PHASE 1
HERITAGE IMPACT ASSESSMENT REPORT

PROPOSED PETROLINE LIQUID FUELS PIPELINE PROJECT MATOLA-NELSPRUIT-KENDAL

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EXECUTIVE SUMMARY

Petroline Holdings Pty (Ltd) (Petroline) wishes to develop a petroleum pipeline between Matola harbour in Mozambique and Kendal in Mpumalanga, South Africa. SRK Consulting has been appointed to undertake the necessary environmental authorization work for the South African component of the project, covering a length of some 384km. This report forms a specialist study within this wider process.

For the purpose of the heritage resources survey, the preferred route, i.e., Corridor A was traversed within certain limitations mentioned in the report. The baseline study undertaken for the exercise made it possible to demarcate the various cultural sequences in time and space on a general locality map.

The survey shows that most of the proposed route for the project had been modified by different human activities in the recent past with the result that the visibility of earlier archaeological remains had been obscured. One area containing a concentration of Late Iron Age stone walled settlements just north of Machadodorp was detected. Mitigation measures will have to be implemented at these sites. It was furthermore concluded that it is highly probable that undetected heritage material will be discovered accidentally during the construction phase of the pipeline. However, in conclusion, we do not consider heritage resources to be a fatal flaw anywhere along the pipeline project. It is nevertheless important, as recommended, that areas where uncertainty exists be re-assessed when the exact/final route has been determined before development commences.

From a heritage resources management point of view, there is no objection with regard to the development on condition that the recommended management and mitigation measures are implemented. This will result in no further significant impacts on the heritage resources through all the stages of development.

1. INTRODUCTION AND TERMS OF REFERENCE

Petroline (Pty) Ltd is planning to construct a petroleum pipeline to run from Matola (Mozambique) to Kendal (in Mpumalanga - South Africa). This report addresses the development of the pipeline of about 384km for the transport of liquid fuel from Komatipoort to Kendal via a proposed liquid fuels storage depot at Nelspruit and aims to increase the availability of fuel to South Africa's inland regions. Impacto, a Maputo-based consulting company, is conducting the EIA for the 64km portion of the pipeline that runs through Mozambique. The two pipeline routes will meet at the Mozambique/South African border in the vicinity of Komatipoort.

The enactment of the Petroleum Pipelines Act (Act 60 of 2003), which is aimed at promoting competition in the construction and operation of petroleum pipelines, has enabled Petroline to pursue the proposed development. The National Energy Regulator of South Africa (NERSA) has issued a license to Petroline to construct the proposed pipeline subject to *inter alia* compliance with environmental regulatory requirements. The high level of economic growth experienced in recent years and projections of continued growth point towards capacity of the transport system being outstripped by demand by mid-2009. Use of Matola harbour as an import point could relieve pressure on congested port facilities in South Africa. The pipeline is planned so that flow can be reversed to enable export of petroleum products via Matola if a new coal-to-liquid-fuels plant manufactures more fuel than required by the local market.

The proposed pipeline will be developed in one phase, as follows:

1. Section of pipeline from Matola to Nelspruit where a storage depot at Alkmaar is proposed
2. Pipeline from Nelspruit to Kendal, where a further depot is proposed.

The preferred route has been identified by VGI Consulting Engineers (see locality map) in conjunction with regional environmental issues.

The pipeline will consist of the following components:

- 3.3 kV or 6.6 kV pump stations.
- 12-inch pipeline buried at about 1 metre.
- Cathodic protection system.
- Inline or block valves.
- Automated pigging stations for launching intelligent pigs for operational and maintenance duties.
- A 6 metre wide servitude.

Petroleum volumes of 1.4 million m^3 are estimated and will require approximately seven pump stations. These will be designed in such as way that they can be upgraded as required.

Terms of reference: Undertake a Phase 1 Heritage Impact Assessment and submit a specialist report, which addresses the following:

- Executive summary;
- Scope of work undertaken, assumptions/and limitations;
- Methodology used to obtain supporting information;
- Overview of relevant legislation;
- Results of all investigations;
- Interpretation of information;
- Assessment of impacts (including cumulative impacts) associated with all the stages of the project (construction, operation, closure and post closure);
- Assessment of effectiveness of management measures proposed by the client;

- Recommendations on other management measures;
- References.

The aim of the report is to give an overview of the heritage status of the entire length of the recommended route; In-depth studies in hotspot areas; Identification and characterisation of potential impacts for construction, operation and closure; Recommendations for mitigation of negative impacts and enhancement of benefits. The significance of heritage resources was assessed in terms of criteria defined in the methodology section and the impact of the proposed development on these resources are evaluated.

2. RELEVANT LEGISLATION

Two sets of legislation are relevant for this study with regard to the protection of heritage resources and graves.

2.1 The National Heritage Resources Act (25 of 1999) (NHRA)

This Act established the South African Heritage Resources Agency (SAHRA) and makes provision for the establishment of Provincial Heritage Resources Authorities (PHRA). The Act makes provision for the undertaking of heritage resources impact assessments for various categories of development as determined by Section 38. It also provides for the grading of heritage resources (Section 7) and the implementation of a three-tier level of responsibilities and functions for heritage resources to be undertaken by the State, Provincial authorities and Local authorities, depending on the grade of the Heritage resources (Section 8).

In terms of the National Heritage Resources Act (1999) the following is of relevance:

Historical remains

Section 34(1) No person may alter or demolish any structure or part of a structure, which is older than 60 years without a permit issued by the relevant provincial heritage resources authority.

Archaeological remains

Section 35(3) Any person who discovers archaeological or palaeontological objects or material or a meteorite in the course of development or agricultural activity must immediately report the find to the responsible heritage resources authority, or to the nearest local authority or museum, which must immediately notify such heritage resources authority.

Subsection 35(4) No person may, without a permit issued by the responsible heritage resources authority-

(a) destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite;
(b) destroy, damage, excavate, remove from its original position, collect or own any archaeological or palaeontological material or object or any meteorite;
(c) trade in, sell for private gain, export or attempt to export from the republic any category of archaeological or palaeontological material or object, or any meteorite; or
(d) bring onto or use at an archaeological or palaeontological site any excavation equipment or any equipment which assist with the detection or recovery of metals or archaeological material or objects, or use such equipment for the recovery of meteorites.

