

**Phase 1 Palaeontological Impact Assessment of
three proposed new water pipelines in Frankfort,
Fezile Dabi District Municipality, FS Province.**

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Summary

A Phase 1 Palaeontological Impact Assessment was carried out for the proposed installation of three new water pipelines in Frankfort, Free State Province. Pipeline 1 will cut into superficial (Quaternary) overburden and dolerite considered to be of no palaeontological significance, as well as unweathered sandstones of the Normandien Formation considered to be of high palaeontological significance. Pipeline 2 will cut into dolerite intrusions considered to be of no palaeontological significance as well as well-developed alluvial deposits (superficial Quaternary overburden) laid down by a small tributary of the Wilge River. As far as the palaeontological heritage is concerned, Pipeline 1 and 2 may proceed provided that a professional palaeontologist is appointed during the construction phase of the project to monitor freshly exposed sedimentary bedrock between J.J. Hadebe Street and the Namahadi WTW as well as along the footprint section of Pipeline 2 from where it splits into two separate lines to its termination point at the Namahadi township. As far as the palaeontological heritage is concerned, Pipeline 3 may proceed with no further palaeontological assessments required, provided that all excavation activities are restricted to within the boundaries of the development footprint.

Table of Contents

Summary	2
Introduction	4
Locality data	5
Background	7
Field Assessment	7
Impact Statement & Recommendation	8
References	9

Introduction

A Phase 1 Palaeontological Impact Assessment was carried out for the proposed installation of three new water pipelines in Frankfort, Free State Province (**Fig. 1 & 2**). The assessment is required as a prerequisite for new development in terms of the National Environmental Management Act and is also called for in terms of the National Heritage Resources Act (NHRA) 25 of 1999. The region's unique and non-renewable palaeontological heritage sites are 'Generally' protected in terms of the National Heritage Resources Act (Act No 25 of 1999, section 35) and may not be disturbed at all without a permit from the relevant heritage resources authority. As many such heritage sites are threatened daily by development, both the environmental and heritage legislation require impact assessment reports that identify all heritage resources including palaeontological sites in the area to be developed, and that make recommendations for protection or mitigation of the impact of the sites.

The NHRA identifies what is defined as a heritage resource, the criteria for establishing its significance and lists specific activities for which a heritage specialist study may be required. In this regard, categories of development listed in Section 38 (1) of the NHR Act are:

- The construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length;
- The construction of a bridge or similar structure exceeding 50m in length;
- Any development or other activity which will change the character of the site
 - a) exceeding 5000 m² in extent; or
 - b) involving three or more existing erven or subdivisions thereof; or
 - c) involving three or more subdivisions thereof which have been consolidated within the past five years;
- The rezoning of a site exceeding 10 000 m²; or
- Any other category of development provided for in regulations by the South African Heritage Resources Agency (SAHRA).

A site visit and subsequent assessment took place in July 2016. The task involved identification of possible paleontological sites or occurrences in the proposed zone, an

assessment of their significance, possible impact by the proposed development and recommendations for mitigation where relevant.

Terms of Reference

- Identify and map possible heritage sites and occurrences using available resources.
- Determine and assess the potential impacts of the proposed development on potential heritage resources;
- Recommend mitigation measures to minimize potential impacts associated with the proposed development.

Methodology

The heritage significance of the affected area was evaluated through a desktop study and carried out on the basis of existing field data, database information and published literature. This was followed by a field assessment by means of a pedestrian survey. A Garmin Etrex Vista GPS hand model (set to the WGS 84 map datum) and a digital camera were used for recording purposes. Relevant publications, aerial photographs (incl. Google Earth) and site records were consulted and integrated with data acquired during the on-site inspection.

Locality data

Maps: 1:50 000 topographical map 2728AB Van Rheenenskop, 2728AD Frankfort and 2728BC Frankfort East / 1: 250 000 scale geological map 2728 Frankfort.

The proposed development involves the construction of

1. a 1380 m long water pipeline between the new Namahadi pump station and the Namahadi WTW (**Fig. 3**),
2. a 3570 m long bifurcated water pipeline between the new Namahadi pump station and the Namahadi Township (**Fig. 4**)
3. and a 6240 m long water pipeline between the Frankfort WTW and the Namahadi Reservoir (**Fig. 4**).

