PROPOSED REHABILITATION OF THE OLD JAGERSFONTEIN MINE PIT LOCATED ON PORTION 15 OF THE FARM JAGERSFONTEIN 14 IS, KOPANONG LOCAL MUNICIPALITY, XHARIEP DISTRICT MUNICIPALITY, FREE STATE PROVINCE

Phase 1 Heritage Impact Assessment

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Declaration of Independence

I, Polke Birkholtz, declare that –

- General declaration:
- I act as the independent heritage practitioner in this application
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting heritage impact assessments, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I will take into account, to the extent possible, the matters listed in section 38 of the NHRA when preparing the application and any report relating to the application;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- I will ensure that information containing all relevant facts in respect of the application is distributed or made available to interested and affected parties and the public and that participation by interested and affected parties is facilitated in such a manner that all interested and affected parties will be provided with a reasonable opportunity to participate and to provide comments on documents that are produced to support the application;
- I will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not
- All the particulars furnished by me in this form are true and correct;
- I will perform all other obligations as expected from a heritage practitioner in terms of the Act and the constitutions of my affiliated professional bodies; and
- I realise that a false declaration is an offence in terms of regulation 71 of the Regulations and is punishable in terms of section 24F of the NEMA.

Disclosure of Vested Interest

- I do not have and will not have any vested interest (either business, financial, personal or other) in the proposed activity proceeding other than remuneration for work performed in terms of the Regulations;

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Report Title	Heritage Impact Assessment for the Proposed Rehabilitation of the Old Jagersfontein Mine Pit located on Portion 15 of the Farm Jagersfontein 14 IS, Kopanong Local Municipality, Xhariep District Municipality, Free State Province.		
Control	**Name**	**Signature**	**Designation**
Author	Polke Birkholtz		Archaeologist/Heritage Specialist/Project Manager – PGS Heritage

DETAILS OF CLIENT:

CLIENT: **Jagersfontein Developments (Pty) Ltd**

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The heritage impact assessment report has been compiled taking into account the NEMA Appendix 6 requirements for specialist reports as indicated in the table below.

NEMA Regs (2014) - Appendix 6	Relevant section in report
Details of the specialist who prepared the report	Page iii and Section 1.2
The expertise of that person to compile a specialist report including a curriculum vita	Section 1.2 – refer to **Appendix B**
A declaration that the person is independent in a form as may be specified by the competent authority	Page ii of the report
An indication of the scope of, and the purpose for which, the report was prepared	Section 1
The date and season of the site investigation and the relevance of the season to the outcome of the assessment	Section 3
A description of the methodology adopted in preparing the report or carrying out the specialised process	Section 3
The specific identified sensitivity of the site related to the activity and its associated structures and infrastructure	Executive Summary, Sections 5 - 9
An identification of any areas to be avoided, including buffers	Section 6
A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Refer to Figures 3, 48 & 117
A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 1.3
A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment	Section 8
Any mitigation measures for inclusion in the EMPr	Section 9
Any conditions for inclusion in the environmental authorisation	Sections 9 & 10
Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Sections 9 & 10
A reasoned opinion as to whether the proposed activity or portions thereof should be authorised and	Executive Summary & Section 10
If the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	
A description of any consultation process that was undertaken during the course of carrying out the study	Not applicable. No public participation process was undertaken by PGS Heritage.
A summary and copies if any comments that were received during any consultation process	Not applicable. See comment above.
Any other information requested by the competent authority.	Not applicable. No consultation with the heritage authorities has as of yet taken place.

EXECUTIVE SUMMARY

Introduction

PGS Heritage (Pty) Ltd (PGS) was appointed by Jagersfontein Developments Pty (Ltd) to undertake a Phase 1 Heritage Impact Assessment (HIA) for the Proposed Rehabilitation of the Old Jagersfontein Mine Pit located on Portion 15 of the Farm Jagersfontein 14 IS, Kopanong Local Municipality, Xhariep District Municipality, Free State Province. The applicant is Jagersfontein Developments (Pty) Ltd.

General Desktop Study

An archaeological and historical desktop study of the study area and surroundings was undertaken. This revealed the depth of history associated with the study area and Jagersfontein Mine. It showed that mining activities at what is today known as the old Jagersfontein Mine Pit already started during the 1870s and continued until 1913, when all opencast mining was halted and only underground mining continued. The desktop study also illustrated the webb and flow of the mine's history, with closures, floods and strikes interposed by incredible highs, such as the recovery of the *Excelsior* and *Reitz* diamonds in 1893 and 1895 respectively.

As part of the above-mentioned desktop study a description of the mining methods utilised at the Jagersfontein Mine was also also provided. This outline of the mining methods and process components included the excavation of kimberlite from the ground, followed by the crushing or weathering of the excavated material, then the separation of the larger diamondiferous material from the smaller non-diamondiferous material through a process of washing and the screening and sorting of the diamondiferous material to finally take possession of the stones. Where possible, the tangible tools and equipment used during each of these process phases were also discussed.

This was augmented by a study of available early editions of topographic maps and old aerial photographs, which provided information on the historic layering of the study area and assisted with the identification and interpretation of archaeological and heritage sites. Interestingly, comparisons between the outlines of the mine pit as depicted on the two early editions of the topographic sheets with its current outline as depicted on a recent Google Earth satellite image, indicate that its current outline is quite a bit wider than the pit outlines indicated on the older topographical map sheets. It seems likely for this disparity to be attributable to break back along the pit walls.

An assessment of previous archaeological and heritage reports undertaken within and in the surroundings of the study area was undertaken. It also revealed a number of sites identified during previous archaeological and heritage studies. The heritage impact assessment report compiled by Loudine Philip (2009) was especially enlightening in that her study assessed the entire property of the Jagersfontein Mine, including the study area. A high number of

archaeological and heritage sites were identified during this previous study, including a number of sites that were identified within the current study area.

Palaeontology

Ms. Elize Butler of Banzai Environmental was commissioned to undertake a Palaeontological Desktop Assessment (PDA). Her report and findings are attached in full in **Appendix C**.

Ms. Butler found that the study area "…*is underlain by the Tierberg Formation, of the Ecca Group (Karoo Supergroup) as well as Quaternary superficial deposits. These superficial sediments mantle the underlaying older deposits. According to the PalaeoMap on the South African Heritage Resources Information System (SAHRIS) database, the Palaeontological Sensitivity of the Tierberg Formation is High, while that of the Quaternary deposits is Low, but locally High (Almond and Pether, 2009; Almond et al., 2013, SAHRIS website)." (Banzai Environmental, 2021:vii).*

*T*he palaeontological report concludes that the *"…the proposed Rehabilitation of the Old Jagersfontein Mine Pit will not comprise of any new mining activities and thus a* ***low*** *palaeontological* ***significance*** *is allocated to the proposed development. It is therefore considered that the proposed Rehabilitation of the Old Jagersfontein Mine Pit is deemed appropriate and feasible and will not lead to detrimental impacts on the palaeontological resources of the area." (Banzai Environmental, 2021:vii).*

The following recommendations are made in the palaeontological report:

- If fossil remains are discovered during any phase of construction, on the surface or exposed by excavations the **Chance Find Protocol** must be implemented by the ECO in charge of these developments. These discoveries ought to be protected (*in situ*) and the ECO must report to SAHRA (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Tel: 021 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za) so that correct mitigation (recording and collection) can be carried out; and

- Preceding any collection of fossil material, the palaeontologist would need to apply for a collection permit from SAHRA. Fossil material must be curated in an accredited collection (museum or university collection), while all fieldwork and reports should meet the minimum standards for palaeontological impact studies suggested by SAHRA (Banzai Environmental, 2021).

Fieldwork

The fieldwork component of the study was aimed at identifying tangible remains of archaeological, historical and heritage significance. This component was undertaken by way of walkthroughs by an experienced archaeological fieldwork team on Tuesday, 23 June 2020 and Wednesday, 24 June 2020. The fieldwork team consisted of an experienced archaeologist and heritage specialist (Polke Birkholtz) and a fieldwork assistant (Derrick James).

The team used hand-held GPS devices throughout the fieldwork. These devices were used to record tracklogs showing the routes followed by the e archaeological fieldwork team during the fieldwork. All sites identified were photographically and qualitatively recorded, and their respective localities documented using a hand-held GPS device.

The fieldwork resulted in the identification of a total of twenty-five (25) sites. These were numbered from JAG 1 to JAG 25. The prefix used in this numbering system was derived from the farm name, namely Jagersfontein. The following sites were identified:

- Old Jagersfontein Mine Pit (JAG 1);
- Historic mine structures which may have formed part of the historic hoisting and haulage activities at the pit (JAG 2, JAG 4, JAG 7, JAG 8, JAG 9, JAG 10 & JAG 13);
- Historic mine structures that were used for mine infrastructure such as bridges, dams and tunnels (JAG 3, JAG 5, JAG 6, JAG 11 & JAG 21);
- Historic structures (JAG 12 & JAG 15);
- Historic middens (JAG 14);
- Historic mine structures used for offices and accommodation (JAG 16, JAG 18, JAG 19 & JAG 20);
- Old mine dumps and deposition floors (JAG 17 & JAG 22);
- Historic mine shafts (JAG 23 & JAG 24); and
- Stone Age sites (JAG 25);

It should be noted that due to safety concerns, no intensive walkthroughs were possible along the close perimeter of the mine pit. Additionally, the focus during the fieldwork was placed on areas where heritage sites were believed to be located, with less attention placed on areas which had been disturbed by more recent developments and activities.

Unfortunately, a comparison between the fieldwork findings of the previous heritage study (Philip, 2009) and the fieldwork undertaken for the present study, has revealed that a high number of the heritage sites identified in the previous study had been destroyed or irreparably damaged in the 12 years since that study was completed. This destruction of previously identified sites was found to have taken place both within the current study area as well as the mine property as a whole. This wanton destruction of identified heritage sites is of great concern. However, the heritage management plan recommended for the entire mine is expected to at least ensure that the heritage sites still located within this property will be better

managed and preserved into the future.

Impact Assessment

An overlay of the identified archaeological and heritage sites over the proposed development footprint areas was made to assess the impact of the proposed development on these identified archaeological and heritage sites. Both pre-mitigation and post-mitigation impact assessments were undertaken.

Assessment of the Heritage Impact of the Proposed Backfilling of the Mine Pit

An assessment of the impact of the proposed rehabilitation or backfilling of the mine pit (JAG 1) was undertaken first. This section of the impact assessment was divided into the assessment of the impact of the proposed rehabilitation or backfilling on the mine pit itself, followed by an assessment of the impact of this same development component on the other sites located in proximity to the rim or perimeter of the mine pit.

The current proposal is for the mine pit to be rehabilitated by filling it with tailings. It is estimated that the pit will be backfilled to a depth of approximately 30m from the top, but this depth may vary according to the available volume of tailings (Turn 180 Environmental Consultants, 2019). It is important to note that the proposed rehabilitation of the pit is expected to be an irreversible process in that it would not be economically feasible to reverse this process once completed. The proposed impact can therefore be considered permanent.

Another consideration included in this assessment is the significance of the mine pit. The research undertaken by Steve Lunderstedt and presented by him during a lecture to the Historical Society of Kimberley and the Northern Cape on Thursday, 19 May 2005 (refer **Appendix D**), indicates that the pit at Jagersfontein is the deepest pick-and-shovel excavation anywhere in the world. With the introduction and development of excavation machinery during the twentieth century, this is a record not expected to be broken anytime in the future. The mine pit also represents a monument to the ingenuity, determination and labour of the miners and mine workers of all races and backgrounds at Jagersfontein. A monument that still stands today. Additionally, the mine pit represents the site where two record-breaking diamonds were discovered, namely the *Excelsior* and the *Reitz*. Even today, these diamonds are mentioned as part of the select group considered to be the finest diamonds ever discovered. This very mine, with its associated mine pit, was for many years known the world over as the source of unique and sought after white diamonds with a bluish tint referred to at the time as 'Jagers.'

As a result, the mine pit at Jagersfontein possesses very high levels of aesthetic, historic and scientific significance and is deemed to be of **Local Significance (LS).** This said, the site even has the potential to be considered of **Provincial Significance (PS)** as well.

From a heritage point of view, the near complete backfilling of the mine pit would have an incredibly negative impact on its aesthetic appeal. A pit with a depth of approximately 30m would certainly not be appealing to visitors or tourists to the site. One of the draw-cards of the mine pit is its sheer volume and depth and its steep-sided walls, which all tie in with its world record status. The filling up of this historic landmark so that the majority of its volume is taken up by tailings, in a process that is furthermore irreversible, would result in an immense negative impact.

A Socio-economic Impact Assessment (SEIA) for the proposed rehabilitation of the mine pit was undertaken by SES Consulting (2019). This study identified the socio-economic impacts of the proposed development through a public consultation meeting and a socio-economic baseline study, which included a household survey and interviews with key informations. As will be shown in the quotation from this study below, the SEIA revealed that a significant section of the community adjoining the mine is against the proposed development. In the quoted section from this study provided below, Jagersfontein Developments (Pty) Ltd is referred to as JD. The draft report for this study that was made available to the author, observed that "…*overall community members are not in favour of the Project. In the public consultation meeting held at the Mayibuye Hall on the 26th November 2019, it was strongly suggested (by the few attendees) that JD build another TSF rather than destroying the heritage value of the Pit, and any potential tourism opportunities in the area. These sentiments were strongly echoed in the household survey where 72.46% of the households felt that the proposal by JD to backfill and rehabilitate the Pit would negatively affect their households. This is mainly attributed to the perception that backfilling the Pit will destroy the heritage value of the Pit rather than rehabilitate the Pit, which is strongly viewed by the communities in Jagersfontein as a community heritage resource. It is believed that the proposal by JD to backfill the Pit would in the long-term destroy any potential for tourism in the area. According to the communities in Jagersfontein the negative impacts of backfilling the Pit far outweigh the value of JD continuing its operations for another eight years in the area. These sentiments stem primarily from poor relations between JD and the neighbouring communities. Even though JD established the Itumeleng Community Trust (ICT) in 2012, the Trust is accused of not serving the needs and interests of the communities.*" (SES Consulting, 2019:ii).

This calculation has revealed that the pre-mitigation impact risk of the proposed development on site JAG 1 falls within Impact Class 5, which represents a Very High Impact Risk.

Assessment of the Heritage Impact of the Proposed Conveyors and Deposition Points

Assessment of the Heritage Impact on sites JAG 8, JAG 9 and JAG 10

An assessment of the pre-mitigation impact of the proposed construction of a conveyor and establishment of two deposition points on sites JAG 8, JAG 9 and JAG 10 was calculated.

These three sites are all foundation remains of historic mining structures and it seems possible for these structures to have formed part of the historic hoisting or haulage system associated with the opencast mining at the mine pit. With all mining activities associated with the mine pit halted in 1913, these structures are certainly older than 100 years.

The available development layout plan indicates that the proposed Conveyor Dump Position will be established at distances of between approximately 45m (for sites JAG 8 & JAG10) and approximately 32m (for site JAG 9) from these identified heritage sites.

At the moment it is not known whether the vibration associated with the conveyor or activities associated with the Conveyor Dump Position are expected to result in break back in the slope and the eventual destruction of one or more of these three sites. The impact assessment calculations shown below did not address or include this possible risk.

This calculation has revealed that the pre-mitigation impact risk of the proposed development on JAG 8, JAG 9 and JAG 10 falls within Impact Class 3, which represents a Moderate Impact Risk.

Assessment of the Heritage Impact on sites JAG 6, JAG 11 and JAG 24

The pre-mitigation impact of the proposed construction of a conveyor and establishment of two deposition points on sites JAG 6, JAG 11 and JAG 24 was calculated. These three sites include two historic mine structures and the position where the original mine shaft was located. All these sites are expected to be older than 100 years. Please note that no headgear or surface marking for site JAG 24 exists, however the actual shaft is still believed to be located here.

The available development layout plan indicates that the proposed conveyor will be built through the southern end of the site, passing the three identified sites at varying distances *en route* to the mine pit. The conveyor will be located approximately 39m from JAG 6, roughly 48m from site JAG 11 and immediately adjacent to JAG 24.

This calculation has revealed that the unmitigated impact risk of the proposed development on sites JAG 6, JAG 11 and JAG 24 falls within Impact Class 3, which represents a Moderate Impact Risk.

Mitigation

Due to the moderate to very high levels of development impact revealed during the impact assessment calculations, extensive mitigation measures would be required.

Mitigation Measures Required for the Proposed Backfilling of the Mine Pit

The assessment undertaken of the pre-mitigation impact of the proposed rehabilitation of the mine pit at JAG 1 is expected to result in a very high negative impact. Due to the nature of the proposed development, this impact will also be non-reversible.

With such a high negative and permanent impact, the considerations of alternatives would be the first choice. An assessment of the development alternatives is provided in the Integrated Water and Waste Management Plan (IWWMP) compiled by Louis de Villiers (Turn 180 Environmental Consultants, 2019). This report indicates that the so-called no-go option would require the construction of a new Fine Tailings Storage Facility (FTST), which may not be economically feasible for the mine to do. Furthermore, the construction of such a facility "…*will result in impacts on the exploitable upper aquifer and create a further loss of land due to the FTSF's footprint. A new FTSF will also likely have a negative impact on hydrology and surface water quality. The quantity of natural runoff will also be reduced, as it (i.e. rainfall) will be retained in the FTSF*." (Turn 180 Environmental Consultants, 2019).

The report titled *Review of Jagersfontein Pit Stability and Backfilling Options* compiled by HAC Metinjes and Dr. GC Howell (SRK, 2012) states that the mine pit "…*is showing signs of ongoing break back of the side slopes*…" and adds that a review of the "…*open pit site conditions indicates that there will be ongoing break back of the side slopes of the open pit for a considerable period of time*." This report recommended only two alternate options, namely to peg the proposed break back area on the ground and fence this zone of break back in perpetuity or alternatively backfill the pit.

These are the only two options available to the mine. As indicated in the IWWMP compiled by Louis de Villiers (Turn 180 Environmental Consultants, 2019:13), the "…*Pit's instability will persist, with the potential risk that vibrations and break-back of the Pit's walls might cause injuries to trespassers or damage to surrounding property and the fence itself. Break-back episodes are intermittent and unpredictable. Regular survey and drone surveys are performed. Current activity is only a minor erosional process, but large block-break back can always be expected and has occurred in the form of boulders falling into the Pit during heavy rain events*."

On the point of back break at the mine pit, an overlay of the depictions of the perimeter of the pit on the 1948 and 1973 topographical maps over a recent satellite image clearly show changes in the general appearance and position of sections of the mine pit's perimeter. These changes also occur in the 'correct' way over time, meaning the earliest depiction of the pit perimeter is smaller than the one depicted on the 1973 which in turn is smaller than the depiction of the pit on the more recent satellite image. Therefore, unless the perimeters of the mine pit were inaccurately surveyed at the time that these maps were compiled, it would be difficult not to interpret these changes in the mine pit perimeter and appearance over time to break back of the pit walls.

With this as background, it is clear the in this scenario of unpredictability in the stability of the mine pit, coupled with the risks identified with the construction of a new FTST, with the possibility of the mine closing down as a result of not being able to build such a facility, strongly suggest that the no-go option is not viable. Additionally, the risks associated with the questionable and unpredictable stability of the mine pit walls would make the provision of access to visitors and tourists to the mine pit difficult, if not impossible. A middle ground between the currently proposed development on the one hand, and the no-go option on the other, is therefore required.

A sign that was observed at the tourist centre located on the southern end of the mine pit, provides a cross-section plan of the mine pit and associated geology. This sign appears to be derived from a surveyed mine plan that was in all likelihood compiled by De Beers. As the De Beers Archive in Kimberley was not open to researchers at the time of this study, the exact origin and date of the information contained on the sign could not be verified. This said, the sign shows that the mine pit was at the time covered in water, and that the depth of the water as measured between the ground surface at the pit's rim and the surface of the water, was 165m. Additionally, this sign also indicates that the depth of the water, as measured between the base of the pit and surface of the water, was 176m. This means that the depth of the entire mine pit was calculated to be 341m. According to the report by Dr GC Howell (SRK, 2019), the depth of the debris surface at the base of the pit in 2019 was 268m below the surface.

The recommended mitigation for the rehabilitation of the mine pit is for the backfilling of the pit to be undertaken up to a point just below the measured depth of the historic water level inside the mine pit as indicated on the sign mentioned above. In other words, the pit should be backfilled to a point roughly 168m below the ground surface at the pit's rim. With an estimated depth of approximately 268m between the ground surface at the mine pit's rim and the debris surface at the base of the pit, this would allow for backfilling to be undertaken to a depth of roughly 100m when measured from the base of the pit to the tailings surface. The difference in depth of the backfilled tailings of 168m as measured from the surface rim of the mine pit versus the historic water depth of 165m below the surface rim, can be used for adding a layer of water to hide the surface of the rehabilitated mine pit. This section of approximately 3m in depth can then be used for this purpose. In other words, once the backfilling is complete and has dried, the surface of the tailings that was pumped into the mine pit (which would be located at a depth of 168m below the surface of the mine pit's rim), can then be filled with 3m of water to cover the surface of the tailings. This would make the mine pit appear in exactly the same way as recorded historically on the sign, with a water level at a depth of 165m below the surface of the rim of the pit.

The proposed mitigation measure outlined above is expected to improve the stability of the walls of the mine pit. However, this must be assessed by geotechnical or structural engineering

specialist. The mine will be able to continue its operations for at least a while, providing at least short-term socio-economic benefit to its employees during the economic downturn experienced as a result of the COVID-19 pandemic. Additionally, the possible risks associated with the construction of a FTSF as outlined in the IWWMP can be avoided.

At the same time, quite a significant depth of the historic mine pit can be preserved. With the improved stability expected as a result of the proposed mitigated development, the tourist centre and gantry can be refurbished and re-used to allow for tourists and interested visitors to enjoy the mine pit and its history.

This mitigation development proposal is dependant on the following heritage-related conditions:

- A heritage management plan must be compiled by Jagersfontein Developments (Pty) Ltd to improve the protection and management of all the heritage resources located within the mine; and

- Jagersfontein Developments (Pty) Ltd must undertake to refurbish the tourist centre and gantry and with the assistance of provincial museums establish a site museum where the significant history of the mine can be memmorialised. Furthermore, the mine must train local community members to act as site guides to assist visitors in the interpretation and enjoyment of the mine and its history. Additionally, the mine must purposefully re-engage all possible stakeholders from national and provincial government, private entities and *De Beers Consolidated Mines Limited* to find a lasting solution for the preservation of the mine and its history, including the marketing of the site to both local and foreign visitors.

Mitigation Required for the Construction and Operation of the Conveyor Dump Position

The assessment undertaken of the pre-mitigation impact of the establishment and operation of the Conveyor Dump Position on the rim of the mine pit on sites JAG 8, JAG 9 and JAG 10 is expected to result in a moderate negative impact.

The following mitigation measures are required:

- An archaeological watching brief is required during the construction of the nearby coveyor and two deposition points. This watching brief would allow for a professional archaeologist to monitor the construction activities to ensure no impacts occur to the nearby sites. Additionally, this watching brief would assist in the identification of archaeological and heritage sites not yet identified; and

- An archaeological monitoring protocol is required during the expected duration of the use of the nearby conveyor and deposition points. This monitoring protocol would

check whether any impacts on the nearby sites can be identified, and if such impacts are indeed identified, the activities can be amended to mitigate such identified impacts.

Mitigation Required for the Construction of the Conveyor

The assessment undertaken of the pre-mitigation impact of the proposed construction and operation of a conveyor through the southern end of the study area to the proposed Conveyor Dump Position on the rim of the pit has indicated that a moderate impact risk can be identified.

The following mitigation measures are required:

- The route for the proposed conveyor must be altered to allow an increased buffer area between it and the identified heritage sites at JAG 6, JAG 11 and JAG 24. A recommended amended route for the conveyor through the southern end of the study area is depicted in **Figure 117**;
- As this study did not include any assessments or work outside of the study area, the proposed conveyor route located outside of the study area, including any amendments that would be required outside the study area to change its route to the one depicted in **Figure 117** below, must be assessed by a heritage specialist; and
- The exact layout and position of the link (pipeline) between the conveyor and the proposed Slimes Deposition Point is not depicted on the final development layout plan made available for this project. It is recommended that this pipeline be built as far as possible across and along recently disturbed areas, such as along the access road and across the extensively disturbed section on the southern end of the study area. The pipeline must also be kept more than 50m away from all identified heritage sites. The above-mentioned archaeological watching brief would also apply for the construction of this pipeline.

Conclusions

The unmitigated impact of the proposed development is expected to result in Medium to Very High negative impacts in terms of the identified heritage fabric of the study area. However, if the mitigation measures proposed in this report are successfully completed, the impact of the proposed development on the identified heritage sites can be reduced. In terms of the mine pit, this reduction of impacts will still mean that the proposed development can be considered to be of a high impact risk. However, the implementation of the proposed mitigation measures is expected to improve the stability of the mine pit without destroying the entire pit, which in turn would allow for the re-utilisation of the mine pit, mine and associated town, for tourism and educational purposes. Coupled with the positive socio-economic effects on the mining staff, the proposed mitigated development will ensure that enough of the pit and the mine's incredible

heritage is preserved to allow for its utilisation for the socio-economic upliftment of the community that adjoins Jagersfontein Mine.

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TERMINOLOGY AND ABBREVIATIONS

Archaeological resources

This includes:

- material remains resulting from human activity which are in a state of disuse and are in or on land and which are older than 100 years including artefacts, human and hominid remains and artificial features and structures;
- rock art, being any form of painting, engraving or other graphic representation on a fixed rock surface or loose rock or stone, which was executed by human agency and which is older than 100 years, including any area within 10m of such representation;
- wrecks, being any vessel or aircraft, or any part thereof, which was wrecked in South Africa, whether on land, in the internal waters, the territorial waters or in the maritime culture zone of the republic as defined in the Maritimes Zones Act, and any cargo, debris or artefacts found or associated therewith, which is older than 60 years or which SAHRA considers to be worthy of conservation;
- features, structures and artefacts associated with military history which are older than 75 years and the site on which they are found.

Cultural significance

This means aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance

Development

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

- construction, alteration, demolition, removal or change in use of a place or a structure at a place;
- carrying out any works on or over or under a place;
- subdivision or consolidation of land comprising a place, including the structures or airspace of a place;
- constructing or putting up for display signs or boards;
- any change to the natural or existing condition or topography of land; and
- any removal or destruction of trees, or removal of vegetation or topsoil

Early Stone Age

The archaeology of the Stone Age between 700 000 and 2 500 000 years ago.

Fossil

Mineralised bones of animals, shellfish, plants and marine animals. A trace fossil is the track or footprint of a fossil animal that is preserved in stone or consolidated sediment.

Heritage

That which is inherited and forms part of the National Estate (historical places, objects, fossils as defined by the National Heritage Resources Act 25 of 1999).

Heritage resources

This means any place or object of cultural significance and can include (but not limited to) as stated under Section 3 of the NHRA,

- places, buildings, structures and equipment of cultural significance;
- places to which oral traditions are attached or which are associated with living heritage;
- historical settlements and townscapes;
- landscapes and natural features of cultural significance;
- geological sites of scientific or cultural importance;
- archaeological and palaeontological sites;
- graves and burial grounds, and
- sites of significance relating to the history of slavery in South Africa;

Holocene

The most recent geological time period which commenced 10 000 years ago.

Late Stone Age

The archaeology of the last 30 000 years associated with fully modern people.

Late Iron Age (Early Farming Communities)

The archaeology of the last 1000 years up to the 1800's, associated with iron-working and farming activities such as herding and agriculture.

Middle Stone Age

The archaeology of the Stone Age between 30 000-300 000 years ago, associated with early modern humans.

Palaeontology

Any fossilised remains or fossil trace of animals or plants which lived in the geological past, other than fossil fuels or fossiliferous rock intended for industrial use, and any site which contains such fossilised remains or trace.

Table 1 – List of abbreviations used in this report.

Abbreviations	Description
AIA	Archaeological Impact Assessment
ASAPA	Association of South African Professional Archaeologists
CRM	Cultural Resource Management
DEA	Department of Environmental Affairs
DWS	Department of Water and Sanitation
ECO	Environmental Control Officer
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
ESA	Early Stone Age
GPS	Global Positioning System
HIA	Heritage Impact Assessment
IAP	Interested and Affected Party
LSA	Late Stone Age

LIA	Late Iron Age
MSA	Middle Stone Age
NEMA	National Environmental Management Act
NHRA	National Heritage Resources Act
PHRA	Provincial Heritage Resources Authority
PSSA	Palaeontological Society of South Africa
SADC	Southern African Development Community
SAHRA	South African Heritage Resources Agency

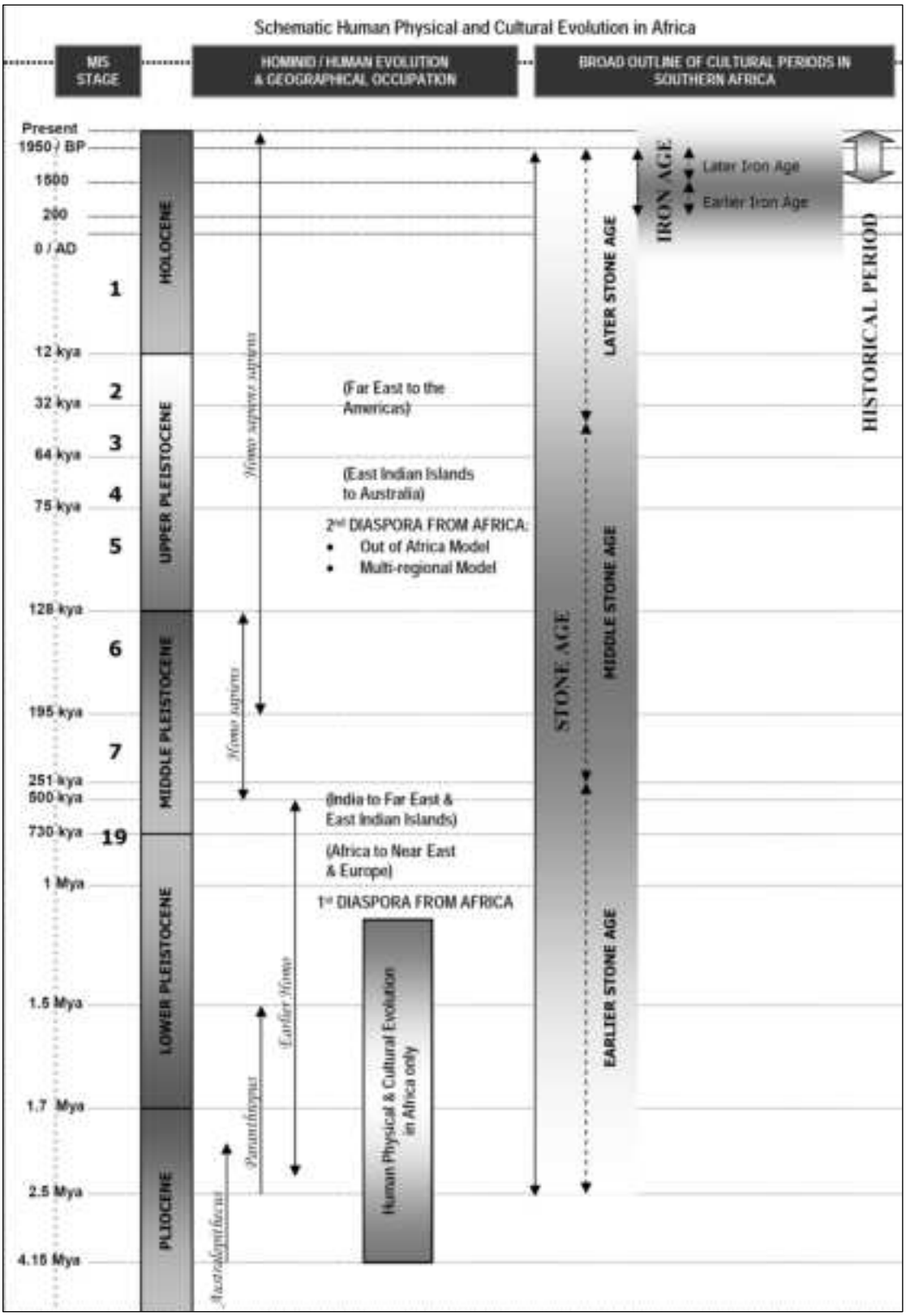

Figure 1 - Human and Cultural Timeline in Africa (Morris, 2008).