Subsection 35(5) When the responsible heritage resources authority has reasonable cause to believe that any activity or development which will destroy, damage or alter any archaeological or palaeontological site is under way, and where no application for a permit has been submitted and no heritage resources management procedures in terms of section 38 has been followed, it may-

(a) serve on the owner or occupier of the site or on the person undertaking such development an order for the development to cease immediately for such period as is specified in the order;
(b) carry out an investigation for the purpose of obtaining information on whether or not an archaeological or palaeontological site exists and whether mitigation is necessary;
(c) if mitigation is deemed by the heritage resources authority to be necessary, assist the person on whom the order has been served under paragraph (a) to apply for a permit as required in subsection (4); and
(d) recover the costs of such investigation form the owner or occupier of the land on which it is believed an archaeological or palaeontological site is located or from the person proposing to undertake the development if no application for a permit is received within two weeks of the order being served.

Subsection 35(6) The responsible heritage resources authority may, after consultation with the owner of the land on which an archaeological or palaeontological site or meteorite is situated, serve a notice on the owner or any other controlling authority, to prevent activities within a specified distance from such site or meteorite.

Burial grounds and graves

Subsection 36(3)

(a) No person may, without a permit issued by SAHRA or a provincial heritage resources authority-
(c) destroy, damage, alter, exhume, remove from its original position or otherwise disturb any grave or burial ground older than 60 years which is situated outside a formal cemetery administered by a local authority; or
(d) bring onto or use at a burial ground or grave referred to in paragraph (a) or (b) any excavation equipment, or any equipment which assists in detection or recovery of metals.

Subsection 36(6) Subject to the provision of any law, any person who in the course of development or any other activity discovers the location of a grave, the existence of which was previously unknown, must immediately cease such activity and report the discovery to the responsible heritage resources authority which must, in co-operation with the South African Police Service and in accordance with regulations of the responsible heritage resources authority-

(a) carry out an investigation for the purpose of obtaining information on whether or not such grave is protected in terms of this Act or is of significance to any community; and
(b)if such grave is protected or is of significance, assist any person who or community which is a direct descendant to make arrangements for the exhumation and re-interment of the content of such grave or, in the absence of such person or community, make any such arrangement as it deems fit.

Culture Resource Management

Subsection 38(1) Subject to the provisions of subsection (7), (8) and (9), any person who intends to undertake a development***** …

must at the very earliest stages of initiating such development notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development.

***'development'** means any physical intervention, excavation, or action, other than those caused by natural forces, which may in the opinion of the heritage authority in any way result in a change to the nature, appearance or physical nature of a place, or influence its stability and future well-being, including-

(a) construction, alteration, demolition, removal or change of use of a place or a structure at a place;
(b) carry out any works on or over or under a place*****;
(e) any change to the natural or existing condition or topography of land, and
(f) any removal or destruction of trees, or removal of vegetation or topsoil;

"place** means a site, area or region, a building or other structure** ..."

***"structure** means any building, works, device or other facility made by people and which is fixed to the ground, …"

2.2 The Human Tissues Act (65 of 1983)

This Act protects graves younger than 60 years. These fall under the jurisdiction of the National Department of Health and the Provincial Health Departments. Approval for the exhumation and re-burial must be obtained from the relevant Provincial MEC as well as the relevant Local Authorities.

3. METHODOLOGY

3.1 Sources of information

The sources of information were the baseline information gathered from published sources. Secondly, aerial photographs covering most of the route were intensively studied after which certain areas required only a drive past in order become familiarised with the terrain. Thirdly, local community members were interviewed especially at the eastern most section of the route at the Lebombo Mountain, and lastly, pedestrian surveys were undertaken randomly along the route.

Standard archaeological practices for observation were followed. Aspects such as favourable geographical and ecological conditions were considered with regard to suitable habitation in the past and such places were inspected where potential heritage remains may be located. Locations of noteworthy heritage remains were recorded on a 1:50 000 map. Archaeological material and the general conditions of the terrain were photographed with a CANON Digital camera.

3.2 Limitations

The survey was affected by a number of limitations:

- The route selection was not yet final.
- Lack of fixed survey points or GPS coordinates to delineate the route.
- Inaccessibility of many areas.
- Intensive agricultural activities as well as subsistence farming, which limited surface visibility and access.
- Inclement weather conditions.
- The alternative routes mentioned hereunder were not surveyed.

3.3 Categories of significance

The significance of archaeological sites is ranked into the following categories.

No significance: sites that do not require mitigation.
Low significance: sites that *may* require mitigation.
Medium significance: sites that require mitigation.
High significance: sites that must not be disturbed at all.

The significance of an archaeological site is based on the amount of deposit, the integrity of the context, the kind of deposit and the potential to help answer present research questions. Historical structures are defined by Section 34 of the National Heritage Resources Act, 1999, while other historical and cultural significant sites, places and features, are generally determined by community preferences.

A crucial aspect in determining the significance and protection status of a heritage resource is often whether or not the sustainable social and economic benefits of a proposed development outweigh the conservation issues at stake. Many aspects must be taken into consideration when determining significance, such as rarity, national significance, scientific importance, cultural and religious significance, and not least, community preferences. When, for whatever reason the protection of a heritage site is not deemed necessary or practical, its research potential must be assessed and mitigated in order to gain data / information which would otherwise be lost. Such sites must be adequately recorded and sampled before being destroyed. These are generally sites graded as of low or medium significance.

3.4 Terminology

Early Stone Age: Predominantly the Acheulean hand axe industry complex dating to $\pm$ 1 Myr – 250 000 yrs. before present.

Middle Stone Age: Various lithic industries in SA dating from ± 250 000 yrs. - 30 000 yrs. before present.

Late Stone Age: The period from ± 30 000 yrs. to the contact period with either Iron Age farmers or European colonists.

Early Iron Age: Most of the first millennium AD.

Middle Iron Age: 10^{th} to 13^{th} centuries AD.

Late Iron Age: 14^{th} century to colonial period. *The entire Iron Age represents the spread of Bantu speaking peoples.*

Historical: Mainly cultural remains of western influence and settlement from AD 1652 onwards – mostly structures older than 60 years in terms of Section 34 of the NHRA.

