- Construct Pipeline on Depressions -
  - The construction of the pipeline along the Routes D1 to D3 poses low risk and will only influence the habitat for the duration of construction. A 100 m corridor along the route was allowed for in the impact assessment. In all cases the route is in proximity of the depression but does not enter the pan itself. However, it is still not total clarity of the regional hydrological functioning of the soils in proximity of the pans.
  - It is recommended that the placement of the routes is as follows:
    - Alternative D1: Eastern side of fence and then cross over to the western side at Enkeldraai 314EQ;
    - Alternative D2: Eastern side of fence; and
    - Alternative D3: Western side of the road (see **Figure 139**).
    - Alternative D4: Follow the new route shown in **Figure 140**.

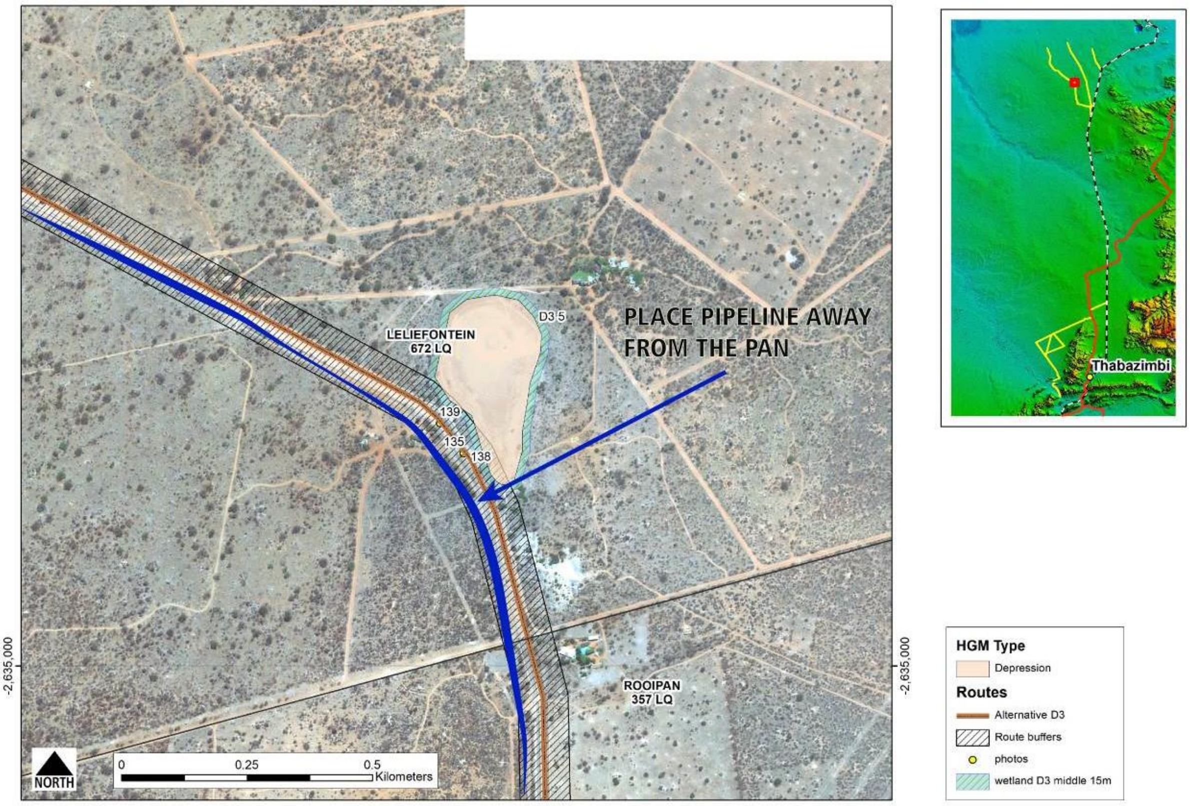


Figure 139: **Pipeline placement on Leliesfontein to negate the impact on the wetland D3 5 (Index, 2018b)**

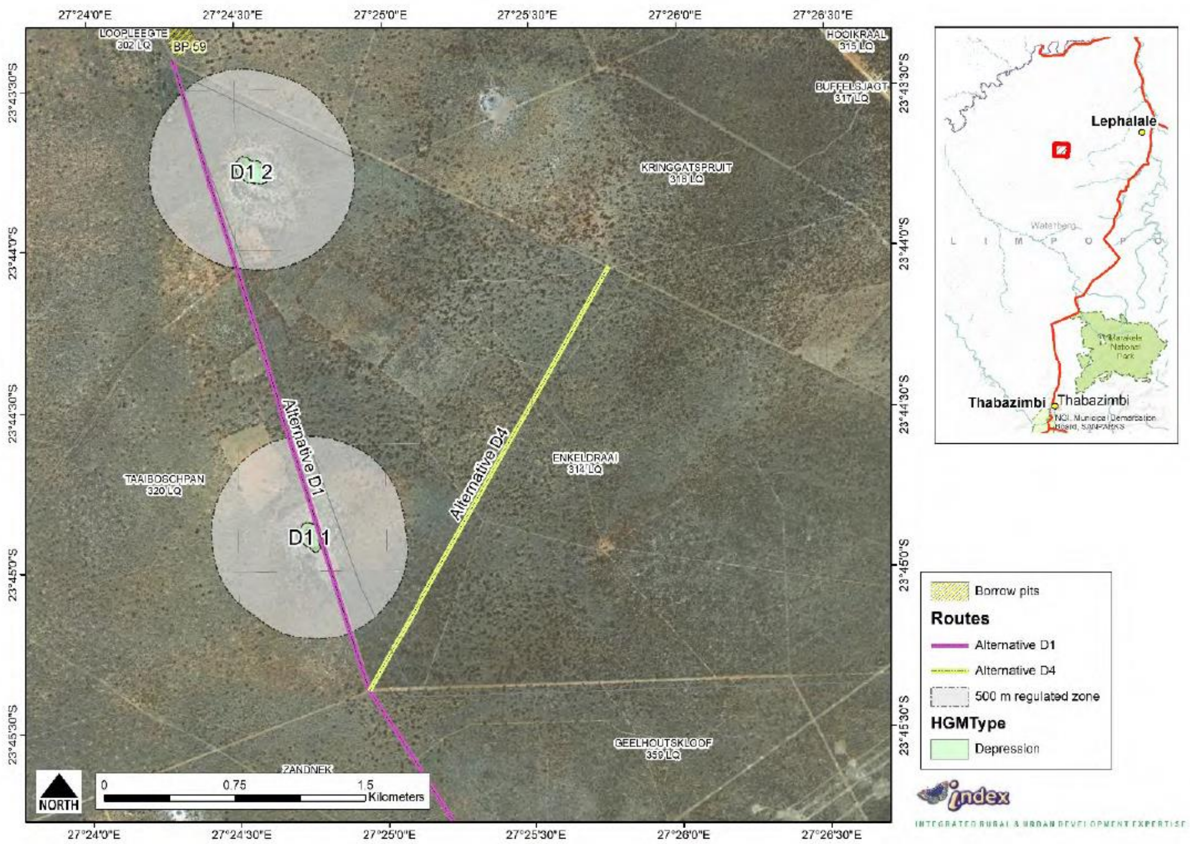


Figure 140: **Pipeline placement to negate the impact on wetlands D1.1 and D1.2 (Index, 2018b)**

13.10 Terrestrial Ecology

13.10.1 Impact Description

Potential impacts to flora include following (amongst others):

- Vegetation will be lost in areas that are to be cleared for the project infrastructure. The potential loss of significant flora species may occur. Refer to the findings of the Terrestrial Ecological Impact Assessment in **Section 12.5**;
- Clearing of vegetation for construction purposes or importing soil may result in the proliferation of exotic vegetation, which could spread beyond the construction domain. These potential impacts will be managed through suitable rehabilitation and eradication methods, as contained in the EMPr;
- The project footprint encroaches into CBAs and ESAs, which are important in terms of biodiversity, ecosystem functionality and ecological processes; and
- The establishment of trees within the pipeline servitude will not be allowed as roots may compromise the stability of the pipeline.

Potential impacts to fauna include following (amongst others):

- Ecosystem disruption may occur where clearing is undertaken to allow for the construction of the project infrastructure;
- Sections of the alternative pipeline routes traverse or pass in close proximity to enclosures where sensitive game is kept. Provision will need to be made to prevent impacts to sensitive game;
- Fauna could be adversely affected through construction-related activities (noise, dust, light pollution, illegal poaching, and habitat loss). This is especially relevant to sensitive game species;
- The construction servitude will minimise animal movement. This is particularly significant on smaller game farms or in instances where access to watering points will be affected;
- Possible disturbance to the bat cave that is situated in the Mooivallei area during construction; and
- Refer to additional potential impacts identified as part of the Wildlife Impact Assessment.

The relevant permits will need to be obtained from the regulatory authorities, including DAFF in terms of NFA and LDEDET in terms of the LEMA, as required.

13.10.2 Impact Assessment

The findings from the Terrestrial Ecological Impact Assessment (see **Appendix I2**) follow.

<table>
<tr><td>Environmental Feature</td><td colspan="6">17. Flora & Fauna</td></tr>
<tr><td>Relevant Alternatives & Activities</td><td colspan="6">All construction activities</td></tr>
<tr><td>Project life-cycle</td><td colspan="6">Pre – construction phase</td></tr>
<tr><td>Potential Impact</td><td colspan="6">Mitigation</td></tr>
<tr><td>Loss of species of conservation concern.</td><td colspan="6">• Permits from DAFF and LDEDET are required before construction commences in order to cut, disturb, destroy or remove the several protected trees noted within the project area.
• It is recommended that search, rescue and relocation be conducted taking into consideration red data, protected and endangered flora and fauna species. For flora species, the following factors need to be considered (amongst others) as part of this plan:
○ Detailed plan of action (including timeframes, methodology and costs);
○ Site investigations;
○ Consultation with authorities and stakeholders;
○ Marking of species to be relocated;
○ Applying for permits;
○ Identification of suitable areas for relocation;
○ Aftercare; and
○ Monitoring (including targets and indicators to measure success).</td></tr>
<tr><td>Without Mitigation</td><td>Nature</td><td>Extent</td><td>Magnitude</td><td>Duration</td><td>Probability</td><td>Significance</td></tr>
<tr><td></td><td>Negative</td><td>Regional</td><td>High</td><td>Short-term</td><td>Almost certain</td><td>2</td></tr>
<tr><td>With Mitigation</td><td>Nature</td><td>Extent</td><td>Magnitude</td><td>Duration</td><td>Probability</td><td>Significance</td></tr>
<tr><td></td><td>Negative</td><td>Regional</td><td>Low</td><td>Short-term</td><td>Likely</td><td>1</td></tr>
</table>

<table>
<tr><td>Loss of Protected species listed in terms of NEM:BA Threatened or Protected Species Regulations.</td><td colspan="6">• In order to protect Southern African Python on or around the site, should this species be encountered or exposed during the construction phase, it should be removed and relocated to natural areas in the vicinity. This remedial action requires the engagement of a herpetologist and or ecologist to oversee the removal. However, if this species if found during winter period, when it is in hibernation, then a permit from LDEDET would be required in order to catch and release it to a safer environment.
• The desktop study shows that spider species such as burst horned baboon spider are expected to occur in the area, and it is therefore suggested that during the search and rescue, if any of these are found, a permit will be required before relocation can take place.</td></tr>
<tr><td>Without Mitigation</td><td>Nature</td><td>Extent</td><td>Magnitude</td><td>Duration</td><td>Probability</td><td>Significance</td></tr>
<tr><td></td><td>Negative</td><td>Regional</td><td>High</td><td>Short-term</td><td>Almost certain</td><td>2</td></tr>
<tr><td>With Mitigation</td><td>Nature</td><td>Extent</td><td>Magnitude</td><td>Duration</td><td>Probability</td><td>Significance</td></tr>
<tr><td></td><td>Negative</td><td>Regional</td><td>Low</td><td>Short-term</td><td>Likely</td><td>1</td></tr>
</table>

<table>
<tr><th colspan="3">Environmental Feature</th><th colspan="4">18. Flora</th></tr>
<tr><th colspan="3">Relevant Alternatives & Activities</th><th colspan="4">All construction activities</th></tr>
<tr><th colspan="3">Project life-cycle</th><th colspan="4">Construction phase</th></tr>
<tr><th colspan="3">Potential Impact</th><th colspan="4">Mitigation</th></tr>
<tr><td colspan="3">Destruction of indigenous flora during site establishment.</td><td colspan="4">Clearly demarcate the construction servitude prior. Vegetation clearing should be kept to a minimum (restricted to construction servitude), and this should only occur where it is absolutely necessary and the use of a brush-cutter is highly preferable to the use of earth-moving equipment.
Rehabilitate all disturbed areas as soon as the construction is completed on the proposed development sites.
Ensure that all construction personnel have the appropriate level of environmental awareness and competence.
Vehicles and construction workers should under no circumstances be allowed outside the construction servitude to prevent impact on the surrounding vegetation.
Prevent contamination of natural areas.
Areas cleared of vegetation must be re-vegetated prior to contractor leaving the site.
Proliferation of alien and invasive species is expected within the disturbed areas and they should be eradicated and controlled to prevent further spread.
No storage of any construction material on sensitive areas.
Avoid translocating topsoil to sensitive areas in order to prevent translocating soil seed banks of alien species.</td></tr>
<tr><td>Without Mitigation</td><td>Nature</td><td>Extent</td><td>Magnitude</td><td>Duration</td><td>Probability</td><td>Significance</td></tr>
<tr><td></td><td>Negative</td><td>Local</td><td>Medium</td><td>Short-term</td><td>Almost certain</td><td>2</td></tr>
<tr><td>With Mitigation</td><td>Nature</td><td>Extent</td><td>Magnitude</td><td>Duration</td><td>Probability</td><td>Significance</td></tr>
<tr><td></td><td>Negative</td><td>Local</td><td>Low</td><td>Short-term</td><td>Likely</td><td>1</td></tr>
</table>

<table>
<tr><td colspan="3">Environmental Feature</td><td colspan="4">19. Fauna</td></tr>
<tr><td colspan="3">Relevant Alternatives & Activities</td><td colspan="4">All construction activities</td></tr>
<tr><td colspan="3">Project life-cycle</td><td colspan="4">Construction phase</td></tr>
<tr><td colspan="3">Potential Impact</td><td colspan="4">Mitigation</td></tr>
<tr><td colspan="3">Loss and displacement of animals on site.</td><td colspan="4">• If any herpetological species are encountered or exposed during the construction phase, they should be removed and relocated to nearby natural areas. This remedial action requires the employment of a herpetologist and or ecologist to oversee the removal of any herpetofauna during the initial ground clearing phase of construction (i.e. initial ground-breaking by earthmoving equipment).
• Training of construction personnel to recognise threatened animal species will reduce the probability of fauna being harmed unnecessarily.
• The contractor must ensure that no faunal species are disturbed, trapped, hunted or killed during the construction phase.
• Vehicles must adhere to the set speed limit.
• All construction and maintenance vehicles must use designated access roads. Off-road driving should be strictly prohibited.
• No fires should be allowed at the site
• No dogs or other domestic pets should be allowed at the site.
• Where the pipeline will cross rivers (especially the Matlabas River) and drainage lines, mitigation measures suggested by the Wetland Study should be followed.
• Fauna (mammals and reptiles) that become trapped in any excavation or in any construction or operational related activity may not be harmed and must be rescued and relocated by an experienced person.</td></tr>
<tr><td>Without Mitigation</td><td>Nature</td><td>Extent</td><td>Magnitude</td><td>Duration</td><td>Probability</td><td>Significance</td></tr>
<tr><td></td><td>Negative</td><td>Local</td><td>Medium</td><td>Short-term</td><td>Almost certain</td><td>2</td></tr>
<tr><td>With Mitigation</td><td>Nature</td><td>Extent</td><td>Magnitude</td><td>Duration</td><td>Probability</td><td>Significance</td></tr>
<tr><td></td><td>Negative</td><td>Local</td><td>Low</td><td>Short-term</td><td>Likely</td><td>1</td></tr>
</table>

<table>
<tr><th colspan="3">Environmental Feature</th><th colspan="4">20. Flora</th></tr>
<tr><td colspan="3">Relevant Alternatives & Activities</td><td colspan="4">All construction activities</td></tr>
<tr><td colspan="3">Project life-cycle</td><td colspan="4">Construction phase</td></tr>
<tr><td colspan="3">Potential Impact</td><td colspan="4">Mitigation</td></tr>
<tr><td colspan="3">Loss of vegetation due to fuel and chemical spills.</td><td colspan="4">• Appropriate measures should be implemented in order to prevent potential soil pollution through fuel and oil leaks and spills.
• Ensure construction vehicles are maintained and serviced to prevent oil and fuel leaks.
• Emergency on-site maintenance should be done over appropriate drip trays and all oil or fuel must be disposed of according to waste regulations. Drip-trays must be placed under vehicles and equipment when not in use.</td></tr>
<tr><td colspan="3">Proliferation of alien invasive species.</td><td colspan="4">• Control of alien invasive species and noxious weeds for areas disturbed by the construction activities, in accordance with the requirements of the NEM:BA Alien and Invasive Species Regulations. Eradication method to be approved by the Project Manager.
• To prevent unnecessary alien plant infestations, an alien plant monitoring and eradication programme needs to be in place, at least until the disturbed areas have recovered and properly stabilised.
• The construction area and immediate surroundings should be monitored regularly for emergent invasive vegetation.
• Promote awareness of all personnel.
• The establishment of pioneer species should be considered with the natural cycle of rehabilitation of disturbed areas, which assists with erosion control, dust and establishment of more permanent species. This can be controlled during construction phase and thereafter more stringent measures should be implemented during the rehabilitation and post rehabilitation.
• Larger exotic species that are not included in the Category 1b list of invasive species could also be allowed to remain for aesthetic purposes</td></tr>
<tr><td colspan="3">Loss of topsoil and erosion.</td><td colspan="4">• During site preparation, topsoil and subsoil are to be stripped separately from each other and must be stored separately from spoil material for use in the rehabilitation phase. It should be protected from wind and rain, as well as contamination from diesel, concrete or wastewater.
• An ecologically-sound storm water management plan must be implemented during construction and appropriate water diversion systems put in place.</td></tr>
<tr><td>Without Mitigation</td><td>Nature</td><td>Extent</td><td>Magnitude</td><td>Duration</td><td>Probability</td><td>Significance</td></tr>
<tr><td></td><td>Negative</td><td>Local</td><td>Medium</td><td>Short-term</td><td>Almost certain</td><td>2</td></tr>
<tr><td>With Mitigation</td><td>Nature</td><td>Extent</td><td>Magnitude</td><td>Duration</td><td>Probability</td><td>Significance</td></tr>
<tr><td></td><td>Negative</td><td>Local</td><td>Low</td><td>Short-term</td><td>Likely</td><td>1</td></tr>
</table>

<table>
<tr><td colspan="3">Environmental Feature</td><td colspan="4">21. Flora & Fauna</td></tr>
<tr><td colspan="3">Relevant Alternatives & Activities</td><td colspan="4">Construction activities in CBAs and ESAs</td></tr>
<tr><td colspan="3">Project life-cycle</td><td colspan="4">Construction phase</td></tr>
<tr><td colspan="3">Potential Impact</td><td colspan="4">Mitigation</td></tr>
<tr><td colspan="3">Loss of CBA and ESA habitats.</td><td colspan="4">
The most significant way to mitigate the loss of habitat is to limit the construction footprint within the natural habitat areas remaining. Disturbance of vegetation must be limited to the construction servitude.
Areas cleared of vegetation must be re-vegetated prior to contractor leaving the site.
Vehicles and construction workers should under no circumstances be allowed outside the site boundaries to prevent impact on the surrounding vegetation.
All stockpiles, construction vehicles, equipment and machinery should be situated away from the natural vegetation.
Prevent contamination of natural areas.
No structures should be built outside the area demarcated for the development.
Although it is unavoidable that sections of the project infrastructure development will need to traverse areas of potential high sensitivity, these should be constructed in such cases so as to avoid further impact to sensitive areas.
Where possible, linear infrastructure proposed as part of the development should be aligned with existing infrastructure or routed through already transformed/degraded areas.
</td></tr>
<tr><td>Without Mitigation</td><td>Nature</td><td>Extent</td><td>Magnitude</td><td>Duration</td><td>Probability</td><td>Significance</td></tr>
<tr><td></td><td>Negative</td><td>Regional</td><td>Medium</td><td>Medium-term</td><td>Almost certain</td><td>2</td></tr>
<tr><td>With Mitigation</td><td>Nature</td><td>Extent</td><td>Magnitude</td><td>Duration</td><td>Probability</td><td>Significance</td></tr>
<tr><td></td><td>Negative</td><td>Regional</td><td>Low</td><td>Short-term</td><td>Likely</td><td>1</td></tr>
</table>

Environmental Feature			**22. Fauna**			
Relevant Alternatives & Activities			**Construction activities in Mooivallei area in proximity to the bat cave**			
Project life-cycle			**Construction phase**			
Potential Impact			**Mitigation**			
Disturbance to and displacement of bat species.			• No damage to the bat caves in the Mooivallei area due to construction activities • Determine the risk to the bat cave (subterranean chambers) in Mooivallei area based on outcomes of the geotechnical investigations.* • Shift the low pressure pipeline within the 100m corridor that was assessed as part of the EIA to avoid the bat cave as much as possible (as required). • Bat species residing within the Mooivallei area (cave) shall not be unnecessarily disturbed. Construction activities must not hinder their access to be cave. • Caution should be taken to ensure construction footprints are kept to an absolute minimum, including storage of materials, stockpiling etc. • Toolbox talks should be provided to contractors regarding disturbance to bats.			
Without Mitigation	Nature	Extent	Magnitude	Duration	Probability	Significance
	Negative	Local	Medium	Short-term	Likely	2
With Mitigation	Nature	Extent	Magnitude	Duration	Probability	Significance
	Negative	Local	Low	Short-term	Unlikely	1

<table>
<tr><td colspan="3">Environmental Feature</td><td colspan="4">23. Flora</td></tr>
<tr><td colspan="3">Relevant Alternatives & Activities</td><td colspan="4">All construction activities</td></tr>
<tr><td colspan="3">Project life-cycle</td><td colspan="4">Construction phase</td></tr>
<tr><td colspan="3">Potential Impact</td><td colspan="4">Mitigation</td></tr>
<tr><td colspan="3">Rehabilitation of site after construction.</td><td colspan="4">• Bare surfaces should be grassed as soon as possible after construction to minimise time of exposure. Locally occurring, indigenous grasses should be used.
• The rehabilitated and seeded areas must be harrowed after spreading the topsoil and fertilizer uniformly.
• Inspect rehabilitated area at three monthly intervals during the first and second growing season to determine the efficacy of rehabilitation measures.
• Take appropriate remedial action where vegetation establishment is unsuccessful or erosion is evident.
• Only locally indigenous vegetation is to be used for rehabilitation.
• All waste generated by the construction activities will be stored in a temporary demarcated storage area, prior to disposal thereof at a licensed registered landfill site.
• As much vegetation growth as possible should be promoted within the proposed project area in order to protect soils and to reduce the percentage of the surface area which is left as bare ground.</td></tr>
<tr><td>Without Mitigation</td><td>Nature</td><td>Extent</td><td>Magnitude</td><td>Duration</td><td>Probability</td><td>Significance</td></tr>
<tr><td></td><td>Negative</td><td>Local</td><td>Medium</td><td>Short-term</td><td>Likely</td><td>2</td></tr>
<tr><td>With Mitigation</td><td>Nature</td><td>Extent</td><td>Magnitude</td><td>Duration</td><td>Probability</td><td>Significance</td></tr>
<tr><td></td><td>Negative</td><td>Local</td><td>Low</td><td>Short-term</td><td>Unlikely</td><td>1</td></tr>
</table>

<table>
<tr><td colspan="3">Environmental Feature</td><td colspan="4">24. Fauna</td></tr>
<tr><td colspan="3">Relevant Alternatives & Activities</td><td colspan="4">Operation of scheme, maintenance activities and servitude inspections</td></tr>
<tr><td colspan="3">Project life-cycle</td><td colspan="4">Operational phase</td></tr>
<tr><td colspan="3">Potential Impact</td><td colspan="4">Mitigation</td></tr>
<tr><td colspan="3">Disturbance of faunal species.</td><td colspan="4">• The disturbance of fauna should be minimized.
• Maintain proper access control for the servitude.
• Ensure that the Ecological Reserve is released from the abstraction point to cater for downstream sensitive faunal species (including crocodiles, Greater Painted-snipe, Yellow-billed Stork and Black Stork).</td></tr>
<tr><td>Without Mitigation</td><td>Nature</td><td>Extent</td><td>Magnitude</td><td>Duration</td><td>Probability</td><td>Significance</td></tr>
<tr><td></td><td>Negative</td><td>Local</td><td>Medium</td><td>Short-term</td><td>Likely</td><td>2</td></tr>
<tr><td>With Mitigation</td><td>Nature</td><td>Extent</td><td>Magnitude</td><td>Duration</td><td>Probability</td><td>Significance</td></tr>
<tr><td></td><td>Negative</td><td>Local</td><td>Low</td><td>Short-term</td><td>Unlikely</td><td>1</td></tr>
</table>

13.11 Wildlife

13.11.1 *Impact Assessment*

The findings from the Wildlife Impact Assessment (see **Appendix I7**) follow.

13.11.1.1 Habitat Loss

Impact	Loss of vegetation and habitats from pipeline construction.				
Nature	Negative	Positive	Neutral		
	Although the larger section of the proposed route is alongside transformed or degraded environments, vegetation clearance measures need be implemented before construction.				
Type	Direct	Indirect	Induced		
	Complete natural habitat loss and modification.				
Duration	Temporary	Short-term	Long-term	Permanent	
	Impact on natural vegetation is envisioned as permanent; However, reclamation measures in establishing a grassland vegetation cover after termination of construction will establish a highly modified but functional habitat type.				
Extent	Local	Regional	International		
	Pipeline impact is considered of regional scale due to the linear route formation extending from Thabazimbi to Steenbokpan. However, unanticipated human induced impacts can be expected all the way to Lephalale (Ellisras), forming an arterial connection with access to many wildlife ranches and farms.				
Scale	The scale of the impact is directly associated with the pipeline construction.				
Frequency	Construction and maintenance of the pipeline are considered single short-term events.				
Likelihood	Likely				
Magnitude	Positive	Negligible	Small	Medium	Large
	Impact on existing floral assemblages is relatively small and although complete habitat modification will occur ecosystem functionality can be maintained or improved by the establishment of an herbaceous vegetation cover with potential for higher productivity after construction.				
Resource/Receptor Sensitivity/Value Importance	Low	Medium	High		
	The receptor sensitivity is low due to the presence of alternative habitat with the limited impact on natural resource-use by other wildlife along the pipeline. However, rivers, water courses and wetlands are considered of medium sensitivity.				
Significance	Negligible	Minor	Moderate	Major	
	Although minor habitat impact is expected in wildlife areas, the impacts associated with borrow pits will be significantly higher.				