1 INTRODUCTION

PGS Heritage (Pty) Ltd (PGS) was appointed by Jagersfontein Developments Pty (Ltd) to undertake a Phase 1 Heritage Impact Assessment (HIA) for the Proposed Rehabilitation of the Old Jagersfontein Mine Pit located on Portion 15 of the Farm Jagersfontein 14 IS, Kopanong Local Municipality, Xhariep District Municipality, Free State Province. The applicant is Jagersfontein Developments (Pty) Ltd.

1.1 Scope of the Study

The aim of the study is to identify possible heritage sites and finds that may occur in the proposed study area and to assess the impact of the proposed development on these identified heritage sites.

The Heritage Impact Assessment aims to assist the applicant in managing the discovered heritage resources in a responsible manner, in order to protect, preserve, and develop them within the framework provided by the National Heritage Resources Act of 1999 (Act 25 of 1999) (NHRA).

1.2 Specialist Qualifications

This HIA Report was compiled by PGS. The staff at PGS has a combined experience of nearly 90 years in the heritage consulting industry. PGS and its staff have extensive experience in managing HIA processes. PGS will only undertake heritage assessment work where they have the relevant expertise and experience to undertake that work competently.

The following individuals were involved with this study:

- Mr Polke Birkholtz, the project manager and principal heritage specialist, is registered with the Association of Southern African Professional Archaeologists (ASAPA) as a Professional Archaeologist and is also accredited with the Cultural Resources Management (CRM) Section of the same association. He has 20 years of experience in the heritage assessment and management field and holds a B.A. (cum laude) from the University of Pretoria specialising in Archaeology, Anthropology and History and a B.A. (Hons.) in Archaeology (cum laude) from the same institution.

1.3 Assumptions and Limitations

The following assumptions and limitations regarding this study and report exist:

- 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. In fact, due to safety concerns, the close perimeter of the mine pit was not accessed and intensively surveyed. The subterranean charactistics of some archaeological sites may also have resulted in some sites from within the study area not identified during the fieldwork. It is therefore likely that the presently identified heritage sites are not a complete record of all the archaeological and heritage resources located within the study area.

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 (refer **Appendix A** for **Heritage Management Guidelines**).

- Two heritage sites partially located within the study area boundary were not included in the fieldwork and report. One of these is the tourist centre located north of the mine pit. The centre comprises a cluster of old buildings and structures which also includes a historic headgear and a modern viewing gantry. The second heritage site excluded from the current report is the house located immediately north of site JAG 20. The reason for not including these two sites in the fieldwork is that the study area boundary represents the actual boundary of a subdivided portion of the farm Jagersfontein, and it is not expected for this subdivided boundary to have been proclaimed in such a way that existing stands or buildings were separated between two portions of the farm. It is therefore assumed that both these sites fall outside this subdivision. However, if these sites are confirmed to fall within the subdivision of the farm, they must be added to the fieldwork findings.

- The fieldwork was undertaken at the time of the first wave of the COVID-19 pandemic in South Africa. As a result, the fieldwork was planned and undertaken in such a way that areas where people lived or worked were avoided. It is for this reason that the interiors of buildings that were occupied at the time of the fieldwork were not assessed.

- It is important to note that the fieldwork undertaken for this study was exclusively focussed on the defined study area consisting of Portion 15 of the Farm Jagersfontein 14 IS. As a result, any development footprints associated with the proposed project located outside of this area, were not assessed in the field and do not form part of this report.

- The development layout plan for the project was provided in jpeg and pdf formats. As a result, an overlay of this development layout plan was made by the author using the overlay function of Google Earth, and the assessment of distances between identified heritage sites and the proposed development footprints was measured using this overlay.

- The exact layout and position of the link (pipeline) between the conveyor and the proposed Slimes Deposition Point is not depicted on the final development layout plan made available for this project. It is recommended that this pipeline be built as far as possible across and along recently disturbed areas, such as along the access road and across the extensively disturbed section on the southern end of the study area. The pipeline must also be kept more than 50m away from all identified heritage sites.

- It is not presently known whether the operation of the two deposition points and conveyor will result in any significant vibration which may result in break back of the mine pit's walls. This risk was not included in the impact assessments undertaken for this work.

- For the purposes of this study it is assumed that the break back identified along the rim and walls of the mine pit by the specialist studies and reports, is expected to negatively impact the mine pit and its preservation as a heritage resource.

- The mitigated development proposal recommended for the proposed development entails the dumping of significantly less tailings into the mine pit than what is currently proposed. This mitigated backfilling is expected to also stabilise the slopes of the mine pit to the extent that the visible portion of the mine pit can be preserved into the future. It is important to note, however, that the question as to whether this more limited backfilling would have any significant impact on the stability of the pit slopes, must be assessed by a geotechnical or structural engineering specialist. For the moment, all impact assessment calculations regarding the backfilling of the mine pit were undertaken on the assumption that the mitigated backfilling would result in stabilising the slopes of the mine pit. If the required study by the geotechnical or structural engineering specialist does not show that the mitigated development will also result in the stabilising of the mine pit and its walls, this heritage report will have to be amended and updated by these specialist findings.

- The information contained on a sign at the tourist centre north of the mine pit is believed to be derived from a surveyed mine plan. It is for this reason that the measurements contained on this sign were used in this assessment and in the formulation of mitigation measures. If the information contained on this sign is not accurate, it may be necessary for the original survey plans to be obtained from the De Beers Archives in Kimberley. As mentioned elsewhere and despite numerous attempts, it was not possible to access the De Beers Archives during the present project.

- One of the components used in the mitigation measures outlined for the proposed development, is the level of water historically located within the mine pit. Neither one of the old aerial photographs assessed as part of this study depicted any water in the mine pit. The sign at the tourist centre does indicate water in the mine pit, whereas the specialist report undertaken Dr. GC Howell et al. (SRK, 2019:6) indicates that "…*the bottom of the*

pit is currently dry with the water table measured in the shaft at 396m, but the water level has relatively recently (in the last 15 years) been at a level 90m below surface (before being pumped)." It is therefore assumed that despite it not shown on any of the aerial photographs, the presence of water in the mine pit is historically known to have occurred over the course of the mine pit's history. If any doubt exists regarding the historic water level inside the mine pit over the course of its history, or exactly where this water level was on average located inside the pit, additional archival information may need to be undertaken. For this purpose, it would be essential to be able to obtain permission to access the De Beers Archives in Kimberley.

1.4 Legislative Context

The identification, evaluation and assessment of any cultural heritage site, artefact or finds in the South African context is required and governed by the following legislation:

i. National Environmental Management Act (NEMA) Act 107 of 1998
ii. National Heritage Resources Act (NHRA) Act 25 of 1999
iii. Minerals and Petroleum Resources Development Act (MPRDA) Act 28 of 2002

The following sections in each Act refer directly to the identification, evaluation and assessment of cultural heritage resources.

i. GNR 982 (Government Gazette 38282, 14 December 2014) promulgated under the National Environmental Management Act (NEMA) Act 107 of 1998

    a. Basic Assessment Report(BAR) – Regulations 19 and 23
    b. Environmental Scoping Report (ESR) – Regulation 21
    c. Environmental Impacts Assessment (EIA) – Regulation 23
    d. Environmental Management Programme (EMPr) – Regulations 19 and 23

ii. National Heritage Resources Act (NHRA) Act 25 of 1999

    a. Protection of Heritage Resources – Sections 34 to 36
    b. Heritage Resources Management – Section 38

iii. MPRDA Regulations of 2014

    a. Environmental reports to be compiled for application of mining right – Regulation 48
    b. Contents of scoping report – Regulation 49
    c. Contents of environmental impact assessment report – Regulation 50
    d. Environmental management programme – Regulation 51

e. Environmental management plan – Regulation 52

iv. The Regulations relating to the Management of Human Remains (GNR 363 of 2013 in Government Gazette 36473) promulgated under the National Health Act (Act No. 61 of 2003)

a. Exhumation and Reburial of Human Remains – Regulations 26, 27 and 28

The NHRA stipulates that cultural heritage resources may not be disturbed without authorisation from the relevant heritage authority. Section 34(1) of the NHRA states that "*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*…".

The NEMA (No 107 of 1998) states that an integrated EMP should (23:2 (b)) "…*identify, predict and evaluate the actual and potential impact on the environment, socio-economic conditions and cultural heritage*".

In accordance with legislative requirements and EIA rating criteria, the regulations of SAHRA and ASAPA have also been incorporated to ensure that a comprehensive and legally compatible HIA report is compiled.

2 TECHNICAL DETAILS OF THE PROJECT

2.1 Locality

Study Area Coordinates	Northernmost point: S 29.760211 E 25.415837	Easternmost point: S 29.764172 E 25.423311

	Southernmost point: S 29.768038 E 25.419656	Westernmost point: S 29.763251 E 25.414973
Location	The study area is located immediately south-west of the town of Jagersfontein and is situated in the Kopanong Local Municipality of the Xhariep District Municipality of the Free State Province.	
Property	Portion 15 of the farm Jagersfontein 14 IS.	
Topographic Map	2925CD	
Study Area Extent	The study area is approximately 53 hectares in extent.	

Figure 2 – Locality map depicting the study area within its surrounding landscape.

2.2 Technical Project Description

The section that follows below was taken nearly *verbatim* from the Integrated Water and Waste Management Plan (IWWMP) compiled by Louis de Villiers (Turn 180 Environmental Consultants, 2019).

Jagersfontein Developments (Pty) Ltd proposes to rehabilitate the historically mined pit on Portion 15 of the Farm Jagersfontein 14 IS, Fauresmith District, Free State as part of an initiative to restore the Pit's safety and to rehabilitate the surrounding environment, which will be done by removing the surface tailings dumps from the surface and backfilling the material into the Pit to create more space for agricultural activities. Portion 15 of the Farm Jagersfontein is owned by Jagersfontein Developments (Pty) Ltd.

The rehabilitation initiative will involve infilling the Pit with fine and coarse tailings generated from the mining company's existing diamond extraction Plant to make the bottom of the Pit shallower.

According to a Geochemical Analyses conducted on the tailings and paste, it was concluded that the paste is potentially a Type 3 waste, which will require a liner consistent with a Category C liner. However, it was also found that the Backfill Material is sterile and immobile in this environment. A Geohydrological Study compiled by GHT Consulting in 2017 indicated that it is more beneficial to backfill the Pit than to develop additional surface storage facilities.

The Pit has an extent of 19.635ha and is a near-vertical sided hole, with some of the faces being more than 200m in height. The Pit is unstable, breaking back and poses vibration risks. The Pit's instability presents a very serious safety risk, potentially placing local residents at risk in the long term. Due to the safety risks, it cannot be accessed by the public and is therefore closed for public viewing.

Jagersfontein Developments (Pty) Ltd appointed a geotechnical and structural engineering specialist, Dr. Graham Howell (Professional Civil Engineer, Corporate Consultant and ex-Chairman of SRK Consulting (SA) Pty Ltd, who has undertaken extensive and on-going assessments. Dr. Graham Howell has confirmed that using tailings for the Pit's rehabilitation is the only viable and practical way to ensure its stability and eliminate associated risks.

The Farm Jagersfontein is scarred from mining operations that have been conducted for over 100 years and is in a state of environmental degradation. Processing of the tailings dumps and backfilling them into the Pit is an environmentally sound project, which will lead to land rehabilitation. A calculation by Dr. Howell indicated that, with the volume of tailings available to be processed, the Pit will be backfilled to a depth of approximately 30m from the top. This is however dependent on when the Backfilling will commence, and the volume of surface tailings available for reprocessing at that stage. If the Backfilling is authorized early, it is expected that this void will be

smaller, as there will be more tailings available for backfilling of the Pit. The opposite is true should the project commence very late.

The mining company's surface tailings processing operations and the Plant are situated in the Xhariep District Municipality of the Free State Province. The Tailings Operation entails reprocessing eleven tailings dumps, where coarse tailings from historic diamond mining operations have been discarded at the Plant. Jagersfontein Developments (Pty) Ltd purchased the Tailings Dumps from De Beers Consolidated Mines Ltd in 2010.

The operational area of the Tailings Operation extends over Portion 16 and the Remaining Extent of the Farm Jagersfontein, with a combined area of 5, 945ha. Portion 15 does not form part of the Operational Site.

Currently the Tailings Operation utilises the existing Fine Tailings Storage Facilities for storage of the fine tailings from the Plant. Coarse tailings are returned to the existing footprints from where they were removed and used to stabilise the FTSF's walls. The FTSF's footprint is currently approximately 110 ha. Although the FTSF's capacity can be increased, it currently has the capacity to store material for approximately 1 more year. The continued storage of the tailings in aboveground facilities will require an additional FTSF to be constructed at a different location to the existing one. *"This new facility would further sterilise another 100 Ha of surface area to a height of some 33m and, in addition, act as a potential pollution source for the upper aquifer (up to 20m below surface), from which water is currently abstracted in the area"*. (SRK, 2019).

However, it was determined by Dr. Howell that the coarse and fine tailings can be utilised for infilling to rehabilitate the Pit. Other than assisting in the rehabilitation of the surface area, this will restore the Pit's stability. It will also remove all current tailings from the Operational Site, ensuring more effective rehabilitation of this Site and creating opportunities for agricultural development. The Pit's rehabilitation will also lessen the groundwater impacts on the shallow aquifer, currently caused by the presence of tailings on the Operational Site.

The total volume of tailings still to be processed on the surface of the Tailings Operation is approximately 36 Million tons, of which 25.6 Million cubic metres will be tailings backfilled into the Pit. The 'usable' volume of air space in the Pit (to level 1400mamsl) is 31Mm3. Accordingly, the remaining Backfill Material will only fill to Pit to a level some 30m below the rim (1371mamsl). From a historical and tourism viewpoint, therefore, the Pit's unique geology will still be observable once the Operations cease. In addition, the current potentially unstable Pit slopes will be buttressed by the Backfill Material and further break-back (towards the Jagersfontein Town and surrounding) will be mitigated. Since the Backfill Material will only reach to a level of 1371mamsl, which is below the upper aquifer depth, no effect on the regional usable aquifer will result.
Processes undertaken at the Tailings Operation include the ploughing and / or ripping of the Tailings Dumps to loosen tailings before they are loaded onto conveyors, which transports the

tailings to the Plant. The Plant consists of 4 X 75 tons/hour Dense Medium Separator Plants, which are used to separate the mineral particles in a sink-float process. A suspension of dense powder in water is used, which forms a heavier liquid, for the separation. This causes the heavier material, containing diamonds, to sink and the lighter material to float. The material is further separated into coarse tailings and fine tailings suspended in water. The fine tailings are then further dewatered to a 'paste' before being deposited. These products will be used to rehabilitate the Pit. The Plant has a minimum processing target of 300 tons of tailings per hour. Jagersfontein Developments (Pty) Ltd has also introduced a pan plant in early 2019, which increased run of mine production to 700tons per hour.

The following development alternatives were assessed as part of the IWWMP.

1. Location alternatives:

Given that the existing Pit needs to be rehabilitated at its current location on Portion 15, there are no location alternatives.

2. Alternative methods to backfilling the Pit

2.1 Fencing

The only feasible alternative to backfilling the Pit with Backfill Material is through maintaining the fence around it on the surface, to prevent people and larger animals from entering the area. The fence, however, provides no absolute barrier against trespassing. Furthermore, the Pit's instability will persist, with the potential risk that vibrations and break-back of the Pit's walls might cause injuries to trespassers or damage to surrounding property and the fence itself. Break-back episodes are intermittent and unpredictable. Regular survey and drone surveys are performed. Current activity is only a minor erosional process, but large block-break back can always be expected and has occurred in the form of boulders falling into the Pit during heavy rain events.

2.2 Civil Engineering Stabilisation Mechanisms

Dr. Howell investigated whether there are any civil engineering mechanisms that could be used to stabilise the Pit. He concluded that it is impractical to carry out any stabilisation work due to the geological circumstances present at the Pit. If it were possible, it would be a world first; the most challenging endeavour of its kind in the world and extremely expensive.

3. Technological alternative (i.e. infilling of material):

3.1 Method of transportation of material into the Pit

The preferred method of transportation and infilling of the Backfill Material is via a conveyor and pipe. A conveyor will be used to transport coarse tailings, whilst the paste will be transported via a pipe.

An alternative mode of transportation of the Backfill Material to the Pit will be the use of trucks. However, due to fuel consumption, it will be very costly and have a larger carbon footprint (due to burning of fossil fuels) and physical footprint (as a result of the roads). Travelling on dirt roads by truck will also create higher emissions of dust. Due to safety reasons, the trucks will also not be permitted to enter the area close to the Pit and use of a shorter conveyor and pipe will be required near the Pit.

3.2 Method of infilling

The proposed method of infilling will involve the constant change of the tailings discharge point into the Pit, and also the type of tailings discharged into it, to ensure a balance between coarse tailings and the paste. Coarse tailings will be discharged into the Pit from the southern rim adjacent to the main shaft, while the Paste will be piped into the Pit on the eastern side. Coarse tailings will be used to “line” the Pit's base and form a base layer or “filter blanket” on the southern side of the Pit. This “filter blanket” will have an initial thickness of 10m, which will increase as deposition continues. The Paste will only be introduced to the Pit's eastern flank in the fourth month after commencement of the coarse tailings’ deposition. Due to the density of the paste being lower than that of the coarse tailings, it will remain above the coarse tailings. “*The continued deposition of tailings from the south rim, will displace the slimes slurry laterally and upwards (sink to the bottom as has been the case at DeBeers pit in Kimberley and as observed from the Jagersfontein surface tailings/slimes dam)*” (SRK, 2019). Deposition of tailings and paste will take approximately 6 years at current production rates.

An alternative method to infilling the Pit is to establish one point from where coarse tailings and the paste are discharged into the Pit. This will entail the co-disposal of coarse tailings and paste. This method will result in unpredictable movement of the paste, as the mixture will be dominated by the mobility of the paste. Thus, there will be no base layer.

3.3 Lining

It was determined that the tailings are classified as a Type 3 waste which, in terms of the National Norms and Standards for Disposal of Waste to Landfill, published under NEMWA in GN R636 of *GG* 36784 of 23 August 2013, requires a liner consistent with a Class C barrier system.
Due to the Pit’s size, depth, inaccessibility and the significant health and safety risks associated with lining it, a liner of this type is unpractical, if not impossible. Even if it was possible, the costs of such a lining would make it unfeasible. Furthermore, groundwater modelling indicated, through simulations, that the migration of the pollution plume from the filled Pit will be limited, due to the:

- fact that the Pit would not be filled to the surface, and therefore the filling would not reach the base of the exploitable aquifer; and
- geohydrological properties of the paste.

The need to backfill the Pit due to the safety risk it poses clearly outweighs any need to line it due to low pollution risks.

4. No Go: The Pit will not be rehabilitated by infilling

Should the no-go option be chosen, the Pit will not be backfilled with tailings and be left dormant. The coarse tailings and paste will then be disposed of into a Fine Tailings Storage Facility (FTSF). Due to the limited capacity of the existing FTSF, a new facility will have to be constructed for the storage of material. However, due to the elevated costs associated with this option, it is not regarded as economically feasible. The Pit would remain fenced and access-controlled to render it safe. Furthermore, the construction and use of an additional surface FTSF will result in impacts on the exploitable upper aquifer and create a further loss of land due to the FTSF's footprint. A new FTSF will also likely have a negative impact on hydrology and surface water quality. The quantity of natural runoff will also be reduced, as it (i.e. rainfall) will be retained in the FTSF.

Figure 3 – Proposed development layout plan. This plan was provided by the client.

3 ASSESSMENT METHODOLOGY

3.1 Methodology for Assessing Heritage Site Significance

This report was compiled by PGS Heritage for the Proposed Rehabilitation of the Mine Pit at the Jagersfontein Mine. The applicable maps, tables and figures are included as stipulated in the NHRA and NEMA.

A Notice of Intent to Develop (NID) was submitted to the SAHRA and FS-PHRA to inform them of the proposed development and the proposed way forward. Apart from notifying these authorities of the proposed development, the NID also suggested the methodology that was going to be followed. A letter of response on the NID was received from SAHRA on Thursday, 7 May 2020. The NID agreed that a Heritage Impact Assessment was required, and did not object to the methodology as proposed in the NID. The SAHRIS Case ID for the project is 14974.

The NID proposed the following methodology:

1) Desktop Study

A desktop study, which is aimed at compiling as much information as possible regarding the known heritage resources within and surrounding the proposed development areas. The desktop study will *inter alia* cover the following:

a) Archival Research

Archival documents and maps housed at archival repositories will be accessed and studied, to provide historical background to the study area as well as the identification of heritage resources located there.

b) Old Aerial Photographs

Old aerial photographs will be utilised, to identify possible places where archaeological sites might be located and provide a historic layering for the study area and its features. Through our experience, this has shown to be a useful tool for surveys.

c) Archaeological and Historical Desktop Study

An archaeological and historical study of the study area and its immediate surroundings will be compiled.

2) Palaeontological Desktop Study

An experienced palaeontologist will be appointed to undertake the palaeontological desktop study for the development.

3) Fieldwork

The fieldwork will be an extension of the completed archival work and focus on the possible impacts on identified heritage resources. The fieldwork component consists of walkthrough of the site and is aimed at identifying heritage resources falling within the impact area. The locations of all heritage resources that are recorded during the survey will be documented using a hand-held GPS.

4) Meetings

It is proposed that meetings take place with one or more knowledgeable individuals regarding the history of the Jagersfontein Pit.

5) Report

A Heritage Impact Assessment will be compiled. This report will include the findings of the desktop study and the findings of the fieldwork and will include an assessment of the significance of the identified heritage sites, including the Jagersfontein Pit. Required mitigation measures and recommendations will also be outlined in the report. As part of the Heritage Impact Assessment, an assessment will also be made of the cultural landscape within which the study area is located.

In the end, the methodology implemented for the purposes of this Heritage Impact Assessment, was almost exactly the same as proposed in the NID. Please find the details of the methodology that was implemented below.

Step I – Desktop Study: A detailed archaeological and historical overview of the study area and surroundings was undertaken. This desktop study research was undertaken from published and available references, with research also undertaken at the Africana Library in Kimberley and at the Free State Archives in Bloemfontein. Although attempts were made to access the De Beers Archive, this was not possible.

Due to the fact that the De Beers Archives could not be accessed, contact was made with Steve Lunderstedt, who conducted historical research on the mine roughly 16 years ago. Mr. Lunderstedt's research at the time focused on the claim that the mine pit at Jagersfontein is the deepest excavation using the pick-and-shovel method anywhere in the world. He originally presented his research during a lecture to the Historical Society of Kimberley and the Northern Cape on Thursday, 19 May 2005. Mr. Lunderstedt provided a copy of this lecture to the the author (refer **Appendix D**).

This work was augmented by an assessment of reports and data contained on the South African Heritage Resources Information System (SAHRIS). Additionally, an assessment was made of the available historic topographic maps and old aerial photographs.

A Palaeontological Desktop Assessment (PDA) was also undertaken. This study was compiled by Elize Butler from Banzai Evironmental (refer to **Appendix C** for full report).

Step II – Field Survey: The fieldwork component of the study was aimed at identifying tangible remains of archaeological, historical and heritage significance. The fieldwork was undertaken by way of walkthroughs by an experienced archaeological fieldwork team on Tuesday, 23 June 2020 and Wednesday, 24 June 2020. The fieldwork team consisted of an experienced archaeologist and heritage specialist (Polke Birkholtz) and a fieldwork assistant (Derrick James).

The fieldwork team used hand-held GPS devices throughout the fieldwork. These devices were used to record tracklogs showing the routes followed by the e archaeological fieldwork team during the fieldwork. All sites identified during the fieldwork were photographically and qualitatively recorded, and their respective localities documented using a hand-held GPS device.

The fieldwork resulted in the identification of a total of twenty-five (25) sites. These were numbered from JAG 1 to JAG 25. The prefix used in this numbering system was derived from the farm name, namely Jagersfontein.

It should be noted that due to safety concerns, no intensive walkthroughs were possible along the close perimeter of the mine pit. Additionally, the focus during the fieldwork was placed on areas where heritage sites were believed to be located, with less attention placed on areas which had been disturbed by more recent developments and activities.

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.

A comparison of the implemented methodology versus the methodology proposed in the NID, shows that almost all espects included in the proposed methodology was implemented. The only exception were meetings. As a result of the COVID-19 pandemic, no meetings took place during the course of this study.

The significance of heritage sites was based on five main criteria:

- site integrity (i.e. primary vs. secondary context),
- amount of deposit, range of features (e.g., stonewalling, stone tools and enclosures),
- Density of scatter (dispersed scatter)

    - Low - <10/50m2
    - Medium - 10-50/50m2
    - High - >50/50m2
- uniqueness and
- potential to answer present research questions.

Management actions and recommended mitigation, which will result in a reduction in the impact on the sites, will be expressed as follows:

A - No further action necessary;
B - Mapping of the site and controlled sampling required;
C - No-go or relocate development position
D - Preserve site, or extensive data collection and mapping of the site; and
E - Preserve site

Site Significance

Site significance classification standards prescribed by the South African Heritage Resources Agency (2006) and approved by the ASAPA for the Southern African Development Community (SADC) region, were used for the purpose of this report (see **Table 2**).

Table 2 – Site significance classification as prescribed by SAHRA.

FIELD RATING	GRADE	SIGNIFICANCE	RECOMMENDED MITIGATION
National Significance (NS)	Grade 1	-	Conservation; National Site nomination
Provincial Significance (PS)	Grade 2	-	Conservation; Provincial Site nomination
Local Significance (LS)	Grade 3A	High	Conservation; Mitigation not advised
Local Significance (LS)	Grade 3B	High	Mitigation (Part of site should be retained)
Generally Protected A (GP.A)	Grade 4A	High/Medium	Mitigation before destruction
Generally Protected B (GP.B)	Grade 4B	Medium	Recording before destruction
Generally Protected C (GP.C)	Grade 4D	Low	Destruction

3.2 Methodology for Impact Assessment

The impact significance rating process serves two purposes: firstly, it helps to highlight the critical impacts requiring consideration in the management and approval process; secondly, it shows the primary impact characteristics, as defined above, used to evaluate impact significance.

Where possible, mitigation measures will be provided to manage impacts. In order to ensure uniformity, a standard impact assessment methodology will be utilised so that a wide range of impacts can be compared with each other. The impact assessment methodology makes provision for the assessment of impacts against the following criteria:

- Significance;
- Spatial scale;
- Temporal scale;
- Probability; and
- Degree of certainty.

A combined quantitative and qualitative methodology was used to describe impacts for each of the aforementioned assessment criteria. A summary of each of the qualitative descriptors along with the equivalent quantitative rating scale for each of the aforementioned criteria is given in **Table 3.**

Table 3: Quantitative rating and equivalent descriptors for the impact assessment criteria

RATING	SIGNIFICANCE	EXTENT SCALE	TEMPORAL SCALE
1	VERY LOW	Proposed site	Incidental
2	LOW	Study area	Short-term
3	MODERATE	Local	Medium/High-term
4	HIGH	Regional / Provincial	Long-term
5	VERY HIGH	Global / National	Permanent

A more detailed description of each of the assessment criteria is given in the following sections.

Significance Assessment

Significance rating (importance) of the associated impacts embraces the notion of extent and magnitude but does not always clearly define these since their importance in the rating scale is very relative. For example, the magnitude (i.e. the size) of area affected by atmospheric pollution may be extremely large (1 000 km2) but the significance of this effect is dependent on the concentration or level of pollution. If the concentration is great, the significance of the impact would be HIGH or VERY HIGH, but if it is diluted it would be VERY LOW or LOW. Similarly, if 60 ha of a grassland type are destroyed the impact would be VERY HIGH if only 100 ha of that grassland type were known. The impact would be VERY LOW if the grassland type was common. A more detailed description of the impact significance rating scale is given in **Table 4** below.

Table 4: Description of the significance rating scale

RATING		DESCRIPTION
5	Very high	Of the highest order possible within the bounds of impacts which could occur. In the case of adverse impacts: there is no possible mitigation and/or remedial activity which could offset the impact. In the case of beneficial impacts, there is no real alternative to achieving this benefit.
4	High	Impact is of substantial order within the bounds of impacts, which could occur. In the case of adverse impacts: mitigation and/or remedial activity is feasible but difficult, expensive, time-consuming or some combination of these. In the case of beneficial impacts, other means of achieving this benefit are feasible but they are more difficult, expensive, time-consuming or some combination of these.
3	Moderate	Impact is real but not substantial in relation to other impacts, which might take effect within the bounds of those which could occur. In the case of adverse impacts: mitigation and/or remedial activity are both feasible and fairly easily possible. In the case of beneficial impacts: other means of achieving this benefit are about equal in time, cost, effort, etc.
2	Low	Impact is of a low order and therefore likely to have little real effect. In the case of adverse impacts: mitigation and/or remedial activity is either easily achieved or little will be required, or both. In the case of beneficial impacts, alternative means for achieving this benefit are likely to be easier, cheaper, more effective, less time consuming, or some combination of these.
1	Very low	Impact is negligible within the bounds of impacts which could occur. In the case of adverse impacts, almost no mitigation and/or remedial activity are needed, and any minor steps which might be needed are easy, cheap, and simple. In the case of beneficial impacts, alternative means are almost all likely to be better, in one or a number of ways, than this means of achieving the benefit. Three additional categories must also be used where relevant. They are in addition to the category represented on the scale, and if used, will replace the scale.
0	No impact	There is no impact at all - not even a very low impact on a party or system.

Spatial Scale

The spatial scale refers to the extent of the impact i.e. will the impact be felt at the local, regional, or global scale.