Pipeline Coordinates (**Fig. 3 & 4**):

#	Coordinates	
A	27°15'41.08"S	28°29'15.47"E
B	27°15'43.60"S	28°29'43.10"E

C	27°15'47.53"S	28°29'52.10"E
D	27°15'43.48"S	28°29'56.47"E
E	27°15'47.53"S	28°29'52.10"E
F	27°15'33.98"S	28°30'1.82"E
G	27°15'4.38"S	28°30'12.60"E
H	27°14'52.73"S	28°30'12.91"E
I	27°14'37.74"S	28°30'21.02"E
J	27°15'3.79"S	28°30'16.18"E
K	27°14'59.19"S	28°30'18.03"E
L	27°14'48.03"S	28°30'38.16"E
M	27°16'49.00"S	28°30'40.06"E
N	27°15'40.79"S	28°31'29.00"E
O	27°15'11.81"S	28°31'36.16"E
P	27°14'47.57"S	28°31'5.99"E
Q	27°14'13.53"S	28°30'18.49"E

Geology

The geology of the region has been described by Muntingh (1989) and is lithostratigraphically subdivided into the Volksrust Formation (Ecca Group), lower Normandien Formation and upper Tarkastad Subgroup (Beaufort Group). From oldest to youngest, the geology around Frankfort is made up of Ecca Group shales and Late Permian sandstones of the Normandien Formation (Beaufort Group) (**Fig. 5**). The Beaufort rocks in the area are intruded by Jurassic dolerite dykes and sills, that are palaeontologically insignificant (Karoo Dolerite Suite), and superficial sediments of Quaternary age, made up of residual soils and alluvium. The Normandien Formation is distinguished by three sandstone members (Frankfort, Rooinek and Schoondraai) and one mudstone member (Harrismith) and is interpreted to have been deposited by meandering streams flanked by wide, semi-arid floodplains (Groenwald 1990).

Background

Biostratigraphically, rocks belonging to the Normandien Formation are assigned to the Dicynodon Assemblage Zone (AZ). The AZ is characterized by the presence of both *Dicynodon* and *Theriognathus* (Kitching 1995). According to Groenwald (1990), three fossil species, namely *Dicynodon lacerticeps*, *Theriognathus platyceps* and *Prorubidgea maccabei*, are present in the Schoondraai Member of the Normandien Formation, while *Lystrosaurus murrayi* sans *Dicynodon lacerticeps* is present in the overlying Harrismith Member. The Normandien Formation is also well-known for the presence of plant fossils belonging to the Glossopterid flora. Two informal plant fossil assemblage zones are distinguished between the Frankfort and Rooinek sandstones; and between the Rooinek and Schoondraai sandstones (Claasen).

Small, fossil rich alluvial exposures of the late Cenozoic Cornelia Formation have been recorded north and east of Cornelia, about 34 km east of Frankfort. One of these sites is known as the Cornelia-Uitzoek vertebrate locality, and is the type site of the Cornelian Land Mammal Age (Butzer *et al.* 1974; Bender & Brink 1992; Brink & Rossouw 2000). The site consists of a pocket of Quaternary alluvial and colluvial gravels and clays in small basins of Karoo Ecce shale. This pocket of Quaternary sediments had been cut through by a small stream, the Schoonspruit, which flows northwards into the Vaal River. This resulted in the erosion of the Quaternary and Karoo sediments and the exposure of a rich Quaternary fossil occurrence. These Quaternary deposits are characterized by several distinct fossil mammal species, including *Stylochoerus compactus*, *Connochaetes laticornutus* and *Megalotragus eucornutus*. During recent excavations a human first upper molar, was discovered during the systematic excavation of a densely-packed bone bed in the basal part of the sedimentary sequence (Brink *et al.* 2012). This sequence was dated by palaeomagnetism which correlated the bone bed to the Jaramillo subchron, between 1.07 and 0.99 Ma. This makes the specimen the oldest southern African hominine remains outside the dolomitic karst landscapes of northern South Africa.

Field Assessment

Pipeline 1 - new Namahadi pump station to Namahadi WTW:

From the proposed new pump station to where it crosses a small tributary of the Wilge River at J.J. Hadebe Street the footprint is underlain by exposed dolerite

outcrop (**Fig. 6**). Coarse-grained feldspathic sandstone is occasionally exposed along the footprint between the road and its termination point at the western boundary of the Namahadi WTW (**Fig. 7**).