Mitigation

Habitat loss will be unavoidable and property owners will need to be compensated for loss of natural resources. Boundary fences of suitable construction that complies with Provincial legislation or in consultation with each property owner must be present along both sides of the proposed MCWAP-2A construction servitude (40 m) before any construction can begin. Existing property fences can be used to delineate one side of the servitude since the linear design follows infrastructure such as roads and railway lines. However, a second, temporary, fence will be required to delineate the construction servitude and safeguard wildlife from entering the construction zone during operations. Due consideration must be given to clearing operations since vegetation clearing and earthworks may damage existing property boundary fences. Existing access to properties must be maintained since property owners may not have alternative access points to their properties. Where property access is disrupted by the pipeline construction, alternative temporary access points may need to be created.

Wildlife farmers (intensive wildlife breeding enterprises using limited sized enclosures) will need to re-evaluate breeding camp design and layout where the proposed construction area servitude is adjacent or too close to camp structures. This may require the translocation of wildlife to more suitable enclosures away from the proposed pipeline servitude to limit the impacts or a reduction and camp size. Affected properties may require reassessment of natural resource availability and the potential to sustain wildlife. New stocking rates must be determined and implemented where sufficient resources will not be available for the duration of the pipeline construction phase. Alternatively, supplementary feeding can be implemented by management's discretion. However, this option is not considered viable or cost efficient.

Although habitat loss is inevitable due to the construction activities and rehabilitation limitations imposed, the rehabilitation measures to be implemented can be beneficial in establishing a highly productive, albeit modified grassland habitat zone exceeding existing vegetation productivity.

13.11.1.2 Habitat Fragmentation

Impact	Bi-section of properties and restricted access to natural resources.			
Nature	Negative	Positive	Neutral	
	Although the larger section of the proposed route is alongside exiting infrastructure such as roads, railway lines and boundary fence lines, consolidated properties to form larger conservation areas may be encountered. Temporary bi-section of properties may need to be implemented.			
Type	Direct	Indirect	Induced	
	Habitat loss and fragmentation. Disruption of animal movement and migration.			
Duration	Temporary	Short-term	Long-term	Permanent
	The impact on natural vegetation is envisioned as permanent. However, reclamation measures in establishing a grassland vegetation cover after termination of construction will establish a highly modified but functional habitat type. The impact on wildlife movement and migration will be of short-term duration i.e. duration of the construction and rehabilitation phases.			
Extent	Local	Regional	International	

	Impact is expected as local since only a few properties will be affected. Although the general pipeline impact is considered of regional scale due to the linear route formation extending from Thabazimbi to Steenbokpan, the properties impacted are considered isolated events.				
Scale	The scale of the impact is directly associated with the pipeline construction.				
Frequency	Construction and maintenance of the pipeline are considered single short-term events.				
Likelihood	Likely				
Magnitude	Positive	Negligible	Small	Medium	Large
	Fragmentation is relatively small and although ecosystem disruption will occur, functionality can be maintained by implementing mitigation measures.				
Resource/Receptor Sensitivity/Value Importance	Low	Medium	High		
	The receptor sensitivity is medium due to the presence of alternative habitat with the limited impact on wildlife movement and access to natural resources.				
Significance	Negligible	Minor	Moderate	Major	
	Significance is considered minor as only isolated instances of habitat fragmentation will possibly be encountered.				

Mitigation

The proposed MCWAP-2A design endeavoured to reduce habitat fragmentation by following existing infrastructure such as roads, railway lines and property boundary fence lines. However, where the boundary fence between two properties has been removed to create a larger conservation area, the construction servitude will bisect the properties for duration of the construction and rehabilitation phases. Double fence lines to delineate the construction servitude will be required and it is recommended that open access points or migratory routes be maintained where possible.

Bisected properties may require reassessment of natural resource availability and the potential to sustain wildlife. New stocking rates for each section must be determined and implemented where sufficient resources will not be available for the duration of the pipeline construction phase. Alternatively, supplementary feeding can be implemented by management's discretion. However, this option is not considered viable or cost efficient. It is recommended that open access points or migratory routes be maintained during the construction phase, where possible.

13.11.1.3 Loss of Wildlife Biodiversity

Impact	Loss of wildlife biodiversity from pipeline and borrow pit construction activities and maintenance.		
Nature	Negative	Positive	Neutral
	Habitat loss, transformation of vegetation and displacement of endemic wildlife will be inevitable. Disruption of wildlife populations dynamics is likely with possible short-term effects on fecundity resulting in poor natality. Inherently sensitive wildlife will be more susceptible to these disruptions.		
Type	Direct	Indirect	Induced

	Loss of suitable habitat and wildlife diversity from borrow pit areas. Complete habitat modification and displacement of wildlife along the proposed pipeline servitude. Potential influx of undesirable, opportunistic wildlife species adapted to these degraded environments. Direct and indirect loss of wildlife diversity due to construction activities along the pipeline servitude. Wildlife loss due to unauthorized access and increased poaching activities.				
Duration	Temporary	Short-term	Long-term	Permanent	
	Impact is envisioned as temporary in nature since natural species diversity may increase after cessation of construction and implementation of rehabilitation measures as alternative habitat more suited to other wildlife becomes available.				
Extent	Local	Regional	International		
	The pipeline impact is considered of regional scale due to the linear route formation from Thabazimbi to Steenbokpan. However, unanticipated human induced impacts can be expected all the way to Lephalale (Ellisras), forming an arterial connection with access to many wildlife ranches and farms.				
Scale	Impact is restricted to the pipeline construction servitude.				
Frequency	The impact is considered disruptive initially with maintenance as a continuous low impact activity after construction. Furthermore, wildlife biodiversity loss is temporary with potential for improved biodiversity after rehabilitation measures are implemented.				
Likelihood	Likely				
Magnitude	Positive	Negligible	Small	Medium	Large
	Impact on biodiversity is medium and extends mainly to the pipeline servitude where habitat will be destroyed and modified. Reduction of wildlife biodiversity is negligible and will be mitigated by implementing effective rehabilitation measures after the initial construction phase. Although the loss of rare and expensive wildlife is considered small, the financial implications of such a loss can be substantial to any wildlife enterprise.				
Resource/Receptor Sensitivity/Value/ Importance	Low	Medium	High		
	The receptor sensitivity is low where pipeline construction and maintenance activities are implemented, with higher sensitivity at borrow pits and where blasting activities are required.				
Significance	Negligible	Minor	Moderate	Major	
	Impact is considered minor to where pipeline construction activities are restricted to the proposed servitude. Furthermore, impacts can effectively be mitigated with the implementation of suitable rehabilitation measures.				

<u>Mitigation</u>

Fencing of the proposed MCWAP-2A corridor (construction servitude) and subsequent habitat destruction will invariably lead to a reduction in natural resource availability and wildlife diversity, at least for the duration of the construction and rehabilitation phases to be implemented. Wildlife may require supplementary feeding where natural resources are limiting. However, supplementary feeding can be cost inhibitive and wildlife stocking rates may have to be reduced, effecting wildlife diversity. Availability of open water must be ensured and obstruction of natural water catchment and flow patterns must be avoided.

Although the removal of all larger wildlife is considered inevitable, smaller opportunistic wildlife species will inhabit the servitude after cessation of construction activities, especially where rehabilitation and re-vegetation measures are implemented. Mitigation of vegetation destruction by establishing a grassland type habitat using suitable grass species after construction may increase resource availability and diversity. Although the natural vegetation structure will never be attained, the modified habitat can be highly productive and potentially increase wildlife species diversity.

13.11.1.4 Wildlife Dispersal and Migration

<table>
<tr><th>Impact</th><td colspan="5">Restricted access to natural resources and disruption of wildlife breeding enterprises.</td></tr>
<tr><th rowspan="2">Nature</th><td>Negative</td><td colspan="2">Positive</td><td colspan="2">Neutral</td></tr>
<tr><td colspan="5">All wildlife must be removed from the proposed pipeline servitude before vegetation clearing and construction can begin. Wildlife breeding camps may require adjustments to fences to ensure a recommended 100 m buffer zone from the pipeline servitude. Disruption of wildlife breeding enterprises and translocation of wildlife.</td></tr>
<tr><th rowspan="2">Type</th><td>Direct</td><td colspan="2">Indirect</td><td colspan="2">Induced</td></tr>
<tr><td colspan="5">Wildlife movement on ranches and access to natural resources will be temporarily curtailed in the proposed pipeline construction zone. Rare and endangered wildlife on wildlife farms will be permanently excluded from the pipeline servitude. High noise levels associated with construction machinery, earth moving equipment and rock blasting will affect land-use viability of small properties and wildlife breeding enterprises.</td></tr>
<tr><th rowspan="2">Duration</th><td>Temporary</td><td>Short-term</td><td>Long-term</td><td colspan="2">Permanent</td></tr>
<tr><td colspan="5">Change of land-use can be short- or long-term, dependant on modification and re-design of infrastructure being required where wildlife breeding remains the preferred land-use option. Risk to wildlife in breeding camps adjacent to the pipeline servitude, although temporary, is high during the construction phase but dissipates completely after cessation of the initial activity.</td></tr>
<tr><th rowspan="2">Extent</th><td>Local</td><td colspan="2">Regional</td><td colspan="2">International</td></tr>
<tr><td colspan="5">Pipeline impact is considered of regional scale due to the linear route formation from Thabazimbi to Steenbokpan, disrupting applied land-use practices.</td></tr>
<tr><th>Scale</th><td colspan="5">Scale of impact is low in wildlife ranching but moderately high in wildlife farming where breeding camps may require redesign or translocation of rare and endangered wildlife to more suitable camps.</td></tr>
<tr><th>Frequency</th><td colspan="5">The impact is considered a single event with permanent implications to wildlife farming enterprises.</td></tr>
<tr><th>Likelihood</th><td colspan="5">Likely</td></tr>
<tr><th rowspan="2">Magnitude</th><td>Positive</td><td>Negligible</td><td>Small</td><td>Medium</td><td>Large</td></tr>
<tr><td colspan="5">Implementation of mitigation measures can reduce the impact on wildlife but the magnitude on intensive wildlife farming practices may require infrastructural changes, translocation of wildlife and active management intervention to ensure viability.</td></tr>
<tr><th rowspan="2">Resource/Receptor Sensitivity/Value/ Importance</th><td>Low</td><td colspan="2">Medium</td><td colspan="2">High</td></tr>
<tr><td colspan="5">Although potential impact on wildlife enterprises is moderate, risks can be substantially reduced if precautionary mitigation measures are implemented.</td></tr>
<tr><th rowspan="2">Significance</th><td>Negligible</td><td>Minor</td><td>Moderate</td><td colspan="2">Major</td></tr>
<tr><td colspan="5">Impact on wildlife is considered moderate, requiring mitigation measures to reduce the potential impacts on, especially, wildlife farming enterprises.</td></tr>
</table>

Mitigation

Larger wildlife will be excluded from the proposed MCWAP-2A pipeline construction servitude for the duration of excavation and rehabilitation. However, after successful establishment of an herbaceous layer in mitigation, the fence line can again be removed, giving larger wildlife access to the newly established resources. Due to the highly modified grassland structure and diversity in vegetation, potentially new feeding, breeding, nesting and resting attributes will become available to other naturally occurring wildlife species. Furthermore, the modified habitat will attract more plains game since the habitat is more suited to their requirements. It is thus expected that natural wildlife diversity will increase after cessation of construction and successful rehabilitation of the pipeline servitude.

13.11.1.5 Land Use

Impact	Land-use change and loss of revenue				
Nature	Negative	Positive	Neutral		
	Disruption of wildlife activity due to excessive noise levels associated with construction, disturbance of wildlife, reduced game viewing opportunities and poor wilderness experiences to national and international trophy hunting enterprises.				
Type	Direct	Indirect	Induced		
	Disruption of wildlife behaviour, avoidance and poor viewing/hunting opportunities. Facility location may be affected, requiring permanent relocation.				
Duration	Temporary	Short-term	Long-term	Permanent	
	The impact is considered of short-term duration.				
Extent	Local	Regional	International		
	Pipeline impact is considered of regional scale due to the linear route formation from Thabazimbi to Steenbokpan, disrupting preferred land-use practices. However, the extent may also be international where eco-tourism and hunting enterprises will be adversely affected during the construction phase.				
Scale	Scale of impact will be significant and will require a dynamic approach in dealing with induced impacts.				
Frequency	The impact is considered a single, short-term event with full recovery after the construction phase.				
Likelihood	Likely				
Magnitude	Positive	Negligible	Small	Medium	Large
	The impact on wildlife enterprises, especially eco-tourism and trophy hunting are moderate, and although recovery of clientele is possible this pipeline construction will result in undesirable financial setbacks and reduced job security. The magnitude on land-use and infrastructural changes will require a large investment				
Resource/Receptor Sensitivity/Value/ Importance	Low	Medium	High		
	Although the current sensitivity is only moderate, the potential consequence to wildlife enterprises can be substantially more.				
Significance	Negligible	Minor	Moderate	Major	
	The impact on wildlife ranches are considered moderate, with more devastating effects on eco-tourism and hunting enterprises.				

<u>Mitigation</u>

Wildlife enterprises dependent on eco-tourism can be negatively affected by the proposed MCWAP-2A pipeline construction. Where housing/lodge infrastructure is too close to the development, the rancher may need to cancel bookings for at least a season with dire financial consequences and potential loss of returning clients. Hunting safaris will also be affected where sufficient hunting areas are not available away from construction activities. Cancellation of hunting bookings from especially international clients can have far reaching financial consequences, thus affecting the economic viability of such an enterprise. Reducing the impacts on sensitive hunting and eco-tourism enterprises by implementing phase development is logistically very complex, especially since construction will be expedited by using multiple contractors and 24-hour site activities.

It is recommended that affected parties be informed in writing of construction progress and that they be warned well in advance (require 12 months' notice) of impending disruption. Pre-emptive action can then be taken by the affected parties by re-scheduling activities or cancelling bookings. It is expected that these measures will not be sufficient in mitigating all the negative implications and income loss from land-use activities will invariably occur. Compensation for financial losses may be the only solution.

13.12 Socio-Economic Environment – MCWAP-2A Physical Footprint

13.12.1 *Impact Description*

The findings from the Socio-Economic Impact Assessment (see **Appendix I6**) follow.

Table 60 below presents an overview of the significant socio-economic impacts associated with project aspects.

Table 60: Activities, Aspects and Impacts from a Socio-Economic Perspective (Bews and Chidley, 2018)

Activity	Aspect	Potential Impact
Land and Servitude Rights Acquisition	Land Acquisition	Loss of agricultural production
		Loss of land (including structures and cultivated areas) through project infrastructure
		Impacts to smaller properties, where the servitude may affect the critical mass required to continue with the current land use (e.g. agricultural activities on Portions 1 and 2 of the Farm Mooivallei 342 KQ)
	Servitude Rights	Some restrictions on use of productive land
Scheme Operations	Water supply to Lephalale increased	Economic growth and induced impacts. Positive air quality impacts
	Supply of goods and services to the scheme	Opportunity for local business
		Opportunity for local labour force
	Administration and Technical Input	Employment of local staff
		Skills development

Activity	Aspect	Potential Impact
Construction Phase	Access into properties	Security Concerns
		Damage to property or equipment
		Damage or wear to access roads
		Improvement of access in the project area
	Pipeline Construction – excavation, pipe laying, backfill and rehabilitation	Proximity to construction work and associated inconvenience and dangers.
		Employment of local people
		Sourcing of equipment, machinery and services locally
		Noise
		Temporary road closures
		Risk to game and livestock as a result of construction related hazards
		Loss of income in eco-tourism sector (hunting and game farming)
		Dust
	Pump station, Desilting Works, Vlieëpoort Weir – excavation, concrete works	Noise
		Influx of workers
		Employment of local people
		Influx of people seeking employment and associated impacts (e.g. foreign workforce, cultural conflicts, squatting, demographic changes, anti-social behaviour, and incidence of HIV/AIDS)
		Sourcing of equipment, machinery and services locally
		Increased traffic
	Transport of goods to site and employment of staff	Increased traffic
		Security
		Damage or wear to access roads
	Pump station, Desilting Works, Vlieëpoort Weir – Mechanical and Electrical Works	Noise
		Employment of local people
		Sourcing of equipment, machinery and services locally
	Rehabilitation	Damage or wear to access roads
		Security Concerns
		Damage to property or equipment

13.12.2 *Impact Assessment*

The findings from the Socio-Economic Impact Assessment (see **Appendix I6**) follow.

The sub-sections to follow provide impact assessments of the socio-economic variables associated with the project. These categories are not exclusive, nor fully inclusive of the project specific impacts, and at times tend to overlap as certain processes may have an impact within more than one category. For instance, changes to the division of labour, as discussed under the category gender relations, will also have an impact on the family and community. In much the same manner increased demand on existing infrastructure, facilities and social service, addressed under the category institutional, legal, political and equity, will have some bearing on the quality of the living environment.

13.12.2.1 Health and Socio-Economic Well-Being

Environmental Feature	Health and Socio-Economic Well Being
Project life-cycle	Construction Phase
Potential Impact	**Proposed Management Objectives / Mitigation Measures**
Annoyance: dust and noise	• Apply dust suppression reduction mitigation measures to vehicle movements, open areas and excavations.
	• Speed restrictions should be applied to unsurfaced roads.
	• Prior notice should be given to surrounding communities of blasting events.
	• Construction work should take place during working hours – defined as dawn until dusk on weekdays and dawn to 15:00 on Saturdays. Should overtime work be required, that will generate noise, consultation with the affected community or landowner should take place.
Security/Increase in crime	• Ensure that construction workers are clearly identifiable. All workers should carry identification cards and wear identifiable clothing.
	• Fence off all construction sites and control access to these sites.
	• Clearly mark any hazardous areas and regularly monitor these areas to ensure that they are avoided by people and animals.
	• Liaise with the South African Police Services (SAPS) and Community Policing Forums to ensure that construction sites are monitored.
	• Encourage local people to report any suspicious activity associated with the construction sites.
	• Prevent loitering within the vicinity of the construction camp as well as construction sites.
	• A security policy should be developed which amongst others requires that permission be obtained prior to entering any property and provisions controlling trespassing by contractor staff.
	• Only security staff should be allowed to reside at contractor camps.
Increased risk of HIV and AIDS	• Ensure that an onsite HIV and AIDS policy is in place and that construction workers have easy access to condoms.
Personal safety and increased hazard exposure	• Ensure all construction equipment and vehicles are properly maintained at all times.
	• Ensure that operators and drivers are properly trained and make them aware, through regular toolbox talks, of any risk they may pose to the community. Place specific emphasis on the vulnerable sector of the population such as children and the elderly.
	• Ensure that fires lit by construction staff are only ignited in designated areas and that safety precautions, such as not lighting fires in strong winds and completely extinguishing fires before leaving them unattended, are strictly adhered to.
	• Ensure all construction equipment and vehicles are properly maintained at all times.
	• Follow mitigation measures recommended in the appropriate specialist report/s

	• Put in place a monitoring system to monitor health risks throughout the life of the project
	• Ensure that there is broad based representation, capable of serving both community and company interests in respect of the monitoring facility referred to above

	Nature	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	Negative	Site	Moderate	Short term	High	2
After Mitigation	Negative	Site	Low	Short term	Medium	1
Significance of Impact and Preferred Alternatives	This impact is a significant concern for landowners, especially security during the construction phase. Mitigation measures are based upon control of the works on site and are effective when structures are in place to monitor contractor performance. This mitigation measure does not influence the choice of alternatives considered in the study.					

13.12.2.2 Quality of the Living Environment

Environmental Feature	Quality of the Living Environment
Project life-cycle	Construction Phase
Potential Impact	**Proposed Management Objectives / Mitigation Measures**
Disruption of daily living activities	• Ensure that, at all times, people have access to their properties as well as to social facilities such as schools, churches, transport, shops, etc..
	• Investigate and consult farmers and local communities on the need to provide suitable access points around the construction sites for people and animals.
	• An access survey should be carried out prior to working in a new section of the project and access arrangements should be discussed and agreed to by the landowner.
Damage to property once access is granted	• If a risk existing of damage taking place on a property as a result of construction, a condition survey should be undertaken prior to construction.
	• The contractor is to make good and acknowledge any damage that occurs on any property as a result of construction work.
	• The farmer should be suitably compensated for any loss of income experienced on the account of the contractor.

	Nature	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	Negative	Site	Moderate	Short term	High	2
After Mitigation	Negative	Site	Low	Short term	Medium	1
Significance of Impact and Preferred Alternatives	The impact on access to properties is a significant concern which can be managed through the recommended mitigation measures. This mitigation measure does not generally influence the choice of alternatives considered in the study and should be applied to all of the route options. In the northern section of the proposed project, Route Alternative D1 (*and D4*) is the route that will result in the least disruption to daily living of the three route alternatives. In the southern section of the pipeline, route Alternative E may result in a lower impact on the project than the central route. Both Alternative E and the central route may be optimised during the tender design phase of the project to reduce the impacts as far as possible.					

13.12.2.3 Economic and Material Well-Being (positive)

Environmental Feature	Economic and material well-being (positive)
Project life-cycle	Construction Phase
Potential Impact	**Proposed Management Objectives / Mitigation Measures**
SMME Development	• Local SMMEs should be given an opportunity to participate in the construction of the project through the supply of services, material or equipment. • A procurement policy promoting the use of local business where possible, should be put in place and applied throughout the construction and operational phases of the project.
Job Creation and Skills Development	• The main contractor should employ non-core labour local study area as far as possible during the construction phase. • The principles of Expanded Public Works Programme can be used for guiding construction phase local employment. • Women should be given equal employment opportunities and encouraged to apply for positions. • A skills transfer plan should be put in place at an early stage and workers should be given the opportunity to develop skills which they can use to secure jobs elsewhere post-construction.
Indirect Employment Impacts	• Spaza/informal trader shops may open next to the site as a consequence of construction. These should be controlled by the contractor to limit their footprint and to ensure that the local Municipalities – Informal Trading By-laws are complied with.

	Nature	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	Positive	Regional	High	Long Term	Likely	3
After Mitigation	Positive	Regional	High	Long Term	Likely	3
Significance of Impact and Preferred Alternatives	Individuals who will benefit during the construction phase are limited to those who actively participate in the construction activity through employment, sub-contracting or other economic opportunities. This mitigation measure does not influence the choice of alternatives considered in the study.					

Environmental Feature	Economic and material well-being (positive)
Project life-cycle	Operational Phase
Potential Impact	**Proposed Management Objectives / Mitigation Measures**
Economic	• Increased water supply provides an economic input that supports economic growth;
Social Benefits	• Positive Impact on air pollution through the reduction in air emissions at the Medupi and Matimba Power Station

	Nature	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	Positive	Regional	High	Long Term	Likely	3
After Mitigation	Positive	Regional	High	Long Term	Likely	3
Significance of Impact and Preferred Alternatives	Mitigation is not necessary for this positive impact. This mitigation measure does not influence the choice of alternatives considered in the study.					

13.12.2.4 Economic and Material Well-Being (negative)

Environmental Feature	Economic and material well-being (negative)
Project life-cycle	Planning Phase
Potential Impact	**Proposed Management Objectives / Mitigation Measures**
Loss of productive land or Business Value	• All negotiations and payments relating to compensating affected landowners should be conducted and concluded before construction begins.
	• The loss of productive land or of business value is handled in terms of prevailing RSA legislation. In this regard, please refer to Section 9.13: Land Acquisition of the environmental impact assessment
Acquisition of Servitude Rights	• All payments relating to the acquisition of servitude rights should be conducted and concluded before construction begins in terms of prevailing RSA legislation.

	Nature	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	Negative	Local	High	Medium Term	Moderate	2
After Mitigation	Negative	Local	Low	Short Term	Un-likely	1
Significance of Impact and Preferred Alternatives	This impact is significant if left un-addressed, and the impact can be successfully managed through programming of construction and management of pipe laying in areas adjacent to high risk areas. The costs for land acquisition and the number and length of servitudes that need to be acquired is considered a technical project aspect that does not fall within the scope of a socio-economic study.					

Environmental Feature	Economic and material well-being (negative)
Project life-cycle	Construction Phase
Potential Impact	**Proposed Management Objectives / Mitigation Measures**
Recreational or Tourism Business Impacts	• Agreement should be reached with each impacted landowner regarding the construction programme and impacts on the property during construction. Where possible in terms of the overall construction programme construction could be scheduled during low tourist season on affected game farms. Agreements made prior to construction with respect to property access, the duration of construction and the impacts on the land should be adhered to by both the landowner and the contractor.
	• For safety reasons, hunting should halt when pipeline construction is ongoing in relevant areas. As far as possible construction should be carried out along game farms during off-peak tourism periods.
	• Construction adjacent or alongside game farms should be restricted as to the lengths of open trench that is permitted. This length should be reduced to as short as practicable and cost effective.

	Nature	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	Negative	Local	High	Short-Term	Likely	2
After Mitigation	Negative	Local	Low	Short Term	Likely	1
Significance of Impact and Preferred Alternatives	This impact is significant if left un-addressed, and the impact can be successfully managed through the payment of compensation for the loss of land and land rights in terms of prevailing legislation. This impact can be reduced by choosing route alternatives which involve the lowest property impacts. In this regard, in the northern section, route D1 (*and D4*) is preferred. This route follows the railway line for longer than the alternatives and impacts upon fewer					

	houses than the alternatives. In the southern section of the pipeline, route Alternative E may result in a lower impact on the project than the central route. Both Alternative E and the central route may be optimised during the tender design phase of the project to reduce the impacts as far as possible. In the central section of the proposed pipeline the central route is preferred over route alternative C owing to its more direct path to the railway line and its impacting upon fewer houses along the adjacent road. The study does not show any preference between route alternative A1, A2 and the central route in that area. The socio-economic impacts of each alternative are equal. The costs for land acquisition and the number and length of servitudes that need to be acquired is considered a technical project aspect that does not fall within the scope of a socio-economic study.

13.12.2.5 Cultural impacts

Environmental Feature	Cultural Impacts
Project life-cycle	Construction Phase
Potential Impact	**Proposed Management Objectives / Mitigation Measures**
Heritage	• Maintain a high level of awareness on site with regards the excavation or unearthing of heritage artefacts and of the possibility of burial sites.
	• Training of the workforce in this regard should be conducted.
	• Follow the mitigation measures suggested by the Heritage Specialist.

	Nature	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	Negative	Site	Moderate	Long term	Unlikely	2
After Mitigation	Negative	Site	Low	Long term	Unlikely	1
Significance of Impact and Preferred Alternatives	The impact on local study area cultural practises is low and mitigation measures suggested by the heritage specialist consultants should be followed. The impact has no impact on alternative route selection.					

13.12.2.6 Institutional, Legal, Political and Equity

Environmental Feature	Institutional, Legal, Political and Equity
Project life-cycle	Construction Phase
Potential Impact	**Proposed Management Objectives / Mitigation Measures**
Effect on existing infrastructure facilities and social services	• Liaise with all relevant services providers such as the district and local municipalities, South African National Roads Agency Limited (SANRAL) and the water authorities in the area to ensure that any disruption to existing infrastructure is limited.
	• Liaise with property owners to ensure that existing infrastructure is recorded and any damage repaired satisfactorily or compensated for.
	• Provide a channel through which communities can route grievances or concerns regarding service disruption as a result of the project.
	• Swiftly address any grievance raised concerning service disruption as a result of the project in a transparent manner.
	• Regularly monitor the effect that the project has had on existing infrastructure facilities and social services within the host community.