The spatial assessment scale is described in more detail in **Table 5.**

Table 5: Description of the significance rating scale

RATING		DESCRIPTION
5	Global/National	The maximum extent of any impact.
4	Regional/Provincial	The spatial scale is moderate within the bounds of impacts possible and will be felt at a regional scale (District Municipality to Provincial)
3	Local	The impact will affect an area up to 10 km from the proposed site.

2	Study Site	The impact will affect an area not exceeding the Eskom property.
1	Proposed site	The impact will affect an area no bigger than the ash disposal site.

Duration Scale

In order to accurately describe the impact, it is necessary to understand the duration and persistence of an impact in the environment.

The temporal scale is rated according to criteria set out in **Table 6.**

Table 6: Description of the temporal rating scale

RATING		DESCRIPTION
1	Incidental	The impact will be limited to isolated incidences that are expected to occur very sporadically.
2	Short-term	The environmental impact identified will operate for the duration of the construction phase or a period of less than 5 years, whichever is the greater.
3	Medium/High term	The environmental impact identified will operate for the duration of life of facility.
4	Long term	The environmental impact identified will operate beyond the life of operation.
5	Permanent	The environmental impact will be permanent.

Degree of Probability

Probability or likelihood of an impact occurring will be described as shown in **Table 7** below.

Table 7: Description of the degree of probability of an impact occurring

RATING	DESCRIPTION
1	Practically impossible
2	Unlikely
3	Could happen
4	Very Likely
5	It's going to happen / has occurred

Degree of Certainty

As with all studies it is not possible to be 100% certain of all facts, and for this reason a standard "degree of certainty" scale is used as discussed in **Table 8.** The level of detail for specialist studies is determined according to the degree of certainty required for decision-making. The impacts are discussed in terms of affected parties or environmental components.

Table 8: Description of the degree of certainty rating scale

RATING	DESCRIPTION
Definite	More than 90% sure of a particular fact.
Probable	Between 70 and 90% sure of a particular fact, or of the likelihood of that impact occurring.
Possible	Between 40 and 70% sure of a particular fact or of the likelihood of an impact occurring.
Unsure	Less than 40% sure of a particular fact or the likelihood of an impact occurring.
Can't know	The consultant believes an assessment is not possible even with additional research.
Don't know	The consultant cannot, or is unwilling, to make an assessment given available information.

Quantitative Description of Impacts

To allow for impacts to be described in a quantitative manner in addition to the qualitative description given above, a rating scale of between 1 and 5 was used for each of the assessment criteria. Thus, the total value of the impact is described as the function of significance, spatial and temporal scale as described below:

$$\textbf{\textit{Impact Risk}} = \frac{(\text{SIGNIFICANCE} + \textit{Spatial} + \text{Temporal})}{3} \times \frac{\text{Probability}}{5}$$

An example of how this rating scale is applied is shown in **Table 9.**

Table 9: Example of Rating Scale

Impact	Significance	Spatial Scale	Temporal Scale	Probability	Rating
	Low	Local	Medium/High-term	Could Happen	

Impact to heritage	2	3	3	3	1.6

Note: *The significance, spatial and temporal scales are added to give a total of 8, that is divided by 3 to give a criteria rating of 2.67. The probability (3) is divided by 5 to give a probability rating of 0,6. The criteria rating of 2.67 is then multiplied by the probability rating (0,6) to give the final rating of 1,6.*

The impact risk is classified according to five classes as described in the **Table 10** below.

Table 10: Impact Risk Classes

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**

Therefore, with reference to the example used for air quality above, an impact rating of 1.6 will fall in the Impact Class 2, which will be considered to be a low impact.

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4 CURRENT STATUS QUO

The study area is located immediately south-west of the town of Jagersfontein and is situated in the Kopanong Local Municipality of the Xhariep District Municipality of the Free State Province. The study area comprises Portion 15 of the farm Jagersfontein 14 IS.

The study area encloses the pit of the Jagersfontein Mine, and this historic mining feature represents a significant section of the total study area. The mine pit is approximately 19.76 hectares in extent, which represents an approximate 37.28% section of the total study area extent of 53 hectares. Due to the depth of the mine pit and its steep-sided walls, no access to the pit itself was possible during the fieldwork. Due to safety concerns, the close perimeter of the mine pit could also not be accessed.

The remainder of the study area can be described as primarily disturbed. This disturbance can essentially be attributed to historic mining activities which had been associated with this parcel of land for many years and which resulted in the presence of several historic mining-related heritage sites and features located within the study area. Many of these sites and features were identified during a previous heritage study (Philip, 2009), with some of these sites, with a small number of additional sites, identified during the present fieldwork. Unfortunately, a comparison between the fieldwork findings of the previous heritage study (Philip, 2009) and the fieldwork undertaken for the present study, has revealed that a high number of the heritage sites identified in that previous study had been destroyed or irreparably damaged in the 12 years since that study was completed. This destruction of previously identified sites was found to have taken place both within the current study area as well as the mine property as a whole. This wanton destruction of identified heritage sites is of great concern.

Additionally, evidence for recent disturbances was also observed within the study area. These recent disturbances include the excavation of drainage trenches in areas north-west, south and south-east of the mine pit, the construction of a number of roads and the dumping and excavation of material north-west and north by north-west of the mine pit.

In terms of vegetation, the Biodiversity Management Plan for the mine indicates that two vegetation types are found here, namely the Xhariep Karroid Grassland and Besemkaree Kopies Shrubland. However, the locality of the study area around the historic mine pit means that the vegetation found within the study area can primarily be described as weeds and invader species. According to the report "…*the area surrounding the kimberlite pit has been subjected to several impacts since the establishment of the mine in the late 19th century. This area still contains excavated rubble, boulders and dilapidated infrastructure. The rubble and rock heaps around the pit form obstructions to water flow and cause damming of surface water flow. Due to the degraded condition of the area several weeds and invader species have become established...*" (Van Rensburg, 2013:14).

Figure 4 – Panoramic view of the study area taken in a north-eastern direction as viewed from a low hill located on the south-western corner of the study area. The mine pit which represents the core of the study area, can be seen in the middle background. The town of Jagersfontein may just be visible in the background on the opposite side of the mine pit. The low hill visible on the right of the photograph is is situated outside of the study area boundaries.

Figure 5 – Panoramic view of the mine pit as seen from the gantry on the northern perimeter of the mine pit. The steep-sided walls and depth of the mine pit can be seen on this photograph. This photograph was taken in a south by south-western direction.

Figure 6 – Panoramic view of the drainage trench that was excavated along the southern perimeter of the mine pit.

Figure 7 – Another panoramic view of the drainage trench. This view was taken in a south-eastern direction and shows the tunnel that was identified at site JAG 11 on the left. Theis image also provides information on the vegetation found throughout the study area.

Figure 8 – Panoramic view of the section of the study area located north of the mine pit. This photograph was taken in a western direction.

Figure 9 – Panoramic view of recent disturbance in the form of a road (foreground) and drainage trench (left). These photographs were taken from a point north-west of the mine pit facing east and south-east.

5 DESKTOP STUDY FINDINGS

5.1 Archaeological and Early Historical Overview of the Study Area

Although the wider surroundings of the study area has a highly significant Stone Age history, with research in this general area undertaken by Professor AJH Goodwin, Professor C van Riet Lowe and Professor AJB Humphreys, the study area itself sits on the perimeter of the old mining pit at the Jagersfontein Mine and had been extensively disturbed since the commencement of diamond mining here during the late 1870s. As a result, no significant presence of Stone Age lithics or sites within the study area can be expected.

With this as background, only a brief summary of the Stone Age of the surroundings of the study area will be provided here.

Figure 10 – Fauresmith lithics from site Biessiesput 1 in the Northern Cape Province that was photographed during an excursion by the Southern African Association of Archaeologists during September 1990 (Mitchell, 2002:62).

The name of the nearby town of Fauresmith was even given to one of the traditions identified in the Early Stone Age of South Africa, after the identification of the first type site for this tradition by Goodwin and Van Riet Lowe in the town during the 1920s. A relatively high number of similar sites were subsequently identified in the wider surroundings of the study area. The Fauresmith tradition

sites are described as follows by Mitchell (2002:62): "*In the South African interior, assemblages incorporating…prepared core techniques with flake tools that include long, narrow flake-blades and convergent points are known as Fauresmith; associated handaxes are small and broad…All known occurrences are at open-air sites.*"

While the Fauresmith tradition was initially believed to represent the transition phase between the earlier Early and the Middle Stone Ages, Philip & Uys (2013:3) indicates that recent radio-metric dating of an in-situ Fauresmith site from Kathu Pan in the Northern Cape has revealed "*…a minimum OSL age of 464 + 47 kyr and a combined U-series–ESR age of 542 + 107 kyr…which firmly places it inside the ESA period.*"

The surroundings of the study area is also well represented by Later Stone Age sites, with so-called Smithfield A sites identified by Goodwin and Van Riet Low in the surrounding landscape. Later Stone Age sites containing rock engravings are also known from the surroundings of the study area (Philip & Uys, 2013).

Philip & Uys (2013) provides the following list for a typical factory-site assemblage associated with a Later Stone Age site from Lockshoek. These authors obtained this assemblage list from a 1929 publication by Goodwin and Van Riet Lowe. The factory-site assemblage from Lockshoek consisted of the following:

- Concavo-convex scrapers (restricted to Smithfield A);
- Large circular scrapers (restricted to Smithfield A);
- Duckbill end-scrapers;
- Side-scrapers;
- Trimmed points;
- Stone borers;
- Bored stones;
- Grooved stones;
- Grindstones;
- Pounders and grinders; and
- Fabricators: cores, detaching hammers, trimming stones & anvils.

5.2 Historical Overview of the Jagersfontein Diamond Mining Company

This section provides an overview of the history of the Jagersfontein Mine. The references utilised for this section include the following: Higgs (2017), Le Barrow (1970), Optima (1954), Philip (2009), Philip (2014) and Philip (2016). These references can be utilised for further reading on the history of Jagersfontein.

5.2.1 Discovery of Diamonds and the Declaration of Jagersfontein as a Public Diggings

The farm Jagersfontein gave the Jagersfontein Diamond Mine its name. While it is not known when the farm was first registered, the farm name was derived from the fountain on the property named Jager's Fountain or Jagersfontein. The fountain, in turn, was named after its first owner Evert Jagers (some references indicate that his name was Jacobus Jagers or Jan Jagers) (Raper, 1987) (Philip, 2016). Evert Jagers was a Griqua farmer, and very little is known about him and his life at Jagersfontein. His acquisition of the farm must have taken place after 1826 when Adam Kok II established a Griqua state in Transorangia with Phillipolis as its capital (Legassick, 2010). After the establishment of this Griqua state, the surroundings of the study area would have fallen under Griqua control.

The control of the Griqua over the study area's surroundings would have remained unchanged for the subsequent years. However, from the late 1830s onwards, a large group of white farmers from primarily the Eastern Cape crossed over the Orange River. These newcomers are known today as Voortrekkers and their movement into South Africa's interior known as the Great Trek (Visagie 2011).

The permanent settlement of white people north of the Orange River led to increased pressure on the Griqua state at Phillipolis. This pressure increased after the establishment of the Boer Republic of the Free State on 23 February 1854. One can assume that many Griqua landowners from the study area's surroundings, including Evert Jagers on his farm Jagersfontein, would have felt threatened by this event.

It is interesting to note that for a relatively long period, Evert Jagers did not live on the farm Jagersfontein. This may have been due to the increasing influence of white people, including Voortrekkers, within the surroundings of the farm. According to Barnard et al. (1982), Evert Jagers rented his farm to a British subject named Gilliame I. Oberholzer 15 years from 26 June 1836 to 26 June 1851.

Barely two years after the establishment of the Free State Republic, Evert Jagers sold Jagersfontein for the sum of £30 to Cornelis Johannes Visser on 14 August 1856 (Pettman, 1985). Cornelis Visser (9 May 1815 – 22 March 1867) was a Voortrekker who moved with his family from present-day Hanover across the Orange River in 1839 to settle on the farm Schraalfontein (Visagie, 2011). As with many other Voortrekkers of the day, Cornelis Johannes Visser was a veteran of the Battle of Boomplaats that was fought between the Voortrekkers and the British on 29 August 1848, roughly 26.7km south-east of Jagersfontein. According to some references, Visser also owned the farm Boomplaats at the time (Le Barrow, 1970).
The farm Schraalfontein adjoins the farm Jagersfontein, and by 1856 Cornelis Johannes Visser owned both farms. He was to hold ownership of these farms until his death on 22 March 1867. His wife, Jacoba Magdalena Cecilia Visser (born Van Staden), remained on the farms after his death.

Meanwhile, roughly 130km to the west, near Hope Town, an event occurred that would change the course of South Africa's history and the history of the farm Jagersfontein forever. In early 1867, a 15-year-old boy named Erasmus Jacobs found a diamond on his father's farm De Kalk on the banks of the Orange River near Hopetown. Two years later, a massive second diamond of 83.5 carats, later named *The Star of Africa*, was picked up on the Vaal River's banks. These discoveries provided the stimulus for a diamond rush to the interior of South Africa and especially to the banks of the Vaal River, where digger's camps were established at Klip Drift, Pniel and Hebron (Davenport, 2013) (Higgs, 2017).

Figure 11 – General view of the diggings near Klip Drift at the time of the early diamond rush of the late 1860s (Duminy & Sabatini, 2008:8).

Likely after her husband's death, Jacoba Visser employed a foreman or overseer named JJ (Jan) de Klerk (Norman & Whitfield, 2006). Jan de Klerk was the son of BJ de Klerk, a relative of Jacoba Visser, who stayed on the property for some time (Philip, 2016). It was Jan de Klerk who, in August 1870 (some references indicate that this was in 1869), started prospecting for diamonds along the non-perennial stream that ran through the farm (Norman & Whitfield, 2006). Many references give Jan de Klerk the credit of deciding to prospect for diamonds at Jagersfontein. Le Barrow (1970) holds a different view and states that it was Dr. CW Neebe from Fauresmith who, during a visit to the farm Jagersfontein, mentioned to the Widow Visser that diamonds might be found along the non-perennial stream running through to property. This author adds that several diamonds were subsequently picked up on the surface of the farm, after which Dr. Neebe suggested that more diamonds may be found deeper down. Other references indicate that a passing diamond digger

had provided Jan de Klerk the suggestion to start prospecting on the farm (Philip, 2016).

Notwithstanding the exact reasons for Jan de Klerk taking up prospecting at Jagersfontein, within one week into his geological investigations, he uncovered a diamond weighing 50 carats. De Klerk discovered this diamond at a depth of six feet. What made this discovery so special was that it was the very first time that a diamond was found within its source rock, namely Kimberlite (Norman & Whitfield, 2006). Philip (2016) supports this by indicating that the discovery made at Jagersfontein was the first discovery of non-alluvial diamonds anywhere in the world. The discovery of diamonds at Jagersfontein heralded in the time of the so-called 'dry diggings' as opposed to the 'river diggings' along the Vaal River, with dry diggings most commonly associated with the diamond diggings around present-day Kimberley (Higgs, 2017).

Jacoba Visser allowed family members, neighbours and eventually Free State burghers to undertake to dig in plots of land assigned to them for a monthly fee of £2 (Optima, 1954) (Le Barrow, 1970). During this early period of mining at Jagersfontein, some 40 diggers assisted by 60 servants worked 45 claims on the farm. Due to a significant lack of water at Jagersfontein, this early work was solely comprised of dry sifting and handpicking the gravels. Despite these primitive methods, as many as seven to eight diamonds were recovered every day (Le Barrow, 1970).

Apart from the lack of water, the development of the Jagersfontein diggings was further hindered by the landowner's insistence that no foreign diggers or English-speaking Free Staters may be permitted to work here (Le Barrow, 1970). "*In this manner a measure of expertise so desperately needed by the local diggers was lost, so that in succeeding years Jagersfontein was rapidly eclipsed by the dry diggings discovered later at Du Toit's Pan, Colesburg Kop and Bultfontein*…" Le Barrow (1970:86). Of course, these three diamond mines are all associated with the history of diamond mining at Kimberley.

Due to increasing public pressure, Jagersfontein was declared a public diggings by the government of the Free State Republic on 5 August 1871 (Higgs, 2017). At the same time, Charles Hutton of Fauresmith was appointed as the first inspector for the public diggings (Le Barrow, 1970).

The declaration of Jagersfontein as a public diggings resulted in large numbers of diggers descending on to the farm. However, no English-speaking Free Staters or persons from outside the Free State Republic were yet allowed to rent claims. The arrival of so many more people on Jagersfontein further exasperated the shortage in water, even for domestic use. This precious resource had to be painstakingly, and likely at significant cost, carted to the public diggings from a dam on an adjoining property. Furthermore, the accommodation of the diggers was considered as primitive as the diggings themselves (Le Barrow, 1970).

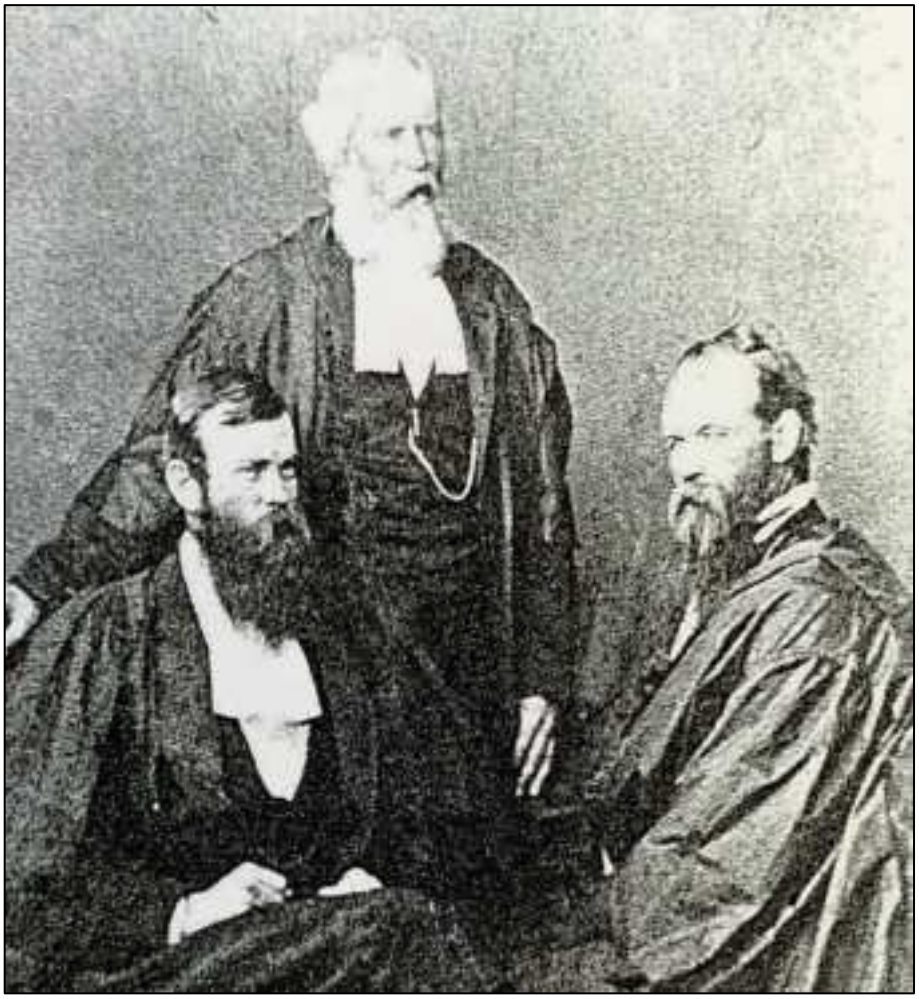


Figure 12 – Remarkable photograph of the three members of the Appeals Court of the Free State Republic. The figures on the left and right are FW Reitz (later president of the Free State Republic) and William Whiskin Collins. The person in the centre is Charles W Hutton, who, three years before this photograph was taken, was appointed the first inspector of the public diggings at Jagersfontein. The photograph was taken in 1874 (Schoeman, 2010).

The conditions at Jagersfontein, including the restriction on English-speaking diggers, the lack of water and the primitive conditions, continued hindering its progress. Many diggers decided to rather pass Jagersfontein en route to Du Toit's Pan, Bultfontein and Colesburg Hill. Despite the conditions and lack water, Jagersfontein was to remain flickering in the minds of those interested in diamonds and diamond fields primarily due to the quality of the stones that were extracted from its diggings. With time, and no doubt as a result of consistent requests by interested parties, the restrictions imposed on English-speaking diggers and foreigners was soon lifted, and the flickering interest in Jagersfontein and its diggings became an inferno (Le Barrow, 1970).

5.2.2 Expansion of Mining Activities and the Establishment of the Town of Jagersfontein

As will be shown below, the year 1878 proved to be massive in the development of Jagersfontein. In this year, the first concerted effort of mining at Jagersfontein took place with the registration of *The Fauresmith Diamond Mining Company* by several residents of Fauresmith, including WH

Beddy, C Wiebe, C Reid and Wertheim. One of the firsts that the company implemented was the use of scotch carts to transport diamond-bearing blue ground from the claims by way of inclined roadways to the surface, where washing was done by a horse-driven whim (Le Barrow, 1970). In this regard, it is interesting to note that Duminy and Sabatini (2008) indicate that whims were used at the opencast mines around present-day Kimberley to lower and raise ropes rather than for washing activities.

Figure 13 – This historic photograph taken in 1873 depicts a horse operated whim at the Kimberley Mine (Duminy & Sabatini, 2008:41).

The first plan of the Jagersfontein diggings was also surveyed and drawn in 1878 by GC Brand, the Government Surveyor of the Free State Republic (Philip, 2016). This plan provided the very first view of the diggings at Jagersfontein and depicts a total of 1,244 individual claims. Each of these claims was 30 feet x 30 feet (9.15m x 9.15m) in extent (Le Barrow, 1970). The mining village of Jagersfontein, which up to this point had been a ramshackle collection of primitive temporary structures, was surveyed at the same time as the diggings in 1878.

Also, during 1878, the Government of the Free State Republic appointed JW Lotz as the new inspector of the mine, whereas Jacoba Visser appointed JA Schickering as her representative. For the subsequent years, all activities relating to the Jagersfontein diggings had first to pass the scrutiny of these two men (Philip, 2016).

And finally, possibly one of the most significant events in the history of Jagersfontein occurred in

November 1878, when several Australian miners arrived at the Jagersfontein diggings. These miners included the brothers Kerr (Samuel and David), William Miller, Thomas McCrae, Tom Dunn, Forster, Richard Smith and Garrett Harrington (Le Barrow, 1970) (Barnard et al., 1982). These men brought massive experience in mining to Jagersfontein, and their arrival provided the necessary impetus for the diggings to develop and progress. In the words of Le Barrow (1970:86), their "*…contributions to the deepening diggings and growing town made such an impact that street names still commemorate them…*"

What appears to be an updated map of the original survey plan of GC Brand forms part of the collection of the Free State Archives in Bloemfontein. This map dates to October 1880 (VAB, Maps, 2/264). While the names of various claim-holders appear on the plan, a vertical band of 32 claims that bisects the diggings along the north-south axis are not allocated. From subsequent diagrams and plans, it is evident that this band of unallocated claims was earmarked for an access road through the diggings. Such roads formed an integral part of the development of all the mine pits associated with diamond diggings in the interior of South Africa and provided indispensable access routes and access points throughout these diggings. A total of 114 different claim-holders are indicated on this map. Please note that in some cases, the same claim-holders may have been separated due to a lack of available information. For example, the list discerns between a claim-holder named 'Brand' and another claim-holder named 'Brand & Co.,' even though both claim-holders may have been the same entity. Similarly, the list discerns between a claim-holder named 'Van der Hoeven' and one called 'Mrs. Van der Hoeven' even though they may also relate to a single claim-holder.

Table 11: List of Individual Claim-Holders at the Jagersfontein Diggings in 1880

Adams	Francisco	R Preston
Andrews	G Fulton	Prettyjohn
Armstrong & Co.	E Gibbon	Quin
Bahh	Giles	R & Co.
Bannau	Gompert Bros.	Reid & Co.
FJ Becker	Hansen & Wille	R & T
Mrs. Becker	G. Harrington	Samuels
Beddy & Cox	D Harris & Co.	Schickerling & Co.
WC Beddy	Hart	Sharp & Rothwell
Bier	Hartog (Hertzog?)	Shine
Braham	Haste	Smith & Strauss
Brand	I Hjul	Snyman
Brand & Co.	A Hockly	Steyn & Co.
Brian	A & D Hockly	Stow

Brietmeyer & Co.	JB Hockly	Tomlinson
L Brietmeyer	P Holm	Tully
Brink	C Hughes	Turton
Bonnickson	Izaaks	Van Arkel
Broo? & Cox	Jessup	Van der Haer & Co.
Brown	Johnstone	Van der Hoeven
Bukes (Beukes?)	Joubert	Mrs. Van der Hoeven
Canicius	Kerr Bros.	Van der Merwie (Van der Merwe?)
Courtenay	Krause	A van der Merwie (Van der Merwe?)
NJ Church	Levy	D van der Merwie (Van der Merwe?)
J Cranfurd (Cranford?)	Liefman	B Visser
D Cronin	Lines	C Visser
Crowson	Livingstone	Mrs. Visser
F Cunningham	Louw	P Visser
W Da?on	Lukhoff	Voortman
Daly	B Mac Crae (McCrae?)	Waterworth
S Dodd	Maclachlan	Wicke
Dougal	Marais	Wiel
Dove	T Mc Crae (McCrae?)	J Wiel
T Dunn	Eschwége Mentjes (Meintjies?)	S Wiel
Du Toit	Miller & Smith	Wilson
Eschwege	Morgan	Wolff & Co.
Fauresmith Company	Pam	Wood
Forster	Plewman	Yockmonitz

It is clear from this 1880 plan that the Australian miners had already acquired several claims at the Jagersfontein diggings. These Australian claim-holders include ‘T Dunn,’ ‘Miller & Smith,’ ‘T McCrae,’ ‘Forster’ and of course the ‘Kerr Bros.’ The Visser family was also well represented as claim-holders, with names such as ‘B Visser’, ‘C Visser’, ‘P Visser’ and ‘Mrs. Visser’ indicated on the map.

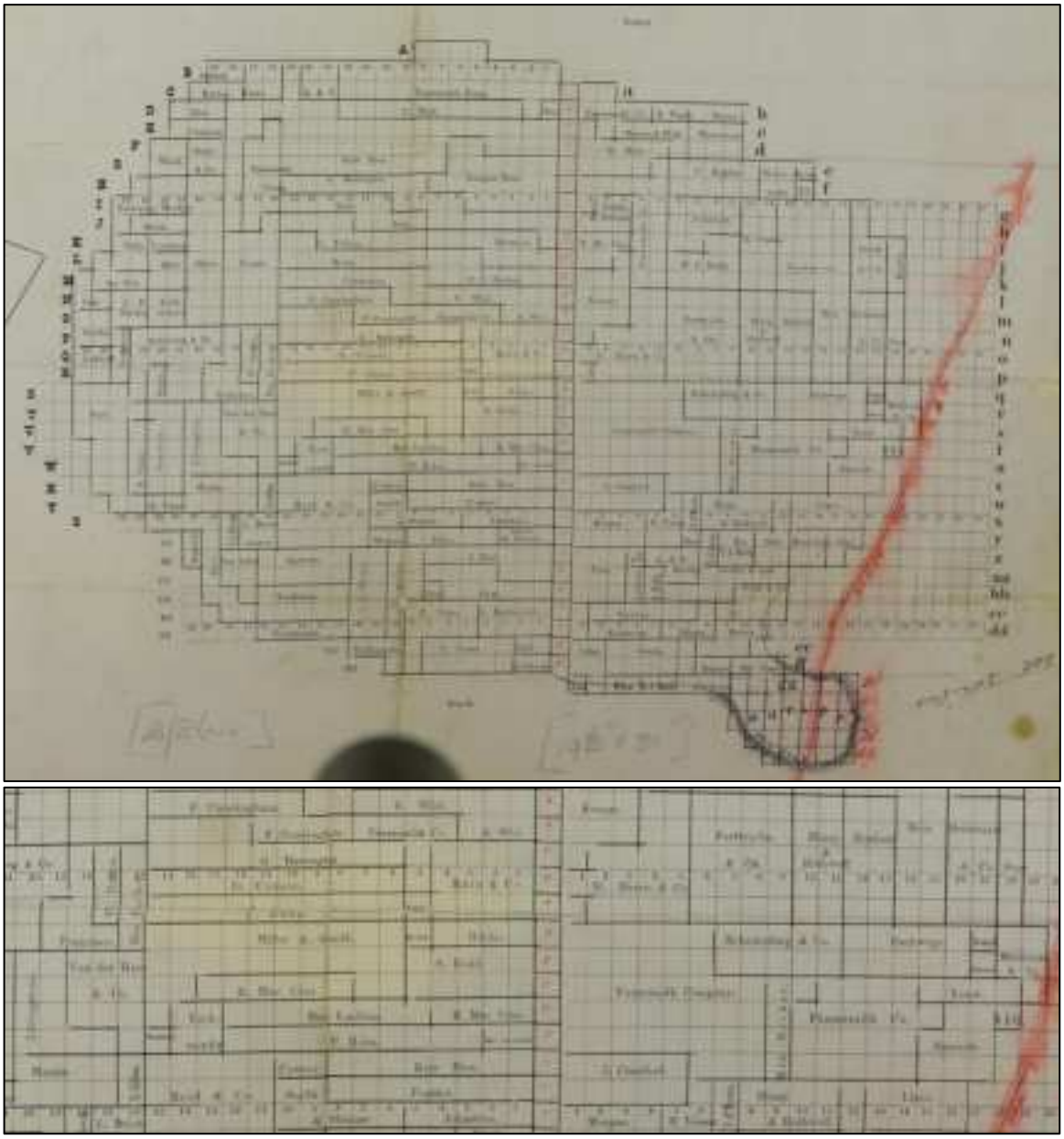


Figure 14 – These two images provide depictions of the survey plan of the Jagersfontein diggings that was updated in October 1880. The top image provides a general view of the map, whereas the bottom image offers a closer view of a section of the map showing the individual claims and the names of claim-holders (Free State Archives, Maps, 2/264). Please note that on this map, north is in a north by north-western direction.

Where 1878 brought the first mining company, the first Australian miners and the first surveyor to Jagersfontein, the year 1880 can also be considered a remarkable year in the history of the property. The 'finest' diamond yet found anywhere in South Africa was discovered at the Jagersfontein diggings that year. The 115.5 carat stone was named *Emma* and was mined from the claim held by the Kerr Brothers. The discovery of this stone further reminded the world-wide diamond industry of the Jagersfontein diggings as a source of good quality diamonds. So, despite the increasing lack of water, fuel and machinery still endured on the farm and the limited access to the diggings, interest in Jagersfontein continued to grow (Le Barrow, 1970).