Pipeline 2 - new Namahadi pump station to Namahadi Township:

From the proposed new pump station to where it splits into two separate lines going into the Namahadi township the footprint is underlain by well-developed superficial sediments underlain by dolerite. The last 800 m of the footprint is capped by well-developed superficial sediments (Quaternary alluvium). According to the geological map this section is underlain by Normandien Fm bedrock, but no outcrop were recorded along the footprint (**Fig. 8**).

Pipeline 3 – Frankfort WTW to Namahadi Reservoir:

From the Frankfort WTW the pipeline runs adjacent to the R26 for about 3.5 km and then diverts to follow an existing gravel road into the Namahadi Township for another 3 km in a northwesterly direction, where it passes the Namahadi Reservoir to terminate at the northwestern boundary of the township (**Fig. 9**). The footprint is completely underlain by dolerite covered by a thin superficial overburden.

Impact Statement & Recommendation

Pipeline 1 will cut into superficial (Quaternary) overburden and dolerite considered to be of no palaeontological significance, as well as unweathered sandstones of the Normandien Formation considered to be of high palaeontological significance. As far as the palaeontological heritage is concerned, the proposed development may proceed provided that a professional palaeontologist is appointed during the construction phase of the project to monitor freshly exposed sedimentary bedrock along the footprint between J.J. Hadebe Street and the Namahadi WTW.

Pipeline 2 will cut into dolerite intrusions considered to be of no palaeontological significance as well as well-developed alluvial deposits (superficial Quaternary overburden) laid down by a small tributary of the Wilge River. A foot survey of the terrain revealed no evidence for the accumulation and preservation of intact fossil material within these superficial, Quaternary sediments and it is expected that the latter will largely buffer the impact of excavations into unweathered sedimentary bedrock along the last 800 m of the footprint. As far as the palaeontological heritage is concerned, the proposed development may proceed provided that a professional

palaeontologist is appointed during the construction phase of the project to monitor freshly exposed sedimentary bedrock along the footprint section from where it splits into two separate lines to its termination point at the Namahadi township.

Pipeline 3 will cut into dolerite intrusions and superficial overburden considered to be of no palaeontological significance. As far as the palaeontological heritage is concerned, the proposed development may proceed with no further palaeontological assessments required, provided that all excavation activities are restricted to within the boundaries of the development footprint.

References

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DECLARATION OF INDEPENDENCE

I, Lloyd Rossouw, declare that I act as an independent specialist consultant. I do not have or will not have any financial interest in the undertaking of the activity other than remuneration for work as stipulated in the terms of reference. I have no interest in secondary or downstream developments as a result of the authorization of this project and have no conflicting interests in the undertaking of the activity.

A handwritten signature in black ink, appearing to read 'L Rossouw', with a large, stylized initial 'L'.