Attitude formation towards project	• Promptly deal with any raised expectations amongst communities regarding perceived benefits associated with the project, through a process of communication and consultation.
	• Promptly address any concerns raised by the public in a transparent manner.
	• Where necessary always provide prompt and clear feedback to communities.
	• Include all relevant community members in decisions affecting them.
Compliance with municipal by-laws	• Ensure that all municipal by-laws are complied with.

	Nature	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	Negative	Site	Moderate	Short term	High	2
After Mitigation	Negative	Site	Low	Short term	High	1
Significance of Impact and Preferred Alternatives	The impact on project progress could be significant if grievances are not addressed. This can be effectively mitigated through the establishment of a grievance procedure and adherence to local by-laws The impact has no impact on alternative route selection.					

13.12.2.7 Gender Relations

Environmental Feature	Gender Relations
Project life-cycle	Construction Phase
Potential Impact	**Proposed Management Objectives / Mitigation Measures**
Cultural resistance towards women	• Sensitise staff in respect of gender sensitive issues that are pertinent to the workplace.
Division of labour	• Ensure gender inclusivity and equity with respect to all compensation.
	• Prioritise gender inclusivity and equity in access to resources, goods, services and decision making with the aim of empowering women.
	• Promote equal job opportunities for women and men during the construction and operational processes.
	• Prioritise and articulate gender inclusivity and equity in the project documents by including specific strategies and guidelines for implementation.
	• The project documents should also include clear mechanisms through which the actual implementation of the activities and the impact on the ground can be monitored and evaluated.
	• Develop a grievance procedure to specifically address gender matters.
	• Factors such as culture should be considered when planning for gender activities since they play a great role in influencing gender relations.

	Nature	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	Negative	Site	Moderate	Short term	High	2
After Mitigation	Negative	Site	Low	Short term	High	1
Significance of Impact and Preferred Alternatives	The impact on project equity promotion would be moderate if this impact were not addressed. This can be effectively mitigated through policy and implementation of policy. The impact has no impact on alternative route selection.					

13.12.2.8 Impacts during the Construction Phase

Environmental Feature	Economic opportunities arising from the construction phase
Project life-cycle	Construction phase
Potential Impact	**Proposed Management Objectives / Mitigation Measures**
SMME Creation	• Local SMMEs should be given an opportunity to participate in the construction of the project through the supply of services, material or equipment.
Job Creation and Skills Development	• The main contractor should employ non-core labour from the Main places as far as possible during the construction phase. • The principles of Expanded Public Works Programme can be used for guiding the construction.
Indirect Employment Impacts	• Spaza/informal trader shops may open next to the site as a consequence of construction. These should be controlled by the contractor to limit their footprint and to ensure that the local Municipalities – Informal Trading By-laws are complied with.

	Nature	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	Positive	Local	Medium	Short Term	Likely	1
After Mitigation	Positive	Local	Low	Short Term	Likely	3
Significance of Impact and Preferred Alternatives	Individuals who will benefit during the construction are limited to those who actively participate in the construction activity through employment, sub-contracting or other economic opportunities. Active participation should be encouraged. The benefits on such a construction will take place irrespective of which routing alternative is preferred.					

Environmental Feature	Disturbance arising from the construction phase
Project life-cycle	Construction phase
Potential Impact	**Proposed Management Objectives / Mitigation Measures**
Traffic	• Ensure that the necessary signage and traffic measures are implemented for safe and convenient access to the site; • Additional creation of routes and access roads must be implemented to reduce heavy traffic flow; • The EMPr must include restrictions on the Contractor and its sub-contractors related to minimising impacts on the safety of road users; Restrictions should include appropriate speed limitations, restricting travel times to daylight hours, communication measures and the establishment of haul routes.; • Measures must be put in place to prevent construction vehicles from entraining dirt onto public roads; • Traffic control personnel must be assigned where deemed necessary, this will be to control the movement of construction vehicles in relation to local vehicles to ensure maximum safety and coherence.
Local Road Condition	• A continuous condition survey of the local roads to be used during the construction phase should be made prior to construction; • Delivery routes should be defined and adhered to during the construction phase; • Maintenance of local roads should take place during the construction phase, ensuring that the local roads used by the contractor are left in the same or better condition than they were prior to the start of construction.
Increase in Dust	• Dust and disturbance can be mitigated through the use of appropriate dust suppression mechanisms; • Adherence to road signage can be added as an advantage and a measure to manage the increase in dust levels; • Mitigation measures management should be adhered to according to the

	relevant specialist studies.
Influx of workers	• All employment of locally sourced labour should be controlled on a contractual basis. If possible, and if the relevant Ward Councillors deem it necessary, the employment process should include the affected Ward Councillors. • People in search of work may move into the area, however, the project will create a limited number of job opportunities. Locally based people should be given opportunities and preferences over others; • No staff accommodation should be allowed on site; • Influx of workers could may lead to increased diseases and HIV/AIDSs & STI as well as STD infections, therefore awareness programmes should be implemented through the local educational institutions and for the workers as well.
Worker Health and Safety	• The provisions of the OHS Act 85 of 1993 and the Construction Regulations of 2014 should be implemented on all sites; • Account should be taken of the safety impacts on the local community when carrying out the longitudinal aspects of the project, such as the pipelines; • Contractors should establish HIV/AIDS awareness programmes at their site camps.
Security	• The camp sites for the project and the non-longitudinal construction sub-site components should be fenced for the duration of construction; • All contractors' staff should be easily identifiable through their respective uniforms; • A security policy should be developed which amongst others requires that permission be obtained prior to entering any property and provisions controlling trespassing by contractor staff; • Security staff should only be allowed to reside at contractor camps and no other employees; • Contractors should establish crime awareness programmes at their site camps.
Noise impacts	• Prior notice should be given to surrounding communities of drilling events; • Construction work should take place during working hours – defined as dawn to dusk on weekdays and dawn to 15:00 on Saturdays. Should overtime work be required, that will generate noise, consultation with the affected community or landowner should take place.
Damage to property	• If a risk existing of damage taking place on a property as a result of construction, a condition survey should be undertaken prior to construction; • The contractor is to make good and acknowledge any damage that occurs on any property as a result of construction work; • Where crops and agricultural machinery are damaged, compensation is to be paid to the farmer for the proven loss of these crops; • The farmer should be compensated for any loss of income experienced at the account of the contractor.

	Nature	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	Negative	Local	Medium	Short Term	Likely	2
After Mitigation	Negative	Local	Low	Short Term	Moderate	1
Significance of Impact and Preferred Alternatives	Disturbances and irritation during construction is to be expected. These can then be successfully mitigated through contractor specifications that are issued at a tender stage and through the continuous monitoring of contractor proceedings and performance during construction phase. Negative impacts owing to the construction will unfortunately be experienced irrespective of the site and routing alternative that is most preferred and chosen.					

13.13 Socio-Economic Environment – Hartbeespoort Dam

13.13.1 Impact Description

The findings from the Socio-Economic Impact Assessment (see **Appendix I6**) follow.

MCWAP-2A proposes to use Hartbeespoort Dam as a source of supply to meet water demands. This implies that water will be released to meet demand requirements in the downstream catchment. Water releases will involve greater fluctuation in the level of the dam than has been the case in the recent past. The dam is a government waterwork, which is defined by the NWA as a waterwork owned or controlled by the Minister and includes the land on which it is situated. Fluctuating water levels are a common occurrence on dams that are optimally utilised.

The source of the following impact discussion are taken from the Hartbeespoort Dam Specialist Opinion (Horizon Environmental Consulting, 2018a), as contained in **Appendix I8**.

The fluctuation in the dam level will vary with the seasons, with winter being the season where the dam level will be the lowest. The modelling indicates that the dam volume will be at an average of approximately 130 million m^3 during the winters. This translates to being 67% full when considering the full supply capacity of 195 million m^3. This implies that the dam level will decrease by between five and six meters in 50% of the winters. For the remaining winters, the fluctuation will either be greater or lesser depending upon a number of factors, including rainfall during the previous rainy season. During the summer seasons the modelling indicates that the dam will be full or nearly so. These results are based on a model that takes rainfall, water usage and other factors into account, and which has been run 1 000 times to obtain the probabilistic results mentioned above. The modelling programme was run as part of the feasibility stage of the project and the figures and graphs have to be interpolated in some cases to capture the results required by this study. The impact of that fluctuation can be seen in **Figure 141** below.

Figure 141 demonstrates with that with the dam at 60% of capacity, water level will follow the yellow area in the map, with the dam at 70% full, the dam will follow the light blue area on the map. Based on the 67% capacity figure, the predicted dam level during 50% of the winters will be between the yellow and the blue areas.

The areas of the dam that will be most impacted by the fluctuating levels are those properties that border the dam in the following areas:

- The eastern shore, including areas near Ifafi, Meerhof and Estate d'Afrique. There are areas of state land bordering the dam in this area, which are being used as camping grounds;
- Parts of the southern shore, including Club Nautique; the Islands Estate;
- Parts of the western shore, including West Lake and Country Estate, The Coves, Lakelands; and
- Parts of the northern shore, including Kshane Lake Lodge, Leloko Lifestyle Estate and Kosmos Ridge.

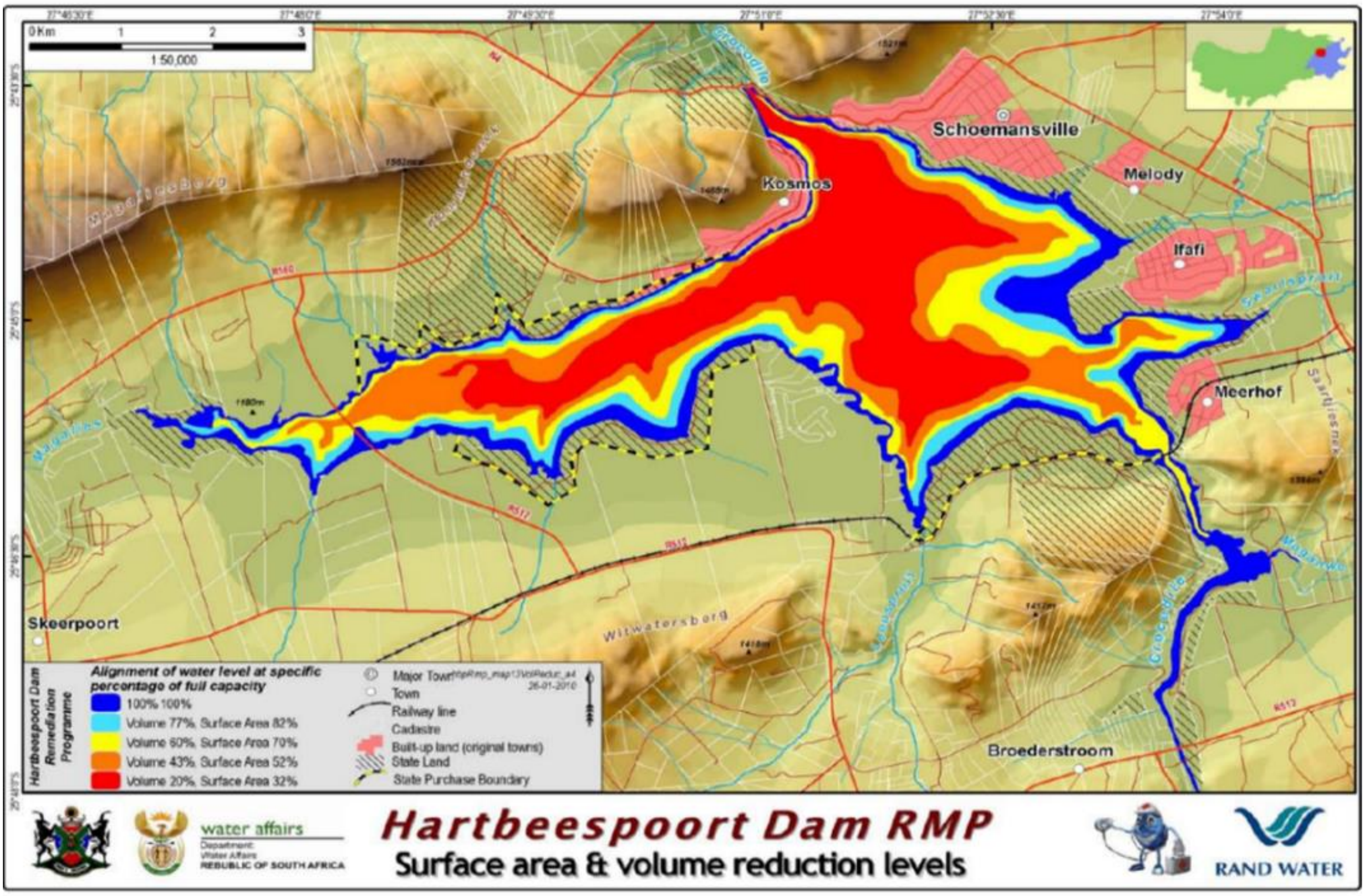


Figure 141: **Surface Area and Volume Reduction levels in Hartbeespoort Dam**

In addition, any marinas or areas that have direct access to the dam will be affected by the fluctuating water levels. This includes jetties, slipways, boat houses, moorings, fishing and picnic areas which will all be affected since the distance to the water will be increased as the dam level drops. This impact will be most felt during winter.

Based on this discussion, and without having the benefit of electronic mapping aids, a census of the direct impacts was carried out along the water's edge. These results are shown in Appendix 2 of the Socio-Economic Impact Assessment (refer to **Appendix I6**).

The affected areas can be divided into two groups. Group one properties are in areas where the reservoir is shallow at the edges, and therefore a drop in the water level will result in the longest distance to the water's edge during winter. Group Two properties are those areas where the steep shoreline profile will result in a lesser increase in the distance to the water's edge during winter. The analysis has been done using the property's access points into the water as a basis for the decision. The groups have been listed in **Table 61** below.

Table 61: Impact Groups for Surrounding Properties – Based on Distance to Water's Edge (Bews and Chidley, 2018)

Group 1 – High Impact	Group 2 – Medium Impact
Schoemansville Municipality Camping Ground	Transvaal Yacht Club
Liitle Venice	No 1 Waterfront
Eagles Waters Wildlife Resort	The Oewer Club
Club Nautique	Sunshine Cruises / Toro Ya Me
The Islands Estate	Eagles Landing
Lakeland Estate	Pecanwood
West Lake Country and Safari Estate	Key West
The Coves	Ifafi Aquatic Club
Magalies Golf Estate and River Club	The Oewer Club
Magalies Park Time Share Resort	Harties Party Boat
Leguaan Leap	Estate d'Afrique
Kshane Lake Lodge	Ile du Lac
Harties Boat Company and Water Freaks	Leloko Lifestyle Estate
	Kommando Nek / Gina's Picnic Spot
	Caribbean Beach Club
	Hartbeespoort Boat Club
	Montego Bay
	Boater's World, near Falconwood
	Kosmos Boat Club
	Mariners Village
	22nd Waterkloof / Kosmos Sea Scout Group

The group two properties all have boating access to the waterline. These properties have been given the designation of medium impact since the boat access facilities (jetties, boat houses, moorings etc.) would generally be above the water line during winter. The impact would therefore be the need to adjust the boating facilities to allow access during periods of low water levels. A prominent example of this is the case of the Hartbeespoort Boat Club: although the waterline would not be too distant from the accommodation, the jetties would be above the waterline during winter, and slipways would have to be used to reach the water during the periods of low water. Such would be the case for Montego Bay, Boaters World and others along the shoreline of the dam.

Table 62 below presents an overview of the impacts associated with aspects during the operational phase of the project.

Table 62: Hartbeespoort Dam: Activity, Aspects and Impacts from a Socio-Economic Perspective (Bews and Chidley, 2018)

Activity	Aspect	Potential Impact
Scheme Operations – Winter Season	Water Level Fluctuations	Existing boat mooring facilities to the water will be high and dry
		Reduced surface area of the dam for recreational use
		Increased beach area
		Impact of water hyacinth production
		Changes in the sense of place for residents of properties surrounding the dam
		Property value impacts
		Tourism revenue impacts

13.13.2 Impact Assessment

The findings from the Socio-Economic Impact Assessment (see **Appendix I6**) follow.

13.13.2.1 Health and Socio-Economic Well-Being

Environmental Feature	Hartbeespoort Dam: Health and socio-economic well-being					
Project life-cycle	Operational phase					
Potential Impact	**Proposed Management Objectives / Mitigation Measures**					
Making existing watercraft mooring facilities unusable during periods of low water	• Notifications to dam users of periods of low water, this would provide owners time to adjust their mooring facilities prior to these periods of low water • Safety awareness campaign prior to periods of low water to inform users with regards beach conditions					
Greater beach area to water's edge during winter	• Notifications to dam users of periods of low water • Safety awareness campaign prior to periods of low water to inform users with regards beach conditions					
Security Impact: Access to water facing properties	• Notifications to dam users of completion of the project to allow time for such properties to re-evaluate their security measures					
	Nature	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	Negative	Local	Low	Seasonal	Certain	1
After Mitigation	Negative	Local	Low	Seasonal	Certain	1
Significance of Impact and Preferred Alternatives	The impact would occur during winter, which is period of lower use recreational use of the dam than during summer. Individuals who are impacted will experience greater inconvenience in relation to access to the water's edge. The impact will occur regardless of the alternative adopted by the proposed project.					

13.13.2.2 Quality of the Living Environment (Liveability) Impacts

Environmental Feature	Hartbeespoort Dam: Quality of the living environment (Liveability) - negative
Project life-cycle	Operational phase
Potential Impact	**Proposed Management Objectives / Mitigation Measures**
Changes to the sense of place	• This impact is only mitigatable through the influence of time and becoming accustomed to the rhythm of the water fluctuations
Reduced surface area for recreation	• Information with regards water level fluctuations, particularly during winter, should be distributed to all affected watercraft users

	Nature	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	Negative	Local	Low	Seasonal	Certain	3
After Mitigation	Negative	Local	Low	Seasonal	Certain	3
Significance of Impact and Preferred Alternatives	The fluctuating water levels will have the greatest impact upon sense of place to those living near or using the water's edge. These impacts would decrease as a person's distance from the dam increases. The impact would be greatest during winter. The impact will occur regardless of the alternative adopted by the proposed project.					

Environmental Feature	Hartbeespoort Dam: Quality of the living environment (Liveability)- positive
Project life-cycle	Operational phase
Potential Impact	**Proposed Management Objectives / Mitigation Measures**
Impact on Air Quality in the Lephalale region	• Medupi clean air technology to be installed and used

	Nature	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	Positive	Regional	High	Long Term	Certain	2
After Mitigation	N/A	N/A	N/A	N/A	N/A	N/A
Significance of Impact and Preferred Alternatives	The installation of clean air technology at the Medupi Power Station will measurably improve air quality and liveability in the region. The impact will occur regardless of the alternative adopted by the proposed project.					

13.13.2.3 Economic and Material Well-Being Impacts (negative)

Environmental Feature	Hartbeespoort Dam: Economic and material well-being impacts (negative)
Project life-cycle	Operational phase
Potential Impact	**Proposed Management Objectives / Mitigation Measures**
Impact on property values	• Claims for loss of property value associated with fluctuating water levels should be addressed to the property developer who sold the properties
Impact on tourism	• Claims for loss of business value associated with fluctuating water levels should be addressed to the property developer who sold the properties • Managed by individual business owners

	Nature	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	Negative	Local	Low	Seasonal	Moderate	3
After Mitigation	Negative	Local	Low	Seasonal	Moderate	3
Significance of Impact and Preferred Alternatives	The fluctuating water levels will impact upon those living near or deriving a living from access to the water's edge. These impacts would decrease as the distance from the water's edge increases. The impact would be felt during winter in "normal" rainfall seasons. The impact will occur regardless of the alternative adopted by the proposed project.					

13.13.2.4 Economic and Material Well-Being Impacts (positive)

Environmental Feature	Hartbeespoort Dam: Economic and material well-being impacts (positive)
Project life-cycle	Operational phase
Potential Impact	**Proposed Management Objectives / Mitigation Measures**
Increased water supply to the Lephalale region	• Increased and stable water supply

	Nature	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	Positive	Regional	High	Long Term	Certain	2
After Mitigation	N/A	N/A	N/A	N/A	N/A	N/A
Significance of Impact and Preferred Alternatives	The increased supply of water to the Lephalale region will have positive impacts on the local economy. The impact will occur regardless of the alternative adopted by the proposed project.					

13.14 Agriculture

The findings from the Agricultural Impact Assessment (see **Appendix I3**) follow.

13.14.1 <u>Impact Description</u>

13.14.1.1 Loss of Agricultural Resources

The land uses on which the agricultural impacts are based are listed in **Table 63**.

The following is noted with regards to agricultural land use:

- Grazing land will be temporary lost for a 50 metres (from the boundary fence of the property) strip along the path of the pipeline. The browsing value of trees, however, will be lost notwithstanding the grass returning.
- Fallow and old lands are now mostly upgraded veld grazing. There are some areas along the Crocodile River (West) that are now fallow, but which is potentially irrigable.
- Irrigated lands are mostly under centre pivot irrigation systems, which has permanent and expensive underground infrastructure that will have to be considered

in the routing of the pipeline. Fertility of irrigated land is usually built up over time and must also be taken into consideration in the evaluation. Traversing the pivot irrigation system will lead to a temporary loss of the land along the pipeline and may influence cropping depending on the season when construction takes place.

- Housing and farming infrastructure is a cost item but will not directly impact on the farming income, unless it is used as packing sheds, which is then part of the production process. Loss of infrastructure should be dealt with under the social assessment of the EIA.

Table 63: Land uses (areas in ha) (Index, 2018a)

Project Components	Fallow	Grazing	Orchards	Irrigated	Old lands	Orchards	Potentially irrigable	TOTAL
Pipeline routes								
A1		104,6						104,6
A2		116,9						116,9
Central A		62,2						62,2
C		172,0	1,3					173,3
Central C		141,1						141,1
E	3,3	38,7		11,5		0,7		54,2
Central E	1,8	40,5	1,4	9,0				52,7
D1		196,9						196,9
D2		198,9			22,2			221,1
D3		253,2			8,7			261,9
Central (other than at diversions)		680,7		17,8	17,8			716,3
Total pipeline routes		2 005,7	2,7	38,3	48,7	0,7		2 101,2
Sedimentation Works		1,6		23,1			7,7	32,4
Construction camps		58,5						58,5
High-lift pumping station				11,5				11,5
BPR		8,1						8,1
OR		15,6						15,6
Weir and low-lift pumping station		0						0

13.14.1.2 Agricultural Infrastructure

The impact on agriculture has three components:

- The replacement of infrastructure;
- Loss of income in cases where the farming opportunity is lost or reduced in size; and
- The temporary loss of income during the period of construction.

Permanent infrastructure on farms is critical in the production process and can have a major impact on farming income, especially in the case where pivot irrigation systems are used. Irrigation may cease during the period that the pipeline is constructed. In the case of permanent infrastructure such as pumping infrastructure and the desilting works, the total pivot system will be permanently lost. Alternative irrigation systems are possible as mitigation but could lead to increase labour requirement for the farming operations and place an additional burden on management. This will have to be considered when the land is valuated.

In addition, there are a number of houses in proximity of the routes that will impact on the farming operations, either permanently, or at least for the duration of the construction.

There are a number of cattle or game watering and handling facilities that will have to be moved or replaced. This may include boreholes from which water is pumped.

It is DWS' standing policy to only provide offtake points for livestock and/or game watering to authorised directly affected landowners. A limited volume of water will be set aside for this purpose. Such users will have to apply for a water use licence (Chapter 4 of the NWA) and enter into an agreement with DWS. Water tariffs will be payable in accordance with the prevailing Pricing Strategy.

The farm infrastructure on each route is listed in **Table 64**.

Table 64: Farm infrastructure along each route (Index, 2018a)

Route	Pivots
A1	0
A2	0
Central A	0
C	0
Central C	0
D1	0
D2	0
D3	0
E	0
Central E	0
Central at Mooivallei	3
Total	**3**

13.14.1.3 Farming Operations

Many of the properties are used for wildlife breeding or production with hunting and safari excursions as focus. Fences are of game standard with many electrified to protect the animals.

The hunting season is a particularly sensitive period when people movement along the construction sites must be controlled or at least be communicated to the farmers in order to ensure the safety of workers. Many farmers expressed a fear that it would disrupt their activities.

Some possible impacts of construction, albeit temporary, on the farmers are as follows:

- ❖ Theft and vandalism is likely to increase during construction;
- ❖ Dust along the main roads that is created by large trucks has a severe impact on animal capacity of adjoining properties;
- ❖ Noise and dust will impact on tourism and hunting opportunities of game farms; and
- ❖ Increased fire hazard emanating from the construction site or camps.

Mitigation measures include the following:

- ❖ Theft and vandalism can be reduced by security measures included in the EMPr;
- ❖ Keep the construction period as short as possible and employ dust reduction methods;
- ❖ Communicate blasting and after-hours construction work of farms where tourism and hunting takes place; and
- ❖ The National Veld and Forest Fire Bill (B122B of 1998) provides guidelines on the prevention of fires and for making fire breaks. The width is not prescribed in the Bill but is left to the discretion of the farmers for their particular situation and with what is acceptable for the region. Fire break will have to be made each year to accommodate the higher risk emanating from the construction process. Compensate the farmers for the cost incurred because of additional actions or locations where fire breaks will have to be made.

13.14.1.4 Impact of the Vlieëpoort Abstraction Weir on Downstream Water Users

The Scoping Report (Nemai Consulting, 2018a) indicated that overall there will be sufficient water for lawful water users in the river system:

- ❖ The increasing surplus return flow in the Crocodile River (West) catchment that can be transferred is set out in the on-going review of the Crocodile River (West) Water Supply System Reconciliation Strategy;
- ❖ Given that the growth in water requirements for the main urban centres (Johannesburg, Midrand, Pretoria, Rustenburg) will continue to be supplied from the Vaal River System via Rand Water’s network, and the commensurate growth in urban return flows towards the Crocodile River (West) and its tributaries, sufficient water is expected to be available to meet all the entitlements for water in its catchment;
- ❖ Return flows to the Crocodile River (West) are discharged into various tributaries. These mainly converge upstream and at the confluence of the Pienaars River with the Crocodile River (West), which offers the opportunity for large scale abstraction (such as for the Lephalale area) and possible regulation downstream of that point;
- ❖ Should the need for water transfer from the Crocodile River (West) catchment to the Lephalale area be taken into account, together with the effluent flows from the Rand Water transfers to the Crocodile River (West) catchment, the low water use scenarios in the Crocodile River (West) catchment also result in the lowest total

transfers from the Vaal River System, despite the need for additional augmentation (raw water) in the Lephalale area to meet the growing requirements; and

- The planning phase, therefore, concluded that the requirement for additional water to the project area should be augmented from the Crocodile River (West) and that adequate volumes of water should be available for such transfer.

Formation of an overall River Management System is suggested in the Final Scoping Report but is not yet in place. In order to supply sufficient water to the take-off point at the Vlieëpoort abstraction works, the upstream lawful users are very likely ensured of a secure supply of irrigation water. The downstream users, however, less so. Their particular circumstances should be included in the River Management System.