Phase 1 assessment: Scoping surveys to establish the presence of and to evaluate heritage resources in a given area.

Phase 2 assessment: In depth culture resources management studies which could include major archaeological excavations, detailed site surveys and mapping / plans of sites, including historical / architectural structures and features. Alternatively, the sampling of sites by collecting material, small test pit excavations or auger sampling.

Sensitive: Often refers to graves and burial sites although not necessarily a heritage place, as well as ideologically significant sites such as ritual / religious places. *Sensitive* may also refer to an entire landscape / area known for its significant heritage remains.

4 LOCATION OF THE STUDY AREA.

The study area falls within three district municipalities; Ehlanzeni District Municipality, Gert Sibande District Municipality and Nkangala District. Collectively these comprise six local municipalities (moving from west to east, Mbombela Local Municipality, Nkomazi Local Municipality, Umjindi Local Municipality, Albert Luthuli Local Municipality, Steve Tshwete Local Municipality and Emalahleni Local Municipality).

5 GENERAL DESCRIPTION OF THE PROJECT AREA AND ROUTE.

Extract from SRK Report No 369396/3

The relief of the Highveld region in the Kendal/Witbank area is generally characterised by slightly undulating plains with some low hills and pans. From Witbank to Belfast the landscape is more variable with a series of ridges elevated above the surrounding elevated plains. The landscape between Belfast and Watervalboven is more variable with high altitude mountains, plateaus, slopes and valleys. The highest point between Matola harbour and Kendal is estimated at 1900m in the Belfast district, with the end at Kendal being approximately 1600m above sea level.

The high escarpment drops away to the lower-lying but mountainous region of the Krokodilpoort Mountain Range. This area poses severe constraints to identifying a suitable corridor alternative. To the north, the Crocodile River also presents difficulties with identifying a suitable route owing to the confined nature of the river valley, abutting often steep terrain to the south of the river.

Nelspruit is characterised by granite inselbergs and boulders, forming gentle to moderate slopes. The alluvial plains towards the Mozambican border pose little constraint to the identification of a suitable corridor, with the major challenge being the river crossings of the Komati River, which will be required. Steep gradients need to be climbed across the Lebombo Mountains.

Four corridor alternatives (A-D) have been identified by VGI (Figure 4-1). This section describes the west-east routing of these proposed corridors. Detailed maps showing the corridor alternatives are presented in Appendix M.

5.1 Corridor A

Corridor A commences near Kendal and goes north of Ogies following the route of the N4 before splitting into two alternatives:

- Alternative A skirts south of the Witbank dam, then goes due north again to rejoin the N4 servitude route near Rietfontein
- Alternative A1 skirts the northwestern side of the Witbank dam to run along the N4 servitude on the northern side of the dam.

This pipeline corridor then follows the N4 again until shortly before Machadadorp, where after it goes north-west of the N4 to avoid hilly terrain. Thereafter the corridor remains adjacent (on the north-western side) to the R36, and then follows the R539 road through the Schoemanskloof valley through which the Crocodile River meanders. Once through the

Schoemanskloof, Corridor A then crosses the N4 at Barvale and joins with Corridor B at Schagen for approximately 1 km (north-east of Rivulets) at Belmont Farm. The route then continues between the N4 and the meandering course of the Crocodile River to the proposed liquid fuels storage depot site at Alkmaar situated on the south banks of the Crocodile River and immediately north of the N4.

From the depot site, Corridor A continues a short distance until Pimlico where it veers south and around Hermansberg, and carries on south-east along the Noordkaap River Valley and crosses over the R40. At the mining development at Noordkaap, the corridor swings due east to follow the Kaap River valley gorge until Bon Accord where it traverses steep terrain to the north, then rejoins the Kaap River valley at Riverbank.
Corridor A eventually joins with Corridor D at Honeybird. The route then continues due east towards Louws Creek and then onward through Three Sisters, Fouriesberg and Singerton farms. The route swings southeast across the flat plains of Buffelspruit, where after it passes over the R570 and bypasses Driekoppies before joining up with Corridor C near Langloop farm. The corridor proceeds in an easterly direction past States Ground and crosses over the Komati River near Ntunda. Thereafter, it continues towards the Lebombo Mountains and the Mozambican border at Konkoni near Ngwenyeni.

5.2 Alternative Corridor B
Alternative Corridor B commences east of Witbank dam, and runs through farmland parallel to, and approximately three kilometers south of, Corridor A. The route joins Corridor A at Schoongezicht about 1km east of Machadadorp. Corridor A is followed until Blauuwboschkraal at Schoemanskloof, where Corridor B veers south-east following a ridge line until it joins the N4 east of Watervalboven at Doornhoek. Here the corridor does a sharp bend to the north-north-west and continues to follow the N4 until Berlin Sate Forest where is follows a route between the railway line and the Crocodile River. The route then crosses the Crocodile River to join Corridor A, approximately 1 km north-east of Rivulets at Belmont Farm.

Alternative Corridor B1 is a short diversion which starts on Corridor A at Montrose in the Schoemanskloof and traverses south east for approximately 2km, swings east-north-east crossing the Crocodile River at two points to rejoin Corridor B at Reception near Belmont (refer to Figure 4-1 and Appendix M).

Alternative Corridor B continues north-east and crosses the Crocodile River and N4, where after it crosses Corridor C at Vlamboom. After about 5km, the route turns due east to Rocky Drift and the proposed Depot site. It turns due south towards the Crocodile River, and after about 4.5 km veers south-east at Friedenheim. From Nelspruit, Corridor B follows the north bank of Crocodile River, which it crosses about 12km east of Nelspruit. It then continues along the Crocodile River until Malelane. After keeping north of Malelane, the corridor leaves the Crocodile River, crosses the N4 at Mahlati and continues south of the N4. The corridor closely follows the N4 as it turns at Komatipoort, and crosses the border to Mozambique still following the N4 route.