02 / 03 / 2017

Figures

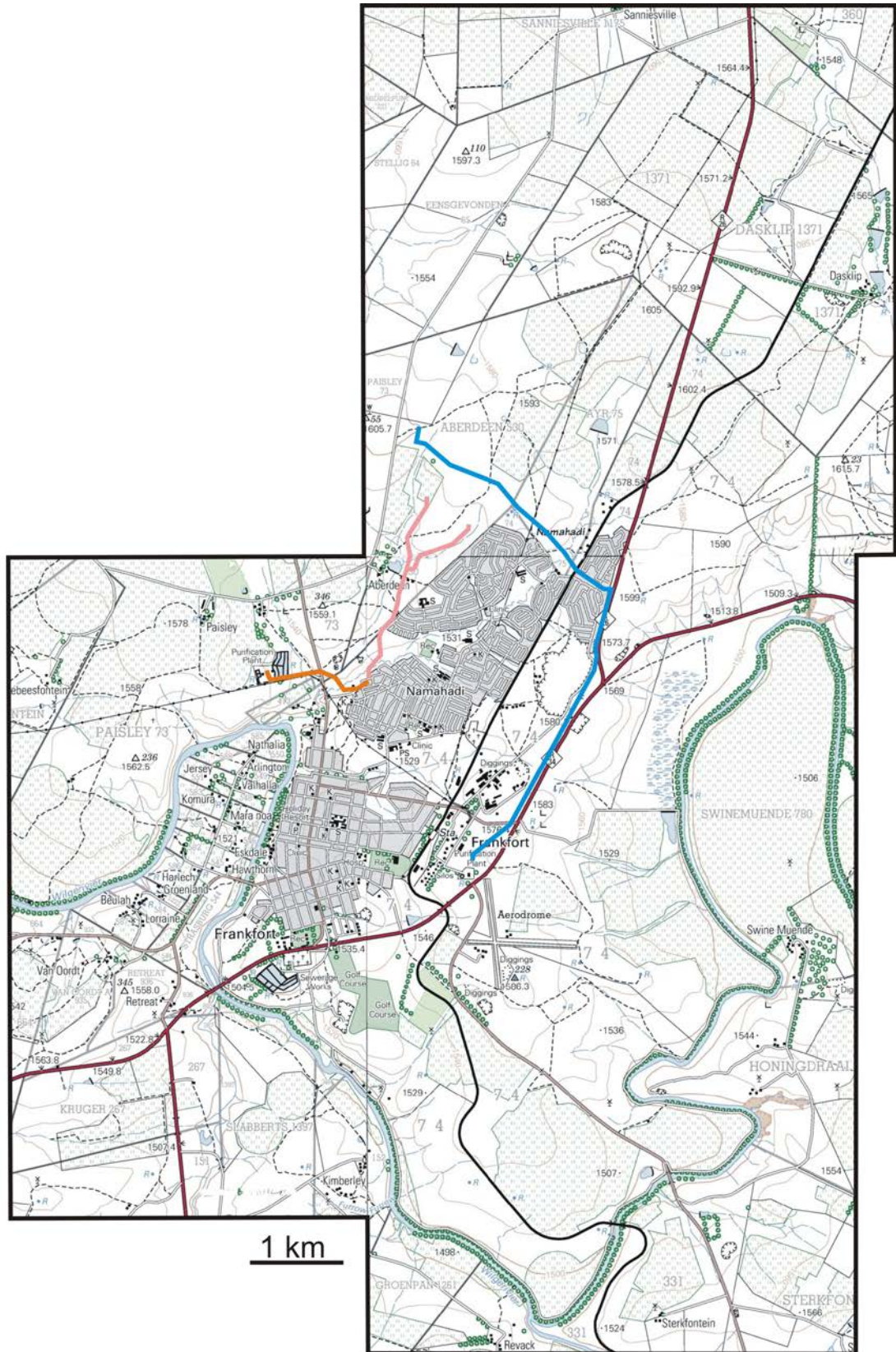


Figure 1. Map of Frankfort and study area (portion of 1:50 000 scale topographic maps 2728AB Van Rheenenskop, 2728AD Frankfort and 2728BC Frankfort East).