During the same year, Jagersfontein's first steam gear was installed with great fanfare by Barney Gomperts. This steam gear was a four horsepower vertical engine named 'The Pioneer' (Le Barrow, 1970). At present, it is not known whether this steam gear was used for hoisting or washing activities.

In July 1880, the *Imperial Diamond Mining Company* was founded as an amalgamation of 38 claims. Two weeks later, the *Jagersfontein Diamond Mining Company* was established to raise capital to the value of £36,000 for the working of 65 claims. The *Star Diamond Mining Company* followed next and was established to work 142 claims, initially with temporary machinery, but in due course with new machinery which the new company had bought for a sum of £22,000 (Le Barrow, 1970). The foundation of these three companies launched the era of mining companies at the Jagersfontein diggings.

In November 1880, the Imperial Mining Company installed a "…*6 h.p. Robey engine, horizontal boiler, with a pendulum pump. The rotary machine is 12 feet in diameter*…" The installation of this steam-driven engine was the second to be installed at Jagersfontein, and followed on the one that was installed by Barney Gomperts in 1878. Although Gomperts's reaction to this event is not recorded in history, he must have been impressed by the fact that the Imperial Mining Company's new machine was able to wash an impressive six hundred loads a day (Le Barrow, 1970:87).

The year 1880 was also made even more significant for Jagersfontein due to visits by two noteworthy officials. During this year, President Johannes Henricus Brand, the fourth president of the Orange River Republic, paid an official visit to Jagersfontein. The president was royally received and shown around the town and mine. The second noteworthy visit during 1880 was that of Bishop Webb of Bloemfontein to officiate at the consecration of the new Anglican Church in the village of Jagersfontein (Le Barrow 1970).

The town of Jagersfontein was described as follows in 1880: "*A rapidly rising town now exists where 18 months ago not a stone had been moved. It promises to become within a short time one of the largest towns in the O.F.S. Already its population exceeds that of old-fashioned Fauresmith and it boasts of a post and telegraph office, well supplied market, church, flourishing shops, hotels and brokers' offices and, of course, its goal.*" (Le Barrow, 1970:87).

The year 1881 started dramatically. On a Sunday in January 1881, rainfall caused a local flood roughly 180m wide to wash into the excavated diggings, submerging the lower sections of the excavated claims under two to three meters of water. It was mainly the claims of the Australian miners as well as the Fauresmith Company that suffered. However, when the *New Star Diamond Mining Company* retrieved a pure white diamond of 108 carats from their claim, the claim-holders affected by the flood enthusiastically proceeded with baling operations in the hope of locating sunken treasures of their own (Le Barrow, 1970).

Government Notice!

TO BE SOLD BY PUBLIC AUCTION,

AT JAGERSFONTEIN,

DISTRICT FAURESMITH, O.F.S.,

ON

FRIDAY, OCTOBER 28, 1881,

At 11 o'clock am. precisely,

SEVENTY-SIX CLAIMS

IN THE

JAGERSFONTEIN DIAMOND MINE.

TERMS:—One-third of purchase amount cash, one-third three months, and one-third 6 months after date of sale.

Further particulars to be obtained on day of sale or on application to the Government Inspector, Jagersfontein.

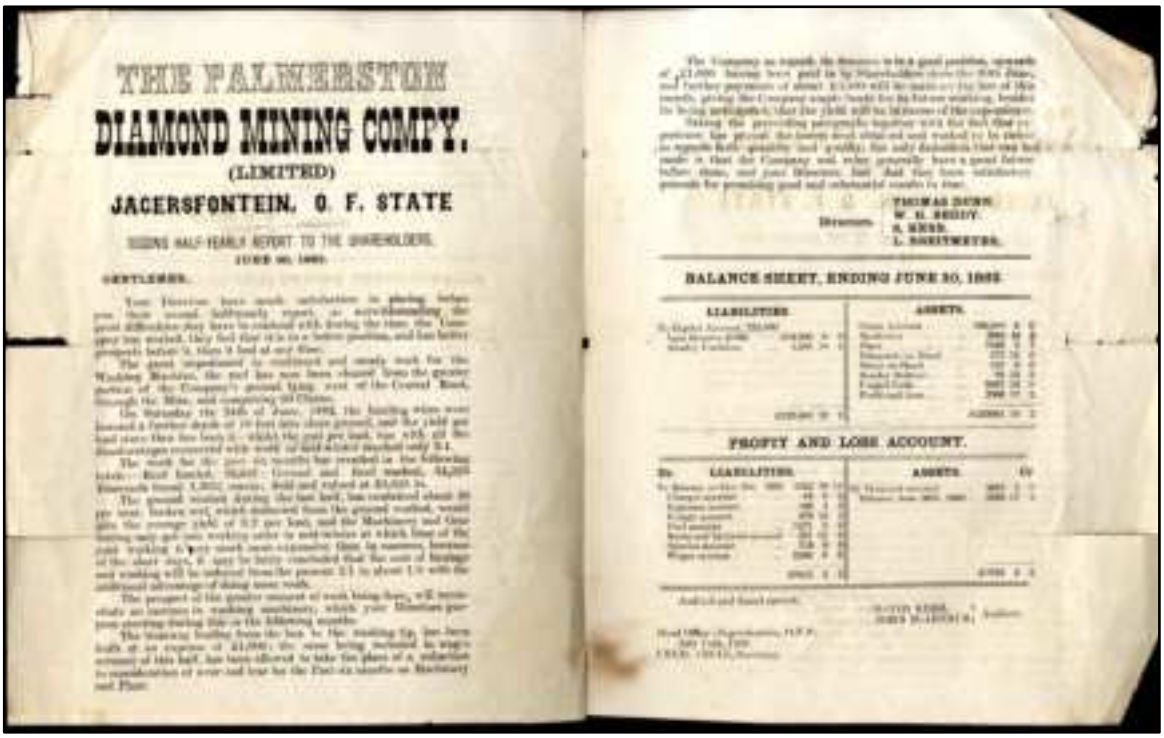
M. G. KEYTER,
Government Inspector.

Mining Inspector's Office,
Jagersfontein, August 29, 1881.

Figure 15 – These three images appeared in an article on the history of Jagersfontein that was published in Optima (Le Barrow, 1970:90, 91 & 95). The two photographs on the left depict the workings at the mine pit of Jagersfontein during the 1880s. The image on the right shows an advertisement for the sale of 76 claims at the Jagersfontein Diamond Mine on 28 October 1881.

An article published in the Cape Argus of 15 January 1881 also reported that the residents of Jagersfontein and the claim-holders of its diggings were getting exasperated by the poor living conditions on the farm. A lot of this resentment came to be levied against the farm owner, Mrs. Visser. She received monthly license fees from all those living and mining on her farm, and it was felt that very little to nothing was done to improve the living and working conditions of the miners (Le Barrow, 1970).

By 1881, the mining companies working at the Jagersfontein diggings included the Central, Fauresmith, Imperial, Jagersfontein, Kohinoor, London & Jagersfontein, Meteor, North East, President, Palmerston, Star and South Western mining companies (Le Barrow, 1970).



THE PALMERSTON

DIAMOND MINING COMPY.

(LIMITED)

JACERSFONTEIN, O. F. STATE

BALANCE SHEET, ENDING JUNE 30, 1882.

LIABILITIES.

ASSETS.

PROFIT AND LOSS ACCOUNT.

Figure 16 – The second half-yearly report for the year 1882 for the Palmerston Diamond Mining Company Limited. This report was compiled on 30 June 1882 (Africana Library, Paton Papers).

Illicit Diamond Buying (I.D.B.) had been a problem in many diamond diggings around South Africa ever since the first diggings and mines were developed. Due to the seriousness of the issue at especially Jagersfontein, the *Volksraad* of the Orange River Republic devoted an entire session in 1882 to the matter of Ilegal Diamond Buying (I.D.B.) (Le Barrow, 1970)(Philip, 2016). The Volksraad recommended the following measures:

- *"A drastic ordinance for the suppression of IDB;*
- *An ordinance establishing a special court exclusively for the trial of IDB cases;*
- *An ordinance for the appointment of an Assistant Landrost (magistrate) at Jagersfontein;*
- *A law for the establishment of an efficient police force;*
- *A law by which Jagersfontein was created a town with the establishment of a Dorpsraad;*
- *An effective searching law (for diamonds)." (Philip, 2016: 81 & 82).*

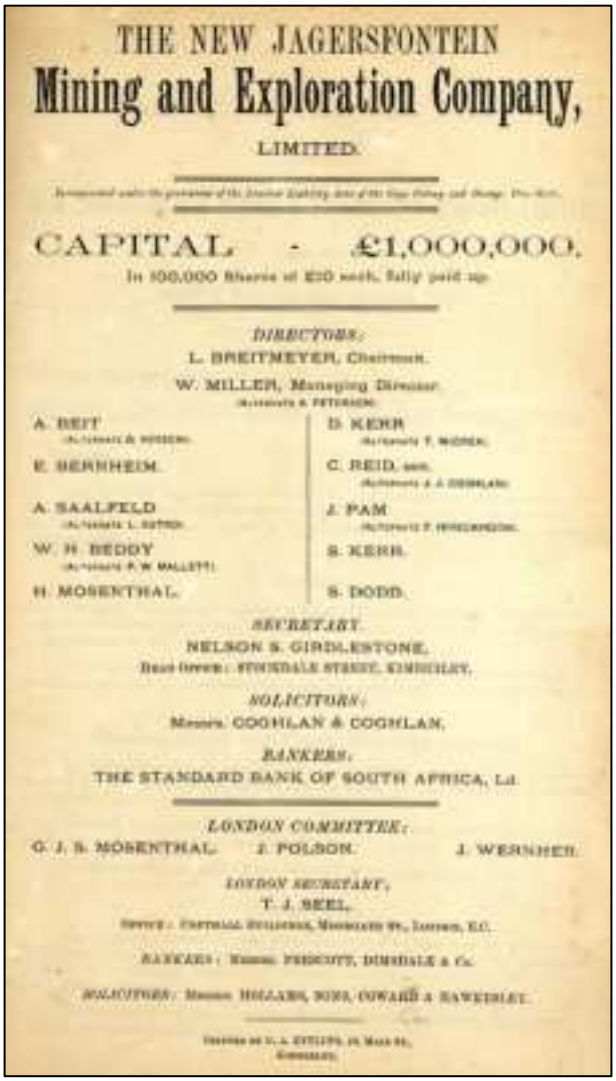
The implementation of third and fifth of these listed measures formally established the town of Jagersfontein. This resulted in a more formally laid out town and the construction of more permanent structures and buildings when compared to the informal collection of primitive temporary structures found here only a few years before (Philip, 2016).

5.2.3 Consolidation of Mining Activities and the Rise of the New Jagersfontein Company

The report for the period between July and December 1882 for the *Kohinoor* or *White Diamond Mining Company* provides valuable insight into the work undertaken during this time at the

Jagersfontein diggings. The report provides the following description of work undertaken during this period: "*Floating reef cleared was 4 360 loads, yellow ground washed, 92 950; yield 9 426¾ carats; cost per load 4/3 and working profit £5 745.6.7. Capital was £53 000, reserve £6 600.*" (Le Barrow, 1970:88).

Even though some claims were worked well and provided good results, the Jagersfontein diggings continued to lag behind the diamond diggings and mines around Kimberley, which persisted in being the main focal point for miners and investors. A massive problem faced by Jagersfontein was claim speculation, where owners of claims at Jagersfontein would not work their claims but simply aimed to sell them for a profit. In some cases, these claim speculators resorted to seeding their claims with diamonds from other claims and mines. With many of the claim speculators not resident at Jagersfontein, the town continued to suffer (Philip, 2016).


THE NEW JAGERSFONTEIN
Mining and Exploration Company,
LIMITED.

CAPITAL - £1,000,000.
In 100,000 Shares of £10 each, fully paid up.

DIRECTORS:
L. BREITMEYER, Chairman.
W. MILLER, Managing Director.
A. BEIT
E. BERNHEIM.
A. SAALFELD
W. H. BEDDY
H. MOSENTHAL.
D. KERR
C. REID.
J. PAM
S. KERR.
S. DODD.

SECRETARY.
NELSON S. GIRDLESTONE.

SOLICITORS:
Messrs. COGHLAN & COGHLAN.

BANKERS:
THE STANDARD BANK OF SOUTH AFRICA, Ld.

LONDON COMMITTEE:
G. J. S. MOSENTHAL. J. POLSON. J. WERNHER.

LONDON SECRETARY,
T. J. SEEL.

Figure 17 - The title page for one of the early annual reports of the New Jagersfontein Mining and Exploration Company. Many of the directors of this company were early claim-holders at the Jagersfontein diggings (Africana Library).

A significant improvement for Jagersfontein was the establishment of the *New Jagersfontein Mining and Exploration Company* in January 1887, primarily by people with experience of the Kimberley Mines. The company aimed to acquire and amalgamate all the claims at the Jagersfontein diggings

(Philip, 2016).

By March 1889, the *New Jagersfontein Mining and Exploration Company* already owned the Kohinoor and Kerr Companies and by this time had taken over 44 claims from the President Company, 164 from the East End Syndicate and nine claims from A. Wertheim, providing it with a total of 827 claims in the Jagersfontein diggings. The New Jagersfontein Company also had by this time bought 449 shares in the *Kimberley Central Mining Company,* which were later exchanged for 9 878 shares in the newly established *De Beers Consolidated Mines Limited*. The company also acquired three-quarters of the shares of the *Jagersfontein Mine and Estate Company*, making it the most significant player in the Jagersfontein diggings. At the time, the New Jagersfontein Company offered to amalgamate the *Jagersfontein United Company*. This offer was declined as the owners of the latter company felt that their claims were producing some of the highest quality diamonds in the world at the time (Le Barrow, 1970).

Meanwhile, the *Jagersfontein Mine and Estate Company*, which by 1891 was entirely owned by the New Jagersfontein Company, purchased the entire Jagersfontein farm from Jacoba Visser for an amount of £89 000. It is said that Mrs. Visser subsequently retired to her other farm Schraalfontein (Le Barrow, 1970). Philip (2016) states that this sale of the farm was by public auction after Jacoba Visser's death in 1887.

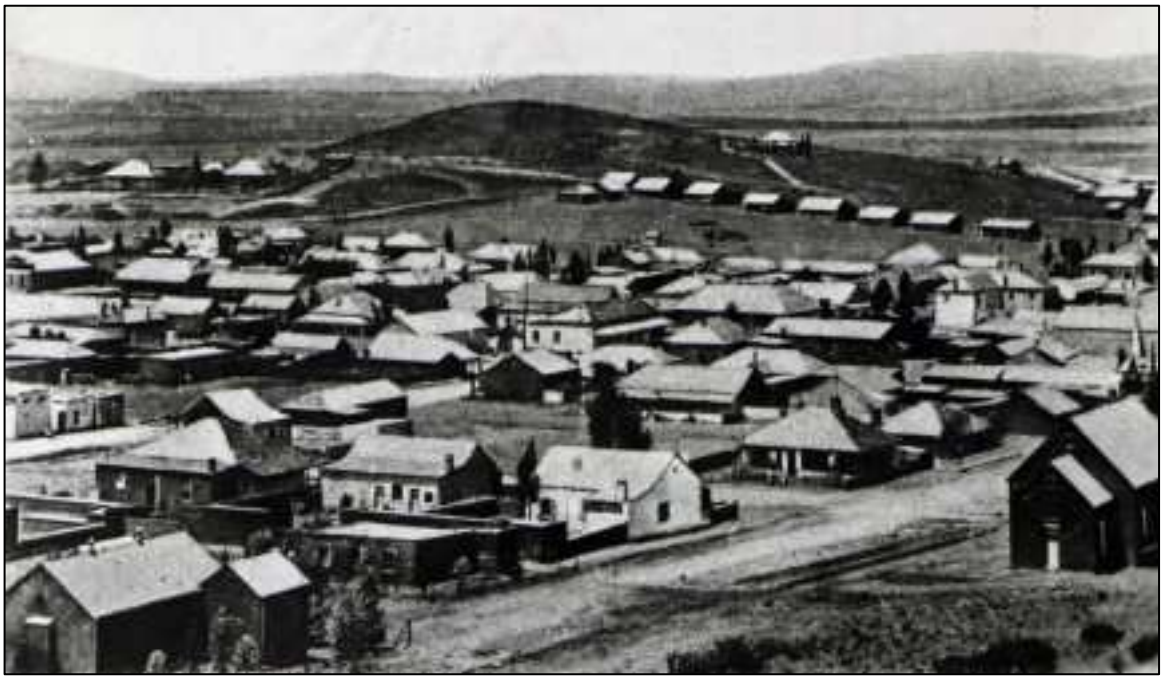


Figure 18 – An early photograph of the town of Jagersfontein. This image was taken in c. 1890 (Free State Archives, Photographs, 5374).

The acquisition of the farm by the *Jagersfontein Mine and Estate Company* "*…benefited the town as it was now run like a business. Prior to this, there were numerous complaints about the fact that Mrs Visser did not use any of the rental collected for property stands towards the upkeep of the*

town. Primitive methods, scarcity of water and lack of sufficient capital, however, made for little success at Jagersfontein during its early years of existence." (Philip, 2016:83).

A report published in 1890 indicates that the Jagersfontein diggings were by now owned by only two companies, namely New Jagersfontein and Jagersfontein United. The former held 847 claims and reduced its requirements for labour and horses by constructing a mechanical haulage for £9 000. The New Jagersfontein's output in diamonds from its 847 claims for the year totalled £216 674, whereas the Jagersfontein United's output in diamonds from its 277 claims was merely £13 326 (Le Barrow, 1970).

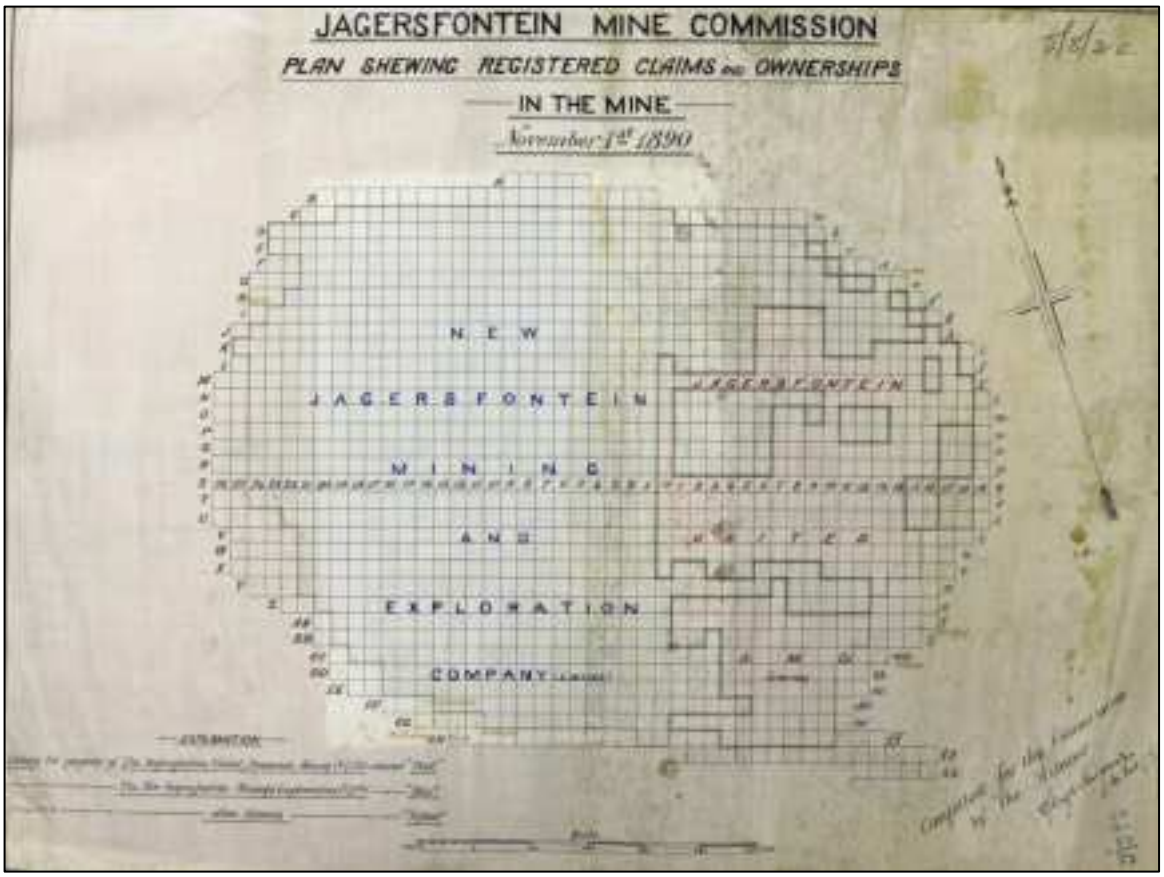


Figure 19 – This plan of the Jagersfontein diggings was compiled by George Kilgour on 1 November 1890 (Free State Archives, Maps, 2/265). It clearly shows how the Jagersfontein diggings had by this time almost exclusively passed into the hands of two dominant mining companies, namely New Jagersfontein and Jagersfontein United.

When the Jagersfontein United Company's bank, the Cape of Good Hope Bank, closed its doors on 20 September 1890 (Terry, 1979), the company had no alternative but to merge with the New Jagersfontein Company. This amalgamation took place in 1891. Except for four shares of £1 each, the *New Jagersfontein Mining and Exploration Company* was by now the sole owner of the Jagersfontein mine (Philip, 2016).

This merger of 1891 also meant that New Jagersfontein was now the second-largest diamond mining company in the world, surpassed only by Cecil John Rhodes's *De Beers Consolidated*

Mines Limited (Le Barrow, 1970). As Rhodes was one of the newly amalgamated New Jagersfontein company's directors, it was also at this juncture that Rhodes and De Beers first became involved at Jagersfontein (Philip, 2016).

Le Barrow (1970:88) indicates that the 1890s was a decade of "…*progress and prosperity and by 1899 New Jagersfontein shared with the De Beers Group the distinction of being one of the most modern and efficient diamond mines. It achieved this distinction despite several handicaps: it was not served by a large railway line and large and heavy machinery had to be tediously brought by ox wagon*."

The decade of 'progress and prosperity' started with William Miller's appointment as mine manager in 1891. During his tenure, the mine's entire boundary, stretching for a distance of 8 miles (12.8km), was fenced and a compound for black mineworkers built. During this period, W. Wagner was appointed as mine inspector as well (Barnard et al., 1982).

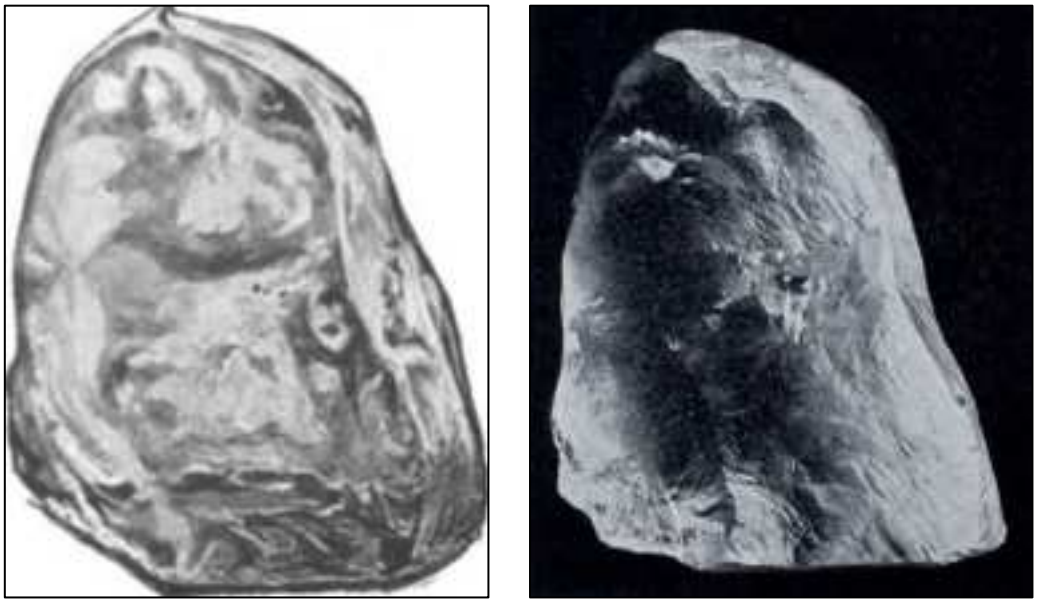


Figure 20 – Two depictions of the Excelsior diamond. The photograph on the left is believed to have been taken of the actual uncut diamond (www.wikipedia.org), whereas the image on the right is of a replica of the uncut diamond (Wagner, 1971:358).

One of the most significant events during the 1890s at Jagersfontein was the discovery on 30 June 1893 of a 995.20-carat diamond, named the *Excelsior*. It was the largest diamond ever discovered up to that point, a record only surpassed 12 years later with the discovery of the Cullinan diamond. The *Excelsior* is described as a "…*magnificent blue-white stone…(that) yielded 21 gems when cut, ten of them weighing between 10 and 70 carats*…" (Le Barrow, 1970:85). Although the name of the discoverer of the *Excelsior* diamond is not recorded, it is known that he was a black mine worker. He received a reward of £500 and a horse with bridle and saddle for his discovery (Barnard et al., 1982).

According to the Annual Report of New Jagersfontein submitted on 30 May 1894, a total of 2,041,015 loads were extracted from the mine pit during the preceding year. These loads refer to cocopan or truck loads, each measuring approximately 16 cubic feet (0.45307 cubic meters). Of this total, some 351,183 loads comprised floating reefs and stones, whereas approximately 1,693,637 loads comprised ground. These loads comprising ground were washed and yielded 203,708 carats of diamonds (The Mining Manual, 1895). A simple calculation of the figures in this paragraph indicates that a total volume of 924,722.67 cubic meters of material was extracted from the mine pit during the year reported on in the Annual Report alone.

A second record-breaking diamond of 634 carats was discovered at Jagersfontein during November 1895. Initially named the *Reitz* diamond in honour of the fifth State President of the Free State Republic, the 239-carat gem that was obtained from it was later renamed *Jubilee* when Queen Victoria's sixtieth year as monarch was celebrated in 1897 (Le Barrow, 1970) (Barnard et al., 1982).

Another Annual Report of New Jagersfontein was submitted on 31 March 1900, and reports on a period that can be considered tumultuous in the history of South Africa. This is as the South African War (also known as the Second Boer War or Anglo-Boer War) broke out on 11 October 1899. According to this Annual Report, a total of 1,301,076 loads (2,301,076?) were extracted from the mine pit during the preceding year. Of this total, approximately 1,670,935 loads were washed and yielded 183,349 carats of diamonds (The Mining Manual, 1902). If the total number of loads from this year can be taken as 2,301,076, a total volume of 1,042,548.50 cubic meters of material was extracted from the mine pit during the year reported on in the Annual Report alone.

5.2.4 Jagersfontein during the Twentieth Century

The South African War (also known as the Second Boer War or Anglo-Boer War) broke out on 11 October 1899. It was a war fought between Great Britain on the one side and the two Boer republics of the Transvaal and Free State on the other.

British forces under the command of General Ralph Arthur Penrhym Clements occupied Jagersfontein on 27 March 1900. Subsequently, Major King-Hall, the District Commissioner for the Jagersfontein and Fauresmith Districts, established his headquarters at Jagersfontein (Barnard et al., 1982).

Early on the morning of 16 October 1900, a Boer commando under Commandant Petrus Johannes Visser attacked the British position at Jagersfontein. This commando fell under the overall command of General (later Prime Minister) JBM Hertzog, who spent part of his childhood in Jagersfontein and whose mother was a resident of the town at the time. Although the British held a defensive position comprising two forts south of Jagersfontein and a range of low hills to the town's west, the Boer attack was supported by the fact that several Boers was able to slip into town

the previous night. Additionally, once the attack started, several residents of Jagersfontein, including women, actively joined in the fight. The prison was also attacked, and Boer prisoners set free. The British losses resulting from the skirmish were nine killed and 12 wounded, whereas on the Boer side, 28 men were killed, including Commandant Visser (Wilson, 1902).

Quite likely, due to the attack of 16 October 1900, all work at the Jagersfontein mine was halted during October 1900 (The Mining Manual, 1902).

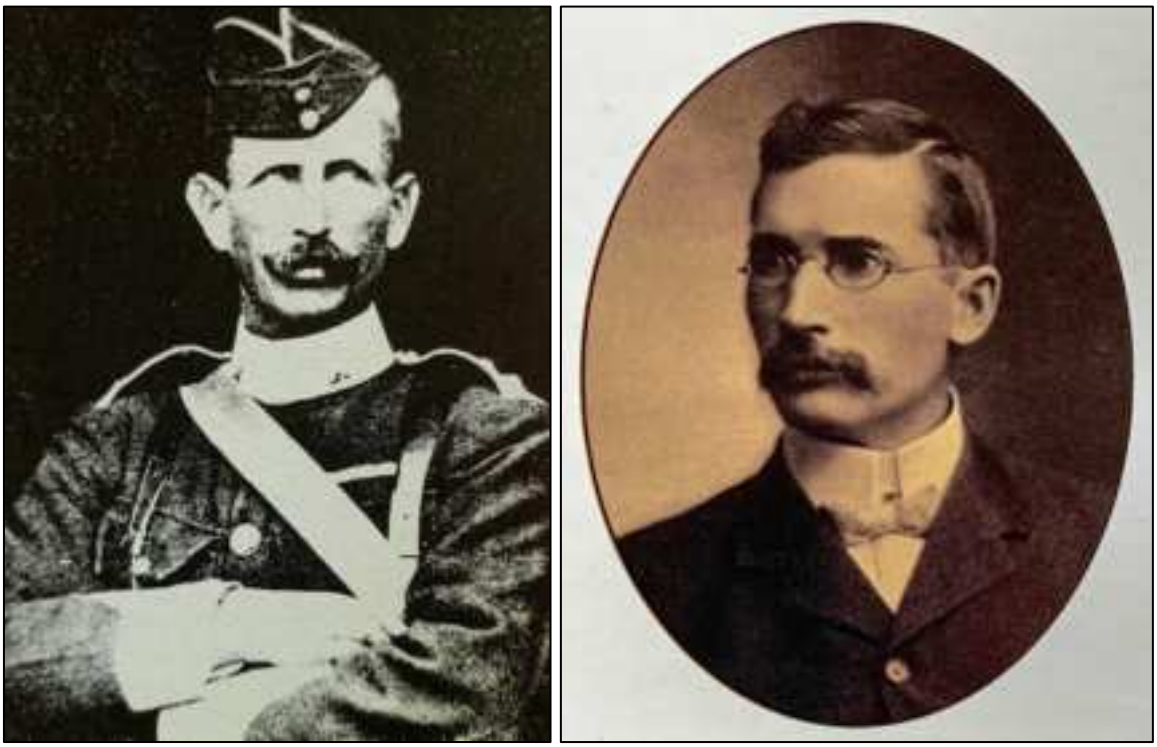


Figure 21 – General RAP Clements (left) occupied Jagersfontein on 27 March 1900 (Wulfsohn, 1992). General JBM Hertzog was the Boer forces overall commander during the attack on Jagersfontein on 16 October 1900. General Hertzog, later Prime Minister of South Africa, spent part of his childhood in the town of Jagersfontein (Raath, 2007:401).