5.3 Alternative Corridor C
Alternative Corridor C begins at Pambilie (about 4.5km due east of Nelspruit) near Hermansberg and runs north north east of Corridor B. It crosses over the N4 and Crocodile River at Mataffin West, and then over Corridor B at Vlamboom. It continues in a northerly direction following the Eskom power lines for about 3 km. The route swings in an easterly direction towards Rocky Drift where it joins with Alternative Corridor B in the vicinity of the alternative liquid fuels storage depot sites. The corridor runs parallel to the Cape River, through Crystal Stream where it crosses over the R33. It then continues in an easterly direction until it begins to head north-east at Lilydale. It passes south of Three Sisters until it joins up with Corridor A at Fourieskraal. Corridor C recommences at Bosfontein and runs

south-east, and passes through the flat plains of States Land towards Sibange. It begins to veer in an easterly direction, where it passes over the Komati River and R571 and continues through the Lebombo Mountains towards Mozambique.

5.4 Alternative Corridor D

Alternative Corridor D begins approximately 15km east of Nelspruit near Duma, runs along the Blinkwater stream valley, and then swings south-east to traverse the Krokodilpoort Mountains. The route veers due east and joins Corridor A at Honeybird.

6. BASELINE INFORMATION

The pipeline route does not affect any formally recorded Stone Age site, whether open air or cave/shelter. It is know that the entire Stone Age sequence spanning from the Early Stone Age through the Middle Stone age to the Late Stone Age is represented in Mpumalanga. Examples of cave deposits exist near Ohrigstad in the vicinity of Echo Caves. The Later Stone Age hunter-gatherer groups known as the San or Bushmen have historically been recorded on the eastern Highveld at Chrissiesmeer.

In more recent pre-colonial times, various Eastern Bantu-speaking people inhabited southern Africa, including Nguni, Sotho-Tswana, Shona and Tsonga. About 1800 years ago, the ancestors of some of these people brought a new way of life to the region, systematically replacing the indigenous hunter-gathers. For the first time, people lived in settled communities, cultivating such crops as sorghum, millets, ground beans and cowpeas, and they herded cattle as well as sheep and goats. Because these early farming people also made their own iron tools, many archaeologists call this block of time the Iron Age. For convenience and to mark widespread events, we divide it into three periods: the Early Iron Age (AD 200-900), the Middle Iron Age (AD 900-1300) and the Late Iron Age (AD 1300-1820).

The project area covers this entire time span and the cultural periods that is represented over time is summarised below. The distribution areas are marked on the locality map.

1. The URUWE TRADITION, originating in the Great Lakes area of Central Africa, was a secondary dispersal centre for eastern Bantu speakers. It represents the eastern stream of migration into South Africa. The Branch that entered South Africa is called the KWALE BRANCH, and in the project area is represented by a sequence of two facies, namely:

1. Silver leaves facies (Matola) AD 280 – 450 (Early Iron Age)
2. Mzonjani facies (Broederstroom) AD 450 – 750 (Early Iron Age)

2. The KALUNDU TRADITION, originating in the far North of Angola, was another secondary dispersal centre for eastern Bantu speakers and represents the western stream of migration into South Africa. The Happy Rest Sub-Branch in the project area is represented by a sequence of three facies, namely:

1. Doornkop facies (Lydenburg) AD 750 – 1000 (Early Iron Age)
2. Klingbeil facies AD 1000 – 1200 (Middle Iron Age)
3. Maguga facies AD 1200 – 1450 (Middle Iron Age)

Elsewhere to the north this sub-branch developed into the well known K2 and Mapungubwe facies along the Limpopo River as the first expression of the Zimbabwe cultural complex.

3. NGUNI DISPERSAL (BLACKBURN BRANCH)

1. Badfontein Central route: At about AD 1600 – 1650 some Nguni groups left KwaZulu-Natal and settled on the Mpumalanga escarpment where they established extensive stone walled settlements named the Badfontein type of walling. These occur from Lydenberg southwards to Belfast, Machadodorp, and Carolina and even in the

Songimvelo Nature Reserve bordering Swaziland. These settlements are associated with Koni people who adopted the Sotho language (Sotho for Nguni).

2. Langa Lowveld route: Around AD 1700 other Nguni groups left KwaZulu-Natal and moved via Swaziland through the eastern lowveld to finally establish themselves in the Polokwane/Mokopane area as the Northern Ndebele.

4. MOLOKO (Sotho-Tswana) BRANCH

1. Marateng facies. AD 1650 – 1840: Marateng pottery is associated with modern day Pedi and developed out of the Madikwe facies (AD 1300 – 1500). The Pedi originated from the Kgatla in the Pretoria/Rustenburg area from where they moved to their current distribution area incorporating other Sotho-Tswana and Koni people who were already there.

Lastly, people of European descent had greatly influenced the project area in the 19th century, establishing farms, towns, and road infrastructure and completed the Delgoa Bay railway line in 1894. The Anglo-Boer war (1899-1902) also affected the area, especially in the Belfast and Machadodorp areas.

7. RESULT OF THE SURVEY

The discussion is based on the result of observations along pipeline route/corridor A, starting at Kendal, and following the route from west to east.

The section of pipeline from Kendal to Machadodorp presented no problems as it is easily accessible and surface visibility was good. Here the route mainly follows existing roads. The aerial photographs also cover this entire section and nothing resembling any kind of heritage site or object was observed.

From Machadodorp the route passes over the Elands River valley and rises up the escarpment to follow an inland route west of the R36. This section of route crosses over a cluster of ***Badfontein*** **stonewalled Late Iron Age** archaeological settlements on the farm Geluk 348 JT before it enters the plantation/forestry area.

In the plantation area the pipeline joins up and follows a route adjacent to an ESKOM high voltage power line until crossing the R36 to follow the R539 down to Schoemans Kloof. Here the plantations obscure any signs of archaeological remains. This section was inaccessible due to fences and lack of access roads. In addition, the aerial photographs did not cover this area. Along the R539, the route initially runs inland to the west of the road and then continues down the valley through Skaapwagters Pass into Schoemans Kloof and the Crocodile River valley. This area has been impacted on by agricultural activities, but it may contain obscured subterranean archaeological remains. In addition, Badfontein type settlements may be present on the inaccessible high lying ground. An example was photographed approximately opposite the 247 km mark (see Figure ?), although not affected by the project.