It is estimated that approximately 5 900 ha are irrigated in the Lower Crocodile Irrigation Area (Drainage Unit A24J) at present (as delineated from 2018 Google satellite images). Most of the irrigation takes place within the first 25 to 30 km downstream of the Vlieëpoort weir. Many fallow lands were observed further downstream of Gana Hoek 111KQ, which are likely land abandoned and that is now grazing.

The farmers claimed that after the completion of the Roodekopjes Dam the water flow in the Crocodile River reduced dramatically and the irrigated area dropped to 2 950 ha. A further reduction took place by the beginning of the 1990's to about 980 ha. According to the farmers, during the 1990's the flow in the river improved as the runoff into the Hartbeespoort Dam increased and the farmers reacted to the improved water situation by again steadily increasing the irrigated area. The irrigators are of the opinion that their assurance of supply in 2010 could be as high as 98% (DWA, 2010b). The present status of the supply has not been confirmed.

The areas and figures in the following tables were supplied by the local Farmers Association in 2010 and seem to also reflect the present situation.

- Irrigated Area: 5 500 ha (now measured at 5 900 ha);
- Crop area at 60% double cropping: 8 800 ha;
- Average water use per ha: 8 000 m^3/annum; and
- Average rainfall per annum: 350mm.

DWS virtually completed the validation of the registered water users. The process is continuing, but according to their present estimate, approximately 22 million m^3 is registered from surface water resources, which is mainly from the Crocodile River (West). This is sufficient for roughly 2 752 ha, but is subject to the final validation. A further 23,4 million^3 is registered from boreholes. This in total comes to about the present figure of land under irrigation.

Table 65 indicates the cropping pattern on which the financial impact is based.

Table 65: Crop distribution in Lower Crocodile Irrigation area (Index, 2018a)

Crop	Ha
Soya Beans	3 300
Maize	1 100
Wheat	3 300
Cotton	275
Lucerne	275
Summer Vegetables	550
Total	**8 800**

The estimated income form farming downstream of the Vlieëpoort Weir is R79,8 million annually. The farmers employ around 1 353 people. It is the major economic activity downstream of the abstraction weir.

The following mitigation measures are proposed:

- A management plan for their particular circumstances should be developed and then included in the suggested River Management System;
- Management procedures should be put in place to indicate the prevailing situation and to timeously inform farmers of potential water shortages;
- A flow gauge must be installed at the Vlieëpoort abstraction weir to inform farmers of the availability of water; and
- Unlawful water use needs to be curtailed, which would reduce the risk of inadequate supply of lawful users.

13.14.2 Impact Assessment

The results of the Agricultural Impact Assessment (see **Appendix I3**) are presented in **Table 66**.

Table 66: Summarised Agricultural Impact Assessment (Index, 2018a)

	Potential impact	Proposed Management Objectives / Mitigation Measures	Extent	Magnitude	Duration	Probability	Significance
PIPELINE ROUTE ALIGNMENTS							
1	**Loss of high potential arable land**						
	Before mitigation	Temporary loss of 38 ha irrigated land on Mooivallei.	Local	High	Temporary	Certain	Low
	Mitigation	Place the line to avoid irrigated land and keep the construction period short. Compensate the farmer for loss on income.					
2	**Loss of dryland cultivated land**						
	Before mitigation	Not applicable. There is no dryland crop production along the alignment.					
	Mitigation	Not applicable.					
3	**Loss of grazing land**						
	Before mitigation	Temporary loss of 2 006 ha of grazing / browsing land.	Local	Low	Temporary	Certain	Low
	Mitigation	Keep the construction period as short as possible. Employ dust reducing practices to protect adjoining grazing land. Compensate the farmer for loss on income.	Local	Low	Temporary	Certain	Low
4	**Loss of agricultural production**						
	Before mitigation	Permanent loss of irrigated crops on Mooivallei. Approximately 80 ha of irrigated crops will be lost for the construction period. Approximately 200 LSU fill be lost for the duration of construction.	Local	Moderate	Temporary	Certain	Low
	Mitigation	Can be partially mitigated by changing the crop selection, unless the land is planted with permanent crops like lucerne of citrus. Compensate the farmer for loss on income.	Local	Moderate	Temporary	Certain	Low
5	**Loss of agricultural infrastructure**						
	Before mitigation	The irrigation infrastructure will be permanently lost.	Local	Moderate	Permanent	Certain	High
	Mitigation	Move infrastructure to alternative site, provided the farmer has suitable land and water if it is available. Compensate the farmer for loss.	Local	Low	Permanent	Uncertain	Low
BALANCING DAMS AND DESILTING WORKS AND HIGH LIFT RESERVOIR							
1	**Loss of high potential arable**						

	Potential impact	Proposed Management Objectives / Mitigation Measures	Extent	Magnitude	Duration	Probability	Significance
	land						
	Before mitigation	Permeant loss of 34,6 ha irrigated land. Some of which will change from pivot irrigation to conventional irrigation or to smaller pivots.	Local	High	Permanent	Certain	High
	Mitigation	The farm may not remain financially viable at its reduced size. Compensate the farmer for loss of income.					
2	**Loss of dryland cultivated land**						
	Before mitigation	Not applicable. There is cultivated land on the site.					
3	**Loss of grazing land**						
	Before mitigation	Not applicable. There is grazing land on the site.					
4	**Loss of agricultural production**						
	Before mitigation	Permeant loss of grain, fodder and fibre that can be produced on 34,6 ha irrigated land.	Regional	Moderate	Permanent	Certain	High
	After mitigation	Compensate the farmer for loss on income.					
5	**Loss of agricultural infrastructure**						
	Before mitigation	The pivot irrigation system will be lost and remaining land outside of the infrastructure boundary replaced with a conventional irrigation system or smaller pivot.	Local	Moderate	Permanent	Certain	High
	Mitigation	Compensate the farmer for loss on income.	Local	Low	Permanent	Uncertain	Low
CONSTRUCTION CAMPS, BREAK PRESSURE RESERVOIR AND OPERATIONAL RESERVOIR							
1	**Loss of high potential arable land**						
	Before mitigation	No loss of high potential land.					
	Mitigation	Not applicable					
2	**Loss of dryland cultivated land**						
	Before mitigation	Not applicable. There is no dryland crop production along the alignment.					
	Mitigation	Not applicable					
3	**Loss of grazing land**						
	Before mitigation	Temporary loss of 58 ha and 23,7 ha permanent loss of grazing / browsing land	Local	Low	Permanent	Certain	Low

	Potential impact	Proposed Management Objectives / Mitigation Measures	Extent	Magnitude	Duration	Probability	Significance
	Mitigation	The construction camp can be restored as grazing after construction. Restore land and reseed. Compensate the farmer for loss on income.	Local	Low	Temporary	Certain	Low
4	**Loss of agricultural production**						
	Before mitigation	The land lost will sustain 8 livestock for the construction period and 2 livestock permanently.	Local	Low	Temporary/ permanent	Certain	Low
	After mitigation	Keep the footprint as small as possible. Restore and reseed the site. Compensate the farmer for loss on income.	Local	Moderate	Temporary	Certain	Low
5	**Loss of agricultural infrastructure**						
	Before mitigation	No infrastructure will be lost.					
	Mitigation	Not applicable					

13.15 Air Quality

13.15.1 Impact Description

As a positive impact, MCWAP-2A will supplement the FGD water demand from Medupi Power Station. The FGD technology is used to reduce the sulphur dioxide emissions from the facility. This is also a condition in Eskom's World Bank loan.

Sensitive receptors to dust and other air quality impacts in the study area include farm dwellings, human settlements, sensitive game species and eco-tourists.

Dust will be generated during the construction period from various sources, including blasting, trenching, activities at the borrow areas, operations at the batching plant(s) and crusher area(s), aggregate stockpiles, use of haul roads and access roads, transportation of spoil material, soil stockpiles and general construction activities on site.

Mitigation measures are included in the EMPr to ensure that the air quality impacts during the construction phase are suitably monitored (dust fallout and particulate matter) and managed and that regulated thresholds are not exceeded. The EMPr also includes measures to control and minimize greenhouse gas emissions by optimising the utilisation of construction resources, as well as preventing fires related to construction activities.

13.15.2 Impact Assessment

Environmental Feature	25. Air Quality
Relevant Alternatives & Activities	Construction domain of all project infrastructure
Project life-cycle	Construction phase
Potential Aspects & Impacts	**Proposed Management Objectives / Mitigation Measures**
Excessive dust levels as a result of construction activities	25.1. Appropriate dust suppression measures or temporary stabilising mechanisms to be used when dust generation is unavoidable (e.g. dampening with water, chemical soil binders, straw, brush packs, chipping), particularly during prolonged periods of dry weather. Dust suppression to be undertaken for all bare areas, including construction area and access roads. Note that all dust suppression requirements should be based on the results from the dust monitoring and the proximity of sensitive receptors. 25.2. Speed limits to be strictly adhered to. 25.3. The Contractor will take preventative measures to minimise complaints regarding dust nuisances (e.g. screening, dust control, timing, pre-notification of affected parties). 25.4. Air quality to be monitored (baseline and during construction) for dust fallout and particulate matter. Sampling locations to consider major sources of dust and sensitive receptors.

	+/- Impacts	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	-	local	medium	short-term	likely	2
After Mitigation	-	local	low	short-term	unlikely	1

13.16 Noise

13.16.1 Impact Description

Similar to air quality, the sensitive receptors to noise impacts in the study area include farm dwellings, human settlements, sensitive game species and eco-tourists Sensitive noise receptors are noted in the Socio-Economic Impact Assessment Report (see **Appendix I6**).

During construction, localised increases in noise will be caused by blasting, trenching, activities at the borrow areas, operations at the batching plant(s) and crusher area(s), vehicles on haul roads and access roads, and general construction activities on site. Noise from night-time construction activities will particularly impact on the quality of living of the affected people. Vibration will also be felt close to construction equipment.

Major construction activities will occur in the Mooivallei area, which will be associated with the construction of the desilting works, balancing dam, high-lift pumping station and pipeline. This may cause a nuisance to the surrounding homesteads located on the surrounding farms.

Noise that emanates from construction and operational activities are addressed through targeted best practices for noise monitoring and management in the EMPr. The associated regulated standards need to be adhered to.

Project personnel working on the construction site will experience the greatest potential exposure to the highest levels of noise and vibration. Workplace noise and vibration issues will be managed as part of the Occupational Health and Safety Management System to be employed on site, which will include specific measures aimed at preventing hearing loss and other deleterious health impacts.

The proposed pumping stations will be operating continuously and may cause noise pollution. The high-lift pumping station superstructure will be designed such that noise from the machines is dissipated within the structure to remain below the prescribed thresholds.

A specialist opinion on the potential operational noise impacts from the abstraction pumping station on the existing ambient noise climate in the surrounding area was sought as part of the previous EIA for MCWAP-2. According to the Environmental Noise Report (Hassall, 2010), which is contained in **Appendix I10**, the noise impact assessment was achieved by measuring the noise of a similar pumping station and comparing it with the zone limit levels recommended by the relevant SANS Codes of practice. The noise impact was quantified as the predicted increase in ambient or zone noise level, in decibels, which can be attributed to the operation of the proposed pumping station appropriate to the proposed operating times. It was assumed that the facility will be operating continuously. A worst-case scenario was considered, i.e. that the primary noise sources are positioned at the closest point on the site to the assessment point under consideration, that there is direct line of sight to such equipment, and that there is continuous noise from such equipment. The investigation found that the proposed pumping station will have a minor impact on the noise climate in the surrounding environment in the operational phase.

The following mitigation measures were proposed in the Environmental Noise Report (Hassall, 2010):

- Maintenance of equipment and operational procedures: Proper design and maintenance of silencers on diesel-powered equipment, systematic maintenance of all forms of equipment, training of personnel to adhere to operational procedures that reduce the occurrence and magnitude of individual noisy events.
- Placement of material stockpiles: Where possible material stockpiles should be placed so as to protect site boundaries from noise from individual operations. If a stockpile is constructed, it should be at a position and of such a height as to effectively act as a barrier to site noise at any sensitive area, if line of sight calculations show this to be practicable. In particular, the erection of suitable earth berms around permanent machinery can significantly reduce the noise by up to 12dB.
- Equipment noise audits: Standardised noise measurements should be carried out on individual equipment at the delivery to site to construct a reference data-base and regular checks carried out to ensure that equipment is not deteriorating and to detect increases which could lead to increase in the noise impact over time and increased complaints.
- Environmental noise monitoring: Should be carried out at regularly to detect deviations from predicted noise levels and enable corrective measures to be taken where warranted.
- Additional measures for fixed plant noise, based on findings of noise monitoring –
  - Reduce noise at source damping acoustic treatment; and
  - Isolate source by enclosure in acoustic building.

13.16.2 *Impact Assessment*

Environmental Feature	26. Noise
Relevant Alternatives & Activities	**Construction domain of all project infrastructure**
Project life-cycle	**Construction phase**
Potential Aspects & Impacts	**Proposed Management Objectives / Mitigation Measures**
Excessive noise levels as a result of construction activities.	26.1. The provisions of SANS 10103:2008 will apply to all areas within audible distance of residents. 26.2. Working hours to be agreed upon with Project Manager, so as to minimise disturbance to landowners/occupiers and community members. 26.3. Construction activities generating output levels of 85 dB or more will be confined to normal working hours. 26.4. Noise preventative measures (e.g. screening, muffling, timing, pre-notification of affected parties) to be employed. 26.5. Blasting operations to be controlled to ensure sound pressure levels are kept below the generally accepted 'no damage' level of 140 decibels. 26.6. Survey potentially affected structures prior to and after blasting. 26.7. Noise to be monitored (baseline and during construction). Sampling locations to consider major noise sources and sensitive receptors.

	+/- Impacts	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	-	local	medium	short-term	likely	2
After Mitigation	-	local	low	short-term	unlikely	1

Environmental Feature	27. Noise
Relevant Alternatives & Activities	**Pumping stations**
Project life-cycle	**Operational phase**
Potential Aspects & Impacts	**Proposed Management Objectives / Mitigation Measures**
Excessive noise levels as a result of the operation of the pumping stations.	27.1. Developing a mechanism to record and respond to complaints. 27.2. Investigate any reasonable and valid noise complaints. 27.3. Improve the acoustic performance of facilities where noise standards are exceeded.

	+/- Impacts	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	-	local	medium	short-term	likely	2
After Mitigation	-	local	low	short-term	unlikely	1

13.17 Historical and Cultural Features

13.17.1 *Impact Description*

The project could lead to the destruction or damage of heritage and cultural features as a result of construction activities. A Phase 1 Heritage Impact Assessment was conducted in accordance with the NHRA. Refer to **Sections 11.15** for the key findings of this assessment.

It is noted that the chances of encountering heritage and cultural resources are reduced where the proposed footprint follows existing infrastructure and where it is located on cultivated land, due to past disturbances.

13.17.2 Impact Assessment

13.17.2.1 Risk Calculation

The findings from the Heritage Impact Assessment (see **Appendix I4**) follow.

The impact risk classes used as part of the Heritage Impact Assessment and the results of the risk calculation are presented in **Table 67** and **Table 68**, respectively.

Table 67: Impact Risk Classes (PGS Heritage, 2018)

Rating	Impact Class	Description
0,1 – 1,0	1	Very Low
1,1 – 2,0	2	Low
2,1 – 3,0	3	Moderate
3,1 – 4,0	4	High
4,1 – 5,0	5	Very High

Table 68: Risk Calculation for Heritage Sites (PGS Heritage, 2018)

IMPACT	SIGNIFICANCE	SPATIAL SCALE	TEMPORAL SCALE	PROBABILITY	RATING
MCWAP 1	High	Regional / Provincial	Medium Term	Could Happen	**Moderate**
	4	4	3	3	**2,2**
MCWAP 2	High	Regional / Provincial	Long Term	Very Likely	**High**
	4	4	4	4	**3,2**
MCWAP 3	High	Regional / Provincial	Long Term	Could Happen	**Moderate**
	4	4	4	3	**2,4**
MCWAP 4	High	Regional / Provincial	Medium Term	Unlikely	**Low**
	4	4	3	2	**1,5**
MCWAP 5	Medium	Local	Medium Term	Could Happen	**Low**
	3	3	3	3	**1,8**
MCWAP 6	Medium	Local	Medium Term	Could Happen	**Low**
	3	3	3	3	**1,8**
MCWAP 7	High	Regional / Provincial	Medium Term	Unlikely	**Low**
	4	4	3	2	**1,5**
MCWAP 8	Medium	Local	Long Term	Very Likely	**Moderate**
	3	3	4	4	**2,7**
MCWAP 9	Medium	Local	Medium Term	Unlikely	**Low**
	3	3	3	2	**1,2**
MCWAP 10	Medium	Local	Long Term	Very Likely	**Moderate**
	3	3	4	4	**2,7**

IMPACT	SIGNIFICANCE	SPATIAL SCALE	TEMPORAL SCALE	PROBABILITY	RATING
MCWAP 11	High	Local	Medium Term	Could Happen	**Moderate**
	4	3	3	3	**2,0**
MCWAP 12	High	Local	Long Term	Could Happen	**Moderate**
	4	3	4	3	**2,2**
MCWAP 13	High	Regional / Provincial	Medium Term	Could Happen	**Moderate**
	4	4	3	3	**2,2**
MCWAP 14	High	Regional / Provincial	Long Term	Could Happen	**Moderate**
	4	4	4	3	**2,4**
MCWAP 15	Medium	Regional / Provincial	Medium Term	Unlikely	**Low**
	3	4	3	2	**1,3**
MCWAP 16	High	Local	Medium Term	Could Happen	**Moderate**
	4	3	3	3	**2,0**
MCWAP 17	High	Local	Medium Term	Unlikely	**Moderate**
	4	3	3	2	**1,3**

Based on the risk calculations, the following can be deduced:

- Low Impact Risk was calculated for MCWAP 4 - MCWAP 7 and MCWAP 9;
- Moderate Impact Risk was calculated for MCWAP 1, MCWAP 3, MCWAP 8 and MCWAP 10 - MCWAP 17. Mitigation would be required for these sites; and
- High Impact Risk was calculated for MCWAP 2.

13.17.2.2 Mitigation Measures

General mitigation measures and recommendations from the Heritage Impact Assessment include the following:

- Whenever possible, all heritage sites identified during this study with a significance of Medium and higher, must be preserved *in situ* by designing the development footprints in such a way that a buffer area of at least 50 m is kept clear between any development footprints and construction activities and these heritage sites. In cases where the preservation of such sites and buffer areas are not possible, site-specific mitigation measures would be required (see below).
- All those areas that could not be accessed during the fieldwork, must be assessed in the field by a heritage specialist / archaeologist before construction commences.
- The archaeological research assessment of the Motlhabatsi (Matlabas) drainage basin that was undertaken by Jan Aukema for his Master's degree from the University of the Witwatersrand, revealed a substantial number of sites. The proposed Central Route passes through a section of the Matlabas drainage basin that represented the area of study for Jan Aukema's archaeological research. As the exact coordinates and site localities for the numerous archaeological sites identified by Aukema are not presently available, it is very difficult to accurately establish the distances between the closest of Aukema's archaeological sites and present study area. It is recommended that all components of the proposed development footprints

must be assessed in the field by way of walkthroughs undertaken by a heritage specialist / archaeologist before construction commences.

- Although significant sections of the pipeline footprints were assessed by vehicle along the railway and road servitudes, the landscape within which this development is proposed is not characterised by a plethora of archaeological and heritage sites. This statement is supported by the fact that although an intensive field assessment was undertaken, which included walkthroughs of almost all the non-pipeline development footprints, only 18 heritage sites could be identified across the entire length of the proposed development footprint which extends over an area in excess of 150 km. As a result, it is not deemed necessary for additional walkthroughs to be undertaken apart from the ones required for those areas which were not included in the current fieldwork (see previous bullet and the ones required by the previous General Recommendation in proximity to the Matlabas River. Rather, it is recommended that an archaeological and heritage workshop be conducted with the project ECO before construction commences to allow the ECO to undertake constant monitoring of construction activities and identify any archaeological and heritage sites which may be located along the pipeline route and which were not identified during the current fieldwork. Additionally, an archaeological watching brief can augment the work of the ECO during construction.
- An assessment of SAHRIS was undertaken to establish whether any previous archaeological and heritage impact assessments had revealed archaeological and heritage sites within, and in close proximity, to the present study area footprints. One of these previous reports from the immediate surroundings of the study area identified a cemetery containing four graves located approximately 65 m north-west of proposed Borrow Pit 13-14, and 55 m south-west of the access road to this borrow pit. The coordinates for this site are as follows: S 23.711420 E 27.497340. Due to the closeness of this cemetery to this borrow pit, the construction team and Environmental Control Officer must be made aware of the position of this site to ensure that it is not disturbed or damaged during construction.
- It is important to note that the impact assessment risk calculations undertaken for the identified heritage sites are based on the current layout of the proposed pipeline and its alternatives. Should the position and layout of any of the footprints change, the impact assessment calculations will have to be modified.

Site-specific mitigation measures are proposed in the Heritage Impact Assessment Report, which are relevant when the preservation of the identified heritage sites with a significance of Medium and higher, as well as their associated buffer areas, is not possible. The site-specific measures are listed below.

MCWAP Site 1, MCWAP Site 3, MCWAP Site 11, MCWAP Site 12 and MCWAP Site 16

- A social consultation process to assess whether any local residents or the wider public is aware of the presence of graves here. Depending on the outcome of the social consultation process, three different outcomes would be the result, namely:
  - Outcome 1: The social consultation absolutely confirms that no graves are located here.
    - No further mitigation would be required.
  - Outcome 2: The social consultation absolutely confirms that graves are located here.
    - A grave relocation process must be undertaken.
    - A detailed social consultation process, at least 60 days in length, comprising the attempted identification of the next-of-kin in order to obtain their consent for the relocation.
    - Bilingual site and newspaper notices indicating the intent of the relocation.
    - Permits from all the relevant and legally required authorities.
    - An exhumation process that keeps the dignity of the remains and family intact.
    - An exhumation process that will safeguard the legal rights of the families as well as that of the mining company.
    - The process must be done by a reputable company well versed in the mitigation of graves.
  - Outcome 3: The social consultation does not yield any confident results.
    - Test excavations to physically confirm the presence or absence graves.
    - If no evidence for graves is found, the site will fall within Outcome 1 as outlined above. This means that no further mitigation measures would be required.
    - If evidence for stillborn babies is found, the site will fall within Outcome 2 as outlined above. This means that a full grave relocation process must be implemented.
- The following additional mitigation measures must be undertaken for these sites -
  - All structures and site layouts from each site must be recorded using standard survey methods and/or measured drawings. The end result would be a site layout plan.
  - A mitigation report must be compiled for these sites within which all the mitigation measures and its findings will be outlined. The recorded drawings from the previous item must also be included in this mitigation report.
  - The completed mitigation report must be submitted to the relevant heritage authorities.

MCWAP Site 2, MCWAP Site 4, MCWAP Site 7 and MCWAP Site 13

- A grave relocation process must be undertaken.

- A detailed social consultation process, at least 60 days in length, comprising the attempted identification of the next-of-kin in order to obtain their consent for the relocation.
- Bilingual site and newspaper notices indicating the intent of the relocation.
- Permits from all the relevant and legally required authorities.
- An exhumation process that keeps the dignity of the remains and family intact.
- An exhumation process that will safeguard the legal rights of the families as well as that of the mining company.
- The process must be done by a reputable company well versed in the mitigation of graves.

MCWAP Site 5, MCWAP Site 6 and MCWAP Site 15

- An architectural historian must conduct a site assessment of these buildings and confirm the site-specific mitigation measures that would be required. These mitigation measures are expected to be as follows -
  - The building(s) must be photographically recorded and described.
  - All the buildings must be recorded with as-built drawings: (a) floor plans; (b) elevations; (c) sections (d) and compiled into a report.
  - A public participation process would be required: (a) copies of advertisements in local papers; (b) photographs of site notices on fences and (c) copies of any comments and letters from interested and affected parties.
  - A permit application must be lodged with the relevant heritage authority to allow for the disturbance / destruction of these buildings.

MCWAP Site 8

- An archaeological watching brief must be implemented during the construction phase. This watching brief is aimed at monitoring the construction and excavation work for any subterranean archaeological deposits and features which may be exposed during these development activities.
- The above-mentioned watching brief must be implemented for all construction work undertaken within 100m of the position of MCWAP Site 8.

MCWAP Site 9 and MCWAP Site 10

- The site must be recorded with photographs and a layout plan.
- A permit application must be lodged with SAHRA to allow for the subsequent mitigation measures to be implemented.
- Once the permit is received, archaeological mitigation of the site can be undertaken. Such archaeological mitigation may include Surface Collection, Shovel Test Pits and archaeological excavation. These techniques will be used to further assess and interpret the site.
- A Phase 2 Archaeological Mitigation report must be compiled.

- The abovementioned report and destruction permit application must be lodged with SAHRA.
- The mitigation proposed here may only be undertaken under the auspices of a suitably qualified and experienced archaeologist.

MCWAP Site 14

- Same as for MCWAP Site 1, MCWAP Site 3, MCWAP Site 11, MCWAP Site 12 and MCWAP Site 16.

MCWAP Site 17

- The landowner of the property on which this site is located, must be consulted to establish the exact function, origin and meaning of the site.
- Depending on the results of the consultation with the relevant landowner, further mitigation measures may be deemed necessary.

It is further recommended that a Phase 1 palaeontology assessment be conducted to assess the value and prominence of fossils along the Central Route.

13.18 Existing Structures and Infrastructure

13.18.1 Impact Description

Refer to the findings of the Socio-Economic Impact Assessment (contained in **Appendix I6**).

Potential impacts of the project to existing structures and infrastructure include:

- Disruptions to services may occur as a result of construction activities;
- Disruptions to traffic at road crossings and where pipeline routes follow existing road alignments (e.g. R510);
- Construction-related disturbances (e.g. noise, dust);
- Pipeline markers (concrete posts) will be installed at changes in direction and at regular intervals along the pipeline route; and
- Permanent access along the pipeline servitude will be required after construction. Following the installation of the pipeline, the servitude can still be utilised by the landowner for certain types of land use, for examples grazing and planting of certain crops. However, the use of the land covering the servitude will be subject to certain restrictions. In this regard, certain activities will not be permitted such as the planting of trees, excavation over the pipeline, building of structures and installation of services.

A detailed survey will be conducted to identify all physical features that are located within the final project footprint. Optimisation of the final pipeline route during the design phase will seek to avoid existing structures and buildings, as well as other sensitive features. Where avoidance is not possible, suitable compensation measures need to be established, as necessary.

As part of the land acquisition process, suitable compensation measures will need to be identified for the affected landowners, and the process will adhere to all statutory requirements. The following factors need to be taken into consideration (amongst others):

- Loss of land, crops, structures (e.g. dwellings) and infrastructure (e.g. irrigation pipelines) within servitudes;
- Impact on the economic viable of remaining land portions;
- Restoration of access and services to properties; and
- Loss of graves as well as other cultural and historical resources.