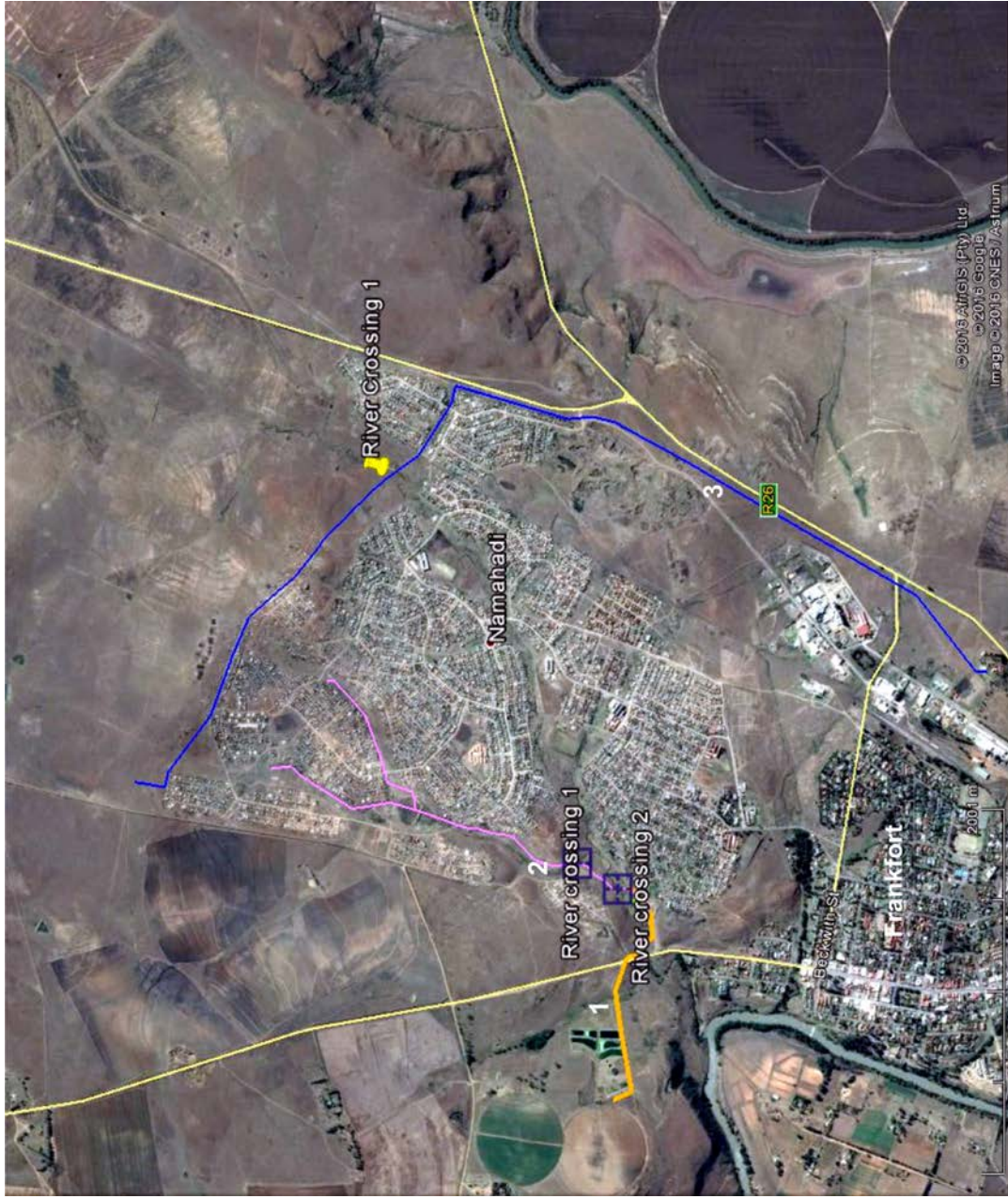


Figure 2. Aerial view and layout of the three new pipeline footprints.