The Schoemans Kloof along the Crocodile River has been severely impacted on by farming. This would have been a highly suitable habitation area for Iron Age people. Pedestrian surveys and checks here did not reveal any archaeological material, although the probability of subterranean archaeological deposits being present here is >50%. Such material would be obscured.

The route crosses the N4 at Barvale where it was not possible to assess whether or not any buildings would be affected due to the scale of the available map. Should that be the case, such building/s must be assessed in terms of Section 34 of the National Heritage Resources

Act. The route then continues between the N4 and the meandering course of the Crocodile River in developed agricultural properties to the proposed liquid fuels storage depot site at Alkmaar.

The route from Alkmaar, swinging south at Pimlico and crossing over the R40 and then again along the Noordkaap river consists of broken Lowveld country. This type of country was highly favoured by Early Iron Age communities. For example, during the construction of the Government buildings at Riverside west of Nelspruit, Archaeological Resource Management of Wits recorded an Early Iron Age Mzonjani site. This area was mostly inaccessible due to it crossing numerous smallholdings, a nature reserve, and lacked access roads up to Noordkaap. The probability of subterranean archaeological deposits being present here is >50%.

The fertile Noordkaap river valley/gorge up to Louws Creek is highly disturbed by agricultural development, infrastructure, and the railway line, but must be regarded as sensitive for archaeological remains as well as historical buildings. The probability of subterranean archaeological deposits being present here is >50%.

The route from Louws Creek onward through Three Sisters, Fouriesberg and Singerton farms is mainly an inaccessible mountainous area dominated by forestry. This area was not physically surveyed, but it is generally unlikely that any significant heritage remains will occur here because of the nature of the terrain and because of the disturbances caused by the forestry industry. Much of this area is covered by aerial photographs, which showed no sign of heritage resources.

After descending from the mountain at Singerton farm, the route crosses the alluvial lowveld plain towards the Lebombo Mountain and Mozambique border. Most of the surface area along the route is obscured by years of repeated ploughing and subsistence farming. The probability of subterranean archaeological deposits being present here is >50% highlighting the probability that such material may be exposed during the pipeline trenching.

8. EVALUATION

The heritage resources survey along the Petroline fuels pipeline was not entirely satisfactory. This is mainly because of the numerous limitations encountered. A glance at the demarcation of archaeological cultural distribution areas on the locality map informs one that the potential to encounter archaeological sites along the route is great. Fortunately, the route mainly passes though disturbed areas. Agriculture, forestry, subsistence farming, roads, and smallholding development have modified and disturbed most areas. Places unaffected by some kind of development are scarce. The aerial photographs were of immense assistance in detecting archaeological sites such as the stone walled *Badfontein* sites, and it was equally valuable in observing the absence of archaeological sites.

We are, therefore, not over concerned about the failure to detect more archaeological sites, especially earlier ones. The large-scale modification of the surface along much of the route would have caused severe damage to any archaeological site and render it a low significance grading, probably not worthy of conservation other than applying for a destruction permit in terms of Section 34, 35 and 36 of the NHRA. Such disturbed remains are difficult to observe in growing agricultural fields or in a good rainy season such as the current season was during the fieldwork. Archaeological material may become visible during the trenching process allowing the opportunity to record and assess it, adding additional data to the heritage database of Mpumalanga. It is nevertheless important, as recommended below, that areas where uncertainty exists be re-assessed when the exact route has been determined and before development commences.

For the pipeline to completely avoid the *Badfontein* stonewalled sites in the Machadodorp and escarpment area, it will necessitate a change of the preferred route. This will, however, not guarantee that other similar sites would not be encountered. There are literarily hundreds of these sites on the escarpment and in order to miss all such sites, an archaeologist would have to accompany a land surveyor to ensure that such sites are located in advance and bypassed. We are therefore of the opinion that the route should remain where it is but that a permit application is to be lodged with SAHRA well in advance to allow for the damage to those sites indicated on the aerial photograph. There are clearly two affected sites, but there could be others no longer clearly visible due to past robbing of stones, etcetera. This would require Phase 2 assessments of the affected sites before damage is caused; the option exists to reconstruct the damaged walls during the post construction phase if SAHRA so demands.

Any building that may stand in the way of the development must be identified as soon as possible in order for it to be assessed in terms of Section 34 of the NHRA.

Most archaeological sites contain graves. These will be unmarked and if encountered will thus be as a result of it being accidentally exposed during trenching. The social consultative and public participation process should address the issue of historical graves and cemeteries.

Almost two thirds of the proposed route crosses country that falls within the distribution pattern of the Iron Age sequence in Mpumalanga. Due to the nature and scope of the proposed project, it is highly probable that undetected heritage material will be discovered accidentally during construction. However, in conclusion, we do not consider heritage resources to be a fatal flaw anywhere along the pipeline project.

It is our opinion that the sustainable social and economic benefits of the proposed development outweigh the conservation issues at hand. The discovery of previously undetected heritage material must be managed by means of the recommendations below.

9. CONCLUSION

Potential impacts on heritage resources may result from activities related to the entire construction process of the proposed pipeline and include aspects such as:

- the clearing of the construction right-of-way and servitude area,
- making access roads,
- building of construction camps,
- accommodation facilities, and
- the trenching of the pipeline.

The potential heritage resources that may be affected include:

- identified stonewalled archaeological settlements
- undetected subterranean archaeological deposits
- historical structures and features
- graves/burials

The environmental receptors are the proposed pipeline plus the construction teams and equipment that is to be used for the construction of the pipeline. The proposed activity could thus potentially result in impacts such as the damage or destruction of a heritage resource through the various aspects of the project. Heritage resources are generally non-renewable and any impact on such a resources will be destructive and permanent, with loss of all relevant information about the resource if mitigation measures are not implemented. Although it is accepted that not all heritage resources warrant protection other than approval

for destruction from the heritage resources authority, legislation requires that such resources be assessed and that relevant data is recorded in terms of minimum standards.

In Mpumalanga the South African Heritage Resources Agency (SAHRA) is responsible for issuing permits for graves and archaeological sites, while the Mpumalanga Heritage Resources Authority is the responsible compliance agency for buildings and structures older than 60 years.