13.18.2 Impact Assessment

Environmental Feature	**28. Existing Structures and Infrastructure**
Relevant Alternatives & Activities	**All construction activities that affect existing structures and infrastructure**
Project life-cycle	**Construction & operational phases**
Potential Aspects & Impacts	**Proposed Management Objectives / Mitigation Measures**
• Disruption of existing services • Relocation of infrastructure	28.1. Identify and record existing services and infrastructure. 28.2. Conform to requirements of relevant service providers and infrastructure custodians (e.g. Transnet, Limpopo Department of Public Works, Roads and Infrastructure, Eskom, Municipalities, etc.). 28.3. Ensure access to infrastructure is available to service providers at all times. 28.4. Immediately notify service providers of disturbance to services. Rectify disturbance to services, in consultation with service providers. Maintain a record of all disturbances and remedial actions on site. 28.5. Notify landowners of any disruptions to essential services. 28.6. Deviate landowners' existing services (e.g. reticulation, irrigation lines), where possible, to accommodate construction activities. 28.7. Adequate reinstatement and rehabilitation of affected environment.

	+/- Impacts	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**
Before Mitigation	-	local	medium-high	short-term to permanent	almost certain	3
After Mitigation	-	local	low	short-term	moderate	1

13.19 Aesthetic Qualities

13.19.1 Impact Description

Potential visual impacts during the construction phase include:

- Clearing of vegetation;
- Construction-related activities;
- Light pollution;
- Inadequate waste management and housekeeping; and
- Inadequate reinstatement and rehabilitation of construction footprint.

Potential visual impacts during the operational phase include:

- High visibility of permanent infrastructure (including the low-lift pumping station, high-lift pumping station, balancing dam, BPR and OR);
- Loss of “sense of place”;
- Section of cleared vegetation along servitude;
- Light pollution;
- Inadequate reinstatement and rehabilitation of construction footprint; and
- Visual impacts of lowered water levels at Hartbeespoort Dam.

The Visual Impact Assessment that was undertaken as part of the previous EIA in 2010 included a visibility analysis of certain components of MCWAP-2A. Although the study was based on outdated information, it nonetheless provides a meaningful understanding of the potential visual influence of the balancing dam, BPR and OR (refer to **Figures 142 – 144**). The visibility analysis, using GIS software, was based on topography and did not take in account the vegetation cover, which may provide further natural screening (Axis Landscape Architects, 2010). From a visibility perspective, it is noted that the BPR and OR will be formed by shallow excavation and surrounding earthfill embankments.

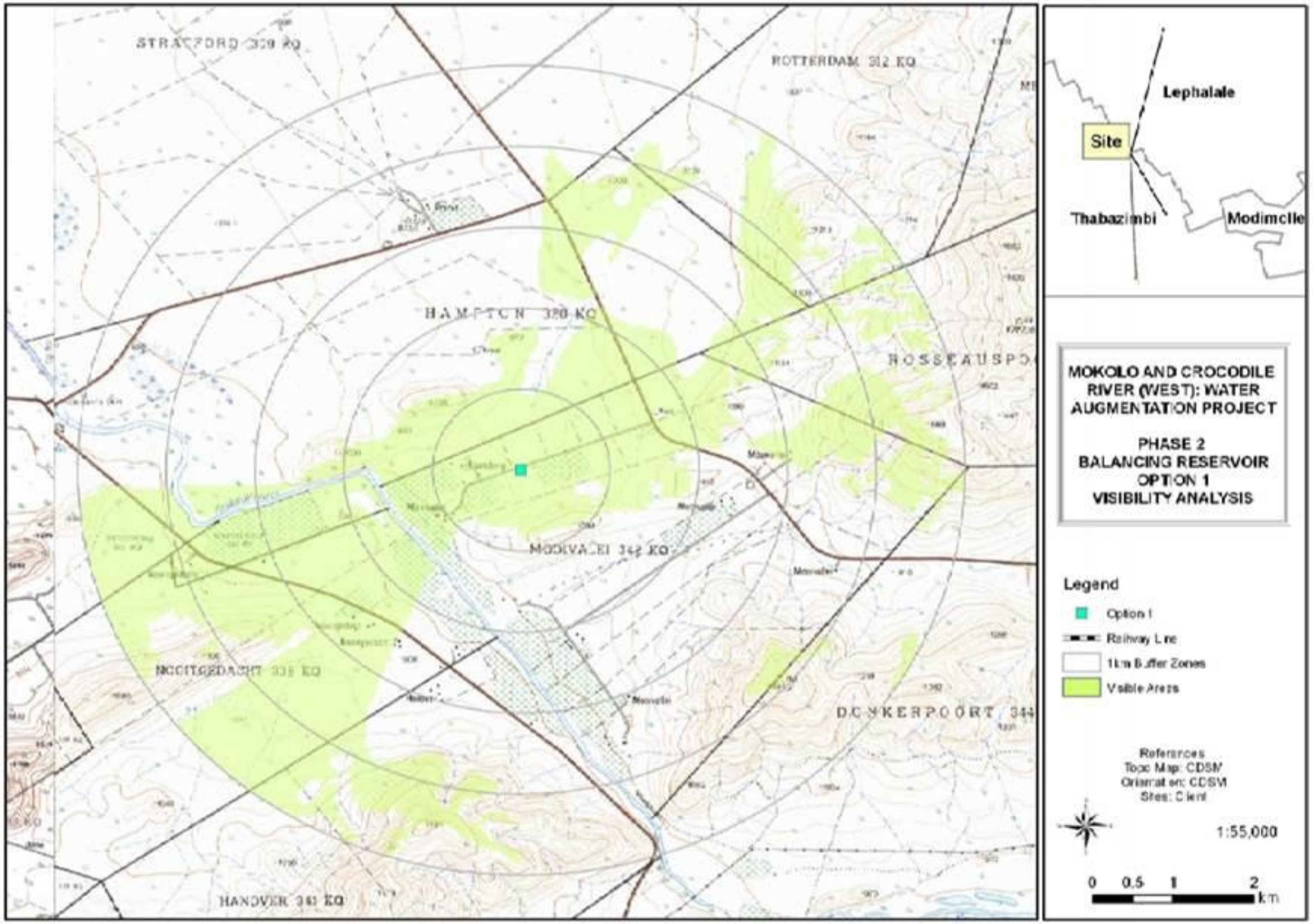


Figure 142: **Visibility analysis for the balancing dam (Axis Landscape Architects, 2010)**

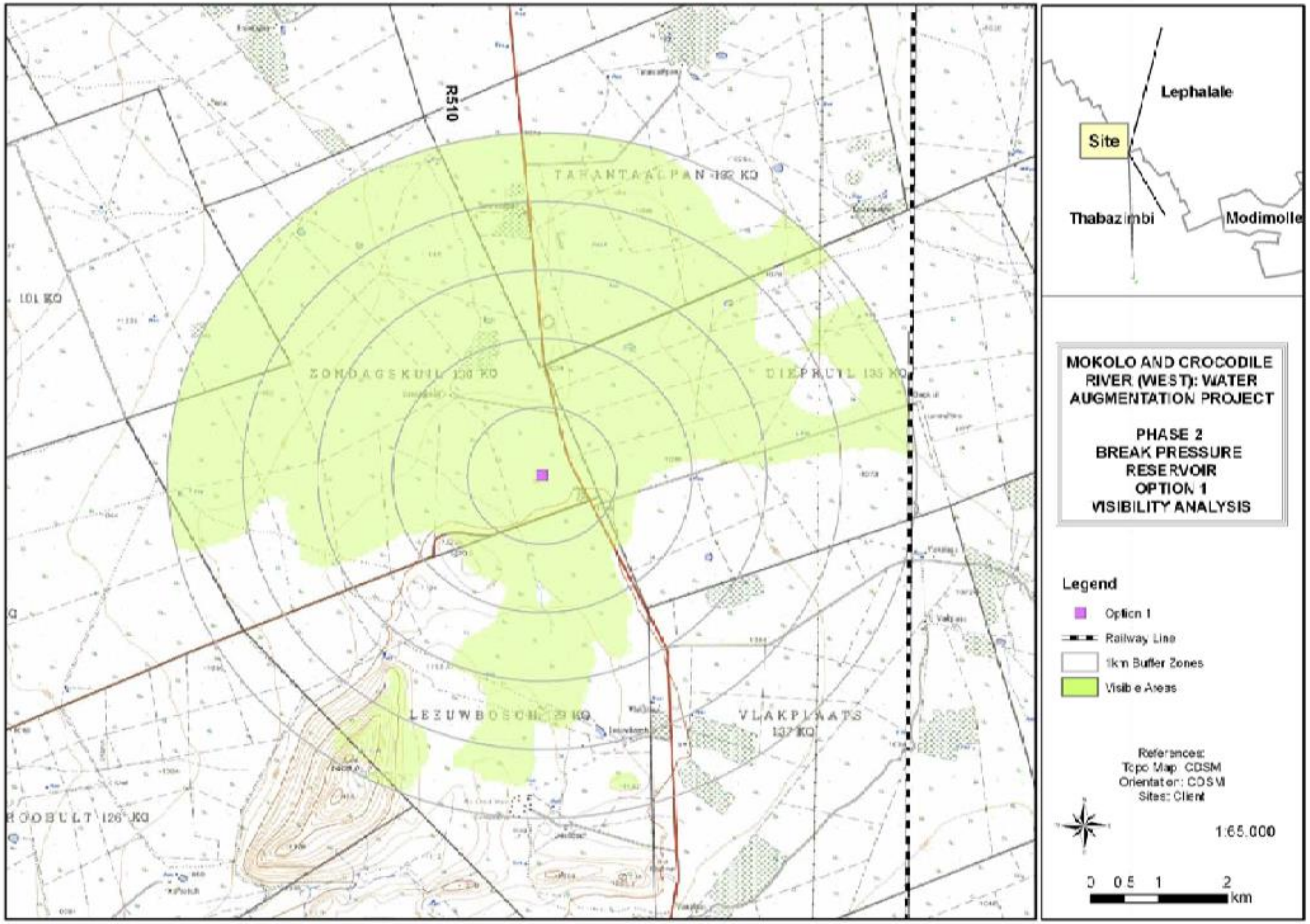


Figure 143: **Visibility analysis for the BPR (Axis Landscape Architects, 2010)**

(*Note: the map shows the previous location of the BPR, which moved approx. 300m to the south-east to Portion 1 of the Farm Leeuwbosch 129 KQ*)

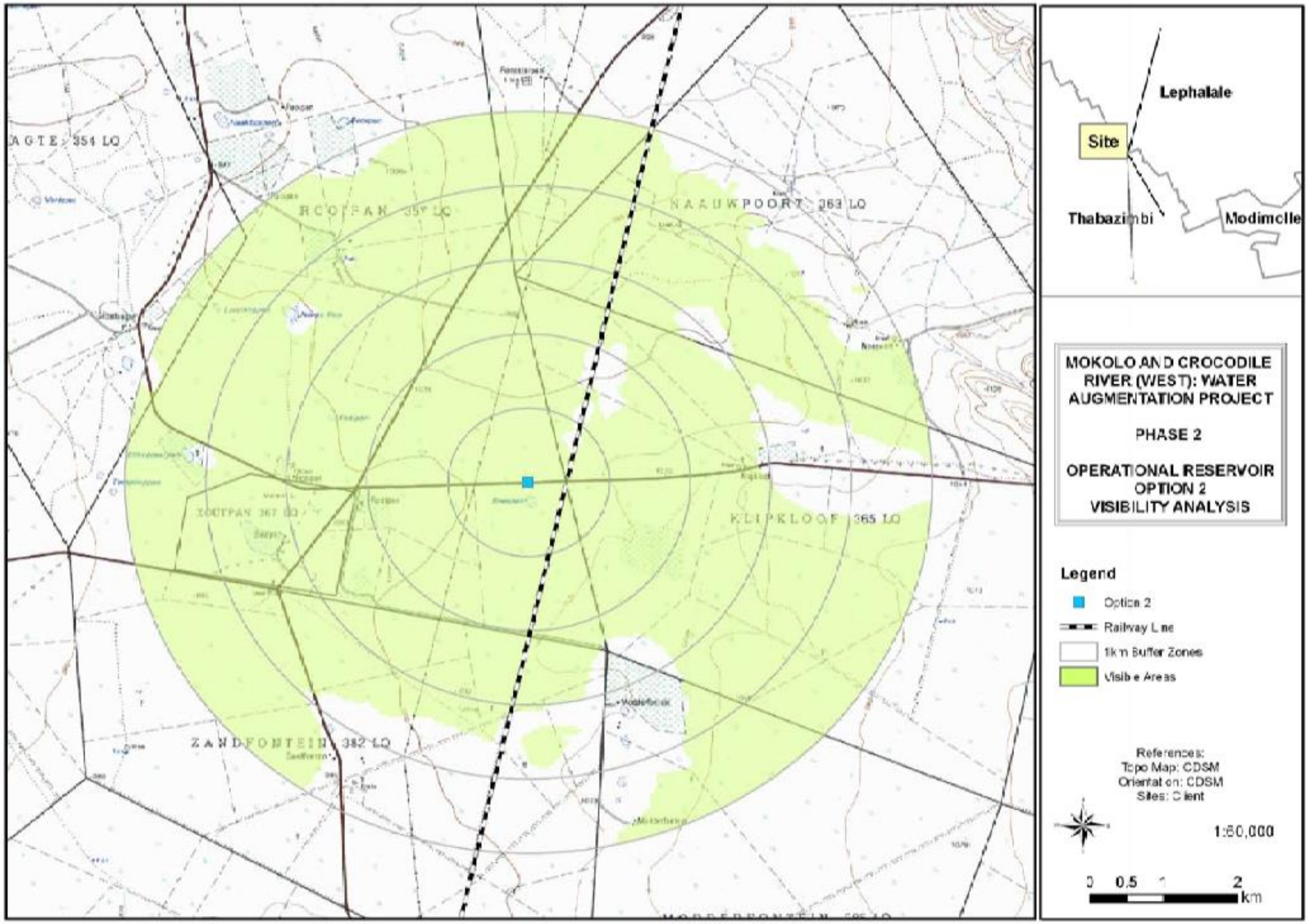


Figure 144: **Visibility analysis for the OR (Axis Landscape Architects, 2010)**

(*Note: the map shows the previous location of the OR, which moved approx. 200m to the east to Portion 4 of the Farm Rooipan 357 LQ*)

13.19.2 *Impact Assessment*

Environmental Feature	29. Aesthetic Qualities
Relevant Alternatives & Activities	Construction domain of all project infrastructure
Project life-cycle	Construction phase
Potential Aspects & Impacts	**Proposed Management Objectives / Mitigation Measures**
Reduction of visual quality of receiving environment.	29.1. Lighting must not constitute an eyesore / hazard to users of the road and the surrounding community. 29.2. Lighting will be sufficient to ensure security but will not constitute 'light pollution' to the surrounding areas. 29.3. The site will be shielded / screened to minimise the visual impact, where practicable. 29.4. Where practicable, development designs to compliment the natural surroundings in order to preserve a sense of place (e.g. facade detailing of pumping stations to blend the structures with the natural environment). 29.5. On-going housekeeping to maintain a tidy construction area. 29.6. After the construction phase, the areas disturbed that are not earmarked for operational purposes (part of infrastructure footprint) must be suitably rehabilitated.

	+/- Impacts	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	-	local	medium-high	short-term to permanent	almost certain	3
After Mitigation	-	local	low	short-term	moderate	1

13.20 Health

Health-related risks associated with the project may include the following:

- Construction phase –
  - Hazards related to construction work;
  - Increased levels of dust and particulate matter;
  - Increased levels of noise;
  - Water (surface and ground) contamination;
  - Poor water and sanitation;
  - Communicable diseases;
  - Psychosocial disorder (e.g. social disruptions);
  - Safety and security; and
  - Lack of suitable health services.

These risks are addressed through mitigation measures identified under other environmental features, such as socio-economic environment, surface water, air quality, noise and vibration, climate, as well as best practices included in the EMPr. Additional management requirements associated with health will be included in the Occupational Health and Safety system.

13.21 Traffic & Access

13.21.1 Impact Description

One of the factors considered in determining the alignment of the alternative pipeline routes included existing road and rail infrastructure, which are associated with existing disturbance, to minimise the fragmentation of the receiving environment.

Various public and private roads are affected by the proposed alternative pipeline routes. Some of the major roads that will be followed or crossed by the pipeline alignments include D1649, Rooibokkraal Road (D3677), R510 and the Steenbokpan Road (D175). A large section (approximately 56 km) of the Central Route follows the north/south railway line to Lephalale. As it is not possible to locate the pipeline within servitudes or reserves of existing infrastructure, it will need to be constructed on the adjoining private properties.

Permanent access roads will be required for the operational phase, whereas temporary access and haul roads will need to be created for construction purposes. Existing roads will be used, as far as possible. During the construction period there will be a significant increase in traffic on the local road networks, due to the delivery of plant and material, transportation of staff and normal construction-related traffic. Haul roads and access roads will also be created on site, within the construction domain.

Access to the abstraction works will be provided by a new access road which will follow the existing access roads as far as possible. The existing alignment will need to be diverted around the balancing dam and high-lift pumping station. It will then again follow the existing alignment of the access road to the farms of Mooivallei. An additional section of about 1,5 km of road will be required along the low pressure pipeline to the low-lift pumping station from where the existing road ends.

As part of the construction phase measures will be implemented for the selective upgrade of the roads (if necessary) and to render these roads safe for other users (amongst others). Dust suppression on the access and hauls roads will also be addressed. Traffic management measures are included in the EMPr.

13.21.2 Impact Assessment

Environmental Feature	30. Traffic & Access
Relevant Alternatives & Activities	**All construction activities that affect the existing road network**
Project life-cycle	**Construction & operational phases**
Potential Aspects & Impacts	**Proposed Management Objectives / Mitigation Measures**
• Inadequate road conditions • Disruptions to existing road users • Safety risks • Crossing main roads • Increase in dust levels • Road maintenance	30.1. Determine and document the road conditions of the D1649, D3677, R510 and D175 (and all other public roads), as well as all private access roads that will be affected by construction traffic, as relevant. Maintain adequate road conditions. 30.2. Selective upgrade of the relevant access roads to ensure that they are capable of accommodating the type of vehicles and/or mechanical plant using these roads. 30.3. Obtain the necessary approval for road upgrades, pipe-jacking and wayleave for road construction from the relevant authorities, as applicable. 30.4. Ensure temporary accommodation of traffic where any public or private roads are to be affected by construction activities (river crossings). 30.5. Make provision for community members to access their properties safely. 30.6. Clearly demarcate all construction access roads. 30.7. Proper access control is to be maintained to prevent livestock / game from accessing construction areas. 30.8. Strict adherence to speed limits by construction vehicles on public roads (including the D1649, D3677, R510 and D175) and access roads. Appropriate speed limits need to be posted on all access roads according to the geometric design and limitations of heavy vehicles. 30.9. The access roads need to provide sufficient width for heavy vehicles to navigate around curves in the road. 30.10. When construction vehicles are required to cross provincial and district roads (as relevant) appropriate safety and traffic calming measures need to be in place. This will include flag men, speed reductions and warning signage. 30.11. Where construction of a pipeline crosses the R510 appropriate safety measures need to be in place to prevent and safeguard crossing of the road as applicable. 30.12. The payloads delivered by heavy vehicles need to be recorded and audited to prevent overloading of heavy vehicles. 30.13. Abnormal load permits must be acquired for the transport of abnormal loads. 30.14. Traffic accommodation to South-African Road Traffic Signs Manual standards where any construction affects an existing road. 30.15. Implement traffic monitoring which includes – • Baseline traffic monitoring, 1 year ahead of construction, to confirm the traffic status quo on the road links that are to be worst affected. • Traffic Monitoring during the construction period, to confirm whether the traffic increase is similar to forecasted increase, whether the contractor complies with activity time restrictions, whether posted speed limits are adhered to, etc. • Overloading Management through auditing of bulk construction material delivery slips to ensure high-level adherence to current legislation. • Monitoring of dangerous locations (e.g. truck crossings, schools, road diversions etc.). • Traffic monitoring after completion of construction (operation phase), 6 months after construction to confirm the new level of traffic resulting from normal operations. • Evidence of the actual impact on the local road network as well as the effect of implemented mitigation measures can then be readily made available.

	+/- Impacts	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	-	local	medium-high	short-term	almost certain	3
After Mitigation	-	local	low	short-term	moderate	1

13.22 "No-Go" Impacts

The "no-go option" is the alternative of not implementing the activity. The "no-go option" also provides the baseline against which the impacts of other alternatives are compared.

The "no go option" needs to be considered in light of the motivation (see **Section 3**) as well as the need and desirability of MCWP-2A (see **Section 8**). The "no-go option" (i.e. should MCWAP-2A WTI not proceed) will have the following implications:

- Underutilisation of the Waterberg coal reserves;
- The development of new power stations is of high strategic importance with tight timeframes. Without a suitable source of water, the new power stations will not be possible, with potential future energy shortages;
- The absence of water will suppress development, with associated macro-economic implications on a national scale; and
- Without MCWAP-2A Eskom will not be able to implement the Flue-Gas Desulphurisation (FGD) technology at the Medupi Power Station to reduce sulphur emissions, which will violate the related condition in Eskom's World Bank loan with devastating economic impacts on the RSA economy.

The "no go option" needs to consider maintaining the existing rights on the affected properties, and in the case of MCWAP-2A, also the water use entitlements in accordance with the NWA. The following is noted in this regard:

- Of the properties affected by the project footprint, the largest impacts are anticipated to be associated with the large infrastructure (abstraction works, balancing dam, BPR and OR). Of these, the most severely affected properties are Portions 1 and 2 of the Farm Mooivalei 342 KQ, which are earmarked for the proposed balancing dam, desilting works, high-lift pumping station, ancillary infrastructure and a section of the Central Route. The outright purchasing of these properties should be considered as part of the land acquisition process, in consultation with the affected landowners. Other properties that will also require careful consideration during land acquisition and managing construction impacts include narrow farms (e.g. along railway line) and farms that are already impacted on by existing infrastructure (e.g. Remainder of the Farm Paarl 124 KQ and Portion 4 of the Farm Rooipan 357 LQ).
- Provision is made for satisfying the requirements of the Existing Lawful Water Users and the EWR, in accordance with the NWA.

Opportunity costs, which are associated with the net benefits forgone for MCWAP-2A, are high for those properties where the future optimal use of the land will be affected. This is particularly relevant to those farms where agricultural production will be adversely affected (e.g. Portions 1 and 2 of the Farm Mooivalei 342 KQ), as well as farms where eco-tourism activities will be compromised. Mitigation in this regard may include fair compensation of landowners for land losses or servitude restrictions. For the downstream water users, which do not have lawful water rights, there may be significant opportunity costs in terms of impacts to livelihoods that are reliant on water (e.g. irrigation), unless production can be established elsewhere or adapted (e.g. different cops).

In contrast, should the proposed MCWAP-2A WTI not go ahead, any potentially significant environmental issues associated with the project (refer to **Section 13**) would be irrelevant and the status quo of the local receiving environment would not be affected by the project-related activities. The objectives of the project would, however, not be met. The immediate significant impact would relate to the risks of not meeting Medupi Power Station's water requirements for FGD and the associated loan agreements with the World Bank and African Development Bank.

13.23 Cumulative Impacts

13.23.1 General

A cumulative impact, in relation to an activity, means the past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity that in itself may not be significant, but may become significant when added to the existing and reasonably foreseeable impacts eventuating from similar or diverse activities.

Cumulative impacts can be identified by combining the potential environmental implications of MCWAP-2A with the impacts of projects and activities that have occurred in the past, are currently occurring, or are proposed in the future within the project area.

The following potential cumulative impacts are associated with the project:

- The water from MCWAP-2A will enable future development associated with the Waterberg Coalfields. Potentially significant cumulative impacts associated with the developments include climate change impacts associated with growth in coal mines, coal-fired power stations, and other related industry. The GHG that will be emitted during the construction phase is assessed in **Section 13.3** and the EMPr includes measures to control and minimize GHG emissions by optimising the utilisation of construction resources. It is noted that the climate change impacts associated with the power stations, coal mines and other intended water users need to be assessed as part of the respective environmental assessments conducted for each of these developments, as they are the sources of the impacts.
- The developments that may be enabled by the water transferred by MCWAP-2A will place a strain on the infrastructure of the Lephalale Town. The future growth of the town and interventions to ensure that the infrastructure can cater for this growth forms part of municipal planning, which includes the IDP and SDF.
- The MCWAP-2A WTI pipeline aims to follow the major infrastructure corridors in the EMF, as far as possible. This serves to minimise the impacts, such as limiting the fragmentation of the affected land. It is also understood that Transnet intends expanding the railway line, which will cause a cumulative impact on the properties along the Central Route and Alternative D1. There will be an increase in the combined footprints of existing linear developments (e.g.

roads, power lines, railway line), which will have significant cumulate impacts on properties that are already affected by linear infrastructure with the associated servitude restrictions. This matter must be duly considered during land acquisition process and fair compensation of the affected parties. The EMPr includes mitigation measures to manage construction-related impacts.

- The construction period may cause traffic-related impacts in terms of the local road network, which will be associated with heavy vehicle construction traffic for the delivery of material, transportation of construction workers and general construction-related traffic. This may compound traffic impacts if other large scale projects are planned during the same period. The EMPr includes mitigation measures to manage traffic-related impacts.
- Land clearing activities and other construction-related disturbances could lead to the cumulative loss of bushveld vegetation as well as the proliferation of exotic vegetation. The EMPr include mitigation measures provided by the Terrestrial Ecological Impact Assessment and Wildlife Impact Assessment to manage impacts to flora.
- There will be an increase in the dust levels during the construction phase, as a result of earthworks, use of haul roads and other gravel roads, stockpiles, material crushing, etc. Measures to manage dust are included in the EMPr.
- The Terrestrial Ecological Impact Assessment identified species of conservation concern that could be adversely affected by the project activities. The aforementioned study took into consideration the existing local impacts to the biodiversity and the incremental loss of conservation-worthy species of the project within the context of the provincial conservation goals and targets. The EMPr include mitigation measures provided by the Terrestrial Ecological Impact Assessment and Wildlife Impact Assessment to manage impacts to species of conservation concern.
- From an aquatic ecological perspective, if the EWR is released there will be limited changes to riverine PES downstream of the abstraction point.
- Construction activities on steep slopes that are already disturbed can contribute towards erosion, if proper reinstatement and rehabilitation is not undertaken. Mitigation measures for erosion protection are included in the EMPr.
- Changes in demographics in the region due to the influx of employment seekers, particularly in the light of the existing and future development in Lephalale, and the associated problems (e.g. crime, STDs). This was assessed as part of the Socio-economic Impact Assessment and mitigation measures are included in the EMPr.
- The fluctuation of water levels in Hartbeespoort Dam due to MCWAP-2A and drought periods may result in various cumulative impacts, such as exacerbating the water quality and hyacinth problems (amongst others) (refer to **Section 13.8.7**). This is to be dealt within the regulatory framework and the recommendations as set out in the Draft National Water Resources and Sanitation Master Plan and the statement (appended) by the Minister following his visit to the dam on 15 June 2018.
- As is common accepted practice, the potential impact of climate change to river flows was considered in the hydrological modelling, where a margin for error in the future predictions was considered. This is based on historical data of wet and dry periods for the area, as well

as all known water use that affects river runoff. The majority of water for the proposed transfer would be return flows. Refer further to discussion on climate change in **Section 13.3**.