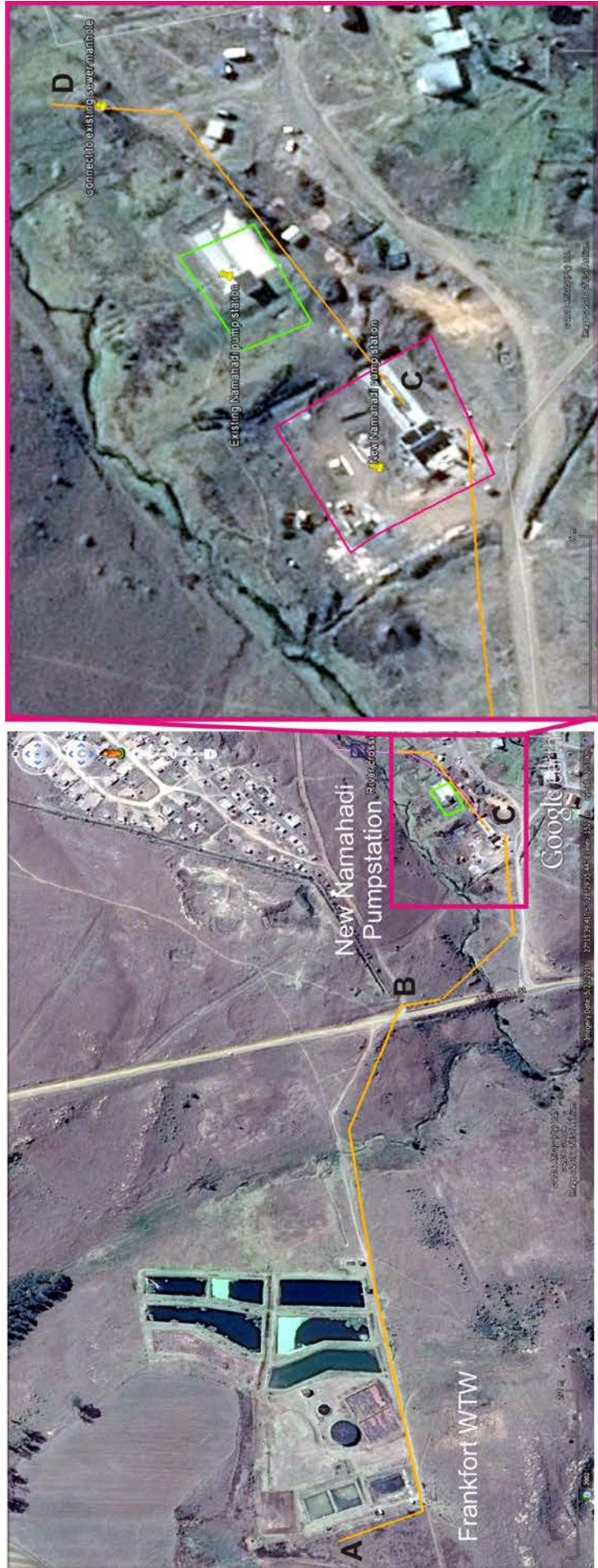


Figure 3. Aerial view of the pipeline footprint between the new Namahadi pump station and the Namahadi WTW



Figure 4. Aerial view of the pipeline footprints between the new Namahadi pump station and the Namahadi Township (left, pink line) and between the Frankfort WTW to Namahadi Reservoir (right, blue line).