On 25 December 1900, Christmas Day, the British Military Authorities decided to abandon Jagersfontein and Fauresmith and withdraw to a stronger position at Edenburg. The residents of these towns were ordered to limit their luggage to 30 pounds each and travel together to Edenburg. The resulting convoy that departing from Jagersfontein that morning was seven miles long and travelled for four days before eventually reaching Edenburg (Barnard et al., 1982).
The impact of the war on the mine was significant. No work was undertaken from October 1900 to March 1901, whereas the mine also suffered war expenses to the value of £9,7474 (The Mining Manual, 1902).

Mining continued at the end of the war, and Jagersfontein was eventually connected with the large cities of South Africa by railway line in 1905 (Le Barrow, 1970). However, events far removed from this dusty spot on the Free State landscape would eventually ring the ‘death knell’ for the New

Jagersfontein company (Philip, 2016:86). An economic depression in 1908 in the United States led to a reduction in the market for diamonds, which resulted in massive retrenchments on the diamond mines of South Africa (Philip, 2016).

Figure 22 – These two images provide depictions of the same historic photograph. This photograph was taken during the first decade of the twentieth century. The top image shows the town of Jagersfontein in the foreground, with a section of the Jagersfontein Mine visible in the back. The bottom image provides a more detailed view of the area showing the mine. Interesting observations to be made from this depiction include the headgear from the original mine shaft with an associated track for cocopans. A large warehouse (possible the winder house) can be seen next to the headgear, with the compound behind it. A row of buildings, quite likely for housing steam engines associated with hoisting activities at the mine pit, can be seen in front of the headgear. Sections of the mine pit are also visible (Free State Archives, Photographs, 2011).

Despite these financial setbacks, several improvements and changes were made to the way mining was undertaken during the early twentieth century. In 1904, work commenced on the sinking of an underground mine shaft. The first skip was hoisted from this shaft in February 1911. Philip (2009:12) states that the "*…main hoisting level was at a depth of 900 ft and blue ground above this level was removed by inclined chambering from working levels approximately 60ft apart*". In 1911 alone, several mining machines were installed that became so crucial to the mine's running that they were maintained and served the mine for the remainder of its life. These include a steam-driven rockhoist by the British company *Yates & Thom Limited*, a manhoist and Woolwash pumps

(Le Barrow, 1970). All open pit mining at Jagersfontein was finally halted in 1913 (Philip, 2009).

What further increased the concerns for the future of Jagersfontein were the events that unfolded on Friday, 9 January 1914. These events occurred in the wake of the widely supported mining and industrial strike of 1913 and started when several hundred Sotho mineworkers at the New Jagersfontein mine refused to go underground. They were met by a group of white workers armed with rifles, revolvers and shotguns, who proceeded to fire into the black mineworkers, killing at least 16 and wounding 36 (Hirson et al., 1987). When the First World War broke out some six months later, on 28 July 1914, the preceding decade-and-a-half's cumulative economic impacts forced the halting of all diamond washing activities at New Jagersfontein. The washing of diamonds continued in 1916, but was halted again when all work at the mine ceased in 1918 (Philip, 2016).

In 1920, shortly after the cessation of the First World War, another economic recession occurred. Additionally, the international diamond market became flooded with Russian diamonds after the Bolshevik (Russian) Revolution. As a result of these two external events, all mining operations at Jagersfontein was halted in 1921. Work was only resumed in November 1922 (Philip, 2009). A few years later, in 1925, a power station was built at the Jagersfontein Mine (Le Barrow, 1970).

Additional setbacks for the mine comprised the discovery of alluvial diamonds at Alexander Bay and Lichtenburg in 1926 and 1928, respectively, and of course significantly, the Wall Street Crash of 1929 and the years of economic hardship and recession after that known as the Great Depression (Philip, 2009).

In 1932, during the Great Depression, all work at the mine was halted, barring pumping and general maintenance. The mine remained closed until 1949. The re-opening of the mine in 1949 is directly associated with the mine's ownership by the *De Beers Consolidated Mines Limited*. De Beers was initially appointed in 1931 as the secretaries and consulting engineers for the Jagersfontein Mine. In 1940 De Beers signed a 10-year lease agreement with the owners of the Jagersfontein Mine. This lease agreement was renewed for the following decades. In 1946 De Beers instructed their engineers to plan for the re-equipping and re-opening of Jagersfontein Mine. During this period, various new developments and mining infrastructure were added at the mine, including the construction of an entirely new plant to handle the crushing, washing and extraction of the kimberlite (Philip, 2009). Additionally, the use of trucks (cocopans) above and below ground was replaced entirely by conveyor belts, and the method of mining changed to the block cave system. The implementation of this system at Jagersfontein represented the first use of the block cave system anywhere in South Africa. Further improvements made during this period include installing a crusher underground and the construction of 144 houses for staff (Le Barrow, 1970).

Production of the new Jagersfontein Mine commenced in July 1949, and the mine was officially re-opened on 12 December 1949. The mine remained in production until 28 May 1971 (Philip, 2009). Le Barrow (1970) indicates that an estimated 9.5 million carats, roughly two tons, of diamonds were

recovered at Jagersfontein between 1887 and 1969.

5.3 Mining Methods used at the Jagersfontein Mine

All South African diamond mining operations of the late nineteenth and early twentieth centuries consisted of the same process components. The first of these was the excavation of kimberlite from the ground, followed by the crushing or weathering of the excavated material, then the separation of the larger diamondiferous material from the smaller non-diamondiferous material through a process of washing and the screening and sorting of the diamondiferous material to finally take possession of the stones.

5.3.1 Excavation of Kimberlite

5.3.1.1 Opencast Mining

Since the start of mining activities at Jagersfontein during the early 1870s, all work focused on the surface excavation of claims to access and process the diamondiferous material. This excavation work would have comprised the use of picks and shovels, as well as the miners' bare hands, to open up the Earth's crust. Duminy and Sabatini (2008:11) indicate that the full set of mining implements associated with these early diamond mining activities would have included spades, circular and rectangular sieves, buckets and "…*barrel-like tubs for washing the diamondiferous gravels'*. With time, rudimentary washing machines would also have made their appearance.

By at least 1878, the Jagersfontein diggings were divided into 1,444 claims held individually or in clusters by various claim holders. A vertical band of 32 claims that bisects the diggings along the north-south axis were not allocated to claim holders and appear to have been earmarked for an access road through the diggings. Such roads formed an integral part of the development of all the mine pits associated with diamond diggings in South Africa's interior and provided indispensable access routes and access points throughout these diggings. These roadways became gradually more dangerous due to the increasing depths between the road surfaces and the adjoining excavated claims, coupled with the hollowing out of the ground underneath the roadways by enthusiastic miners. These roadways were eventually closed-off and included in the excavations.

As the diggings got deeper, the hoisting of excavated kimberlite from the claim floors to the surface for screening and processing became increasingly difficult and expensive. The *Fauresmith Diamond Mining Company* started using scotch carts by 1878 to transport diamond-bearing blue ground from the claims by way of inclined roadways to the surface. With the deepening pit, whims would undoubtedly have been used at Jagersfontein as well. The whims' working comprised a circular movement, the direction of which defined whether the attached ropes or cables were lowered or raised. These ropes and cables from the whims would have been connected to pulleys or hoists on raised structures of wood and other materials located near the pit's rim. Duminy and Sabatini (2008:37) indicate that hand-operated whims were first used at the diamond mines around

Kimberley and stated that these whims "…*worked on the simple winch principle. A rope could be lowered and raised into the deepening pit using a simple hand operated winch. However, as mining increased in both depth and volume, the open pit grew even deeper, thus the manual labour required to operate the whims increased to the point that horses and mules were introduced…it was not long before steam operated winding engines replaced the horses and mules*."

Although Barney Gomperts installed Jagersfontein's first steam gear in 1878, it is not clear whether this four horsepower vertical engine was used for hoisting or washing. What is known is that by November 1890, the open pit at Jagersfontein had as many as twelve steam-driven 'hauling gears', with a thirteenth one in the process of being constructed. These 'hauling gears' consisted of a steam engine, a box, jumper and dual cable system. These features are all depicted on a map titled '*Jagersfontein Mine Commission: Sketch of Workings*' compiled by George Kilgour in November 1890. While the steam engines provided the power for running the dual cable haulage system, it seems likely for the boxes to have been the structures to which the kimberlite material was brought and the jumpers to have been situated around the rim as pulleys or hoists to lift the circular steel drums over the mine pit's edge. This haulage system appears to have comprised a fixed system of two cables running parallel to one another, along which circular buckets of steel fastened to four-wheeled platforms were hauled up to the surface using a separate set of ropes or cables powered by a steam engine. Although this map does not provide enough details to confirm whether the steam engines were portable (with wheels) or stationary (without wheels) ones, it does depict a number of steam engines in use at Jagersfontein at the time. These depicted steam engines are:

- Davey Paxman (16 Horse Power) - 4
- Davey Paxman (32 Horse Power) – 1
- Hornsby (20 Horse Power) – 1
- Hornsby (25 Horse Power) - 1
- Ransome & Sims (16 Horse Power) – 1
- Ransome & Sims (20 Horse Power) – 3
- Robey (25 Horse Power) – 1

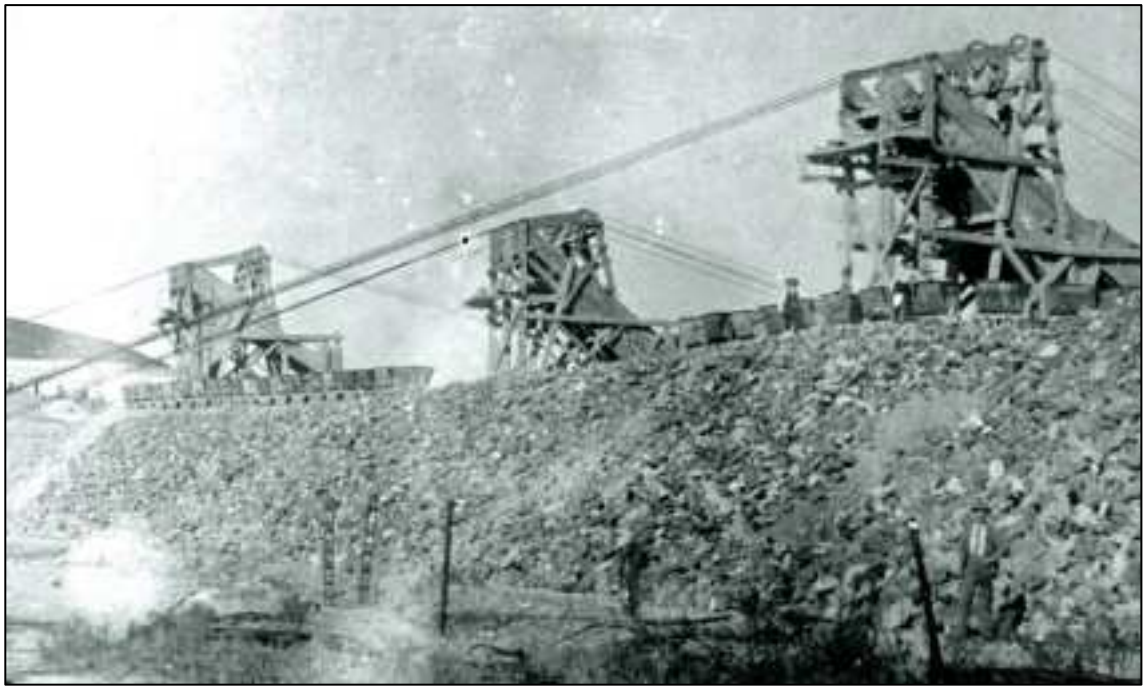


Figure 23 – This historic photograph depicts the headgears of three timber hoists lining the perimeter of Jagersfontein's open pit. These hoists were powered by steam-driven engines and hauled steel drums from the bottom of the pit to the surface. These drums would be tipped over these hoists, and the excavated material channelled along the diagonal wooden structures into waiting cocopans ready for washing (Africana Library).

Figure 24 – This historic photograph of the open pit at Jagersfontein was taken in 1910. It depicts the headgears of two timber hoists lining the perimeter of the open pit at Jagersfontein. Note the associated buildings that would have housed the steam-driven engines (Africana Library).

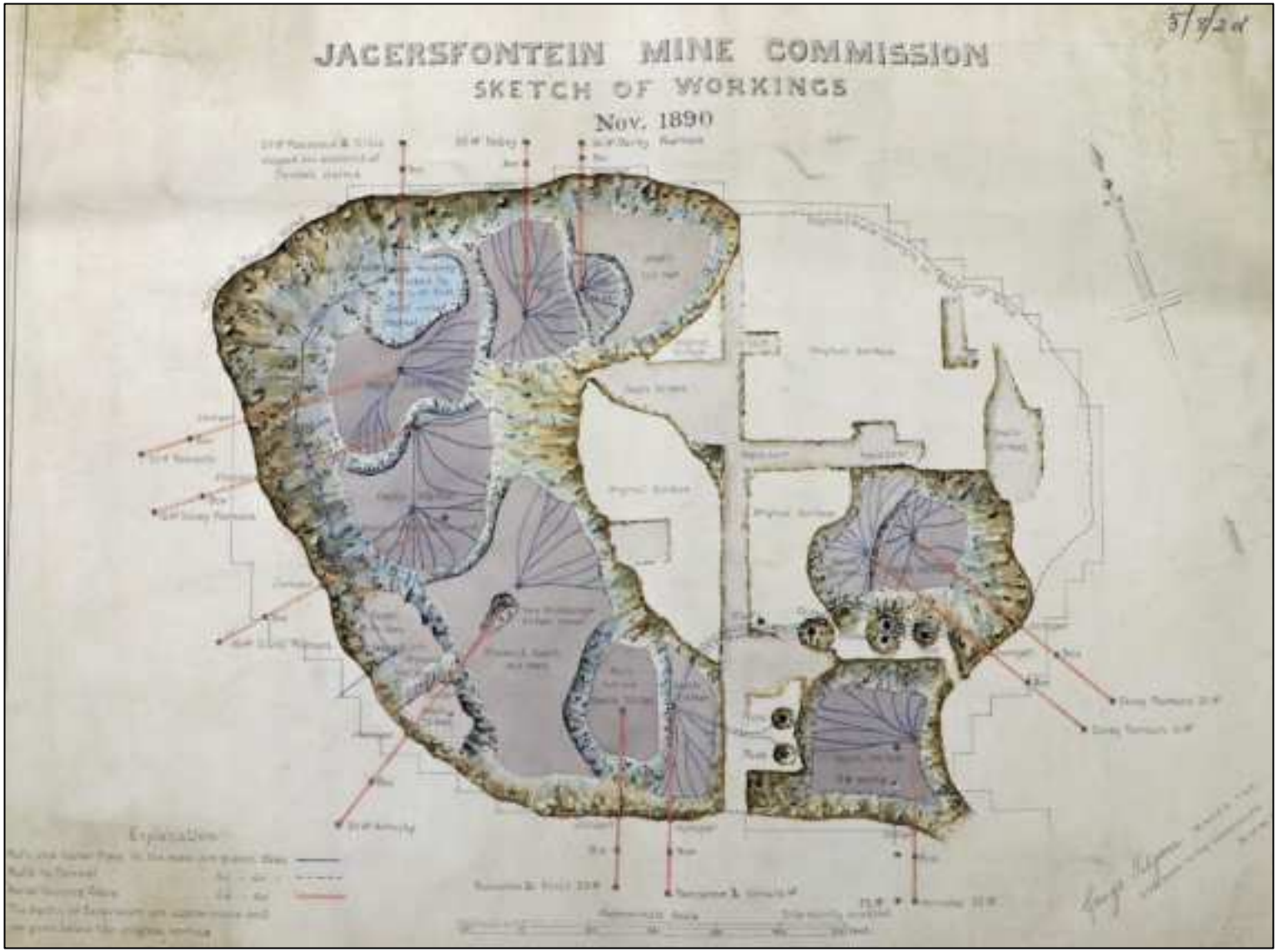


Figure 25 – Archival map of the Jagersfontein Mine compiled in November 1890 (Free State Archives, Maps, 2/286).

Figure 26 – More detailed view of the same archival map (Free State Archives, Maps, 2/286).

This November 1890 map indicates that the base of the excavated mine claims at Jagersfontein was strewn with cocopan tracks, which spread out in a fan-like fashion from a loading station at the bottom of each hauling gear to various positions around this part of the mine pit. The map depicts these track ends in different places, suggesting that the tracks could be moved with relative ease across the base of the mine pit to positions where the cocopans were required at a particular time. Once filled with excavated material, the cocopans were manhandled to the various points where these tracks converged. Here these cocopans' contents would have been transferred to the buckets from the haulage gears and hoisted to the surface for washing and processing. One of the images from **Figure 15** depicts such a loading station at the Jagersfontein Mine.

Figure 27 – Historic postcard depicting a loading station at a depth of 400 feet inside the mine pit at Jagersfontein. The postcard dates to 1910. It forms part of the Richard Oliver Postcard Collection and was made available to the author by the kind permission of Mr Richard Oliver.

The November 1890 map also illustrates, that although the western half of the mine pit has been extensively worked to depths of up to 285 feet, significant sections of the eastern half of the mine pit had not yet been excavated at all. The deepest excavated depth in this eastern half is shown to be only 135 feet. The location of the steam-driven hauling gear also enforces this difference, with nine of the twelve hauling gears installed in the western half of the mine pit and only three in the eastern half. The reason for this apparent disparity between the western and eastern halves of the mine pit can in all likelihood be found in the ownership of these two sections of the mine pit, with the western half by this stage owned by the New Jagersfontein company and significant sections of the eastern half of the mine owned by the Jagersfontein United company.

Figure 28 – Historic postcard depicting some of the men responsible for the excavation of the mine pit at Jagersfontein. It forms part of the Richard Oliver Postcard Collection and was made available to the author with the kind permission of Mr Richard Oliver.

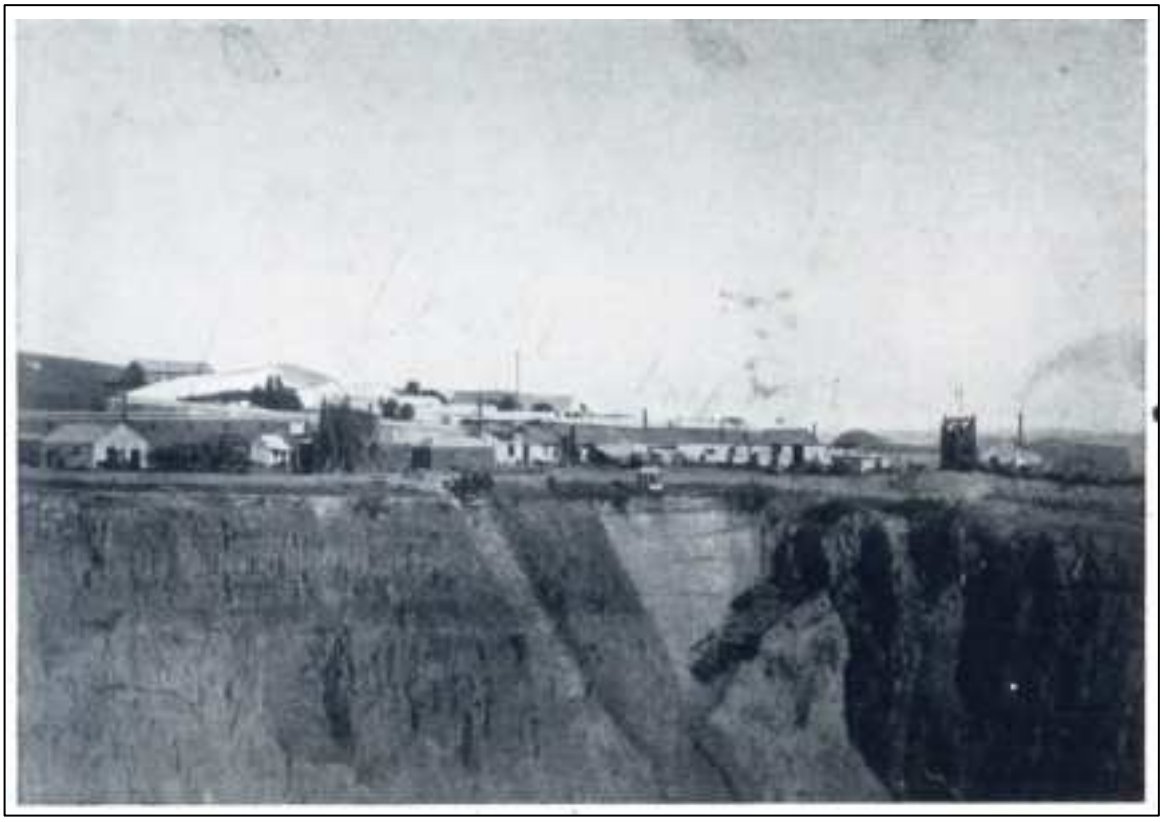


Figure 29 – Historic photograph taken in 1910, which depicts the edge of the mine pit. A number of buildings and structures associated with the mining and extraction of material from the pit can be seen, including several that they were used to house steam-driven engines (Africana Library).

Figure 30 – Historic photograph of the mine pit at Jagersfontein. This photograph depicts the viewing platform erected in 1925 in preparation for the planned visit to the mine by The Prince of Wales (later King Edward VIII) (Africana Library). Although undated, it is believed that this image likely dates to the second half of the twentieth century. The depiction of the crushing and washing plan that was built during the late 1940s (see background on the left), and the clothing worn by the figure in the foreground, support the suggested date.

5.3.1.2 Underground Mining

In 1904, work commenced on the sinking of an underground mine shaft.

The first skip was hoisted from this shaft in February 1911. Philip (2009:12) states that the "*…main hoisting level was at a depth of 900 ft and blue ground above this level was removed by inclined chambering from working levels approximately 60ft apart*."

During 1911 alone, several mining machines were installed to assist with the underground mining and new shaft, including a steam-driven rockhoist by the British company *Yates & Thom Limited* as well as a manhoist (Le Barrow, 1970).

All open pit mining at Jagersfontein was finally halted in 1913 (Philip, 2009).
During the late 1940s, at roughly the same time that the new washing and crushing plant was built

near the main shaft, a completely new method of underground mining was commenced with. Known as 'block cave mining', Le Barrow (1970) indicates that this was the very first mine in South African where this mining method was implemented. Other references, such as Rex (1985), rather indicates that the very first experimental implementation of this mining method in South Africa was actually undertaken at the Bultfontein Mine, subsequent to which block cave mining was introduced three South African diamond mines, namely Bultfontein, Dutoitspan and Jagersfontein.

Dr. GC Howell et al. indicates that from "…*about 1947, the mine went underground using a sequence of 'block-caving' mining methods maintained by the main shaft, sub shaft and declines. The workings reached a depth of 865m, with extensive development at all levels to that level.*" (SRK, 2019:5-6).

During the same time that underground mining switched to block cave mining, aa crusher was also built underground "…*to deliver ground ready for immediate treatment…*" (Le Barrow, 1970).

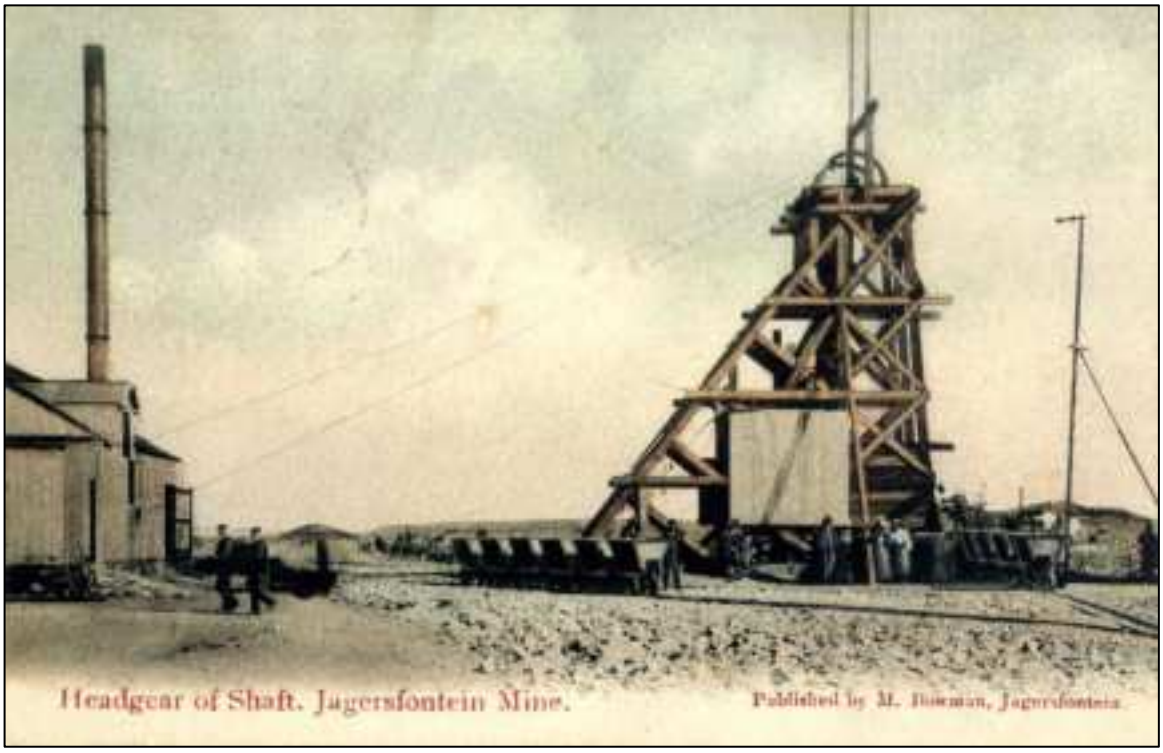


Figure 31 – Historic postcard depicting the original headgear at the first mine shaft at Jagersfontein. The postcard dates to 1910. It forms part of the Richard Oliver Postcard Collection and was made available to the author by the kind permission of Mr Richard Oliver.

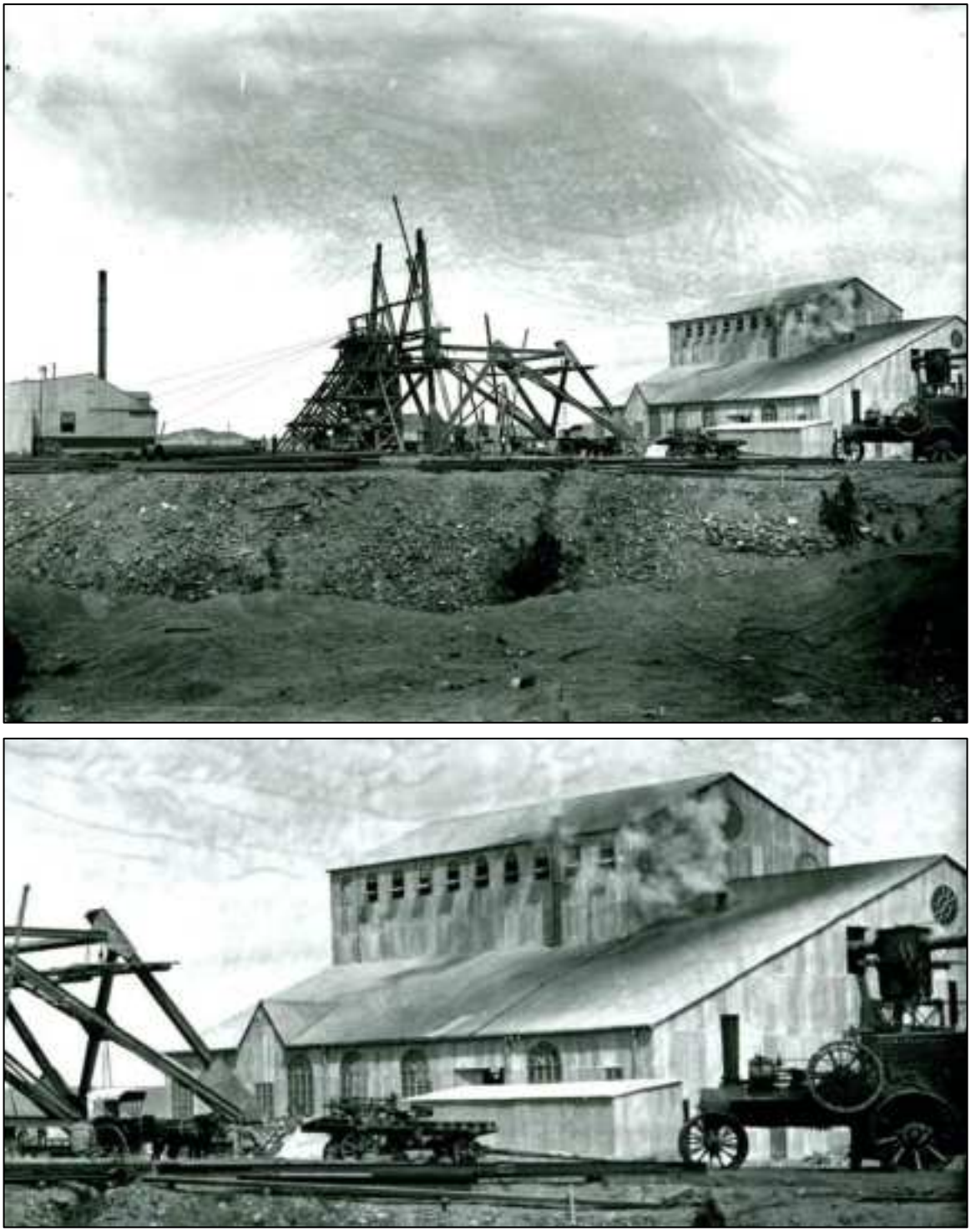


Figure 32 – These two images provide an uncropped and cropped version of the same historic photograph. The top, uncropped image depicts the older existing headgear in the back with a second, more sturdy headgear in the foreground, which was still under construction when this photograph was taken. Although the photograph is undated, it appears to have been taken during the first or second decade of the twentieth century. This is said as work on the first mine shaft at Jagersfontein was only started in 1904. It is clear from this image that the older headgear shown here is the same headgear as depicted in the previous image. Additionally, as can be seen in the cropped image below, this historic photograph also depicts a scotch cart, ox-wagon and portable steam engine. The portable steam engine depicted here was likely a Davey Paxman, although this cannot be stated for certain. This photograph also shows the buildings associated with this part of the mine, including a massive structure clad with corrugated iron exhibiting highly decorative round arch windows (Africana Library).