The cumulative water user requirements of the Crocodile River (West) have been duly considered in the DWS water resource planning process, including the Reconciliation Study for the Crocodile West Water Supply System (DWS, 2015) and the MCWAP Feasibility Study. One of the objectives of the Reconciliation Strategy included maintaining a positive water balance in future and reconciling growing water requirements and availability. In addition, the water requirements between the four upstream dams (i.e. Hartbeespoort, Roodekopjes, Klipvoor and Vaalkop) and Vlieëpoort, the flows required past Vlieëpoort and the other factors that will affect the flow in the river at Vlieëpoort such as rainfall, evaporation from the river water surface, evapo-transpiration from the riverine vegetation, tributary and diffuse inflows and diffuse seepage outflows from the river, will need to be considered as part of the overall River Management System.

14 ANALYSIS OF ALTERNATIVES

14.1 General

Alternatives are the different ways in which the project can be executed to ultimately achieve its objectives. Examples could include carrying out a different type of action, choosing an alternative location or adopting a different technology or design for the project.

By conducting the comparative analysis, the BPEOs can be selected with technical and environmental justification. Münster (2005) defines BPEO as the alternative that "*provides the most benefit or causes the least damage to the environment as a whole, at a cost acceptable to society, in the long term as well as in the short term*".

14.2 "No-Go" Option

As standard practice and to satisfy regulatory requirements, the option of not proceeding with the project is included in the evaluation of the alternatives. The implications of the "no-go" option are discussed in **Section 13.22**.

14.3 Screened & Feasible Alternatives

Alternatives considered during the Technical Pre-Feasibility and Feasibility Studies included the following (see **Section 10.2**):

- ❖ Ground Water -
  - The expected extent of this source is not even remotely within the range of the required industrial demands.
- ❖ Re-use of effluent in the project area -
  - Relative to the total demand, it is not a very significant quantity.
- ❖ Mokolo Dam -
  - The potential to obtain additional water from Mokolo Dam on a sustainable basis is limited. The spare yield has already been fully allocated in MCWAP-1.
- ❖ Crocodile Water -
  - Based on current knowledge, it is not envisaged that irrigation water entitlements on the Crocodile River (West) will need to be obtained.
- ❖ Return flows in Crocodile River (West) and Vaal River Catchments -
  - The water resources considered for the new development is to be mainly the growing volume of return flows (purified water discharged from wastewater treatment plants) originating from urban developments in the Gauteng and surrounding areas.
- ❖ Creating more storage by raising of existing dams and/or building new dams -
  - The creation of storage poses the following challenges:

    - It does not provide adequate yield;
    - It is costly and not viable in current circumstances;
    - It also has the further challenge in that the Crocodile and Mokolo catchments are part of the international river basin shared with three other countries. Agreement will have to be secured in terms of the Revised SADC Protocol on Shared Water Courses that will take a significant period of time to obtain;
    - In the Crocodile River System with a high percentage of return flows passing through, the ability of the dam to store high flows (floods) for later use is diminished and make it less effective; and
    - Filling times required.
  - The available storage in the Crocodile River (West) is not being used optimally at this stage due to the steady stream of return flows that has kept Hartbeespoort Dam spilling most of the time during the past decade and a half. This storage capacity will be better utilised once the transfer of water to the Lephalale area commences.
- Abstraction point at Faure Weir -
  - Various abstraction points were analysed from the confluence of the Crocodile and Pienaars Rivers to the confluence of the Crocodile and Limpopo Rivers. Due to the geomorphology of the Crocodile River (West) and other evaluation criteria only two suitable sites were identified and investigated further. Due to non-compliance with various evaluation criteria the Faure Weir site was not deemed to be suitable.
- Water transfer from rivers beyond the borders of South Africa -
  - It was found that the cost and the time frames required for such development render this option unfeasible.

14.4 Specialist and Technical Studies

The pipeline route was broken up into the following sections (shown in **Figure 145**) to allow for an indication of preferred options identified in the specialist studies and based on technical considerations (refer to **Tables 69 – 73**):

- Section 1 –
  - Central Route; and
  - Alternative E.
- Section 2 –
  - Central Route;
  - Alternative A1; and
  - Alternative A2.
- Section 3 –
  - Central Route; and
  - Alternative C.
- Section 4 –

- Alternative D1;
- Alternative D2; and
- Alternative D3.

❖ Section 5 –
- Alternative D1; and
- Alternative D4.

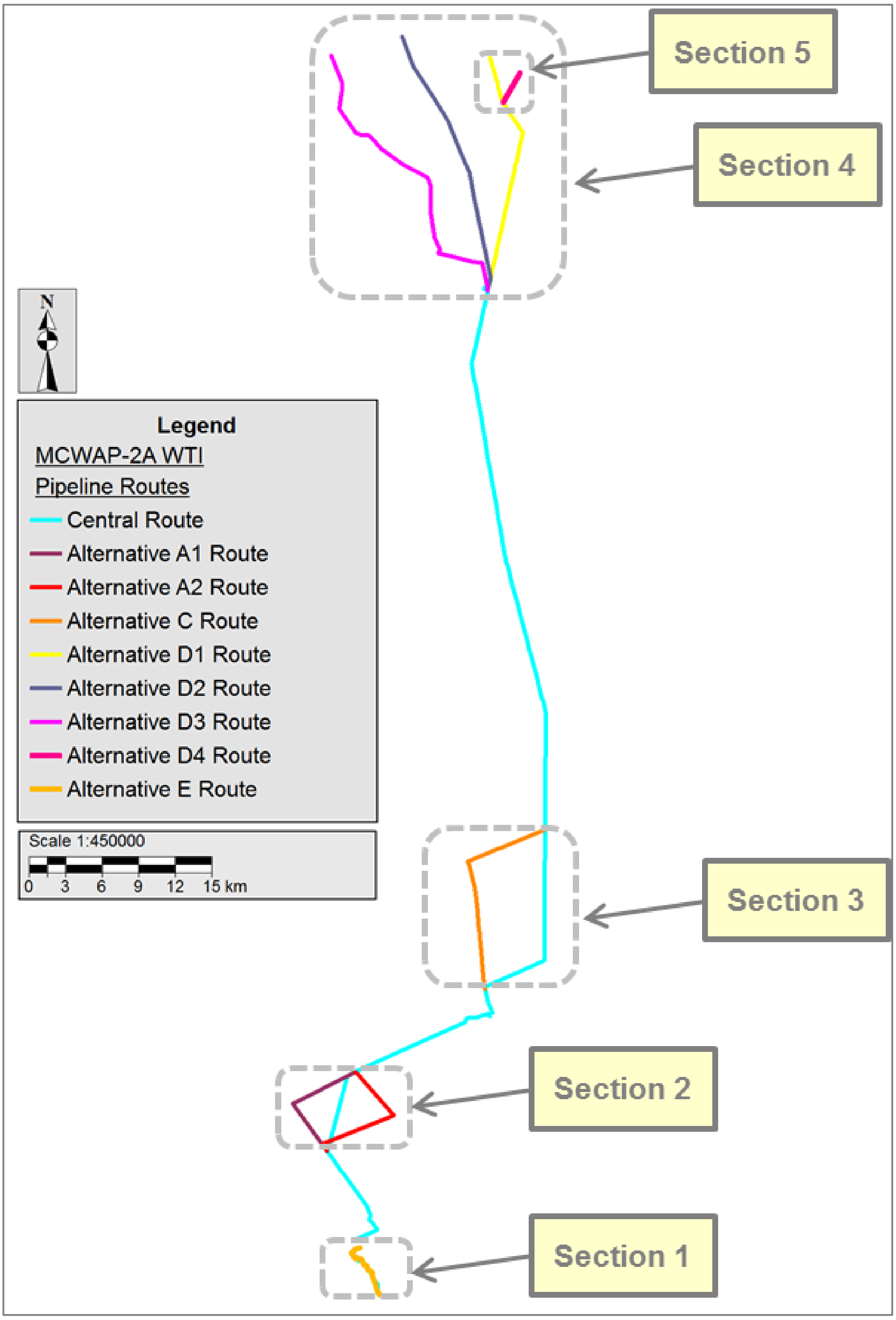


Figure 145: Sections of pipeline route alternatives

Table 69: Preferred Options recommended by Specialists and Technical Team for Pipeline Route Alternatives in Section 1

Project Area	Alternatives		Terrestrial Ecology		Aquatic		Agriculture		Heritage
Section 1	Central Route		-	-	No preference.				Directly impacts on MCWAP Site 1.
	Alternative E	✓	This route is situated further away from the bat cave.			✓	It will have less of an impact on the irrigation farmers.	✓	No impacts to identified heritage resources.
			Socio-Economic		**Wildlife**		**Wetlands**		**Technical**
	Central Route			-	No preference.	-	No preference.	✓	The Central route is still preferred as the minor issues raised by the scientists can be amicably mitigated. The hydraulic performance to be achieved is top-grade. It also needs to be remembered that this servitude needs to accommodate two pipes now and potentially a 3rd pipe in future. (The redundancy is required to manage the cleaning of silt from the pipeline.)
	Alternative E	✓	This route is more tortuous than the Central route alternative in this area. This route is more effective in avoiding impacts on dwellings, structures and irrigated lands than the central route. Thus, this route is preferred over the Central route. However, consideration must be given to the optimisation of the central route that is possible during the tender design phase. Both Alternative E and the central route may be optimised during the tender design phase of the project to reduce the impacts as far as possible. Additional modifications to the route near its commencement point could be made during detailed design stage to further reduce its socio-economic impact within technical constraints.						The performance of Alternative E is inherently inferior as it has too many bends which impacts negatively on its hydraulic performance (hydraulic and energy losses) and more complex construction.

Table 70: Preferred Options recommended by Specialists and Technical Team for Pipeline Route Alternatives in Section 2

<table>
<tr><th>Project Area</th><th>Alternatives</th><th colspan="2">Terrestrial Ecology</th><th colspan="2">Aquatic</th><th colspan="2">Agriculture</th><th colspan="2">Heritage</th></tr>
<tr><td rowspan="7">Section 2</td><td>Central Route</td><td>✓</td><td>This route follows the existing ESKOM's powerlines over the Farm Paarl 124KQ, with existing disturbance.</td><td rowspan="3">-</td><td rowspan="3">No preference.</td><td rowspan="3">-</td><td rowspan="3">No preference.</td><td rowspan="3">-</td><td rowspan="3">No preference.</td></tr>
<tr><td>Alternative A1</td><td></td><td>-</td></tr>
<tr><td>Alternative A2</td><td></td><td>-</td></tr>
<tr><td></td><td colspan="2">Socio-Economic</td><td colspan="2">Wildlife</td><td colspan="2">Wetlands</td><td colspan="2">Technical</td></tr>
<tr><td>Central Route</td><td rowspan="3">-</td><td rowspan="3">No preference.</td><td>✓</td><td>Less disruptive to adjacent wildlife farms and ranches. Least impact is expected following the existing powerlines across Paarl 124 KQ. Both Buffelsvley 127 KQ and Karoobult 126 KQ are wildlife farms that will require internal fence-lines to be moved to achieve the desired buffer zone from construction activities.</td><td rowspan="3">-</td><td rowspan="3">No preference.</td><td>✓</td><td>From a technical perspective the Central route is the best. The Central route is also parallel to an Eskom existing servitude reducing sterilising unnecessary sections of land / camps. Alternative routes were simply investigated to potentially mitigate the impact on security of sensitive game farming operations.</td></tr>
<tr><td>Alternative A1</td><td></td><td></td><td>✓</td><td rowspan="2">Alternative A1 is marginally better than Alternative A2 from a hydraulic perspective and the Alternative A2 route is closer to residential property.</td></tr>
<tr><td>Alternative A2</td><td></td><td></td><td>-</td></tr>
</table>

Table 71: Preferred Options recommended by Specialists and Technical Team for Pipeline Route Alternatives in Section 3

Project Area	Alternatives		Terrestrial Ecology		Aquatic		Agriculture		Heritage
Section 3	Central Route		-	-	No preference.	-	No preference.		Directly impacts on MCWAP Site 8.
	Alternative C	✓	This route follows the R510 main road. Less than 1% falls within sensitive CBA 1.					✓	Less impacts to identified heritage resources.
			Socio-Economic		**Wildlife**		**Wetlands**		**Technical**
	Central Route	✓	Less impacts on socio-economic environment.	✓	Less disruptive to adjacent wildlife farms and ranches.	-	No preference.	✓	The Central Route remains the preferred route following the existing rail servitude being easier to construct/align than Alternative C along the road (R510) servitude. However, the construction of the R510 road crossing will require a large pipe jacking operation but it has already been done before.
	Alternative C		This route follows an existing road and takes a more northerly route to the railway line than the Central route in this area. It follows the railway line for less distance than the Central route alternative in this area. The impact upon dwellings along this road is greater than the comparable impact of the Central route in this area.		Alternative C is also considered as a viable option in reaching the railway line corridor with little additional impact on wildlife.			-	

Table 72: Preferred Options recommended by Specialists and Technical Team for Pipeline Route Alternatives in Section 4

Project Area	Alternatives	Terrestrial Ecology		Aquatic		Agriculture		Heritage	
Section 4	Alternative D1		-	-	No preference.	-	No preference.	✓	No heritage sites were identified along Alternative D1. *However, a 1.2km section along this route could not be driven due to locked gates along the railway servitude.*
	Alternative D2		-						Alternative D2 may affect three sites, namely MCWAP Site 16, MCWAP Site 17 and MCWAP Site 18.
	Alternative D3	✓	This route mainly follows the existing gravel road and falls within 'No Natural Remaining' areas. In areas denoted as CBA 1, mitigation measures must be followed in order to minimise the negative impacts. The pipeline should be aligned along the fence boundary.						Alternative D3 may affect a high number of sites, namely MCWAP Site 11, MCWAP Site 12, MCWAP Site 13, MCWAP Site 14 and MCWAP Site 15.
		Socio-Economic		**Wildlife**		**Wetlands**		**Technical**	
	Alternative D1	✓	This route follows the railway line to its termination point for longer than the alternatives. The route alternative passes by three dwellings and impacts upon eight farm portions, lower than the alternative routes.	✓	No preference.			-	If D1 is economically a more optimal solution for the reduced development scenario (Coal 3 and IPP), then D1 is better.
	Alternative D2		This route cuts across previously undisturbed land towards its termination point. The route alternative passes by four dwellings and impacts upon twelve farm portions.			✓	Least impacts to pans.	-	
	Alternative D3		This route follows existing roads along its route to a termination point just south of Steenbokpan. This route would require a parallel pipeline servitude to accommodate the pipeline and this would directly impact upon fourteen dwellings and other buildings. The route would impact upon eleven farm portions. The impact on the road during	×	Most disruptive to adjacent wildlife farms and ranches, existing structures, pan on Leliefontein 672 LQ.			✓	The preference is for the original western route D3 due to the planned development of Coal 3 and Coal 4. Coal 3 or an IPP may still be developed at this location. It should be noted that more detailed geotechnical investigation was already done for this route D3. At the feasibility stage the route along the existing service road was deemed to mitigate the impact on land use and security. Although it is

Project Area	Alternatives	Terrestrial Ecology	Aquatic	Agriculture	Heritage
		construction would be significant.			technically feasible to “straighten” Alternative route D3 construction access would however be more difficult from 3 points to the (i) south (farm boundary between Grootlaagte 354 and Rooipan 355), (ii) centrally (farm boundary between Doornlaagte 353 and Zandheuvel 356) and (iii) at the northern end of this alternative. Additional access roads will also be required to the borrow pits adjacent to D3. The security risk associated with a second access parallel to the existing road will also have to be considered by the land owners.

Table 73: Preferred Options recommended by Specialists and Technical Team for Pipeline Route Alternatives in Section 5

Project Area	Alternatives	Terrestrial Ecology	Aquatic	Agriculture	Heritage
Section 5	Alternative D1			- No preference.	- No preference. Walk-down survey to confirm.
	Alternative D4	✓ The D4 route does not affect the two pans.	✓ Alternative D4 route is in excess of 500 m of pans, and no impacts to identified pans are anticipated.		
		Socio-Economic	**Wildlife**	**Wetlands**	
	Alternative D1	This route passes ± 130m to the west of buildings on the Farm Enkeldraai 314 LQ.	- No preference.		
	Alternative D4	✓ This route does not impact on any buildings. The landowner of the Farm Enkeldraai 314 LQ indicated that the route can traverse his property.		✓ There are no sensitive areas along the route from a wetland perspective. The pans on Taaiboschpan and Enkeldraai are further away than 500 m of the construction site. Due to the topography and distance, it is unlikely that there will be impact on the hydrology of the pans or on its habitat value for fauna and flora.	

A simplified summary of the specialists' and technical team's preferences to the project alternatives is provided in **Table 74**.

Table 74: Summary of alternatives referred by specialists and technical team (✓ = preferred)

<table>
<tr><th>Project Area</th><th>Alternatives</th><th>Terrestrial Ecology</th><th>Aquatic</th><th>Agriculture</th><th>Heritage</th><th>Socio-Economic</th><th>Wildlife</th><th>Wetlands</th><th>Technical</th></tr>
<tr><td rowspan="2">Section 1</td><td>Central Route</td><td></td><td rowspan="2">-</td><td></td><td></td><td></td><td rowspan="2">-</td><td rowspan="2">-</td><td>✓</td></tr>
<tr><td>Alternative E</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td></td></tr>
<tr><td rowspan="3">Section 2</td><td>Central Route</td><td>✓</td><td rowspan="3">-</td><td rowspan="3">-</td><td rowspan="3">-</td><td rowspan="3">-</td><td>✓</td><td rowspan="3">-</td><td>✓</td></tr>
<tr><td>Alternative A1</td><td></td><td></td><td></td></tr>
<tr><td>Alternative A2</td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">Section 3</td><td>Central Route</td><td></td><td rowspan="2">-</td><td rowspan="2">-</td><td></td><td>✓</td><td>✓</td><td rowspan="2">-</td><td>✓</td></tr>
<tr><td>Alternative C</td><td>✓</td><td>✓</td><td></td><td></td><td></td></tr>
<tr><td rowspan="3">Section 4</td><td>Alternative D1</td><td></td><td rowspan="3">-</td><td rowspan="3">-</td><td>✓</td><td>✓</td><td rowspan="2">✓</td><td></td><td></td></tr>
<tr><td>Alternative D2</td><td></td><td></td><td></td><td>✓</td><td></td></tr>
<tr><td>Alternative D3</td><td>✓</td><td></td><td></td><td></td><td></td><td>✓</td></tr>
<tr><td rowspan="2">Section 5</td><td>Alternative D1</td><td></td><td></td><td rowspan="2">-</td><td rowspan="2">-</td><td></td><td rowspan="2">-</td><td></td><td></td></tr>
<tr><td>Alternative D4</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td></td></tr>
</table>

14.5 Comparative Impacts of Alternatives

14.5.1 General

The alternatives to the project components are compared in the subsections to follow based on the receiving environment (**Section 11**), findings from specialist studies (**Section 12**) and the outcome of the impact assessment (**Section 13**) (with the successful adoption of the suggested mitigation measures).

Note that the ticked (✓) blocks in the tables indicate the preferred option for each environmental feature. In some instances, no obvious preference exists which may imply that there are no discernible differences with regards to impacts posed by the options. Blocks marked with an "x" denote those options that are least preferred due to potential significant residual impacts (after mitigation) posed.

14.5.2 Pipeline Route Alternatives

A high level comparison of adverse impacts associated with the pipeline route alternatives in Sections 1 – 4 (shown in **Figure 145**) is presented in **Tables 75 - 78**. In the case of Section 5, the overriding factor for the selection of Alternative 4 is the avoidance of the two pans.

Table 75: Comparative Adverse Impacts – Pipeline Route Alternatives in Section 1

<table>
<tr><th rowspan="2">Environmental Feature / Attribute</th><th colspan="2">Pipeline Route Alternatives – Section 1</th></tr>
<tr><th>Central Route</th><th>Alternative E</th></tr>
<tr><td rowspan="2">Land Use</td><td colspan="2">Both routes primarily affect agricultural land use and natural areas.</td></tr>
<tr><td>-</td><td>-</td></tr>
<tr><td rowspan="2">Geology & Soils</td><td colspan="2">Similar potential impacts to geology and soils. Recommendations from geotechnical investigations to be employed.</td></tr>
<tr><td>-</td><td>-</td></tr>
<tr><td rowspan="2">Topography</td><td colspan="2">Similar potential impacts to topography. Proper rehabilitation required for areas affected by construction activities.</td></tr>
<tr><td>-</td><td>-</td></tr>
<tr><td rowspan="2">Watercourses</td><td colspan="2">Similar potential impacts to surface water in terms of watercourse crossings along routes.</td></tr>
<tr><td>-</td><td>-</td></tr>
<tr><td rowspan="2">Terrestrial Ecology - General</td><td>Sections of this route follow existing roads and traverse areas that are already disturbed. Route in closer proximity to the bat cave.

Note that the following mitigation measure is included in the EMPr (amongst others) to safeguard the bat cave:
Determine the risk to the bat cave (subterranean chambers) in Mooivallei area based on outcomes of the geotechnical investigations. Shift the low pressure pipeline within the 100 m that was assessed to avoid the bat cave as much as possible.</td><td>Sections of this route follow existing roads and traverse areas that are already disturbed. This route is situated further away from the bat cave.</td></tr>
<tr><td></td><td>✓</td></tr>
<tr><td rowspan="2">Agriculture</td><td colspan="2">Similar potential impacts to agriculture.</td></tr>
<tr><td>-</td><td>-</td></tr>
<tr><td rowspan="2">Heritage Resources</td><td>MCWAP Site 1 heritage site is located 9 m north-east of the proposed pipeline, and represents a Moderate Impact Risk.

Note that the following mitigation measures is included in the EMPr (amongst others) to safeguard heritage sites:
Whenever possible, all heritage sites identified during this study with a significance of Medium and higher, must be preserved in situ by designing the development footprints in such a way that a buffer area of at least 50m is kept clear between any development footprints and construction activities and these heritage sites; and
Permits to be obtained in terms of the NHRA if heritage resources are to be impacted on (where avoidance is not possible).</td><td>Site 1 is located 116 m east of this proposed pipeline and therefore has no risk</td></tr>
<tr><td></td><td>✓</td></tr>
</table>

Environmental Feature / Attribute	Pipeline Route Alternatives – Section 1	
	Central Route	Alternative E
Socio-Economic Aspects	More socio-economic impacts to the receiving environment.	The tortuous nature of the route is more effective in avoiding impacts on dwellings, structures and irrigated lands than the Central Route.
		✓
Existing Structures & Infrastructure	Pipeline route traverses existing farming infrastructure (shed) and situated closely to landowner's house and associated infrastructure.	Pipeline route falls in close vicinity to landowner's house and associated infrastructure.
	-	-
Road Network & Access	Alignment alongside private farm road in Mooivallei area.	
	-	-
Visual Quality	Similar potential impacts to visual quality of area. Proper rehabilitation required for areas affected by construction activities.	
	-	-
Technical	The Central route is preferred as the hydraulic performance to be achieved is top-grade. It also needs to be remembered that this servitude needs to accommodate two pipes now and potentially a 3rd pipe in future (the redundancy is required to manage the cleaning of silt from the pipeline).	The performance of Alternative E is inherently inferior as it has too many bends which impacts negatively on its hydraulic performance (hydraulic and energy losses) and more complex construction.
	✓	×
Wildlife	No preference.	
	-	-

Table 76: Comparative Adverse Impacts – Pipeline Route Alternatives in Section 2

Environmental Feature / Attribute	Pipeline Route Alternatives – Section 2		
	Central Route	Alternative A1	Alternative A2
Land Use	This route follows the existing ESKOM's powerlines over Portion 7 and the Remainder of the Farm Paarl 124KQ, with existing disturbance. The pipeline will lead to further fragmentation of these properties which will affect the viability of continuing with current land use. Compensation to be considered.	Primarily affects grazing land and natural areas.	Primarily affects grazing land and natural areas.
	×	✓	✓
Geology & Soils	Similar potential impacts to geology and soils. Recommendations from geotechnical investigations to be employed.		
	-	-	-
Topography	Similar potential impacts to topography. Proper rehabilitation required for areas affected by construction activities.		
	-	-	-
Watercourses	No impacts to watercourses.		

Environmental Feature / Attribute	Pipeline Route Alternatives – Section 2		
	Central Route	**Alternative A1**	**Alternative A2**
	-	-	-
Terrestrial Ecology - General	Follows the alignment of the existing power line, with existing disturbance.	About 4 km of this route follows the gravel road (even though for almost 2,8 km of it falls within the CBA1).	For about 6 km, this route follows the existing gravel road.
	✓		
Agriculture	Primarily affects grazing land. No clear preference by Agricultural Specialist.		
	-	-	-
Heritage Resources	Routes traverse similar disturbed areas consisting of existing grazing land, powerline servitudes and existing public and private farm roads.		
	-	-	-
Socio-Economic Aspects	Similar socio-economic impacts, based on findings from Socio-Economic Impact Assessment.		
	-	-	-
Existing Structures & Infrastructure	Route situated in close vicinity (150 m) to existing house and associated structures.	Route situated in close vicinity (50 m) to existing infrastructure and within 100 m from landowner house and associated infrastructure.	Route situated in close vicinity (150 m) to existing house and associated structures.
	✓		✓
Road Network & Access	Follows the alignment of the existing Eskom power line servitude in a north-easterly direction.	First section follows alignment of Rooibokkraal Road (D769). Second section travels along a farm boundary and existing private farm road.	Entire route follows an existing private farm road along a farm boundary.
	-	-	-
Visual Quality	Follows the alignment of the existing power line. Located in "industrial corridor".	Affects more natural areas along property boundaries.	Affects more natural areas along property boundaries.
	✓		
Technical	The Central route is parallel to an Eskom existing servitude reducing sterilising unnecessary sections of land / camps.	Alternative A1 is marginally better than Alternative A2 from a hydraulic perspective.	Alternative A2 route is closer to residential property.
	✓		
Wildlife	Less disruptive to adjacent wildlife farms and ranches. Least impact is expected following the existing powerlines across Paarl 124 KQ.	Route will be disruptive to adjacent wildlife farm.	Route will be disruptive to adjacent wildlife farm.
	✓		

Table 77: Comparative Adverse Impacts – Pipeline Route Alternatives in Section 3

Environmental Feature / Attribute	Pipeline Route Alternatives – Section 3	
	Central Route	**Alternative C**
Land Use	Primarily affects grazing lands and a small section traverses old lands.	Primarily affects grazing land, with a small section of route affecting

Environmental Feature / Attribute	Pipeline Route Alternatives – Section 3	
	Central Route	Alternative C
		orchards.
	✓	
Geology & Soils	Similar potential impacts to geology and soils. Recommendations from geotechnical investigations to be employed.	
	-	-
Topography	Similar potential impacts to topography. Proper rehabilitation required for areas affected by construction activities.	
	-	-
Watercourses	Neither routes impact watercourses/pans.	
	-	-
Terrestrial Ecology - General	Follows existing access road to railway line, then rest of route runs adjacent to railway line in a northerly direction. The route traverses areas that contain CBA1, CBA2, ESA1 and ESA2.	This route follows the R510 main road. Most sections of this route fall within CBA 2, ESA 1, ESA 2 and Other Natural Area. Only less than 1% falls within the sensitive CBA 1 region.
		✓
Agriculture	Primarily affects grazing land and a small section traverses old lands.	Primarily affects grazing land, with a small section of route affecting orchards.
	-	-
Heritage Resources	Directly impacts on MCWAP Site 8.	Less impacts to identified heritage resources.
		✓
Socio-Economic Aspects	Less impacts on socio-economic environment.	This route follows an existing road and takes a more northerly route to the railway line than the central route in this area. It follows the railway line for less distance than the central route alternative in this area. The impact upon dwellings along this road is greater than the comparable impact of the central route in this area.
	✓	
Existing Structures & Infrastructure	Approximately 100m away from existing house and associated infrastructure.	Nearer to several houses and farming infrastructure.
	✓	
Road Network & Access	Along access road to railway servitude from R510. Follows alignment of railway line.	Situated along alignment R510 (Thabazimbi / Lephalale Road).
	-	-
Visual Quality	Similar potential impacts to visual quality of area. Proper rehabilitation required for areas affected by construction activities.	
	-	-
Technical	The Central Route remains the preferred route following the existing rail servitude being easier to construct/align than Alternative C along the road (R510) servitude. However, the construction of the R510 road crossing will require a large pipe jacking operation but it has already been done before.	