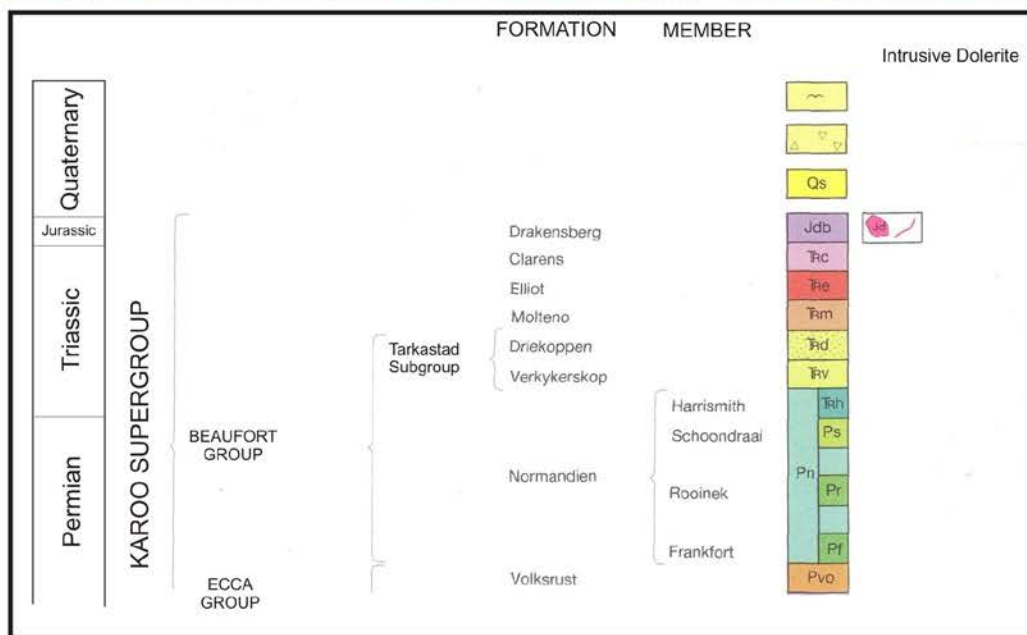
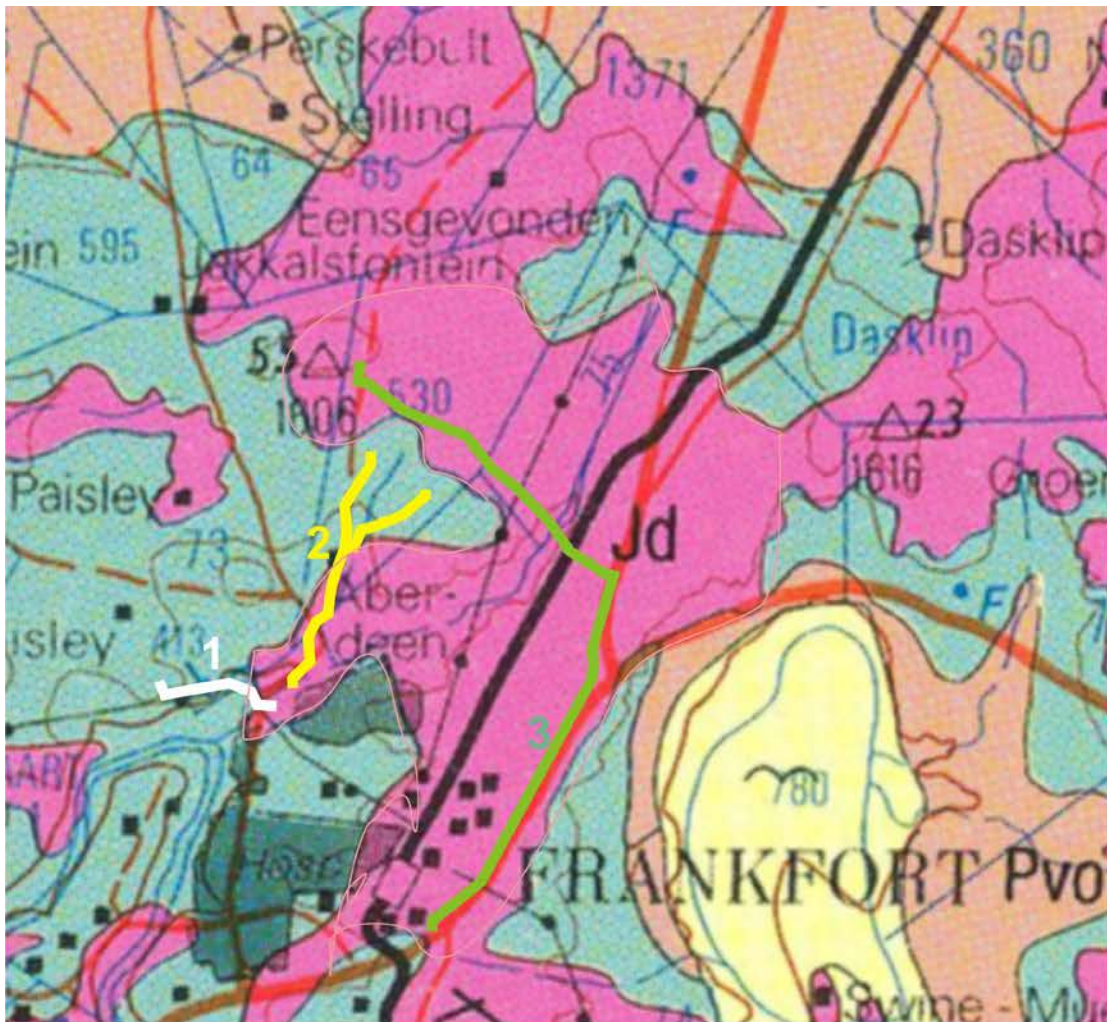


Figure 5. Portion of 1:250 000 scale geological map 2728 Frankfort. From oldest to youngest, the geology around the affected area is made up of Ecca Group shales (brown area, Late permian sandstones and mudstones (Normandien Formation, blue area). Jurassic dolerite intrusions (Karoo Dolerite Suite, pink area) and superficial sediments of Quaternary age, made up of residual soils and alluvium (flying bird symbol).



Figure 6. From the proposed new pump station site (A) the pipeline crosses a small tributary of the Wilge River at J.J. Hadebe Street (B) and then follows the road for about 100 m in a northerly direction (C) all underlain by dolerite intrusions (D).



Figure 7. The pipeline crosses J.J. Hadebe Street (A) and then follows the Namahadi WTW access road (B - D) to its termination point at the western boundary of the facility, all underlain by coarse-grained sandstone bedrock (E).
 Scale 1 = 10 cm.