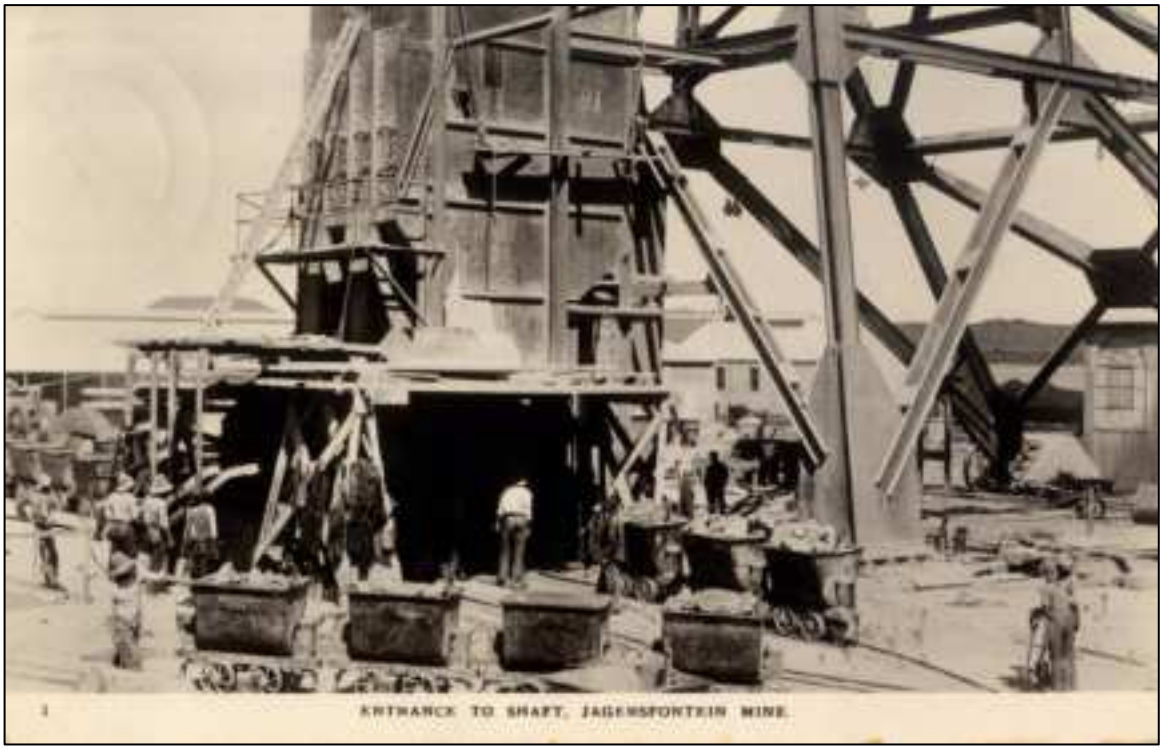


Figure 33 – Historic photograph that was taken in 1915 and that depicts the entrance to the mine shaft at the Jagersfontein Mine. The lower sections of the headgear visible on the right is the same headgear that was still under construction in the previous photograph. Note the use of cocopan tracks to transport the extracted material (Africana Library).

5.3.2 Crushing or Weathering the Diamondiferous Material

The excavated diamondiferous material had to go through a process of either weathering or crushing before it could proceed to the washing phase. From the very start of mining activities at Jagersfontein, undisturbed level sections in the surroundings of the diggings were earmarked as so-called 'depositing floors.' These depositing floors were used at the Jagersfontein Mine from 1871 to its closure in 1931 (Philip, 2009).

The excavated material was transported to these areas in scotch carts and later by mechanical haulage. Once transported to the floors, the diamondiferous material was spread out on the floors at depths of roughly 16 inches to undergo a time-consuming process called 'weathering' whereby the material was constantly exposed to the elements for months on end, thereby assisting with it breaking up and deteriorating. This weathering process was augmented at Jagersfontein by watering and ploughing activities (Philip, 2009).

From available information, including two historic survey diagrams, at least two areas were used for depositing floors at the Jagersfontein Mine. These two areas were indicated to be located on the southern and south-western ends of the mine. The remnants of some of these floors were identified some distance south of the present study area (Philip (2009).

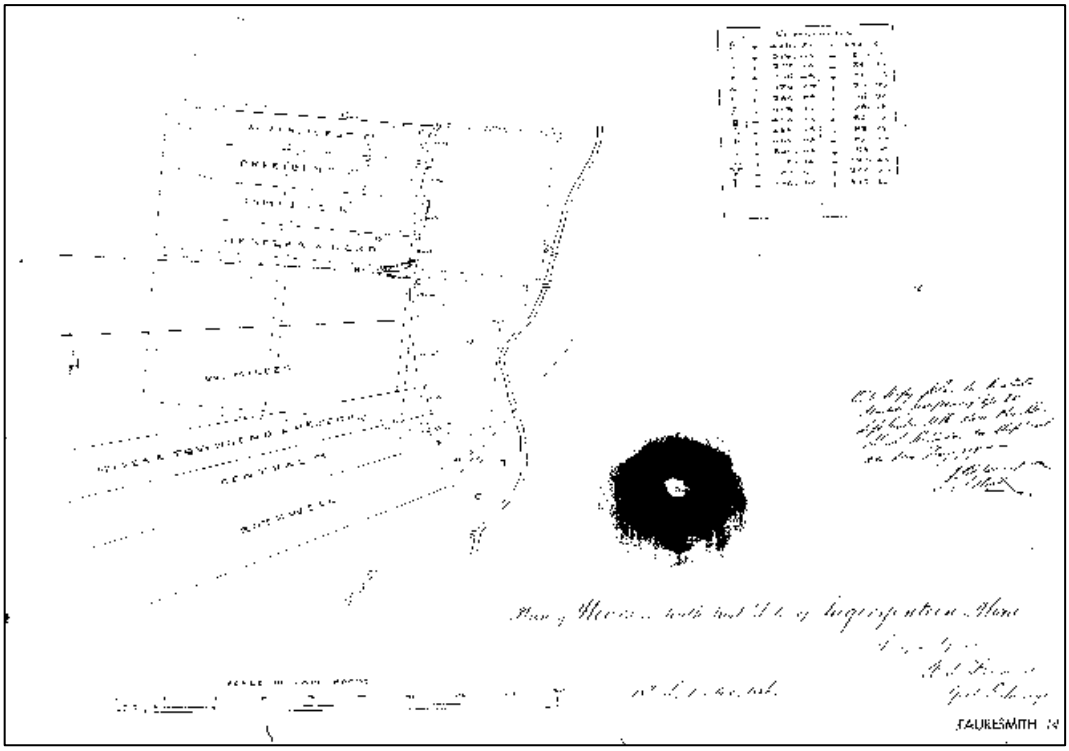


Figure 34 – Survey diagram dated to September 1886, which depicts the depositing floors on the south-western end of the Jagersfontein Mine (www.csg.dla.gov.za).

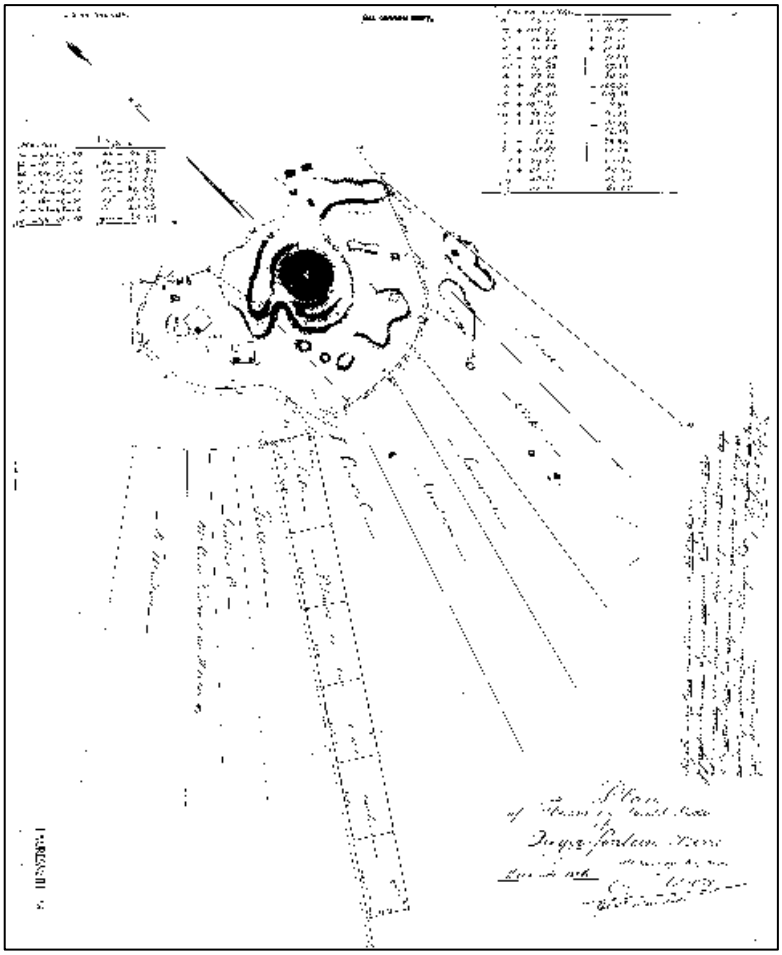


Figure 35 – Survey diagram dated to December 1886, which depicts the depositing floors on the southern end of the Jagersfontein Mine (www.csg.dla.gov.za).

The first crusher was installed at Jagersfontein Mine in 1909, albeit it was at first only used for so-called cylinder-dumps from the washing gears and the processing of 'hardebank' from the mine.

Figure 36 – These two images provide depictions of the same historic photograph. This photograph appears to have been taken during the first decade of the twentieth century and provides an early view of the mine and some of the depositing floors used at the time. Although it is difficult to orientate this photograph accurately, it appears to have been taken from the north by north-east and depicts several houses from the town of Jagersfontein in the foreground. The depositing floors can be seen between these houses and the opencast mine pit. The original headgear with associated buildings can be seen on the other side of the mine pit. What appears to be an old compound can be seen on the right, with a possible farmhouse situated behind it. Philip (2009) suggests that the original compound may have been located in this position, on the north-western end of the mine pit (Africana Library).

During the late 1940s, a modern crushing plant was erected near the mine shaft. Primary and

secondary crushing was undertaken here, which reduced the diamondiferous ground from 6 inches to 1¼ inches (Philip, 2009).

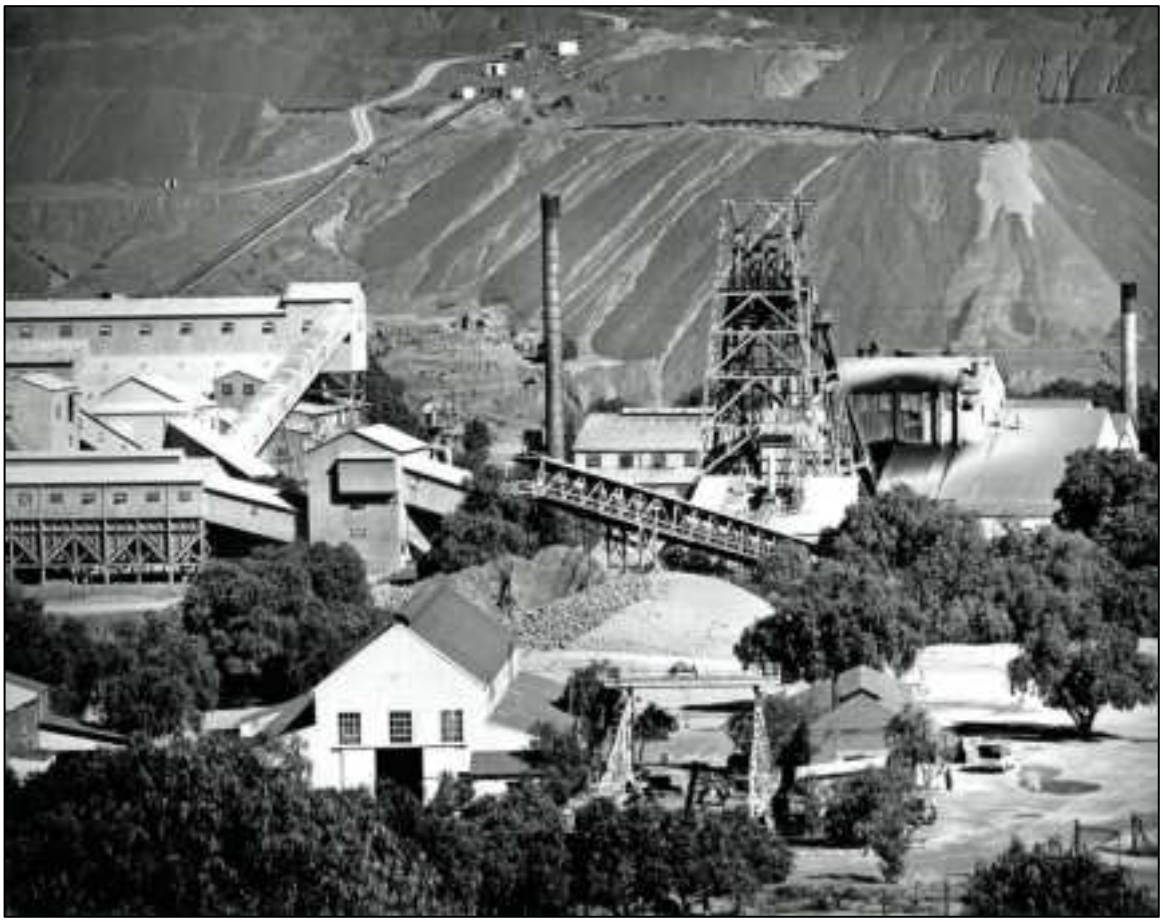


Figure 37 – Undated photograph of the modern and washing plant that was built during the late 1940s (Africana Library).

5.3.2 Washing and Screening of the Diamondiferous Material

As with other diamond diggings around the interior of South Africa at the time, washing and screening activities would at first have been undertaken with circular and rectangular sieves and "…*barrel-like tubs for washing the diamondiferous gravels*…" (Duminy & Sabatini, 2008:11). In fact, due to the lack of water at Jagersfontein, the early washing and screening activities were solely comprised of dry sifting and handpicking the gravels (Le Barrow, 1970). With time, rudimentary washing machines would in all likelihood have made their appearance at Jagersfontein as well. In November 1880, the Imperial Mining Company installed a "…*6 h.p. Robey engine, horizontal boiler, with a pendulum pump. The rotary machine is 12 feet in diameter*…" The installation of this steam-driven washing machine was able to wash an impressive six hundred loads a day (Le Barrow, 1970:87).

Eventually, a total of 14 washing machines were established by the New Jagersfontein company. Nine of these were so-called two-pan plants that were not associated with crushers. As a result,

these two-pan plants were located near the depositing floors. They were often built on top of prominent hills, and mechanical haulage systems had to be built to transport the diamondiferous material from the floors to the plants. The reason for placing these two-pan plants on top of hills was to allow for the easy disposal of tailings by merely discarding it down the side of the hill. These two-pan plants were already utilised before 1900 until 1917-1921 (Philip, 2009).

Five larger washing plants with crushers and rollers were utilised from 1908 onwards. These plants had up to six pans and were operated until 1922 (Philip, 2009).

During the late 1940s, a modern washing and screening plant was erected near the mine shaft (Philip, 2009).

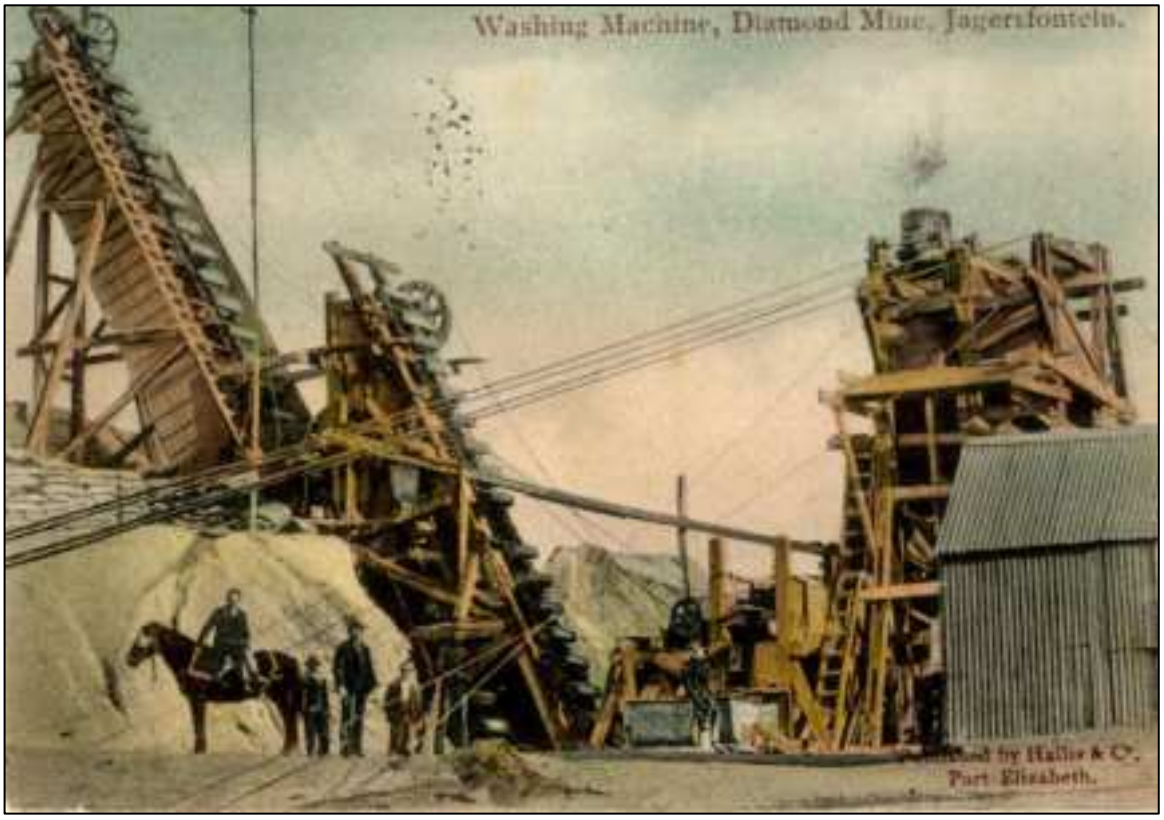


Figure 38 – Historic postcard depicting one of the early washing machines at Jagersfontein. The postcard dates to 1910 and was published by Hallis & Company of Port Elizabeth. The corrugated iron structure partially visible on the right would have housed a steam engine, which appears to have driven the washing machine depicted in this postcard. A headgear of a timber hoist seems to be located behind the steam engine structure. Due to the presence of this timber hoist headgear, it would appear that this early washing machine was located close to the opencast mine pit. Two sets of endless bucket systems are visible on the left, and may have deposited the washed discard material on to the dump visible on the right. The actual washing activities appear to have taken place between the endless bucket systems and the timber hoist headgear. This postcard forms part of the Richard Oliver Postcard Collection and was made available to the author with the kind permission of Mr Richard Oliver.

Figure 39 – Historic photograph that was taken in 1910. It depicts one of the mechanical haulage systems at Jagersfontein. Mechanical haulage was used at the mine to transport excavated material from the open pit and mine shafts to the deposition floors, crushers and washing plants. This photograph also provides a glimpse into the plethora of buildings, structures and infrastructure that were erected at the Jagersfontein Mine to assist with the process of mining, hoisting and extraction of diamonds (Africana Library).

5.2 Historical Maps

An assessment of available archival and historical maps was undertaken as a way to establish a historic layering for the study area. These historic maps are also valuable resources in identifying possible heritage sites and features located within the study area.

5.2.1 First Edition of the 2925CD Topographic Sheet

This section deals with the First Edition of the 2925CD Topographical Sheet. This sheet was based on aerial photography undertaken in 1948, was surveyed in 1949, compiled in 1950 and drawn in 1954 by the Trigonometrical Survey Office.

Overlays of the study area over these map sheets are provided in the image below. The following features can be identified on this depiction of the study area:

- Feature 1

The Jagersfontein Mine Pit is depicted here. A comparison of the outline of the mine pit with its current outline as depicted on a recent Google Earth appears to indicate that its current outline is quite a bit wider than the pit indicated on this topographical map sheet. The reason for this is not exactly certain, but may be attributed to the break back along the pit walls.

- Feature 2

  A cluster of four buildings are depicted within the study area. Three of these buildings were identified during the fieldwork. Refer sites JAG 18, JAG 19 & JAG 20 below.

- Feature 3

  A single building is depicted here. The building was not identified during the fieldwork.

- Feature 4

  A cluster of two buildings is depicted here. No buildings were identified here during the fieldwork.

- Feature 5

  A building is depicted here. This building formed part of a cluster of three buildings, only one of which was located within the study area. This building was identified during the fieldwork. Refer site JAG 16 below.

- Feature 6

  A cluster of at least four buildings is depicted here. These four buildings formed part of a cluster of at least nine buildings, of which only four are located within the study area. These buildings formed part of the plant that was built during the 1940s.

- Feature 7

  A mine dump is depicted here. This dump could not be identified during the fieldwork.

Figure 40 – Detail view of the depiction of the study area (red polygon) and immediate surroundings on the First Edition of the 2925CD Topographical Map Sheet.

5.2.2 Third Edition of the 2925CD Topographic Sheet

This section deals with the Third Edition of the 2925CD Topographical Sheet. This sheet was surveyed in 1988 and published in 1992 by the Chief Director of Surveys and Mapping.

Overlays of the study area over these map sheets are provided in the image below. The following features can be identified on this depiction of the study area:

- Feature 1

  The Jagersfontein Mine Pit is depicted here. A comparison of the outline of the mine pit with its current outline as depicted on a recent Google Earth appears to indicate that its current outline is very similar to the outline depicted on this topographical map sheet.

- Feature 2

  Only one of the four buildings that were depicted on the First Edition map is still shown within the study area boundary. This despite the fact that three of these buildings were identified during the fieldwork. Refer sites JAG 18, JAG 19 & JAG 20 below.

- Feature 3

  A single building is depicted here. The building was not identified during the fieldwork.

- Feature 4

  No evidence of these two buildings depicted on the First Edition is shown on this Third Edition map. No buildings were identified here during the fieldwork.

- Feature 5

  A building is depicted here. This building formed part of a cluster of three buildings, only one of which was located within the study area. This building was identified during the fieldwork. Refer site JAG 16 below.

- Feature 6

  Only one of the buildings depicted on the First Edition map is still depicted here on the Third Edition map. This building formed part of the plant that was built during the 1940s.
- Feature 7

A mine dump is depicted here. This dump could not be identified during the fieldwork.

- Feature 8

  A monument is depicted north of the study area. It is not presently certain what this monument commemorates.

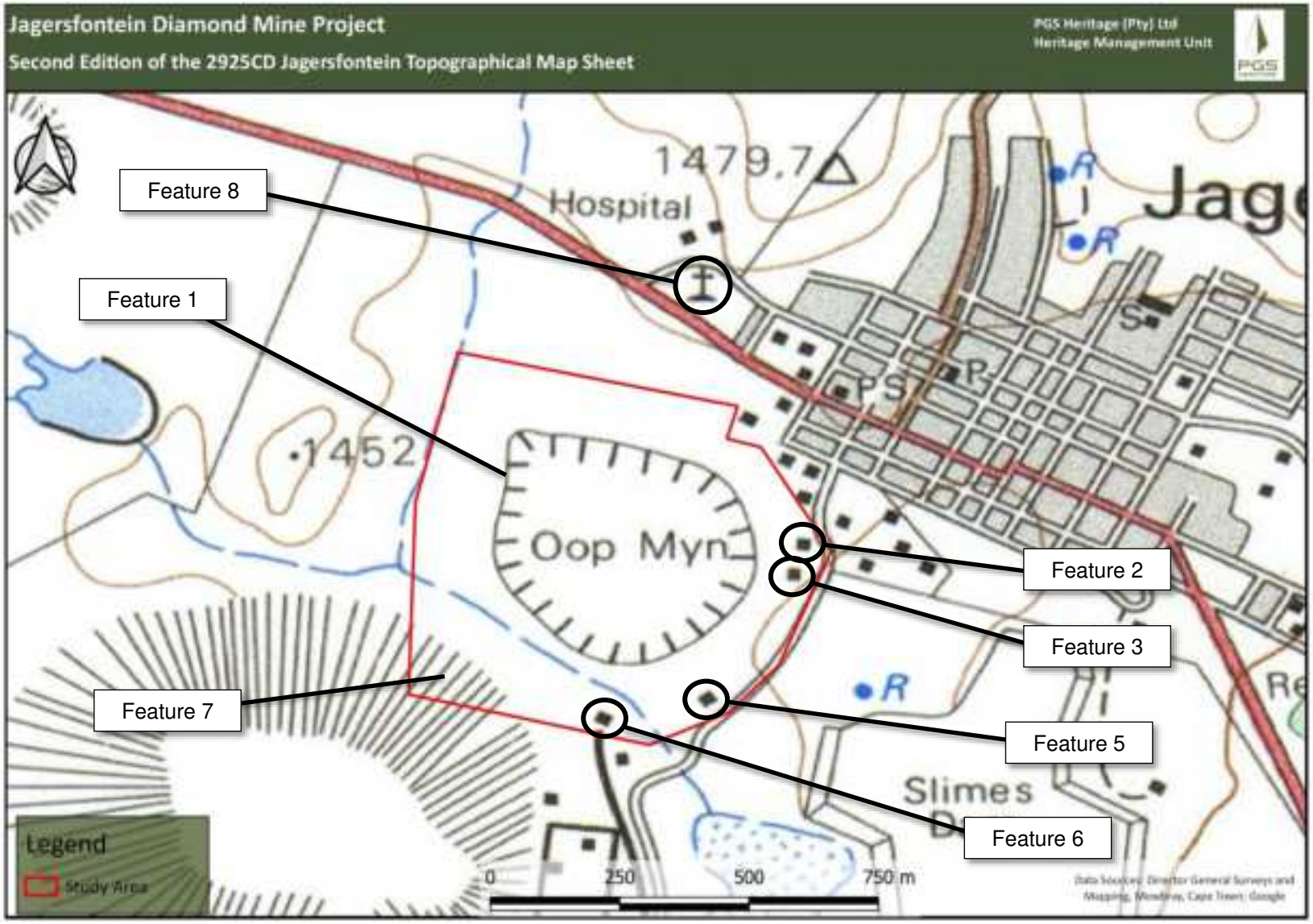


Figure 41 – Detail view of the depiction of the study area (red polygon) and immediate surroundings on the Third Edition of the 2925CD Topographical Sheet.

Figure 42 – This map depicts the changing outline of the mine pit as depicted on the First (1948) and Third (1988) Editions of the 2925CD Topographical Sheet. The pit outline as depicted on the First Edition is shown in pink, whereas the outline on the Third Edition is shown in green. The study area is in red.

5.2 Aerial Photographs

The study of the depiction of a particular study area on old aerial photographs assists with the identification of heritage sites, establishing ages of identified buildings and structures and provide an overview of the changes taking place in a landscape over time.

Aerial photographs of the study area dating to 1948 and 1973 were obtained from the Chief Directorate: Geo-Spatial Information of the Department of Rural Development and Land Reform in Cape Town.

5.2.1 Aerial Photograph taken in 1948

This section deals with the aerial photograph that was taken in August 1948 (NGI, Aerial Photographs, 214_001_25490).

An overlay of the study area boundary over the relevant section of this aerial photograph is provided in the image below. A number of features can be identified on this depiction of the study area. These are as follows:

- Feature 1

  The Jagersfontein Mine Pit is depicted here. Although this aerial photograph was not taken directly from above, a comparison of the outline of the mine pit depicted on this aerial photograph with its current outline as depicted on a recent Google Earth image, appears to indicate that its current outline is quite a bit wider than the pit indicated on this aerial photograph. The general shape and appearance of the pit is also different when compared with the recent satellite image.

  From the comparison outlined above it would appear that the walls and the perimeter of the mine pit have fallen in over the 73 years since this photograph was taken.

- Feature 2

  A building is depicted here. It was identified during the fieldwork. Refer site JAG 20 below.

- Feature 3

  A building is depicted here. During the fieldwork, the building known as the 'Engineers Office' was identified here Refer site JAG 19 below.
- Feature 4

A bridge is depicted here. This appears to be the same bridge that was identified during the fieldwork. Refer site JAG 21 below.

- Feature 5

  A building is depicted here. It was identified during the fieldwork, albeit a section of the building was removed at an unknown time after 1948. Refer site JAG 18 below.

- Feature 6

  What appears to be a cluster of buildings and structures is depicted on the eastern perimeter of the mine pit. The building cluster was not identified during the fieldwork. This may be due to the fact that at least some of these buildings and structures may have fallen into the mine pit.

- Feature 7

  What appears to be a building is located here. The building was not identified during the fieldwork.

- Feature 8

  The old access road into the mine is depicted here. A comparison of the layout of this original access road and the one currently found on site clearly shows that the southern section of this road was straightened and moved further away from the mine pit. It is not exactly certain when this alteration to the road was undertaken. This alteration of a section of the road may have been due to to the fact that this section of the original road was located too close to the perimeter of the mine pit.

- Feature 9

  What appears to be a linear trench, possibly for water runoff, was located here.

- Feature 10

  An extensive cluster of mining-related structures is depicted here. No evidence for any of these structures or buildings could be identified during the fieldwork.

- Feature 11

  What appears to be several structures or foundations are located here. These structures and foundations are scattered across this section of the study area. A number of poorly

preserved mining-related structures were identified in primarily the southern end of this area. Refer sites JAG 7, JAG 8, JAG 9 and JAG 10 below.

- Feature 12

  Several buildings and structures are depicted here. Only one of these is still located within the study area. Refer site JAG 16 below.

- Feature 13

  The tunnel identified at site JAG 11 is depicted here.

- Feature 14

  Several buildings and structures are depicted here. At the time, this area was where the plant for the mine shaft and the more modern crushing and washing plant were located. During the fieldwork, a dam (refer site JAG 6) and the position of the old mine shaft (refer site JAG 24) were identified here.

- Feature 15

  The bridge and associated retaining wall identified at site JAG 5 are depicted here.

- Feature 16

  A raised linear feature is depicted here. It is not certain whether one of the mechanical haulage systems or conveyor was located here. It eventually crosses over the tunnel at site JAG 11.

- Feature 17

  At least one building is depicted here. This area is known to have been the position where the second mine shaft at Jagersfontein was established. During the fieldwork, a brick structure that was associated with the second mine shaft was identified in this position. Refer site JAG 23.

- Feature 18

  A raised linear feature is depicted here. It seems likely for one of the mine's mechanical haulage systems to have been located here. It eventually crosses over the bridge at site JAG 5.

- Feature 19

  The bridge or tunnel identified at site JAG 3 are depicted here.

- Feature 20

  An extensive disturbed area is depicted here. Sections of this area appear to have been used for one of the mine dumps. The remains of such dumps were identified during the fieldwork. Refer site JAG 17.

- Feature 21

  What appears to be a linear trench, possibly for water runoff, was located here. This trench is shown to run roughly parallel to the perimeter of the mine pit.

- Feature 22

  Two structures are depicted here. The southern structure was not identified and may have fallen down the mine pit. The northern structure appears to be the concrete foundation that was identified during the fieldwork at site JAG 13.