Environmental Feature / Attribute	Pipeline Route Alternatives – Section 3	
	Central Route	Alternative C
	✓	
Wildlife	Hunting/wildlife farms situated adjacent to access road to railway line and along railway line.	Alternative C is considered viable reaching the railway line corridor with little additional impact on wildlife.
		✓

Table 78: Comparative Adverse Impacts – Pipeline Route Alternatives in Section 4

Environmental Feature / Attribute	Pipeline Route Alternatives – Section 4		
	Alternative D1	Alternative D2	Alternative D3
Land Use	Primarily affects grazing land and natural areas.	Primarily affects grazing land and natural areas, with a small section of the route affecting old lands. Certain farms are being operated as a single unit and therefore do not have internal boundaries in place. The pipeline will fragment these properties.	Significant impact on surrounding hunting and eco-tourism farms.
	✓		
Geology & Soils	Similar potential impacts to geology and soils. Recommendations from geotechnical investigations to be employed.		
	-	-	-
Topography	Similar potential impacts to topography. Proper rehabilitation required for areas affected by construction activities.		
	-	-	-
Watercourses	This alignment affects two pans. Wetland Assessment provides a route that can be followed in order to minimise impact on pans.	This alignment has one depression of significance that will be impacted.	This alignment has one depression of significance that will be impacted.
	✓	✓	
Terrestrial Ecology - General	Traverses CBA 2 for approximately 13km.	Most sections of this route fall within natural areas.	This route mainly follows the existing gravel road and with 'no natural remaining area'. In areas denoted as CBA 1, mitigation measures mentioned in the terrestrial impact assessment report must be followed in order to minimise the negative impacts.
			✓
Agriculture	Primarily affects grazing land.	Primarily affects grazing land, with a small section of the route affecting old lands. There is no clear preference between the routes.	Primarily affects grazing land, with a small section of the route affecting old lands.
	-	-	-

Environmental Feature / Attribute	Pipeline Route Alternatives – Section 4		
	Alternative D1	**Alternative D2**	**Alternative D3**
Heritage Resources	Least impacts to heritage resources.	Alternative D2 may affect three sites, namely MCWAP Site 16, MCWAP Site 17 and MCWAP Site 18.	Alternative D3 may affect a high number of sites, namely MCWAP Site 11, MCWAP Site 12, MCWAP Site 13, MCWAP Site 14 and MCWAP Site 15.
	✓		
Socio-Economic Aspects	This route follows the railway line to its termination point for longer than the alternatives. The route alternative passes by three dwellings and impacts upon eight farm portions, lower than the alternative routes.	This route cuts across previously undisturbed land towards its termination point. The route alternative passes by four dwellings and impacts upon twelve farm portions.	The route would impact upon eleven farm portions. The impact on the road during construction would be significant.
	✓		
Existing Structures & Infrastructure	Follows alignment of existing railway network/servitude, along farm boundaries/fences. Approximately 100m from existing house and associated infrastructure.	Cuts across properties for first section of route not following any existing routes. Approximately 300m from existing house and associated infrastructure.	Route and construction servitude traverses and falls in close vicinity to several houses and associated infrastructure. Crosses beneath existing power lines, with existing Eskom pylons on both sides of the road.
	✓	✓	
Road Network & Access	First section follows existing railway servitude for 14km and second section follows farm boundaries till the termination point.	First section of fragments farm portions, and the rest of the route situated along farm boundaries.	Alignment along Steenbokpan Road. Access during construction along main road will be an issue for road users.
	✓		✓
Visual Quality	Along existing railway servitude for most of the route, and then follows farm boundaries, existing visual impact.	Fragments farm/properties and falls along boundaries causing high visual impact.	Situated along existing road (main road to Steenbokpan) situated close to existing houses and school.
	✓	x	x
Technical	First section of route follows railway servitude and second section of route follows farm boundaries. Situated closer to Medupi therefore connection will be shorter. Straightest alternative, lowest cost.	Wildlife and hunting operations along route. Highly contested/opposing IAPs along route.	Many hunting and wildlife operations occur in close vicinity to this route. Landowner's houses are situated in close vicinity to Steenbokpan Road, thus impact high compensation relocation cost. Most bends in route highest cost.
	✓		
Wildlife	If D1 is economically a more optimal solution for the reduced development scenario (Coal 3 and IPP), then D1 is preferred.		The preference is for Alternative D3 due to the planned development of Coal 3 and Coal 4. Coal 3 or an IPP may still be developed at this location. It should be noted that more

Environmental Feature / Attribute	Pipeline Route Alternatives – Section 4		
	Alternative D1	Alternative D2	Alternative D3
			detailed geotechnical investigation was already done for this route. At the feasibility stage the route along the existing service road was deemed to mitigate the impact on land use and security. Although it is technically feasible to "straighten" Alternative route D3 construction access would however be more difficult from 3 points to the (i) south (farm boundary between Grootlaagte 354 and Rooipan 355), (ii) centrally (farm boundary between Doornlaagte 353 and Zandheuvel 356) and (iii) at the northern end of this alternative. Additional access roads will also be required to the borrow pits adjacent to D3. The security risk associated with a second access parallel to the existing road will also have to be considered by the land owners. Alternative D3 is technically preferred due to the field investigations already completed and the ease of access.
	✓		✓

14.6 BPEOs Selection

Based on the recommendations of the specialists, technical considerations and the comparison of the impacts, the following options were identified as the BPEOs for the related pipeline alignments:

- Section 1 – Central Route;
- Section 2 – Central Route;
- Section 3 – Central Route;
- Section 4 – Alternative D1 and
- Section 5 – Alternative D4.

A layout diagram of the selected scheme, showing cadastral boundaries, is provided in **Figure 146**.

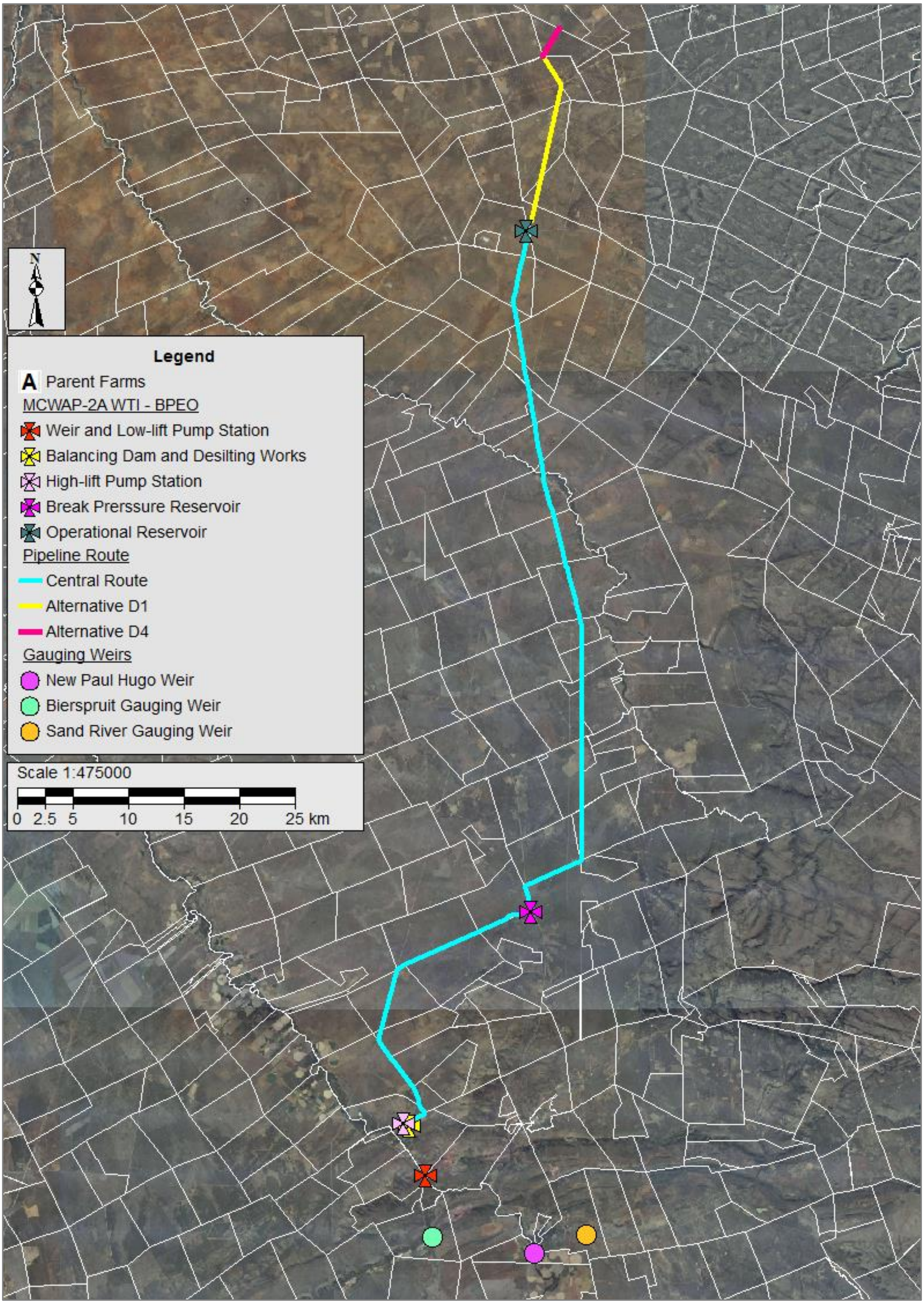


Figure 146: **Preferred Layout for MCWAP-2A, showing BPEOs**

Where the other alternatives were more favourable based on specific factors identified by the specialists, the residual impacts following the recruitment of suitable mitigation measures were not regarded as sufficiently significant or overriding to sway the ultimate selection of the scheme's preferred layout. It should also be noted that during the optimisation of the pipeline route during the design phase, the route can be shifted within the 100m corridor to avoid sensitive features, if found to be technically feasible. This will be further informed by the findings of the environmental sensitivity walk through survey of the entire project footprint prior to construction.

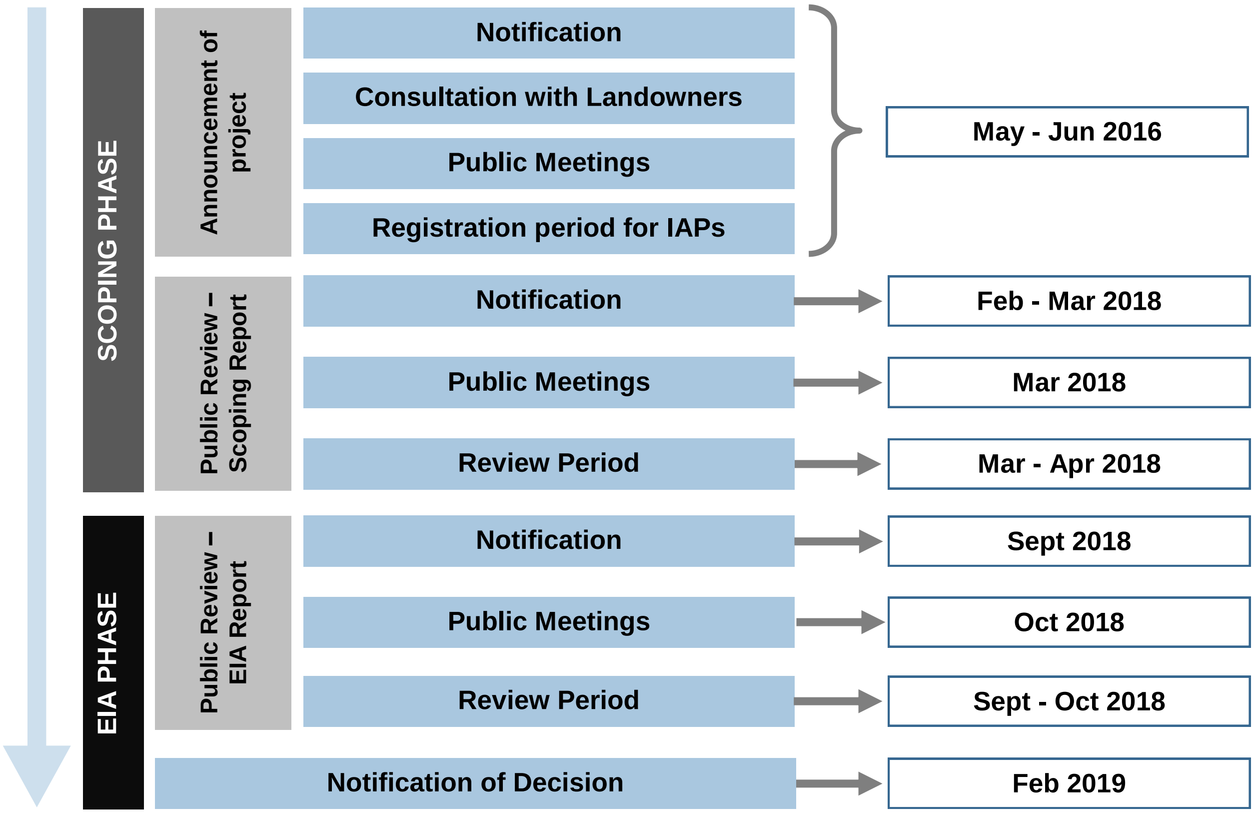
15 PUBLIC PARTICIPATION

15.1 General

The purpose of public participation includes:

1. Providing IAPs with an opportunity to obtain information about the project;
2. Allowing IAPs to express their views, issues and concerns with regard to the project;
3. Granting IAPs an opportunity to recommend measures to avoid or reduce adverse impacts and enhance positive impacts associated with the project; and
4. Enabling DWS, TCTA and the project team to incorporate the needs, concerns and recommendations of IAPs into the project, where feasible.

The public participation process that was followed for the proposed MCWAP-2A is governed by NEMA and GN No. R 982 of 4 December 2014 (as amended). **Figure 147** outlines the public participation process for the Scoping phase (completed) and EIA phase (current).



Note: *Dates may change during the course of the EIA process*

Figure 147: Outline of Public Participation Process

15.2 Public Participation during the Project Announcement and the Scoping Phase

The primary tasks undertaken as part of public participation during the project announcement and Scoping phase included the following (details provided in Scoping Report):

1. Compiling a database of IAPs;
2. Convening a Pre-Application Consultation Meeting with DEA;
3. Notifying the affected landowners of the project;
4. Announcing the project, which included distributing a Background Information Document (BID) and Reply Form, erecting onsite notices, placing newspaper notices, as well as convening public meetings and an authorities meeting;
5. Notifying IAPs of the review of the Draft Scoping Report by erecting onsite notices and placing newspaper notices;
6. Convening focus group meetings with irrigators (Hartbeespoort Irrigation Board, Crocodile-West Irrigation Board and Makoppa Irrigation Group), the Mooivallei Landowners and stakeholders from Hartbeespoort Dam;
7. Convening public meetings and an authorities meeting to present the drat Scoping Report;
8. Granting IAPs and authorities an opportunity to review the Draft Scoping Report; and
9. Compiling and maintaining a Comments and Responses Report.

15.3 Public Participation during the EIA Phase

15.3.1 Maintenance of the I&AP Database

A database of IAPs (refer to **Appendix L**), which includes authorities, different spheres of government (national, provincial and local), parastatals, stakeholders, landowners, interest groups and members of the general public, was maintained during the EIA phase.

15.3.2 Landowner Meetings

Certain directly affected landowners requested individual meetings on their respective properties. The aims of these meetings included the following:

- To provide these landowners with more information regarding the project;
- To explain the EIA process; and
- To provide an opportunity for these landowners to raise their individual concerns and to address comments to the project team.

The meetings were held on 4 – 5 May 2018. Refer to **Appendix P** for a copy of the minutes of the meetings.

15.3.3 Notification of Review of Draft EIA Report

In accordance with Regulation 43 of GN No. R. 982 of 4 December 2014 (as amended), registered IAPs were granted an opportunity to review and comment on the Draft EIA Report.

IAPs were notified as follows of the opportunity to review the Draft EIA Report and of the details of the public meetings:

- Landowners, authorities and registered IAPs were notified via email;
- Notices were placed in the following newspapers (copies of the newspaper advertisements are contained in **Appendix R**) -
  - The Star;
  - The Daily Sun;
  - Die Kwêvoël;
  - Kormorant;
  - Beeld;
  - Mogol Pos; and
- Notices were placed at various locations (photographs of notices are contained in **Appendix S**).

15.3.4 IAPs' Access to the Draft EIA Report

The review period for the Draft EIA Report took place from 28 September to 29 October 2018. Copies of the document were placed at the locations provided in **Table 79**.

Table 79: Locations for review of Draft EIA Report

Copy	Location	Address	Tel. No.
1.	Lephalale Public Library	Lephalale Civic Centre, c/o Joe Slovo & Dou Water St, Lephalale	014 762 1453
2.	Thabazimbi Public Library	4th Ave, next to Police station in Thabazimbi	014 777 1525
3.	National Library of South Africa (Pretoria)	c/o Johannes Ramokhoase St and Thabo Sehume St	012 401 9700
4.	Steenbokpan Winkel	Steenbokpan	014 766 0167
5.	Kosmos Library	108 Paul Kruger Ave, Kosmos, Brits	012 253 5128
6.	Lesedi Thusong Community Centre	Steenbokpan	079 321 3150 / 014 762 1423
7.	Marapong Public Library	916 Phukubye St, Marapong	014 762 1484

The Draft EIA Report was also uploaded to the DWS MCWAP website, as well as Nemai Consulting's website.

15.3.5 Copies of Draft EIA Report to Authorities

Copies of the Draft EIA Report were provided to the following regulatory and commenting authorities:

- DEA;
- LDEDET;
- DWS Limpopo Regional Office;
- DAFF;

- DMR;
- LIHRA;
- SAHRA (via SAHRIS); and
- Waterberg DM, Thabazimbi LM and Lephalale LM.

15.3.6 Copies of Draft EIA Report to Agricultural Groups

Copies of the Draft EIA Report were provided to the following agricultural groups:

- Hartbeespoort Irriion Board;
- Crocodile River (West) Irrigation Board;
- Makoppa Irrigators;
- Sentrum Agricultural Union and Thabazimbi District Agricultural Union;
- Agri Lephalale Office; and
- Transvaal Agricultural Union South Africa (TAU-SA).

15.3.7 Focus Group Meetings

The details of the focus group meetings that were held during the EIA phase are provided in **Table 80**. The minutes of these meetings are contained in **Appendix T**.

Table 80: Details of Focus Group Meetings

Date	02 Oct 2018	03 Oct 2018	
Group	Crocodile-West Irrigation Board & Hartbeespoort Irrigation Board	Makoppa Ad Hoc Committee	Mooivallei Landowners
Time	13:00 – 17:00	9:00 – 12:30	14h00 – 17h00
Venue	Agricultural Union Hall, Koedoeskop	Staankraal Farm, Makoppa	Kumba Bioscope Hall, Thabazimbi

The primary aims of the focus group meetings included the following:

- To present the status of the EIA;
- To provide an overview of the draft EIA Report;
- To afford an opportunity to the Focus Groups to raise their specific comments;
- To afford an opportunity to DWS to provide motivation with regards to specific issues pertaining to MCWAP-2A; and
- To provide a platform for project-related discussions.

15.3.8 Public Meetings to Present the Draft EIA Report

The details of the public meetings that were held to present the Draft EIA Report are provided in **Table 81**. The minutes of these meetings are contained in **Appendix U**. Note that the same presentation was given during the public meetings in Thabazimbi, Lephalale and Steenbokpan. Hence, the presentation is only appended to the minutes of the public meeting in Thabazimbi.

Table 81: Details of Public Meetings - EIA Phase

<table>
<tr><th>Date</th><th>09 Oct 2018</th><th>10 Oct 2018</th><th colspan="2">11 Oct 2018</th></tr>
<tr><td>Area</td><td>Hartbeespoort Dam</td><td>Thabazimbi</td><td>Lephalale</td><td>Steenbokpan</td></tr>
<tr><td rowspan="2">Time</td><td>Open Session:
12:00 – 15:30</td><td rowspan="2">Public Meeting:
13h00 – 17h00</td><td rowspan="2">Public Meeting:
9:00 – 13:00</td><td rowspan="2">Public Meeting:
14:30 – 17:00</td></tr>
<tr><td>Public Meeting:
16:00 – 18:30</td></tr>
<tr><td>Venue</td><td>Hartbeespoort
NG Kerk</td><td>Kumba Bioscope Hall,
Thabazimbi</td><td>Mogol Club,
Grootgeluk
Conference Room</td><td>Lesedi Thusong
Community Centre</td></tr>
</table>

15.3.9 Authorities Meeting to Present the Draft EIA Report

An authorities meeting was held on 10 October 2018 in Thabazimbi to present the Draft EIA Report. The minutes of this meeting are contained in **Appendix V**.

15.3.10 Comments received during the EIA Phase

Copies of the comments received during the review period for the Draft EIA Report are included in **Appendix W**. These comments were incorporated into the Comments and Responses Report which is contained in **Appendix M**.

15.3.11 Comments and Responses Report

The EIA Comments and Responses Report (contained in **Appendix M**) provides a comprehensive summary of comments, issues and queries received from IAPs to date. This report also attempts to address the comments through input received from the project team.

All comments received during the review period for the Draft EIA Report were included in the updated EIA Comments and Response Report.

15.4 Notification of DEA Decision

Registered IAPs will be notified after having received written notice from DEA (in terms of NEMA) on the final decision for the project. Advertisements will also be placed as notification of the Department’s decision.

The notification will include the appeal procedure to the decision and key reasons for the decision.

16 EIA CONCLUSIONS & RECOMMENDATIONS

16.1 Outcomes of the EIA Phase

Key tasks undertaken during the EIA phase for the proposed MCWAP-2A included the following:

- ❖ The specialist studies identified in the Plan of Study for the EIA were undertaken and the findings were incorporated into the EIA Report in terms of the understanding the environmental status quo and sensitive features, assessing the potential impacts and establishing concomitant mitigation measures, as well as identifying the preferred alternatives;
- ❖ Certain IAPs were engaged with to obtain input with regards to the environmental assessment and specialist studies;
- ❖ Potentially significant impacts pertaining to the pre-construction, construction and operational phases of the project were identified and assessed, and mitigation measures were provided; and
- ❖ Alternatives for achieving the objectives of the proposed activity were considered, and a comparative analysis was undertaken to identify the BPEO for each of the project alternatives. The "no-go" option is not supported when considered the implications of not implementing MCWAP-2A.

The outcomes of these tasks are captured below.

16.2 Sensitive Environmental Features

The following sensitive environmental features and aspects that are associated with the project are highlighted (refer to **Figures 148 - 150**), for which mitigation measures are included in the EIA Report and EMPr:

- ❖ All watercourses in the project area, which include the Crocodile River (West) and its tributaries (including Bierspruit and Sand River), Matlabas River and its tributaries, as well as wetlands (including pans) are regarded as sensitive and require suitable protection from the construction and operational activities. All activities of the project life-cycle to comply with the NWA, as well as the mitigation measures identifies as part of the Baseline Aquatic and Impact Study and Wetland Impact Assessment.
- ❖ Heritage and archaeological sites, as identified through the Heritage Impact Assessment, are situated in relative close proximity to the project infrastructure or may be directly affected. These sites are protected in terms of the NHRA and need to be suitably safeguarded.
- ❖ Flora and fauna species of conservation concern that are known to naturally occur in certain areas of the project footprint were identified during the Terrestrial Ecological Impact Assessment. All project activities that may impact on species of conservation concern need to comply with the NEM:BA (and associated Regulations), NFA and LEMA.
- ❖ Game farming is the dominant land use encountered in the majority of the project area, which is associated with various sensitive and high-value wildlife. Specific mitigation measures that

emanated from the Wildlife Impact Assessment and Socio-Economic Impact Assessment need to be adhered to.

- ❖ Opportunity costs are high for those properties where the future optimal use of the land will be affected. This is particularly relevant to those farms where agricultural production will be adversely affected (Mooivallei area), as well as farms where eco-tourism activities will be compromised. Mitigation in this regard may include fair compensation of landowners for economic losses and servitude restrictions, as well as by implementing the environmental best practices and mitigation measures contained in the EMPr.
- ❖ Dolomitic conditions occur at the sites for the balancing dam, desilting works and high-lift pumping station. Dolomitic stability investigations need to be conducted and the recommendations implemented.
- ❖ The alluvial deposits of the Crocodile River (West) constitute the primary aquifer in terms of ground water utilisation. The recommended monitoring requirements in terms of the potential impact of the abstraction weir on the equilibrium of sub surface flow conditions need to be implemented.
- ❖ The impact of the abstraction from the Crocodile River (West) and of the management of the system on the existing agricultural water users is regarded as a key environmental issue associated with the project and has been raised as a concern by many IAPs during public participation. The requirements of the Ecological Reserve (EWR) and Existing Lawful Water Users need to be met, in accordance with the NWA. The DWS was busy undertaking the Verification and Validation of Existing Lawful Water Uses in the Crocodile River (West), in accordance with the NWA, at the time of the EIA.
- ❖ The River Management System must also be implemented to monitor, control and manage the releases into the river, the flows in the river and abstractions from the river. This includes monitoring of the flow downstream, thereby allowing verification that the minimum downstream water requirements are met.
- ❖ The safety and security of the public is of paramount importance and must not be compromised by the activities associated with the construction and operational phases.
- ❖ MCWAP-2A will cause limnological and socio-economic impacts to Hartbeespoort Dam as a result of fluctuating water levels during dry periods. The fluctuation of water levels in Hartbeespoort Dam due to MCWAP-2A and drought periods may result in various cumulative impacts, such as exacerbating the water quality and hyacinth problems (amongst others) (refer to **Section 13.8.7**). This is to be addressed within the regulatory framework and the recommendations as set out in the Draft National Water Resources and Sanitation Master Plan and the statement by the Minister (refer to **Appendix N**) following his visit to Hartbeespoort Dam on 15 June 2018 where several water quality and land related challenges were brought to his attention. These challenges will need to be addressed in parallel.
- ❖ Measures need to be implemented to prevent erosion at all steep areas, such as the low mountains encountered in the Vlieëpoort region, and to avoid or minimise impacts to koppies that occur along the pipeline route.