10. RECOMMENDATIONS FOR MANAGEMENT AND MITIGATION MEASURES

In view of the above, the following management and mitigation measures are recommended

1. When the pipeline route is finally determined and pegged by the land surveyor, the heritage practitioner/archaeologist is to re-assess certain sections of the existing corridor/route A, as well as any deviation from the original route A. The sections are:
   1.1 The farms Schoongezigt 347 JT, Blaauboschkraal 347 JT, Zwartkopie 329 JT, Mooiplaats 328 JT and Zondagskraal 145 JT north of Machadodorp.
   1.2 The area from Pimlico to Noordkaap.
   1.3 The farms Three Sisters 254 JU & 256 JU, Fourieskraal 267 JU and Singerton 260 JU.
2. The environmental control officer must be trained in basic archaeological site identification in order to immediately inform the archaeologist of any chance discovery of archaeological sites or burials. The archaeologist will then implement the required legal steps in terms of the applicable section of the NHRA.
3. Buildings 60 years and older must be assessed and a permit obtained from SAHRA before demolition is considered.
4. Phase 2 assessments to be mitigated for the affected *Badfontein* stonewalled sites, unless the route is deviated to bypass any such sites under supervision of an archaeologist. A Phase 2 assessment will entail the drawing of a site plan and the excavation of the necessary number of test pits in order to interpret and date the site.
5. The temporary construction right-of-way of approximately 20-25m wide must be abolished when working over one of the above-mentioned stonewalled sites. Only the servitude of 6m wide should be retained for the distance where the site is affected.
6. Culture resource management mitigation should be implemented on an *ad hoc* basis at any chance discovery of archaeological remains. The archaeologist should determine the extent of the management or mitigation measures required by means of a site assessment of the significance of the find. This implies that provision must be made for such costs.
7. The archaeologist must be allowed to routinely inspect any section of the pipeline for monitoring purposes with due consideration of health and safety regulations and any other applicable site-specific requirements.

From a heritage resources management point of view we have no objection with regard to the development along Corridor/route A on condition that the recommendation below is implemented. The discovery of undetected heritage remains must be reported to the archaeologist, who will then comply with the necessary legal requirements.

11. REFERENCES

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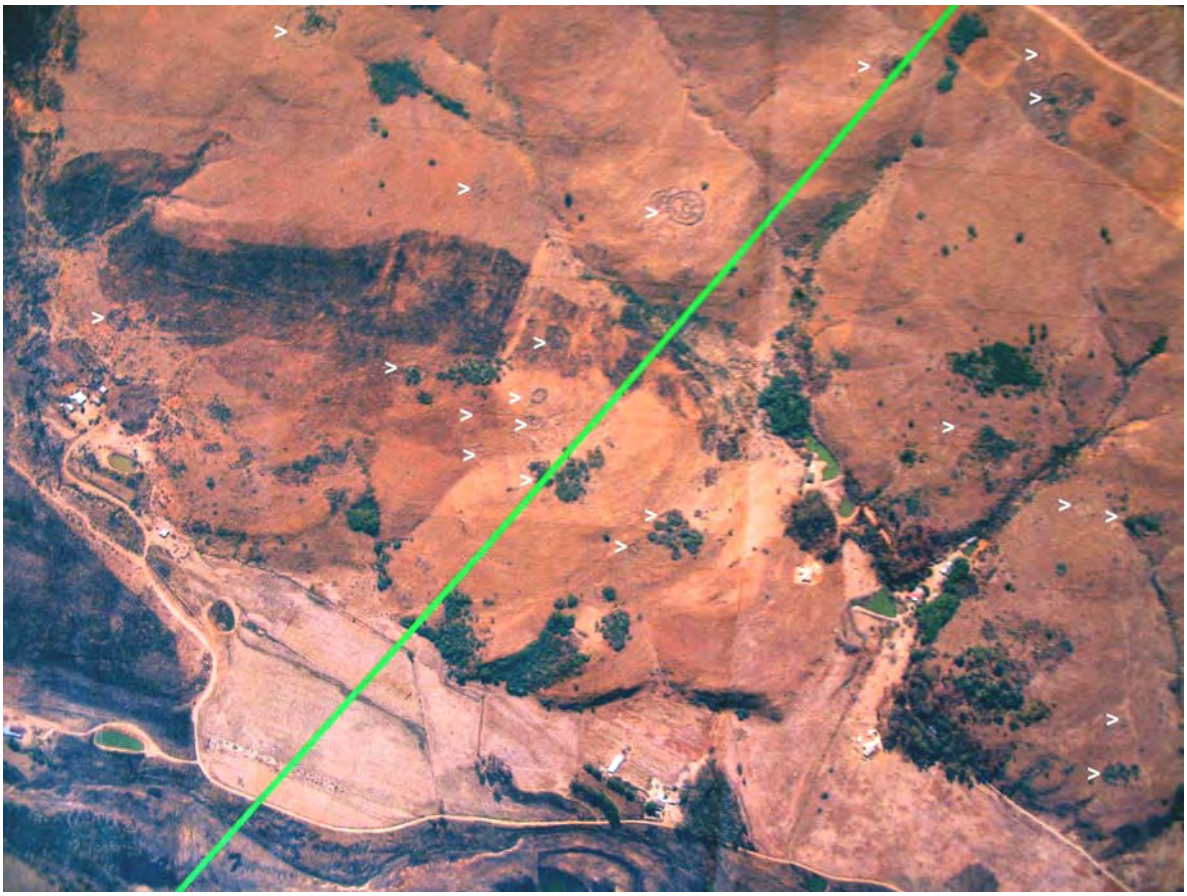


Fig. 1 Aerial photo showing stonewalled settlements north of Machadodorp.
The **>** indicates sites.