- Feature 23

  A number of disturbances appear to be depicted here. This includes an extensive shallow disturbance which may have been a water drain. Possible structures are also depicted here. Due to the presence of water in this part of the study area, this section was not assessed in the field.

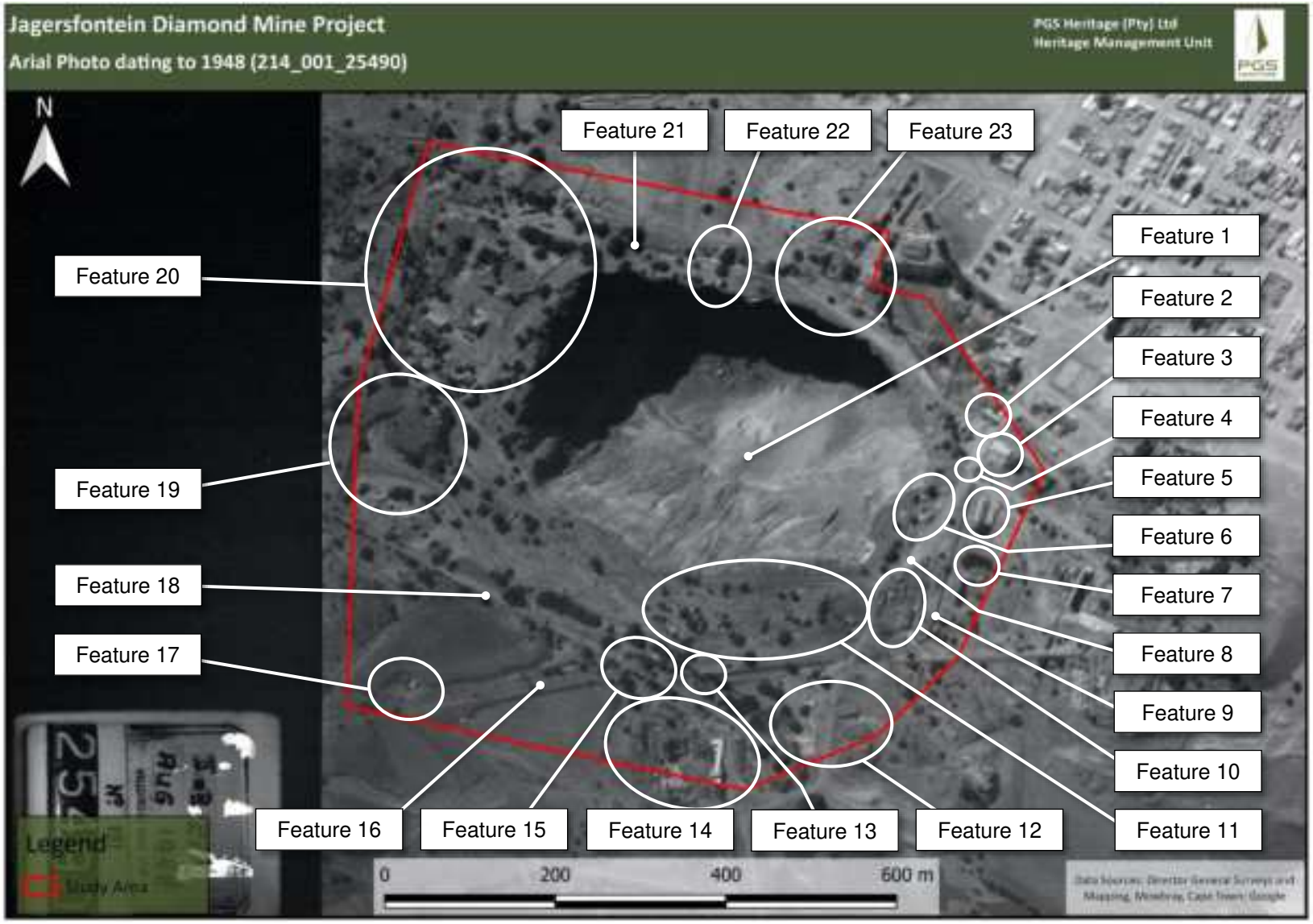


Figure 43 – Detail view of the depiction of the study area (red polygon) on the 1948 aerial photograph (NGI, Aerial Photographs, 214_001_25490).

5.2.2 Aerial Photograph taken in 1973

This section deals with the aerial photograph that was taken in 1973 (NGI, Aerial Photographs, 715_013_00524). An overlay of the study area boundary over the relevant section of this aerial photograph is provided in the image below. A number of features can be identified on this depiction of the study area. Please note that the feature numbers provided in this section do not necessarily correspond to the same feature numbers as discussed above. The following features were identified:

- Feature 1

  The Jagersfontein Mine Pit is depicted here. A comparison of the outline of the mine pit depicted on this aerial photograph with its current outline as depicted on a recent Google Earth image, appears to indicate that its current outline may be slightly different than the pit indicated on this aerial photograph. This appears to indicate that sections of the walls and the perimeter of the mine pit have fallen in over the 48 years since this photograph was taken.

- Feature 2

  A building is depicted here. It was identified during the fieldwork. Refer site JAG 20 below.

- Feature 3

  A building is depicted here. During the fieldwork, the building known as the 'Engineers Office' was identified here Refer site JAG 19 below.

- Feature 4

  A bridge is depicted here. This appears to be the same bridge that was identified during the fieldwork. Refer site JAG 21 below.

- Feature 5

  A building is depicted here. It was identified during the fieldwork. Refer site JAG 18 below.

- Feature 6

  What appears to be a cluster of buildings and structures is depicted on the eastern perimeter of the mine pit. The building cluster was not identified during the fieldwork.

- Feature 7

  The access road into the mine is depicted here. The layout of the access road depicted on this aerial photograph appears to more closely correspond with the access road currently located on site than what was the case with the original access road.

- Feature 8

  A single building is depicted here. This building may have been associated with the cluster of mining-related buildings and structures depicted on the 1948 aerial photograph (refer Feature 10) from previous section. No evidence for this buildings could be identified during the fieldwork.

- Feature 9

  What appears to be several structures or foundations are located here. These structures and foundations are scattered across this section of the study area. A number of poorly preserved mining-related structures were identified here during the fieldwork. Refer for example sites JAG 9 and JAG 10 below.

- Feature 10

  A single building is depicted here. No evidence for this building could be identified during the fieldwork.

- Feature 11

  A single building is depicted here. This building was identified during the fieldwork. Refer site JAG 16 below.

- Feature 12

  The tunnel identified at site JAG 11 is depicted here.

- Feature 13

  Several buildings and structures are depicted here. At the time, this area was where the plant for the mine shaft and the more modern crushing and washing plant were located. During the fieldwork, a dam (refer site JAG 6) and the position of the old mine shaft (refer site JAG 24) were identified here.

- Feature 14

  A large rectangular area is depicted here. This structure formed part of the washing plant.

- Feature 15

  The bridge and associated retaining wall identified at site JAG 5 are depicted here.

- Feature 14

  Several buildings and structures are depicted here. At the time, this area was where the plant for the mine shaft and the more modern crushing and washing plant were located. During the fieldwork, a dam (refer site JAG 6) and the position of the old mine shaft (refer site JAG 24) were identified here.

- Feature 15

  The bridge and associated retaining wall identified at site JAG 5 are depicted here.

- Feature 16

  A raised linear feature is depicted here. It is not certain whether one of the mechanical haulage systems or conveyor was located here. It eventually crosses over the tunnel at site JAG 11. The south-western sections of this feature appears to have been disturbed since its depiction on the 1973 image.

- Feature 17

  A cluster of buildings is depicted here. This area is known to have been the position where Jagersfontein's second mine shaft was established. During the fieldwork, a brick structure that was associated with this mine shaft was identified in this position. Refer site JAG 23.

- Feature 18

  A raised linear feature is depicted here. It seems likely for one of the mine's mechanical haulage systems to have been located here. It eventually crosses over the bridge at site JAG 5.

- Feature 19

  A road is depicted here for the first time.

- Feature 20

  An extensive area comprising either a runoff or catchment for water is shown for the first time. This area was extended for some distance since this aerial photograph was taken in 1973

- Feature 21

  The bridge or tunnel identified at site JAG 3 are depicted here.

- Feature 22

  An extensive disturbed area is depicted here. Sections of this area appear to have been used for one of the mine dumps. The remains of such dumps were identified during the fieldwork. Refer site JAG 17.

- Feature 23

  What appears to be a linear trench, possibly for water runoff, is shown here. A comparison of this trench with the one depicted on the 1948 image clearly shows that sections of the perimeter of the mine pit had fallen in during the period between 1948 and 1973.

- Feature 24

  Only one structure is depicted here. This structure was identified during the fieldwork (refer site JAG 13). The southern structure depicted on the 1948 image appears to have falled down the mine pit in the period between 1948 and 1973.

- Feature 23

  An extensive area comprising a number of disturbances is depicted here. At the northern end of this section a trench, possibly for the drainage of water, is shown.

Figure 44 – Detail view of the depiction of the study area (red polygon) on the 1948 aerial photograph (NGI, Aerial Photographs, 214_001_25490).

5.3 Previous Heritage Impact Assessment Reports from the Study Area and Surroundings

An assessment of the South African Heritage Resources Information System (SAHRIS) of SAHRA was undertaken to establish whether any previous archaeological and heritage impact assessments had identified any archaeological and heritage sites within, or in close proximity, to the present study area footprints.

This assessment has revealed that at least one previous study was partially undertaken within the present study area. Additionally, a number of studies have also been undertaken in the surroundings of the study area.

All these previous studies located on the SAHRIS system will be briefly discussed in chronological order below. The previous study that was partially undertaken within the present study area will be discussed first. In each case, the results of each study are shown in bold.

The following previous study was undertaken within the present study area:

- PHILIP, L. 2009. Phase I Impact Assessment of the Dormant Jagersfontein Mine (Free Sate) in terms of Archaeological and other Heritage Sites. **A high number of archaeological and heritage sites were identified during the study, including numerous historic structures, burial grounds and surface scatters of lithics. While most of these sites were identified outside the present study area, a fair number of the sites identified during this 2009 study are also located within the present study area. This will be discussed further in the chapter dealing with the findings and observations from the fieldwork (refer Chapter 6).**

The following studies have been undertaken in the surroundings of the present study area:

- Dreyer, C. 2006. First Phase Archaeological and Cultural Heritage Investigation of the Jagersfontein – Fauresmith Bulk Water Supply Scheme, Free State. **Heavy patinated stone tools and a single condensed milk can from the Anglo-Boer War were found.**

- Dreyer, C. 2006. First Phase Archaeological and Cultural Heritage Assessment of the proposed Residential Developments in the Madikhetla Township, Trompsburg, Free State. **No cultural remains were found.**

- ROSSOUW, L. 2014. Phase 1 Heritage Impact Assessment of a Proposed New Landfill Site near Jagersfontein, Kopanong Local Municipality, FS Province. **Two singular cores were recorded.**

- GAIGHER, S. 2019. Prospecting Rights Application for the Remainder of Portions 1 and 16 of the farm Jagersfontein 14, Fauresmith District, Free State. **No heritage sites were found.**

5.4 Palaeontology

Ms. Elize Butler of Banzai Environmental was commissioned to undertake a Palaeontological Desktop Assessment (PDA). Her report and findings are attached in full in **Appendix C**.

Ms. Butler found that the study area "…*is underlain by the Tierberg Formation, of the Ecca Group (Karoo Supergroup) as well as Quaternary superficial deposits. These superficial sediments mantle the underlaying older deposits. According to the PalaeoMap on the South African Heritage Resources Information System (SAHRIS) database, the Palaeontological Sensitivity of the Tierberg Formation is High, while that of the Quaternary deposits is Low, but locally High (Almond and Pether, 2009; Almond et al., 2013, SAHRIS website)." (Banzai Environmental, 2021:vii).*

*T*he palaeontological report concludes that the *"…the proposed Rehabilitation of the Old Jagersfontein Mine Pit will not comprise of any new mining activities and thus a* ***low*** *palaeontological* ***significance*** *is allocated to the proposed development. It is therefore considered that the proposed Rehabilitation of the Old Jagersfontein Mine Pit is deemed appropriate and feasible and will not lead to detrimental impacts on the palaeontological resources of the area." (Banzai Environmental, 2021:vii).*

The following recommendations are made in the palaeontological report:

- If fossil remains are discovered during any phase of construction, on the surface or exposed by excavations the **Chance Find Protocol** must be implemented by the ECO in charge of these developments. These discoveries ought to be protected (*in situ*) and the ECO must report to SAHRA (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Tel: 021 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za) so that correct mitigation (recording and collection) can be carried out; and

- Preceding any collection of fossil material, the palaeontologist would need to apply for a collection permit from SAHRA. Fossil material must be curated in an accredited collection (museum or university collection), while all fieldwork and reports should meet the minimum standards for palaeontological impact studies suggested by SAHRA (Banzai Environmental, 2021).

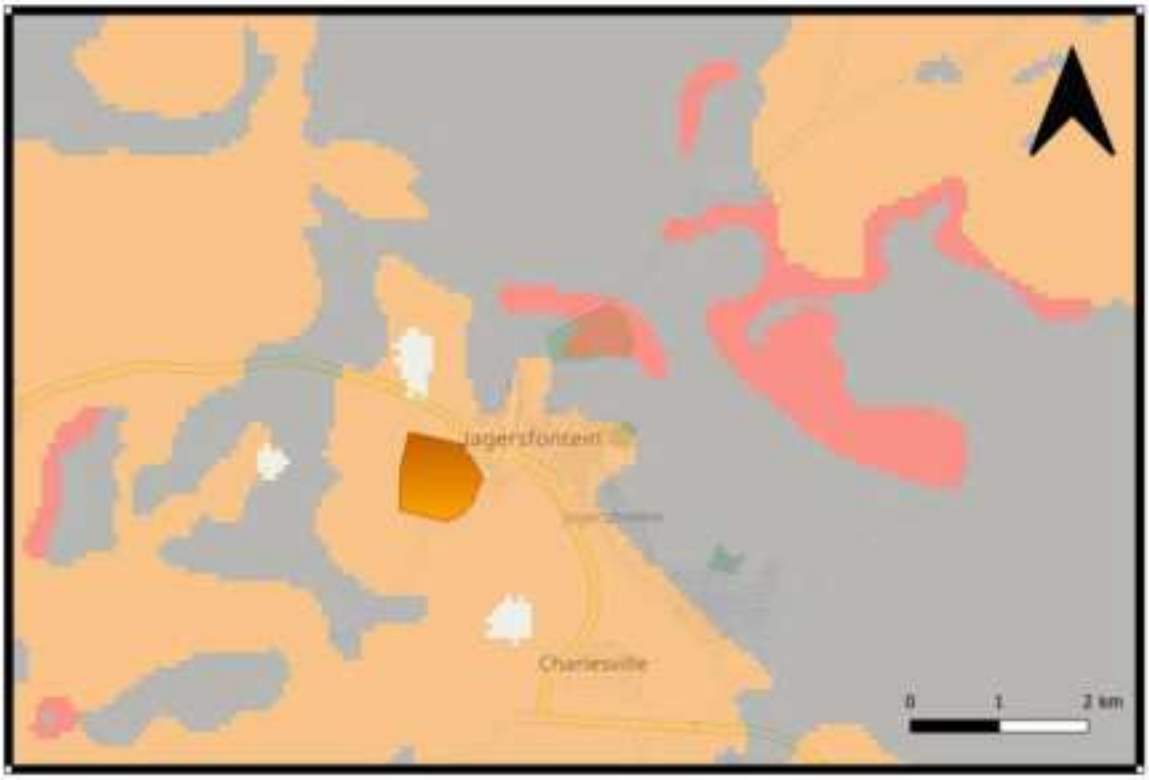


Figure 45 – Extract of the 1 in 250 000 SAHRIS PalaeoMap map (Council of Geosciences). Indicating the location of the proposed development (Banzai Environmental, 2021:30).

The different palaeontological sensitivities that are defined on the Palaeontological Sensitivity Map of SAHRIS, is outlined in the table below.

Table 12: Palaeontological Sensitivities and Required Actions

Colour	Sensitivity	Required Action
RED	VERY HIGH	Field assessment and protocol for finds is required.
ORANGE/YELLOW	HIGH	Desktop study is required and based on the outcome of the desktop study, a field assessment is likely.
GREEN	MODERATE	Desktop study is required.
BLUE	LOW	No palaeontological studies are required however a protocol for finds is required.
GREY	INSIGNIFICANT/ZERO	No palaeontological studies are required.
WHITE/CLEAR	UNKNOWN	These areas will require a minimum of a desktop study. As more information comes to light, SAHRA will continue to populate the map.

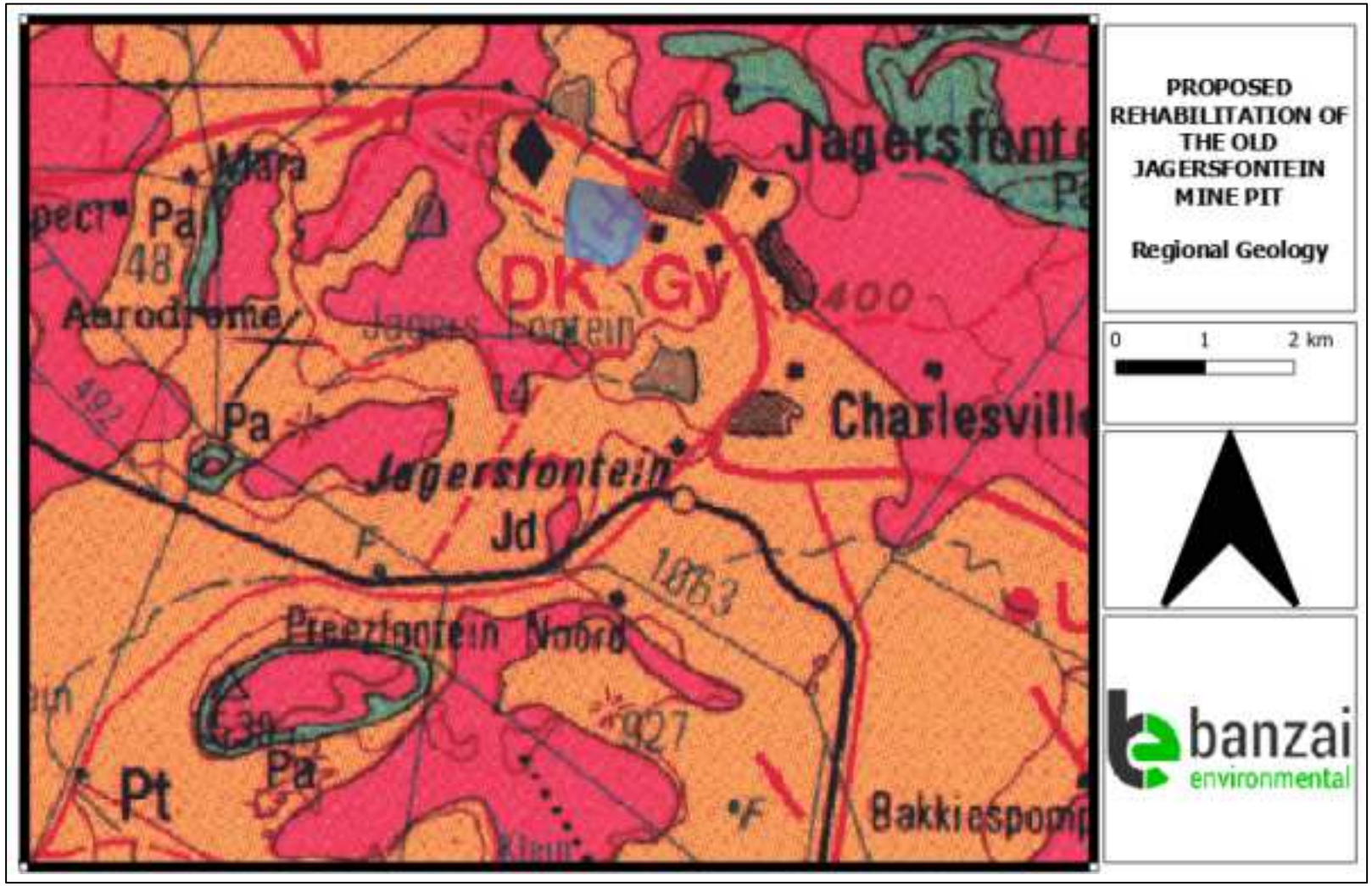


Figure 46 - The surface geology of the proposed Jagersfontein Mining Pit Rehabilitation is indicated on the 1: 250 000 2924 Koffiefontein (1992) Geological Map (Council of Geosciences, Pretoria). The geology of the proposed development is underlain by the Tierberg Formation, of the Ecca Group (Karoo Supergroup) and is indicated in blue (Banzai Environmental, 2021:29).

6 FIELDWORK FINDINGS

6.1 Introduction

The fieldwork component of the study was aimed at identifying tangible remains of archaeological, historical and heritage significance. The fieldwork was undertaken by way of walkthroughs by an experienced archaeological fieldwork team on Tuesday, 23 June 2020 and Wednesday, 24 June 2020. The fieldwork team consisted of an experienced archaeologist and heritage specialist (Polke Birkholtz) and a fieldwork assistant (Derrick James).

The fieldwork team used hand-held GPS devices throughout the fieldwork. These devices were used to record tracklogs showing the routes followed by the two archaeological fieldwork teams. During the fieldwork, all sites identified were photographically and qualitatively recorded, and their respective localities documented using a hand-held GPS device.

The fieldwork undertaken resulted in the identification of a total of twenty-five (25) sites. These were numbered from JAG 1 to JAG 25. The prefix used in this numbering system was derived from the farm name, namely Jagersfontein 14.

The distribution of these identified sites in relation to the study area boundaries is shown on one of the maps appearing below.

Figure 47 – Google Earth image depicting the tracklogs that were recorded in the field. The study area boundaries are shown in red.

Figure 48 – Google Earth image depicting the heritage sites identified during the fieldwork. The study area boundaries are depicted in red.

6.2 Heritage Sites identified during the Fieldwork

6.2.1 JAG 1

GPS Coordinates:

S 29.763698
E 25.419207

Type: Old Mine Pit

Description:

The old mine pit of the Jagersfontein Mine is located here. The mine pit has an approximate extent of 19.76 hectares and a perimeter of roughly 1,700 meters. Work on the mine pit started during the early 1870s, and this work continued sporadically until 1913 when the focus shifted to underground mining. Details regarding the mining methods utilised in the excavation of the mine pit are outlined in **Chapter 5** above.

The pit encompasses a significant section of the study area and is located near its centre. The surface of the landscape enclosing the mine pit is characterised by tangible remains of mining activity, with discarded cocopans, horse-shoes and spades observed in numerous places, especially along the southern end of the mine pit. While good views of the mine pit are in many cases difficult due to safety concerns of getting too close to its perimeter, a steel viewing platform that was erected before 2005 provides good views of the mine pit.

The base of the mine pit is currently dry. It is understood over the last 100 years or so, the pit is believed to have been intermittently covered by water, with pumping operations undertaken by the mine to ensure that the base of the pit remains dry. According to the preliminary design report for the proposed backfill of the Jagersfontein mine pit, the surface of the pit's floor is also covered in debris "… *from surface erosion overlying the waste country rock from the block cave mining.*" (SRK, 2019).

For many years the mine pit has been considered one of the world's mine pits with the steepest sidewalls (Le Barrow, 1970). According to research undertaken by Steve Lunderstedt, the Jagersfontein mine pit holds the world record of the deepest human-made excavation using the pick-and-shovel method anywhere in the world. The table below provides the findings of the research undertaken by Mr. Lunderstedt and presented by him during a lecture to the Historical Society of Kimberley and the Northern Cape on Thursday, 19 May 2005 (refer to **Appendix D**). Please note that the author of this report added the final column to this table to indicate the respective years in which all opencast work at these mines was halted. Lunderstedt's research also

notes that by the time that opencast operations at Jagersfontein were suspended in 1913, the excavation in the pit had reached a depth of 720ft.

Table 13: Depths Reached at Different South African Historical Mines (Lunderstedt, 2005).

Mining Company	Depth of Excavation (Pick & Shovel)	Associated Date	Cessation Date
De Beers Mine	400ft	1886	1887
Kimberley Mine (Big Hole)	460ft Never deeper than 500ft	1886 – 1890/91	1888
Dutoitspan Mine	510ft	1889	1889
Bultfontein Mine	620ft	1889	1889
Jagersfontein Mine	660ft	1911	1913
	1ft = .3048 meters		

Significance:

The mine pit at Jagersfontein is the deepest pick-and-shovel excavation anywhere in the world. With the introduction and development of excavation machinery during the twentieth century, this is a record not expected to be broken anytime in the future. The mine pit also represents a monument to the ingenuity, determination and labour of the miners and mine workers of all races and backgrounds at Jagersfontein. A monument that still stands today. Additionally, the mine pit represents the site where two record-breaking diamonds were discovered, namely the *Excelsior* and the *Reitz*. Even today, these diamonds are mentioned as part of the select group considered to be the finest diamonds ever discovered. This very mine, with its associated mine pit, was for many years known the world over as the source of unique and sought after white diamonds with a bluish tint referred to at the time as 'Jagers.'

In terms of famous or well-known people who can either be associated with the mine or who have visited the mine, a number of names can be mentioned. President JH Brand, the fourth president of the Orange River Republic, paid an official visit to Jagersfontein town and mine in 1880. General JBM Hertzog, who was Prime Minister of South Africa from 1924 to 1939, spent part of his childhood in the town of Jagersfontein. His family is believed to have owned and worked claims at the mine as well. Furthermore, Jagersfontein was visited during the Southern African tour of the Prince of Wales (later King Edward VIII) in 1925. A viewing platform was erected on the perimeter of the mine pit for this purpose.

The mine pit at Jagersfontein possesses very high levels of aesthetic, historic and scientific significance. As such, the site is deemed to be of **Local Significance (LS).** This said, the site even

has the potential to be considered of **Provincial Significance (PS)** as well.

Site Extent:

The site is approximately 19.76 hectares in extent.

Impact Assessment and Mitigation*:*

See **Chapter 8** for impact assessment calculations and **Chapter 9** for required mitigation measures.

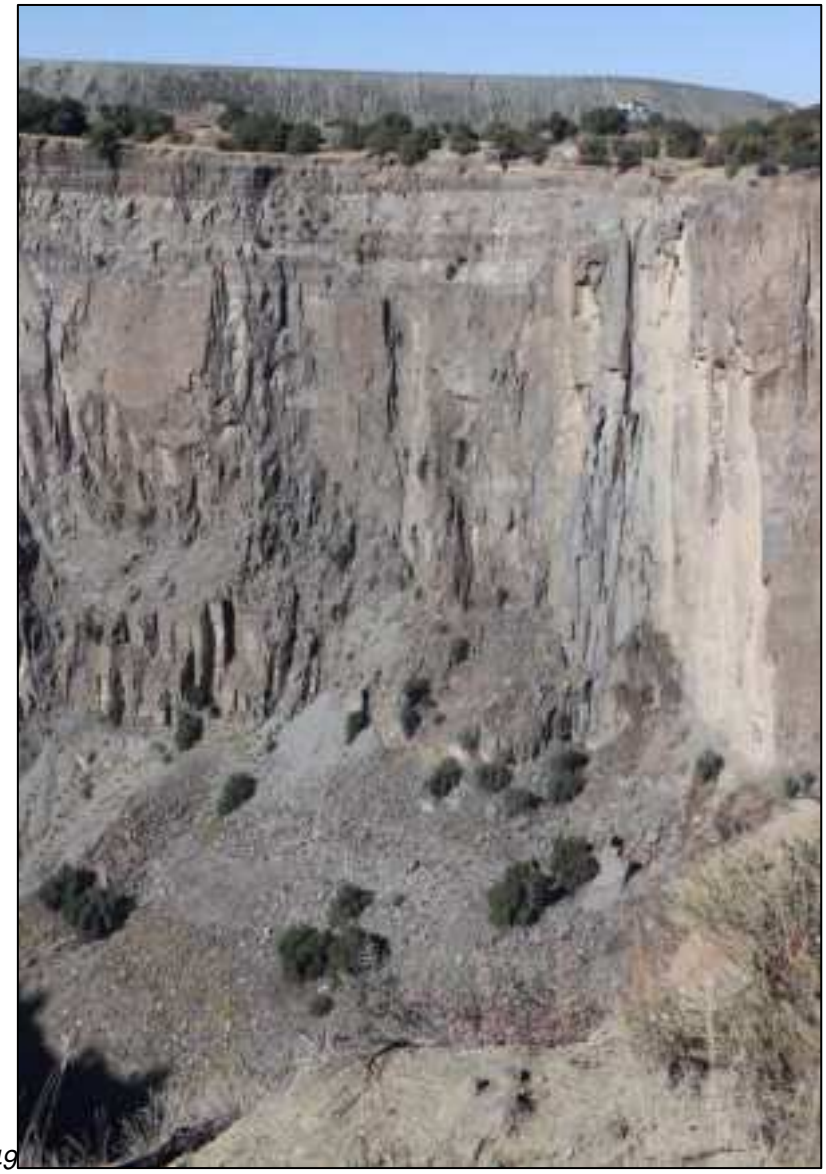


Figure 50 - General view across the mine pit at Jagersfontein. This photograph was taken from a point on the north by north-western perimeter of the pit facing towards the south-east.

Figure 52 – Another general view across the mine pit. This photograph was taken from a point on the north by northwestern perimeter of the pit facing towards the south-east.

Figure 53

These two photographs of mining-related artefacts were taken on the surface in close proximity to the mine pit. They provide a reminder of the limited equipment and technology that were available to excavate the massive volume of soil and rock from the mine pit. The scales used in both photographs are in 1cm increments.

6.2.2 JAG 2

GPS Coordinates:

S 29.763368
E 25.416068

Type: Historic Mine Structure

Description:

A historic mine structure was identified on the western edge of the mine pit. The structure is currently 37m to the west of the pit's rim. It comprises a towering structure of rocks and concrete, with a number of horizontal concrete slabs included in the structure for reinforcing. A section of thick wire rope was observed at the very top of the structure, with more wire rope sections observed in proximity to the structure. All the wire rope sections observed here appear to have been 1½ inch in diameter.

It seems likely for the structure at site JAG 2 to have formed part of the historic hoisting or haulage system associated with the opencast mining at the mine pit. With all mining activities associated with the mine pit halted in 1913, this structure is certainly older than 100 years.

Significance:

The site represents one of the few remaining tangible remnants of historic mining activities at Jagersfontein. If viewed in isolation, the structure can be deemed to be of **Generally Protected B (GP. B)** or **Medium Significance.** However, the site forms part of a cultural landscape associated with the historic mine pit and may not be destroyed.

Site Extent:

The site is approximately 50m x 50m in extent.

Impact Assessment and Mitigation*:*

See **Chapter 8** for impact assessment calculations and **Chapter 9** for required mitigation measures.

Figure 55 - General view of site JAG 2. Note the conical structure that appears to have formed part of the mechanical hoisting or haulage system at the mine pit.