- Measures included in the EMPr need to be implemented to safeguard all traffic and pedestrians on the public roads (including the D1649, D3677, R510 and D175) and private roads.
- All existing infrastructure and structures need to be safeguarded from construction activities until they have been relocated, where avoidance is not possible. This needs to take place in consultation with the owners or custodians of the infrastructure.
- Prevent construction-related nuisance to sensitive socio-economic receptors. The noise and air quality monitoring programmes need to take cognizance of these sensitive receptors, which include (amongst others):
  - Farm houses and dwellings of farm labourers;
  - The settlement in Steenbokpan;
  - The Matshaneng Primary School on the Steenbokpan Road;
  - Churches;
  - Smaller / narrower farms (e.g. along railway line);
  - Properties that are traversed by the MCWAP-2A pipeline that are already affected by other linear infrastructure (e.g. power lines, roads, railway line);
  - Farm stalls; and
  - Tourists.

The sensitivity maps shown in **Figures 148 - 150** need to be updated with the findings of the environmental sensitivity walk through survey and be made available to the implementation team (including the Project Manager, Environmental Control Officer and Contractor) in GIS format to allow for further consideration and adequate interpretation at an appropriate scale.

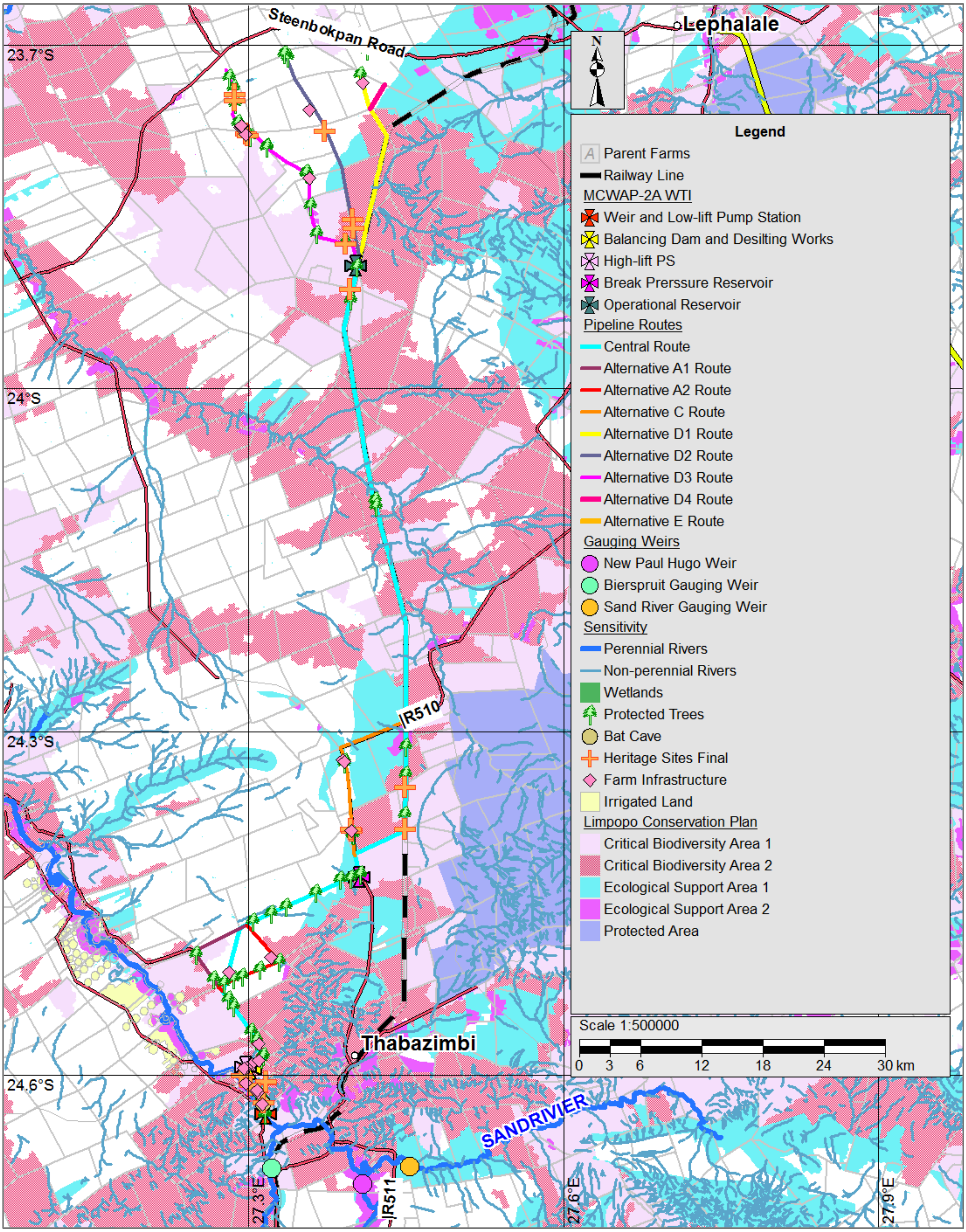


Figure 148: Overall Sensitivity Map

(Note: not all sensitive features shown; Farm Portions not shown due to scale)

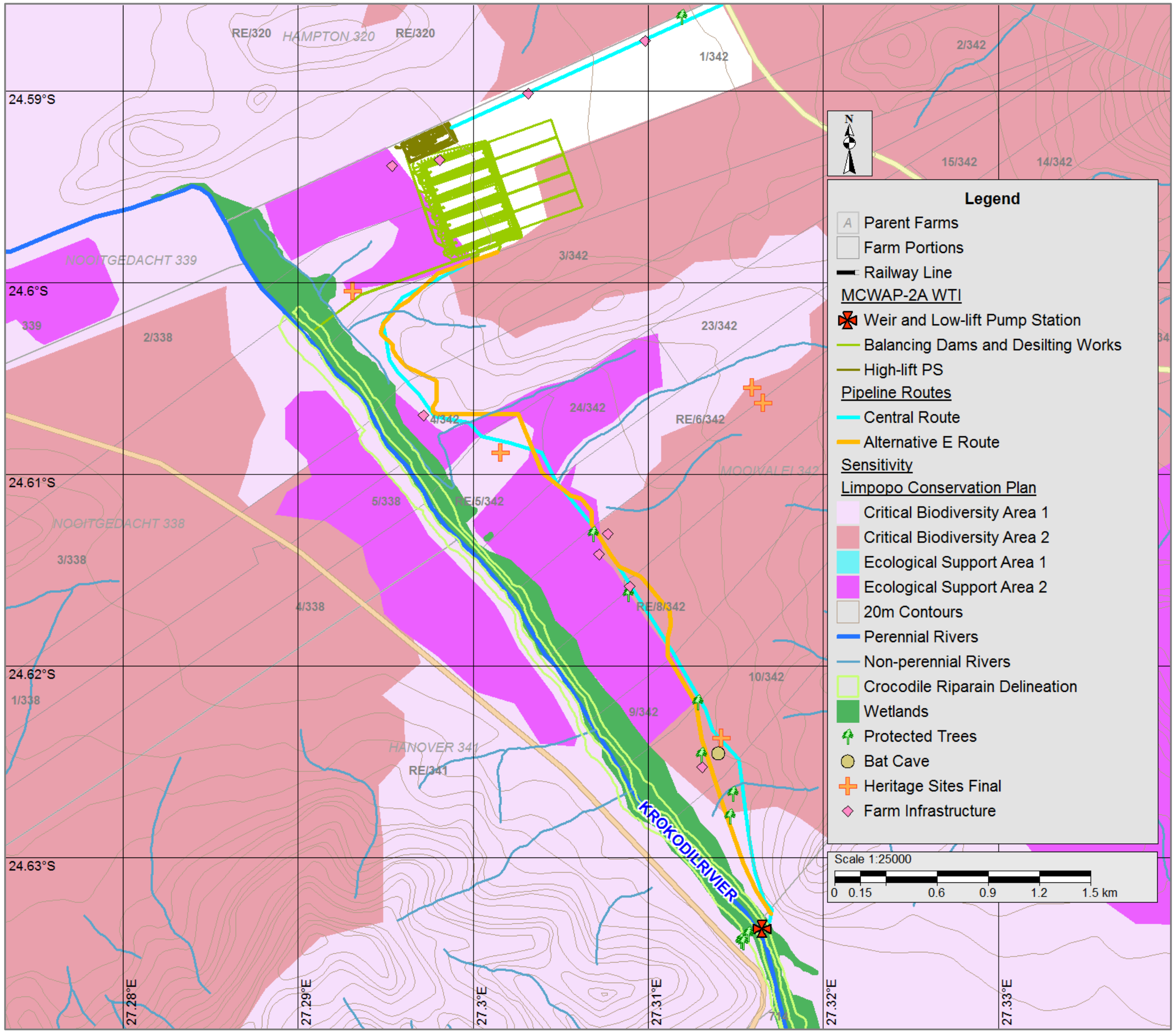


Figure 149: **Sensitivity Map – Southern Section**

(Note: not all sensitive features shown)

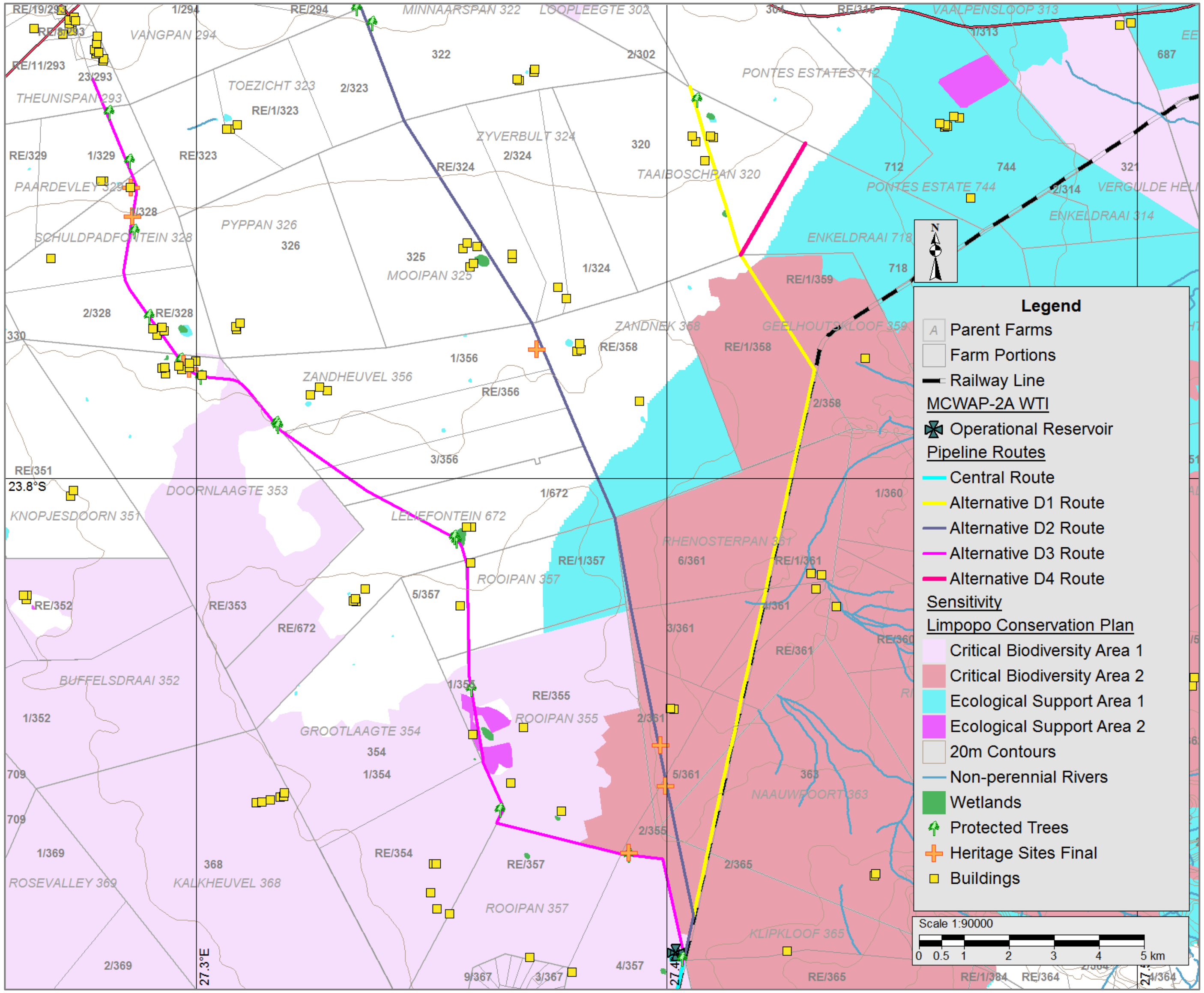


Figure150: Sensitivity Map – Northern Section

(Note: not all sensitive features shown; buildings based on topographical map)

16.3 Environmental Impact Statement

The strategic intent of the project stems from the necessity to support water requirements related to SIP 1, which aims to unlock SA's northern mineral belt, by utilising surplus return flows from Gauteng being discharged in the Crocodile River (West) Catchment. Various options to meeting the project's objectives were considered during the Technical Pre-Feasibility and Feasibility Studies that were undertaken for MCWAP-2A. The currently proposed water transfer scheme is deemed to be the most viable option to provide a large volume of water to fulfil these water requirements. The immediate short term driver entails supplementing the FGD demand from Medupi Power Station, which cannot be supplied from the Mokolo Dam source (MCWAP-1). In addition, the existing developments in Lephalale are currently dependent on a single source of water and without additional water the water availability in the town will be constrained. Furthermore, a drought in the Mokolo River Catchment will place a significant portion (approximately 20%) of Eskom's generation at risk and the town's water supply will be severely constrained. Water is required from the Crocodile River (West), through MCWAP-2A, to mitigate this risk.

The project infrastructure is mostly located on privately-owned properties that are primarily used for agricultural practices and game-farming. There is also a direct reliance on the water from the Crocodile River (West), up- and downstream of the proposed Vlieëpoort abstraction point, for irrigation purposes. Following thorough engagement with the affected landowners as part of the public participation process, as well as through specialist studies, all the concerns were identified and considered as part of the EIA. The concerns raised by IAPs with regards to the proposed project primarily fall into the following categories: (1) concerns related to the footprint of the physical infrastructure and associated impacts to land use as well as existing structures and infrastructure; (2) concerns related to water availability in the Crocodile River (West) and impacts to irrigation; and (3) concerns related to the cumulative impacts associated with the various developments that are linked to the Waterberg Coalfields.

With regards to impacts associated with the MCWAP-2A's infrastructure on the affected properties, mitigation measures are included in the EMPr based on the findings of the specialist studies and environmental best practices. Key forms of mitigation to land use impacts include adequate engagement of landowners prior to and during construction, maintaining the fenced construction servitude and fair compensation. To further minimise impacts, the proposed pipeline route attempts to remain alongside existing linear-type infrastructure, such as roads (main roads and dirt roads), the railway line (i.e. section of approximately 56 km), transmission lines, industrial corridors (linked to the EMF for the Waterberg DM) and farm boundaries where the environment is regarded as less sensitive. A 100 m corridor (i.e. 50 m on either side of the centre line of the pipeline, as well as the access road to the abstraction weir) was adopted as the study area during the EIA phase, which allows for possible deviations from the proposed alignment within this corridor (e.g. avoidance of sensitive features, if possible).

The availability of water for the proposed transfer of water as part of MCWAP-2A was modelled during the Reconciliation Studies (latest in 2015), which took into consideration the Existing Lawful Water Uses (including the Hartbeespoort Irrigation Board, Crocodile River (West) Irrigation Board and the Makoppa Irrigation Area). The return flows from growing urban areas that feed into the Hartbeespoort Dam and Klipvoor Dam provide surplus water that is available and targeted for the proposed water transfer, which is more than the natural yield of the Crocodile River (West). Water-related concerns are addressed by ensuring that the scheme makes provision for the Ecological Reserve and Existing Lawful Water Use (in accordance with the NWA), as well as by maintaining a positive water balance in future and reconciling growing water requirements and availability. This is to be achieved through *inter alia* the implementation of the River Management System and Operational Rules for the scheme. For the downstream water users, which do not have lawful water rights, there may be significant opportunity costs in terms of impacts to livelihoods that are reliant on water (e.g. irrigation).

The water from MCWAP-2A will enable future development associated with the Waterberg Coalfields. Potentially significant cumulative impacts include climate change impacts associated with coal-fired power stations, coal mines and other related industries. It is noted that the climate change impacts associated with these water users need to be assessed as part of the respective environmental assessments conducted for each of these developments, as they are the sources of the impacts.

The available storage in the Crocodile River (West) is not being used optimally at this stage due to the steady stream of return flows that has kept Hartbeespoort Dam spilling most of the time during the past decade and a half. This storage capacity will be better utilised once the transfer of water to the Lephalale area commences, if approval is received. The operating level of the Hartbeespoort Dam will fluctuate as per seasonal rains, which may result in various impacts. The primary purpose of Hartbeespoort Dam is to provide raw water for irrigation and domestic use. The dam is a government waterwork, which is defined by the NWA a waterwork owned or controlled by the Minister and includes the land on which it is situated. Fluctuating water levels are a common occurrence on any dams that are optimally utilised. It is recommended that the Hartbeespoort Dam RMP be updated to make provision for fluctuating water levels and that Business Plans be developed to deal with specific issues (e.g. sustainable harvesting of water hyacinth).

Critical environmental activities that need to be executed during the project life-cycle include the following:

- <u>Pre-construction phase</u> –
  - Diligent compliance monitoring of the EMPr, Environmental Authorisation and other relevant environmental legislation;
  - Search, rescue and relocation of red data, protected and endangered species, heritage resources and graves (based on area of influence of the construction activities). Develop

Search, Rescue and Relocation Management Plan, based on findings of walk through survey;
- Develop Environmental Monitoring Programme (air quality, water quality, noise, traffic, social);
- Conduct further baseline environmental studies for EMPr;
- Barricading of sensitive environmental features (e.g. graves);
- Obtain permits for species of conservation concern, as required;
- Obtain permits if heritage resources are to be impacted on and for the relocation of graves;
- Establish EMC; and
- On-going consultation with IAPs.

❖ Construction phase –
- Diligent compliance monitoring of the EMPr, Environmental Authorisation and other relevant environmental legislation;
- Ongoing search, rescue and relocation of red data, protected and endangered species, heritage resources and graves (based on area of influence of the construction activities) – obtain the relevant permits for impacts to protected environmental features;
- Implement Environmental Monitoring Programme (air quality, water quality, noise, traffic, social);
- Reinstatement and rehabilitation of construction domain (as necessary);
- Convene EMC Meetings; and
- On-going consultation with IAPs.

❖ Operational phase –
- Monitoring Programmes (including erosion, invasive alien species, surface and groundwater interactions, water quality, sediment management);
- Satisfy requirements in terms of EWR and Existing Lawful Water Users;
- Implement the River Management System;
- On-going consultation with IAPs; and
- Other activities as per EMPr for Operational Phase.

Based on the recommendations of the specialists, technical considerations and the comparison of the impacts, the following options were identified as the BPEOs for the related project components:

❖ Section 1 – Central Route;
❖ Section 2 – Central Route;
❖ Section 3 – Central Route;
❖ Section 4 – Alternative D1; and
❖ Section 5 – Alternative D4.

Where the other alternatives were more favourable based on specific factors, the residual impacts following the recruitment of suitable mitigation measures were not regarded as sufficiently significant or overriding to sway the ultimate selection of the scheme's preferred layout.

With the selection of the BPEO, the adoption of the mitigation measures include in the EIA Report and the dedicated implementation of the suite of EMPr, it is believed that the significant environmental aspects and impacts directly associated with this project can be suitably mitigated. With the aforementioned in mind, it can be concluded that there are no fatal flaws associated with the project and that authorisation can be issued, based on the findings of the specialists and the impact assessment, through the compliance with the identified environmental management provisions.

16.4 Recommendations

The following key recommendations, which may also influence the conditions of the Environmental Authorisation (where relevant), accompany the EIA for the proposed MCWAP-2A:

1. The River Management System must be in place prior to the commissioning of the proposed transfer scheme.
2. Conduct environmental sensitivity walk through survey of entire project footprint prior to construction. Survey team to include the following specialists -
   a. Terrestrial ecologist;
   b. Aquatic ecologist;
   c. Heritage specialist; and
   d. Social specialist.
3. Avoid or minimise impacts to koppies that occur along the pipeline route;
4. Specific attention will need to be paid to managing impacts to road users for all public roads (including the D1649, D3677, R510 and D175) and private roads. Traffic monitoring programme to be implemented and roads to be maintained. Safety of road users to be ensured at all times through appropriate safety and traffic calming measures.
5. Properties may not be accessed for construction purposes unless consent has been granted by the landowner, or until the land acquisition process has been concluded and a construction servitude has been registered.
6. The land acquisition and compensation process needs to adhere to all legal requirements, in negotiation with the affected landowners. This process must be undertaken fairly and must commence timeously prior to the construction phase.
7. Construction and operational activities need to be planned and coordinated in consultation with the affected landowners in order to minimise impacts on game farming, ecotourism and crop production.
8. Ensure compliance with Thaba Tholo's (and other landowners, as relevant) biosecurity protocols in relation to the construction and maintenance of the pipeline on the related properties.

9. Management of impacts associated with the scouring of sediment back to Crocodile River (West) from the desilting works during the operational phase –
    a. Return sediment during floods and flush at the end of the same floods back to river. Flushing is not allowed during low flow conditions in the river;
    b. Monitoring of the sediment levels in the Crocodile River (West) before and after flushing, as necessary, to determine impacts; and
    c. Periodic monitoring of chemical characteristics of sediment to confirm storage requirements and that scouring is suitable.
10. Establish an EMC in the pre-construction phase, with suitable representation of authorities, stakeholders and IAPs.
11. It is recommended that a Rehabilitation Management Plan be developed, which should include additional measures identified during construction to supplement the reinstatement and rehabilitation provisions included in the EMPr for the construction phase (if necessary).
12. Of the properties affected by the project footprint, the largest impacts are anticipated to be associated with the large infrastructure (abstraction works, balancing dam, BPR and OR). The properties that are the most severely affected by MCWAP-2A include Portions 1 and 2 of the Farm Mooivalei 342 KQ (affected by the balancing dam, desilting works, high-lift pumping station, ancillary infrastructure and a section of the pipeline). The outright purchasing of these properties should be considered as part of the land acquisition process, in consultation with the affected landowners. Other properties that will also require careful consideration during land acquisition and managing construction impacts include narrow farms (e.g. along railway line) and farms that are already impacted on by existing infrastructure (e.g. Remainder of the Farm Paarl 124 KQ and Portion 4 of the Farm Rooipan 357 LQ).
13. As discussed in the EMPr, various forms of monitoring is required to ensure that the receiving environment is suitably safeguarded against the identified potential impacts, and to ensure that the environmental management requirements are adequately implemented and adhered to during the execution of the project. The types of monitoring to be undertaken include –
    a. Baseline Monitoring needs to be undertaken to determine to the pre-construction state of the receiving environment, and serves as a reference to measure the residual impacts of the project by evaluating the deviation from the baseline conditions and the associated significance of the adverse effects;
    b. Environmental Monitoring will entail checking, at pre-determined frequencies, whether thresholds and baseline values for certain environmental parameters are being exceeded; and
    c. Compliance Monitoring and Auditing by the independent ECO to monitor and audit compliance against the EMPrs and Environmental Authorisation.
14. Key recommendations from the Baseline Aquatic and Impact Study (The Biodiversity Company, 2018) –
    a. Apart from instream structures and activities, all other construction activities should remain outside of the 30 m buffer zone from the edge of the riparian zones of the Crocodile River (West) and Matlabas Rivers, as well as their tributaries;

b. The ecological status of the Matlabas River needs to be determined during the high-flow period, prior to construction. The high flow survey needs to address potential impacts of the valve scouring on water quality, erosion and sedimentation of the Matlabas. Furthermore, a study of the potential introduction of nuisance and invasive species into the Matlasbas should be conducted. This should include a diatom assessment of the Crocodile and Matlabas Rivers to determine risk during valve scouring and leaks. This will determine the requirements for crossing the watercourse (i.e. open trench), as well as for scouring (i.e. draining water from the pipeline, typically during maintenance);
c. A high flow baseline assessment of the Bierspruit and Sandspruit is recommended prior to construction, as no surface water was available during the low flow survey;
d. Provision for a fishway at the Vlieëpoort abstraction weir should be included based on the considerations mentioned under maintenance of connectivity; and
e. It is recommended that a sediment study be conducted by a fluvial-geomorphologist to determine the baseline sediment balance associated with the Vlieëpoort Abstraction Weir, and the potential risks and benefits of sediment abstraction and return during the operational phase of the MCWAP-2A.

15. Key recommendations from the Heritage Impact Assessment (PGS Heritage, 2018) –
    a. Undertake a Phase 1 palaeontology assessment along the Central Route prior to construction;
    b. Whenever possible, all heritage sites identified with a significance of medium and higher, must be preserved *in situ* by designing the development footprints in such a way that a buffer area of at least 50m is maintained from construction activities. In cases where the preservation of such sites and buffer areas are not possible, site-specific mitigation measures would be required; and
    c. Conduct a walk through survey by a heritage specialist / archaeologist before construction commences;
16. Key recommendations from the Terrestrial Ecological Impact Assessment (Nemai Consulting, 2018b) –
    a. Undertake a walk through survey of the approved route alternative prior to the start of the construction activities in order to survey the area in detail for any Red Data Listed species. The survey should preferably be undertaken during summer season in order to have a higher probability of detecting species of conservation concern; and
    b. Determine the risk to the bat cave (subterranean chambers) in Mooivallei area based on outcomes of the geotechnical investigations. Determine mitigation measures based on the findings, in consultation with a suitable specialist. This may include realigning the low pressure pipeline within the 100 m that was assessed to avoid the bat cave as much as possible.
17. Key recommendations from the Wetland Impact Assessment (Index, 2018b) –
    a. Avoid encroachment of construction activities and the project footprint into any pans; and
    b. The Construction Camp at Rooipan 357 LQ is adjacent to the pan and within the buffer zone of 15 metres. The location of the camp will have a negative impact on the functioning

of the pan habitat. It is recommended that the camp be relocated further east of the present proposal.

18. Key recommendations from the Wildlife Impact Assessment (NABRO Ecological Analysts, 2018) –
    a. Affected parties (wildlife ranches and farms) need to be informed well in advance (require 12 months' notice) of impending disruptions; and
    b. Where avoidance measures during the peak hunting seasons are not possible, compensation for loss of income due to cancellation of bookings needs to be considered.

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APPENDICES