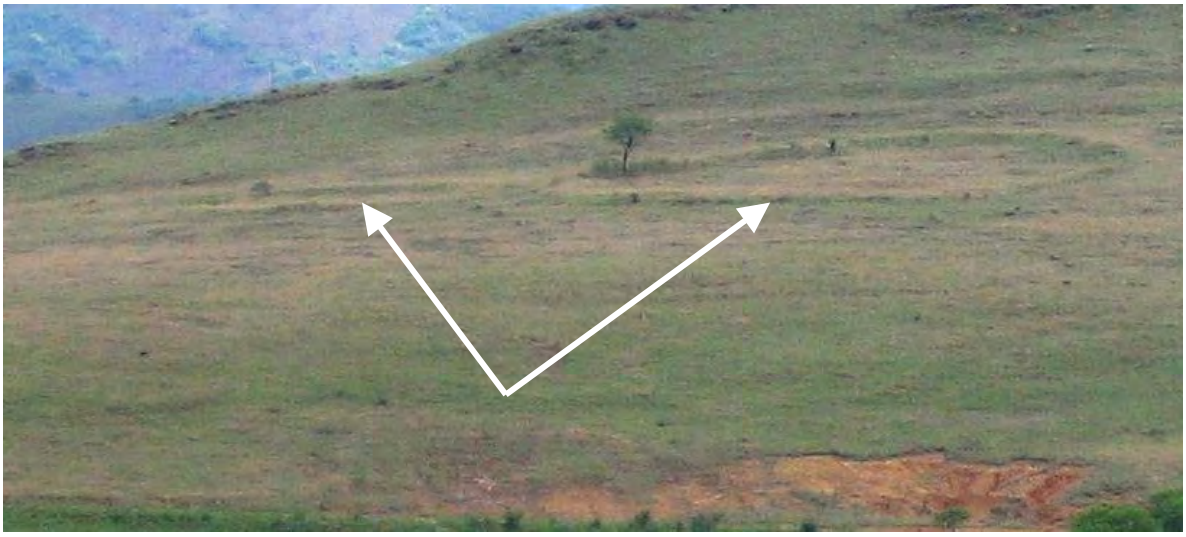


Fig 2. Remnants of stonewalled structures along the R539.

Fig 3. Route A along a power line and in the plantations of the farm Geluk 348 JT.

Fig 4. Skaapwagters Pass in the distance to the south-west on the R539.

Fig 5. View down towards Louws Creek.

Fig 6. Route through a cane field near Driekoppies.

Fig 7. Route crossing the R571 south of Esibayeni.

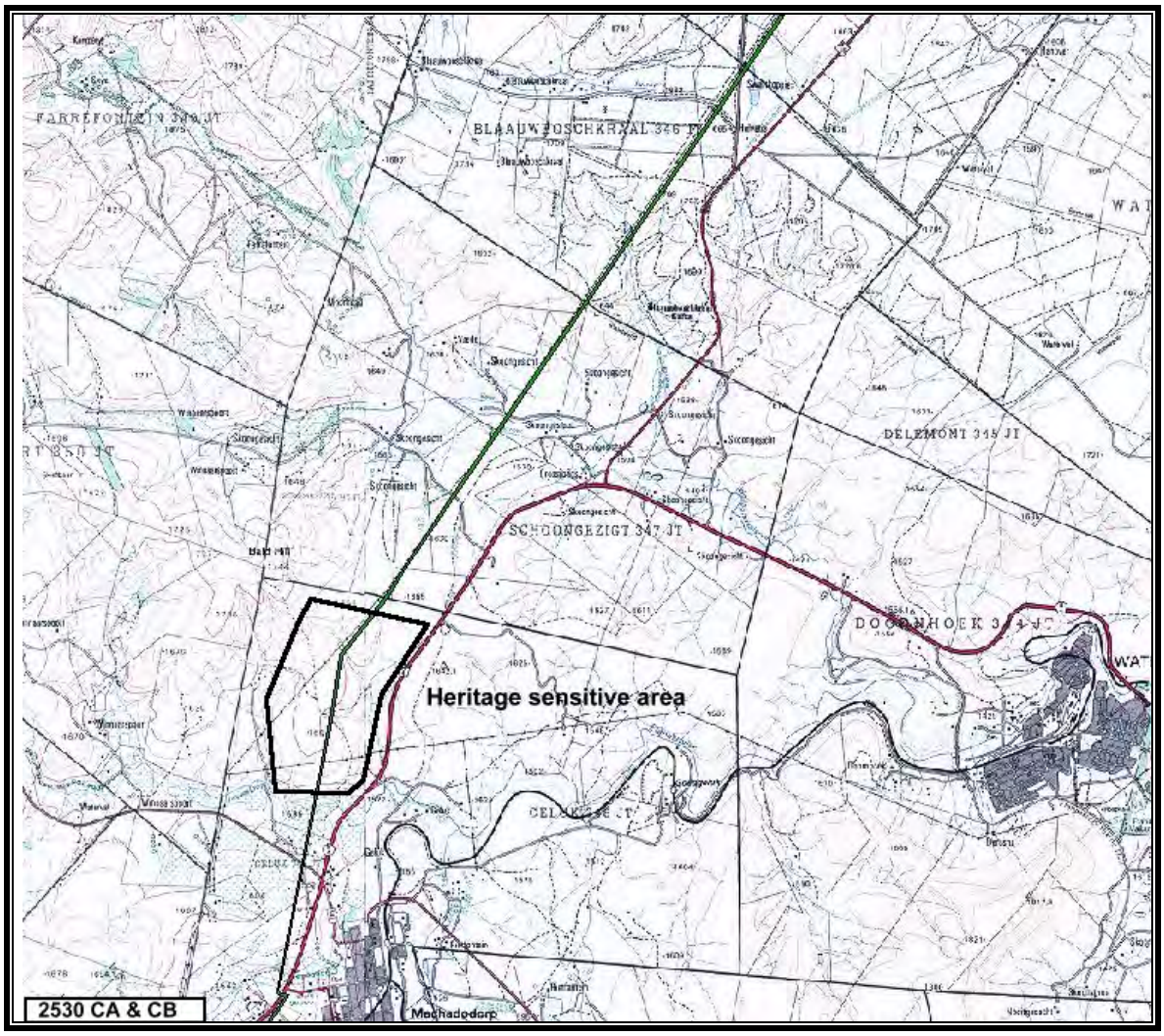
Fig 8. Route through ploughed field east of Esibayeni towards the Lebombo mountain.

Fig 9. Route crossing the road just north of Ngwenyeni. Previously ploughed area.

Fig 10. Route crossing over previously ploughed field between Ngwenyeni and Lebombo Mountain (in distance).

Fig 11. General view of environment immediately west of Lebombo Mountain.

Fig 12. The neck through which the route passes at the Mozambique border.