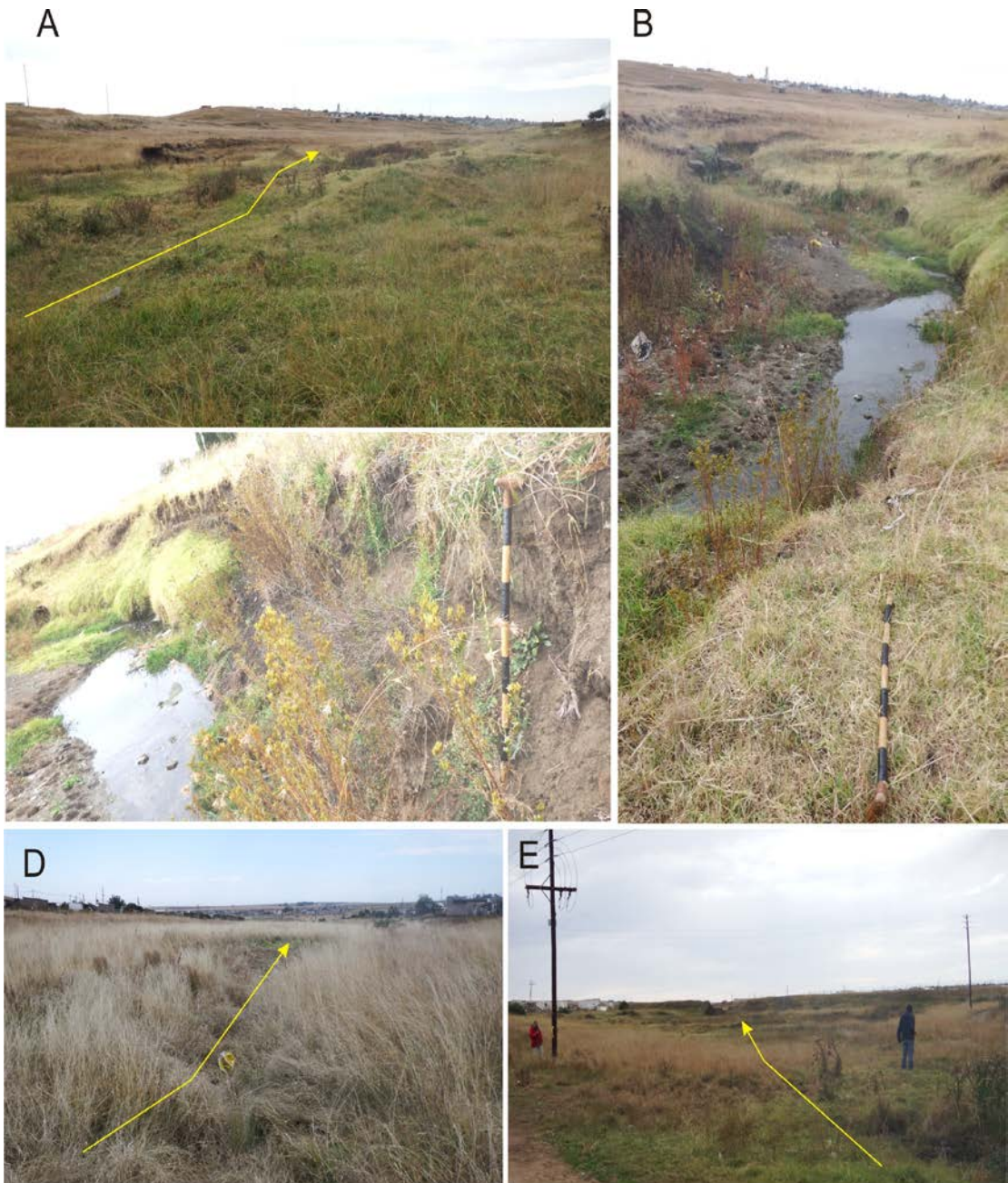


Figure 8. The pipeline follows a small tributary of the Wilge River (A) and crosses it twice cutting northeast into well-developed superficial overburden (B, C). It then splits into two separate lines going into the township at the Aberdeen dam wall (D, E).

Scale 1 = 10 cm.



Figure 9. From the Frankfort WTW the pipeline runs adjacent to the R26 (A) and then divert east to follow an existing gravel road (B, C) in a northwesterly direction within the Namahadi township (D - F) where it passes the Namahadi Reservoir (G) and terminates at the northwestern boundary of the township. The footprint is completely underlain by dolerite intrusions (H).