Map 1. 1:50 000 scale: demarcation of Badfontein stonewalled sites.

Table 1: Framework for Assessing Environmental Impacts (CULTURAL RESOURCES)

SEVERITY OF IMPACT	RATING
Insignificant / non-harmful	1
Small / potentially harmful	2
Significant / slightly harmful	3
Great / harmful	4
Disastrous / extremely harmful	5

SPATIAL SCOPE OF IMPACT	RATING
Activity specific	1
Area specific	2
Whole project site / local area	3
Regional	4
National	5

DURATION OF IMPACT	RATING
One day to one month	1
One month to one year	2
One year to ten years	3
Life of operation	4
Post closure / permanent	5

CONSEQUENCE

FREQUENCY OF ACTIVITY / DURATION OF ASPECT	RATING
Annually or less / low	1
6 monthly / temporary	2
Monthly / infrequent	3
Weekly / life of operation / regularly / likely	4
Daily / permanent / high	5

FREQUENCY OF IMPACT	RATING
Almost never / almost impossible	1
Very seldom / highly unlikely	2
Infrequent / unlikely / seldom	3
Often / regularly / likely / possible	4
Daily / highly likely / definitely	5

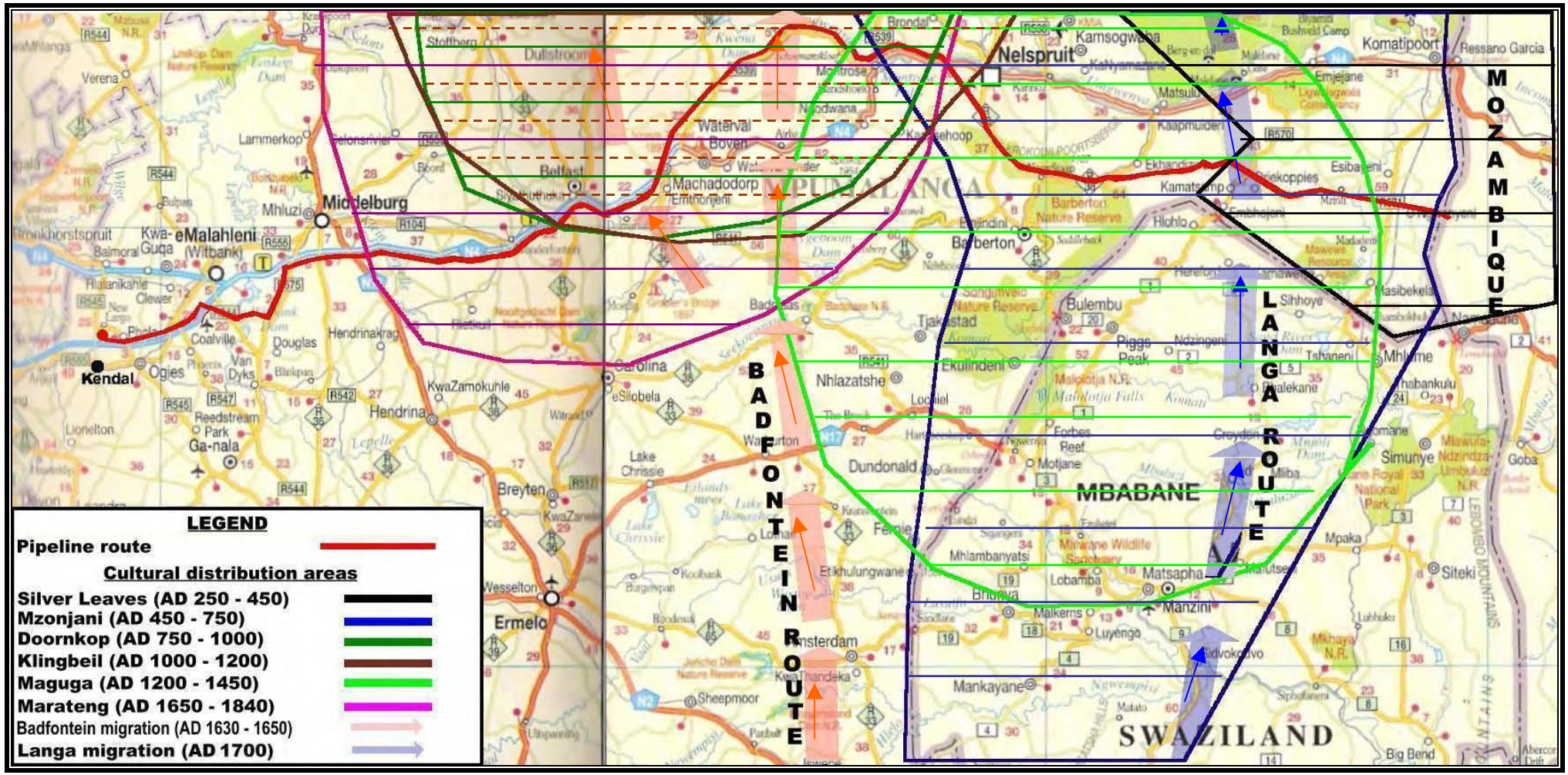
LIKELIHOOD

Table 2: Significance Rating Matrix

LIKELIHOOD (Frequency of activity + Frequency of impact)	CONSEQUENCE (Severity + Spatial Scope + Duration)														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30
	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45
	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60
	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75
	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90
	7	14	21	28	35	42	49	56	63	70	77	84	91	98	105
	8	16	24	32	40	48	56	64	72	80	*88*	96	104	112	120
	9	18	27	36	45	54	63	72	81	90	99	108	117	126	135
	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150

Table 3: Positive/Negative Mitigation Ratings

Colour Code	Significance Rating	Value	Negative Impact Management Recommendation	Positive Impact Management Recommendation
	VERY HIGH	126-150	Improve current management	Maintain current management
	HIGH	101-125	Improve current management	Maintain current management
√	MEDIUM-HIGH	76-100	Improve current management	Maintain current management
	LOW-MEDIUM	51-75	Maintain current management	Improve current management
	LOW	26-50	Maintain current management	Improve current management
	VERY LOW	1-25	Maintain current management	Improve current management



Map 2: Locality Map with archaeological cultural distribution area.