Figure 56 - Closer view of the conical structure at site JAG 2. Note the section of wire rope at the top of the structure. The insert provides a closer view of a section of wire rope observed near the base of the structure. The scale is in 1cm increments.

6.2.3 JAG 3

GPS Coordinates:

JAG 3A	JAG 3B
S 29.763980 E 25.415155	S 29.763551 E 25.414986

Type: Historic Mine Structure

Description:

A historic mine structure was identified here. It comprises a well-built bridge or tunnel consisting of a foundation of dressed stone with a combination of brick arching and buttressing on top. Metal girders reinforced the central section of the structure. The two entrances of the structure are roughly 50m apart and are both supported on the outside by stone buttresses. More recently, the buttress at the northern entrance was decorated with old cocopans. The deck or surface of the structure is covered in discarded waste rock and its two sides are finished off with stone parapets.

It is not certain whether the original intent of the structure was as a bridge or tunnel. A non-perennial stream is currently channelled through the structure, which supports its interpretation as a bridge. However, the width of the structure is 50m, which seems extensive if the function of the structure was simply to cross over the non-perennial stream. Furthermore, there is no clear roadway in existence that crosses over the stream in this locality. It seems likely for the structure to have fulfilled a dual role, with one section acting as a bridge but with an associated extension, which assisted with the channelling of the stream along a predefined course.

The structure at JAG 3 formed part of the historic mining infrastructure associated with Jagersfontein and is expected to be older than 100 years.

Significance:

The site represents one of the few remaining tangible remnants of historic mining activities at Jagersfontein. If viewed in isolation, the structure can be deemed to be of **Generally Protected A (GP. A)** or **High/Medium Significance.** However, the site forms part of a cultural landscape associated with the historic mine pit, and may not be destroyed.

Site Extent:

The site is approximately 75m x 75m in extent.

Impact Assessment and Mitigation*:*

See **Chapter 8** for impact assessment calculations and **Chapter 9** for mitigation measures.

Figure 57 - General view of the northern entrance to the structure at site JAG 3. Note the use of cocopans in the buttressing as well as the stone parapet defining the top edge of the structure. The scale is in 10cm increments.

Figure 58 - Closer view of the brickwork on the arch section of the structure as seen at its northern entrance.

Figure 59 – The buttress at the northern end of the structure that was decorated with cocopans. The insert provides a closer view of the manufacturer's plaque from one of the cocopans. This particular cocopan was built by the company Dick, Kerr and Company Limited from London and Kilmarnock. This company was a well known British manufacturer of locomotives and tramcars, and this plaque may have been used between 1890 and 1919.

Figure 60 – Detail views along the interior walls of the structure showing sections of the masonry foundation with the brick arching and buttressing on top. The scale is in 10cm increments.

6.2.4 JAG 4

GPS Coordinates:

JAG 4A	JAG 4B
S 29.765302 E 25.416773	S 29.765498 E 25.417141

Type: Historic Mine Structure

Description:

Historic mine structures were identified here. The structures include stone-packed terracing and walling. With sections of the site located only a few meters from the mine pit's perimeter, it seems more than likely for the structures to have formed part of the historic mining activities at the mine pit. It is also possible for the site's structures to have formed part of the historic hoisting or haulage system associated with the opencast mining at the mine pit. With all mining activities associated with the mine pit halted in 1913, these structures are certainly older than 100 years.

Significance:

The site represents one of the few remaining tangible remnants of historic mining activities at Jagersfontein. If viewed in isolation, the structures can be deemed to be of **Generally Protected B (GP. B)** or **Medium Significance.** However, the site forms part of a cultural landscape associated with the historic mine pit, and may not be destroyed.

Site Extent:

The site is approximately 90m x 50m in extent.

Impact Assessment and Mitigation*:*

See **Chapter 8** for impact assessment calculations and **Chapter 9** for required mitigation measures.

Figure 61 - General view of one of the stone structures at site JAG 4. The scale is in 10cm increments.

Figure 62 - Closer view of the masonry used in the construction of the structure. The scale is in 10cm increments.

6.2.5 JAG 5

GPS Coordinates:

JAG 5	JAG 5A	JAG 5B
S 29.767037 E 25.418602	S 29.766257 E 25.417133	S 29.767200 E 25.419106

Type: Historic Mine Structure

Description:

A historic mine structure was identified here. It comprises a well-built bridge (see waypoint JAG 5 above) that allowed material to be transported across the non-perennial stream situated here. Depending on the age of the structure, this transportation of material may have been by way of cocopans along a tramway (late nineteenth and early twentieth centuries) or by conveyor line (if the site can be associated with the new washing plant that was built during the 1940s). It is also possible that the bridge from the site can be associated with both usages. The approximate ends of the existing tramway or conveyor line are defined by waypoints JAG 5A and JAG 5B above.

The bridge is a single-span structure with concrete abutments supported by brick wing walls on both ends. The central surface, deck and girders are all absent and appear to have fallen in. Only the concrete superstructure sections on the sides of the bridge still span across the stream.

A section along the southern wall of the raised tramway or conveyor route was reinforced using old cocopans. Judging from the photographs taken during the previous fieldwork (Philip, 2009), this entire retaining wall of cocopans was still in excellent condition. Unfortunately, this can not be said about the retaining wall at present. Since the previous fieldwork of 2009, this retaining wall has been extensively disturbed, to the extent where only remnants of the original retaining wall can still be seen on site. It is not presently known exactly when this disturbance occurred and by whom it was perpetrated.

Apart from the above-mentioned disturbance to the retaining wall, no evidence for other associated structures identified in proximity to the bridge during the previous fieldwork (Philip, 2009) could be identified during the current fieldwork. These absent structures and sites include the 'Study Office.'

The bridge at JAG 5 formed part of the historic mining infrastructure associated with Jagersfontein and is expected to be at least 60 years old. The possibility also exists for the structure to be older than 100 years as well, but this is not presently certain.

Significance:

The site represents one of the few remaining tangible remnants of historic mining activities at Jagersfontein. If viewed in isolation, the structure can be deemed to be of **Generally Protected A (GP. A)** or **High/Medium Significance.** However, the site forms part of a cultural landscape associated with the historic mine pit, and may not be destroyed.

Site Extent:

The site is approximately 220m x 30m in extent.

Impact Assessment and Mitigation*:*

See **Chapter 8** for impact assessment calculations and **Chapter 9** for mitigation measures.

Figure 63 - General view of the bridge at site JAG 5. The eastern wing wall can be seen in the foreground. The scale is in 10cm increments.

Figure 64 – Another more general view of the bridge at site JAG 5. Note the steel beam in the foreground, which in all likelihood originated from the bridge above. The scale is in 10cm increments.

Figure 65 – Closer view of the brickwork on the eastern wing wall. Note the use of English Bond in the construction of the structure. The scale is in 10cm increments.

Figure 66 – The remnants of the retaining wall that was reinforced with old cocopans.

Figure 67 – Another view of the remnants of the retaining wall at site JAG 5. The extensive disturbance of the site can be seen in this photograph.

6.2.6 JAG 6

GPS Coordinates:

S 29.767396
E 25.418994

Type: Historic Mine Structure

Description:

A historic mine structure was identified here. It comprises a rectangular stone and cement dam (32m x 12m) that was associated with the Rock Shaft Plant area. The dam was also included in the previous heritage impact assessment report (Philip, 2009). This said, a number of the sites, structures and features in the immediate surroundings of the dam that were still included in the 2009 report are now completely destroyed. These include two riggers and at least one cooling dam.

The dam formed part of the Rock Shaft Plant area. As mentioned elsewhere, the first mine shaft at Jagersfontein was opened in 1911. Additionally, a date written into the wet cement on one section of the dam indicates that the structure dates from at least 1920. The date that was written into the wet cement reads as follows: '21 4 1920'. From this information, it seems evident for the dam to already have been in existence on 21 April 1920. As a result, it appears to be older than 100 years.

A number of unidentified structures and foundations were observed in the immediate surroundings of the dam. These structures and features were not included in the heritage report undertaken in 2009 but appear to have formed part of the plan area associated with the dam. Additionally, the original mine shaft excavated between 1904 and 1911 appears to have been located approximately 40m south-east of the dam.

Significance:

The site represents one of the few remaining tangible remnants of historic mining activities at Jagersfontein. If viewed in isolation, the structure can be deemed to be of **Generally Protected A (GP. A)** or **High/Medium Significance.** However, the site forms part of a cultural landscape associated with the historic mine pit, and may not be destroyed.

Site Extent:

The site is approximately 50m x 50m in extent.

Impact Assessment and Mitigation*:*

See **Chapter 8** for impact assessment calculations and **Chapter 9** for mitigation measures.

Figure 68 - General view of the dam at site JAG 6. The crane visible in the background at the right marks the position where the original mine shaft at Jagersfontein was located.

Figure 69 – These two images depict the date that was written into the wet cement on a section of the dam at JAG 6. The lower image provides a highlight of the written date.

6.2.7 JAG 7

GPS Coordinates:

JAG 7A	JAG 7B
S 29.766365 E 25.420420	S 29.766270 E 25.420423

Type: Historic Mine Structure

Description:

A historic mine structure was identified here between the safety fence and the mine pit. Due to the presence of a safety fence in this locality, the exact coordinates for the site could not be recorded in the field. The closest point to the structure that could be recorded is shown as waypoint JAG 7A above. A set of coordinates, shown as waypoint JAG 7B above, was recorded closer to the actual position of the site using Google Earth.

The structure comprises a stone foundation located less than 27m from the perimeter of the mine pit. It seems more than likely for the structure to have formed part of the historic mining activities at the mine pit. It is also possible for the structure from the site to have formed part of the historic hoisting or haulage system associated with the opencast mining at the mine pit. With all mining activities associated with the mine pit halted in 1913, these structures are certainly older than 100 years.

Significance:

The site represents one of the few remaining tangible remnants of historic mining activities at Jagersfontein. If viewed in isolation, the structures can be deemed to be of **Generally Protected B (GP. B)** or **Medium Significance.** However, the site forms part of a cultural landscape associated with the historic mine pit, and may not be destroyed.

Site Extent:

The site is approximately 40m x 40m in extent.

Impact Assessment and Mitigation*:*

See **Chapter 8** for impact assessment calculations and **Chapter 9** for mitigation measures.

Figure 70 - General view of the stone structure at site JAG 7. This photograph was taken through the safety fence located in this section of the mine pit's perimeter. The mine pit can be seen in the background.

6.2.8 JAG 8

GPS Coordinates:

S 29.766326
E 25.420229

Type: Historic Mine Structure

Description:

A historic mine structure was identified here between the safety fence and the mine pit. The structure comprises a raised area of concrete and stone. A section of thick wire rope was also observed at the structure.

The structure is located less than 28m from the perimeter of the mine pit. It seems more than likely for the structure to have formed part of the historic mining activities at the mine pit. It is also possible for the structure from the site to have formed part of the historic hoisting or haulage system associated with the opencast mining at the mine pit. With all mining activities associated with the mine pit halted in 1913, the site is certainly older than 100 years.

Significance:

The site represents one of the few remaining tangible remnants of historic mining activities at Jagersfontein. If viewed in isolation, the structure from the site can be deemed to be of **Generally Protected B (GP. B)** or **Medium Significance.** However, the site forms part of a cultural landscape associated with the historic mine pit, and may not be destroyed.

Site Extent:

The site is approximately 40m x 40m in extent.

Impact Assessment and Mitigation*:*

See **Chapter 8** for impact assessment calculations and **Chapter 9** for mitigation measures.

Figure 71 - General view of the structure at site JAG 8. The safety fence located in this section of the perimeter of the mine pit can clearly be seen, with the mine pit visible in the back.

Figure 72 – Closer view of site JAG 8.

6.2.9 JAG 9

GPS Coordinates:

S 29.766333
E 25.420064

Type: Historic Mine Structure

Description:

At least two historic mine structures were identified. In the area between the safety fence and the mine pit, directly adjacent to the safety fence, a raised area of concrete, stone and cement was identified. A concrete foundation structure was also observed few meters outside the safety fence. Sections of thick wire rope were observed across the site.

At its closest point, the site is located less than 25m from the perimeter of the mine pit. It seems more than likely for the structures from this site to have formed part of the historic mining activities at the mine pit. It is also possible for these structures to have formed part of the historic hoisting or haulage system associated with the opencast mining at the mine pit. With all mining activities associated with the mine pit halted in 1913, these structures are certainly older than 100 years.

Significance:

The site represents one of the few remaining tangible remnants of historic mining activities at Jagersfontein. If viewed in isolation, the structures can be deemed to be of **Generally Protected B (GP. B)** or **Medium Significance.** However, the site forms part of a cultural landscape associated with the historic mine pit, and may not be destroyed.

Site Extent:

The site is approximately 50m x 50m in extent.

Impact Assessment and Mitigation*:*

See **Chapter 7** for impact assessment calculations and **Chapter 8** for mitigation measures.

Figure 73 - General view of one of the structures at site JAG 9. The safety fence located in this section of the perimeter of the mine pit can clearly be seen.

Figure 74 – Elements of the concrete foundation structure at site JAG 9 can be seen. This structure is located on the southern end of the site, outside the safety fence depicted in the previous photograph. The scale is in 10cm increments.

6.2.10 JAG 10

GPS Coordinates:

JAG 10A	JAG 10B
S 29.766492 E 25.419222	S 29.766360 E 25.419147

Type: Historic Mine Structure

Description:

A historic mine structure was identified here between the safety fence and the mine pit. Due to the presence of a safety fence in this locality, the exact coordinates for the site could not be recorded in the field. The closest point to the structure that could be recorded is shown as waypoint JAG 10A above. A set of coordinates, shown as waypoint JAG 10B above, was recorded closer to the actual position of the site using Google Earth.

The site comprises what appears to be the remains of massive foundation structures consisting of concrete blocks, stones and cement. Sections of thick wire rope were observed across the site. The site is located approximately 10m from the perimeter of the mine pit.

It seems more than likely for the structures from the site to have formed part of the historic mining activities at the mine pit. It is also possible for these structures to have formed part of the historic hoisting or haulage system associated with the opencast mining at the pit. With all mining activities associated with the mine pit halted in 1913, these structures are certainly older than 100 years.

Significance:

The site represents one of the few remaining tangible remnants of historic mining activities at Jagersfontein. If viewed in isolation, the structures can be deemed to be of **Generally Protected B (GP. B)** or **Medium Significance.** However, the site forms part of a cultural landscape associated with the historic mine pit, and may not be destroyed.

Site Extent:

The site is approximately 40m x 40m in extent.

Impact Assessment and Mitigation*:*

See **Chapter 8** for impact assessment calculations and **Chapter 9** for mitigation measures.

Figure 75 - General view of the structures at site JAG 10. The safety fence located in this section of the perimeter of the mine pit can clearly be seen. Although not visible in this photograph, the mine pit is located to the left.

Figure 76 – Closer view of one of the structures from site JAG 10. Note the use of concrete and stone. The poor preservation of the structures from the site can be seen.

6.2.11 JAG 11

GPS Coordinates:

S 29.766745
E 25.419001

Type: Historic Mine Structures

Description:

Historic mine structures were identified here. The structures include a well-built brick tunnel associated with a brick terrace. The tunnel is supported by buttressing and both the tunnel and terrace appear to have been built on stone foundations. Only the north-western entrance to the tunnel was found. According to a map included in the previous heritage impact assessment (Philip, 2009:35), the tunnel appears to have been used to channel water along the so-called '*No. 2 Drain*'. This watercourse passed under the bridge at site JAG 5, from where it was channelled sharply to the right to pass through the tunnel at this site. It seems likely for the tunnel also to have allowed the raised tramway or conveyor route from site JAG 5 to pass over the watercourse here.

In the more recent past, a wide trench was excavated all along the side of the terrace wall. This trench extends for some distance roughly parallel to the perimeter of the pit. The trench appears to have been excavated to assist with the drainage of stormwater.

It seems more than likely for the structures from the site to have formed part of the historic mining activities at the mine pit. Although it may be associated with the later developments at the mine dating to the 1940s, the possibility also exists for the structures from the site to date from the earlier activities, which could mean that these structures are older than 100 years.

Significance:

The site represents one of the few remaining tangible remnants of historic mining activities at Jagersfontein. If viewed in isolation, the structure can be deemed to be of **Generally Protected A (GP. A)** or **High/Medium Significance.** However, the site forms part of a cultural landscape associated with the historic mine pit, and may not be destroyed.

Site Extent:

The site is approximately 70m x 50m in extent.

Impact Assessment and Mitigation*:*

See **Chapter 8** for impact assessment calculations and **Chapter 9** for mitigation measures.

Figure 77 - General view of site JAG 11 showing the tunnel in the background on the right. This view was taken across the terraced area in front of the tunnel. Note the discarded cocopans in the foreground. A section of the recent drainage trench can be seen on the left.

Figure 78 – Another view of the structures at site JAG 11. Both the tunnel and associated terrace wall can be seen. This photograph was taken from within the recently excavated drainage trench.

Figure 79 - Closer view of a section of the terrace wall. As can be seen from this image, the terrace wall has a stone foundation with brick walling. The scale is in 10cm increments.

Figure 80 – Closer view of the tunnel at site JAG 11. Note the cocopans in the foreground that appear to have been exposed during the excavation of the more recent drainage trench.

Figure 81 – The tunnel as seen from the front. Note the use of concrete in the buttressing.

Figure 82 – General view along the northern end of the tunnel and terrace wall from site JAG 11. This photograph also provides a view along a section of the more recently excavated drainage trench. The mine pit is located to the right.

6.2.12 JAG 12

GPS Coordinates:

S 29.761141
E 25.416810

Type: Historic Mine Structure

Description:

A historic mine structure was identified approximately 90m north-west of the mine pit's perimeter. The structure is poorly preserved, with only sections of concrete foundations with lower sections of masonry walling still evident.

The structure's position on the north-western end of the mine pit suggests that it may have formed part of the original mine compound at Jagersfontein. According to Philip (2009), the original compound was located on the north-western end of the mine pit.

It seems more than likely for the structures from the site to have formed part of the historic mining activities at the mine pit. Although it may be associated with the later developments at the mine dating to the 1940s, the possibility also exists for the structures from the site to date from the earlier activities, which could mean that these structures are older than 100 years.

Significance:

The site represents one of the few remaining tangible remnants of historic mining activities at Jagersfontein. If viewed in isolation, the structure can be deemed to be of **Generally Protected C (GP. C)** or **Low Significance.** However, the site forms part of a cultural landscape associated with the historic mine pit, and may not be destroyed.

Site Extent:

The site is approximately 50m x 50m in extent.

Impact Assessment and Mitigation*:*

See **Chapter 8** for impact assessment calculations and **Chapter 9** for mitigation measures.

Figure 83 - General view of the poorly preserved structure at JAG 12.

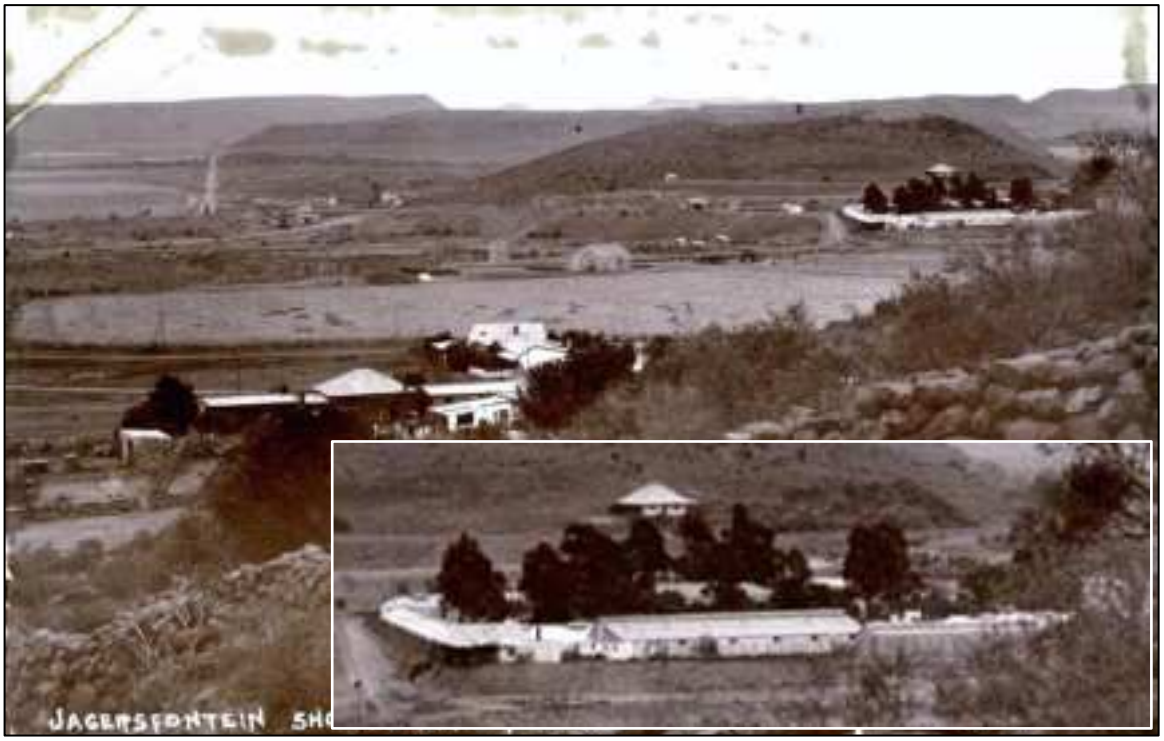


Figure 84 – This historic photograph appears to have been taken during the first decade of the twentieth century and provides an early view of the mine. Although it is difficult to orientate this image accurately, it appears to have been taken from the north by north-east and depicts several houses from the town of Jagersfontein in the foreground. What appears to be an old compound can be seen on the right (see insert for enlarged view of the compound), with a possible farmhouse situated behind it. Philip (2009) suggests that the original compound may have been located here on the north-western end of the mine pit (Africana Library). The poorly preserved structure from site JAG 12 was identified near the compound depicted in this image.

6.2.13 JAG 13

GPS Coordinates:

S 29.761755
E 25.419364

Type: Historic Mine Structure

Description:

A historic mine structure was identified a few meters north of the perimeter of the pit. All that remains of the structure is its elaborate concrete foundation. The centre of the structure has a number of rectangular recessed pits enclosed by upward-facing bolts. These bolts would have locked the superstructure of the hoisting mechanism to the foundation.

It seems more than likely for the structures from the site to have formed part of the historic mining activities at the mine pit. It is also possible for these structures to have formed part of the historic hoisting or haulage system associated with the opencast mining at the pit. With all mining activities associated with the mine pit halted in 1913, these structures are certainly older than 100 years.

Significance:

The site represents one of the few remaining tangible remnants of historic mining activities at Jagersfontein. If viewed in isolation, the structures can be deemed to be of **Generally Protected B (GP. B)** or **Medium Significance.** However, the site forms part of a cultural landscape associated with the historic mine pit, and may not be destroyed.

Site Extent:

The site is approximately 50m x 50m in extent.

Impact Assessment and Mitigation*:*

See **Chapter 8** for impact assessment calculations and **Chapter 9** for required mitigation measures.

Figure 85 - General view of the concrete foundation structure at site JAG 13. The mine pit can be seen in the background.

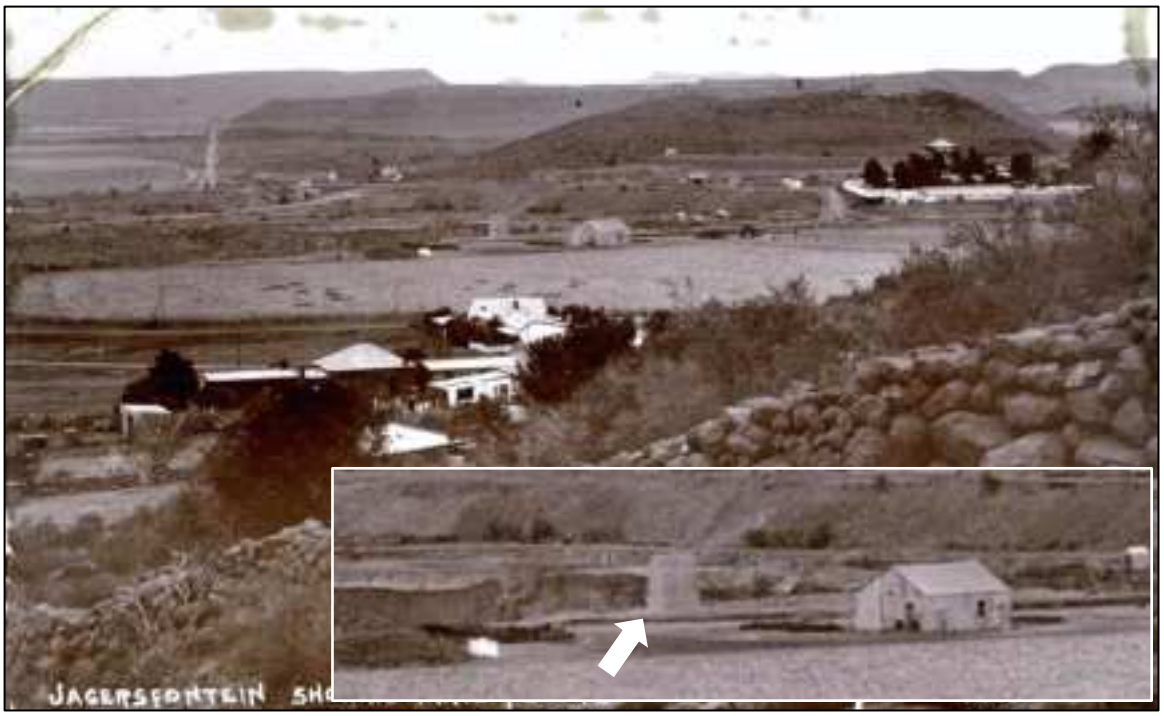


Figure 86 – This historic photograph is depicted on the previous page and appears to have been taken during the first decade of the twentieth century. Although it is difficult to orientate this image accurately, it seems to have been taken from the north by north-east and depicts several houses from the town of Jagersfontein in the foreground. What appears to be a hoist situated on the perimeter of the pit would have been located in close proximity to the structure identified at JAG 13. The insert provides a closer view of the hoist-like structure. The pitched-roofed structure to the right may have housed the steam engine, which provided the power to lower and hoist men and material in and out of the mine pit (Africana Library).

6.2.14 JAG 14

GPS Coordinates:

S 29.761322
E 25.419401

Type: Historic Midden

Description:

A historic midden was identified here. The cultural material observed on the surface of the site includes imported ceramics, glass fragments (including the base of an old ginger beer bottle and metal items (including two paraffin tins). No evidence of structural remains could be observed in proximity to the midden.

It seems more than likely for the midden to have been associated with the historic mining activities at the mine pit. With all mining activities associated with the mine pit halted in 1913, it seems likely for the midden to be older than 100 years.

Significance:

Interestingly, the midden at JAG 14 was the only midden that could be identified anywhere within the study area. This may have to do with the fact that, except for of the old compound located north-west of the mine pit, there was never a strong domestic association within the study area itself. Additionally, the disturbed nature of the study area may also have attributed to the dearth of concentrated cultural remains from the study area. The site is deemed to be of **Generally Protected B (GP. B)** or **Medium Significance.** However, the site forms part of a cultural landscape associated with the historic mine pit, and may not be destroyed.

Site Extent:

The site is approximately 50m x 50m in extent.

Impact Assessment and Mitigation*:*

See **Chapter 8** for impact assessment calculations and **Chapter 9** for required mitigation measures.

Figure 87 - General view of site JAG 14. This photograph was taken in a northern direction. Cultural material was observed on the surface of the site.

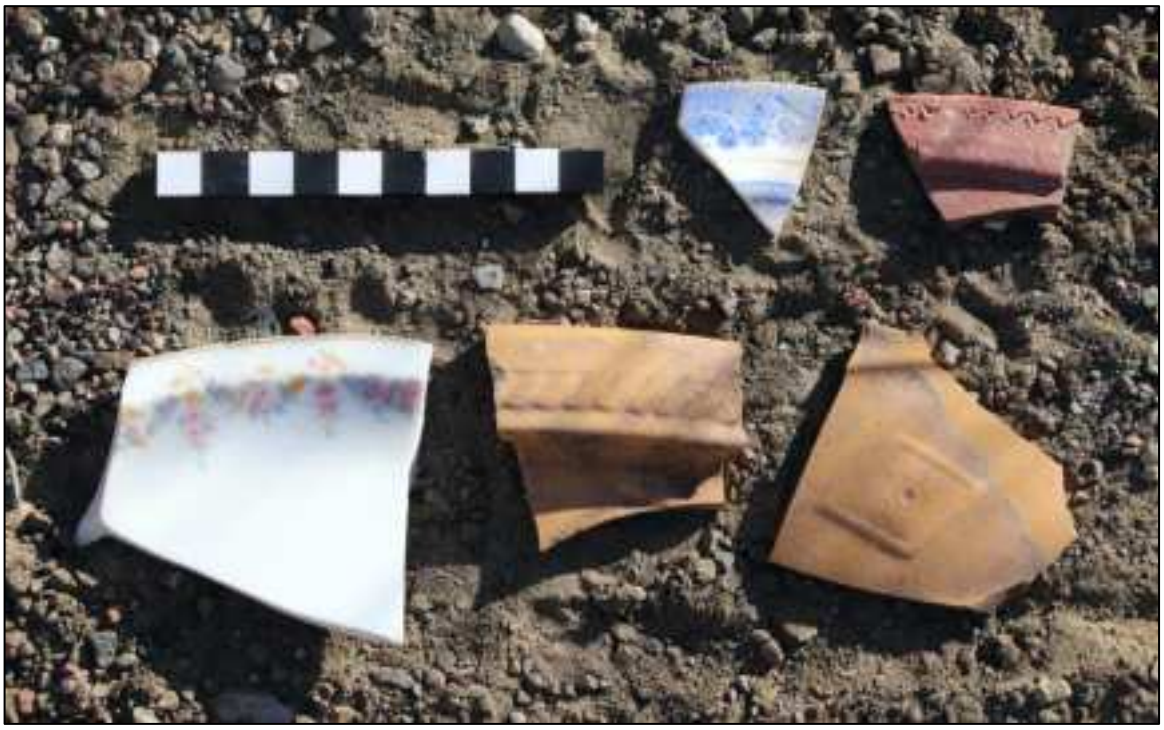


Figure 88 – Sample of imported ceramics observed on the surface of the site. The scale is in 1cm increments.

Figure 89 – Detail view of the top of one of the metal tins observed on the surface of site JAG 14. The scale is in 1cm increments. The information provided on this tin indicates that it contained so-called 'Laurel' kerosene or paraffin manufactured by the Vaccum Oil Company S.A. Ltd.

Figure 90 – Detail view of the top of another metal tin observed on the surface of the site. The scale is in 1cm increments.

6.2.15 JAG 15

GPS Coordinates:

S 29.766146
E 25.414911

Type: Historic Structure

Description:

Historic structures in the form of low stonewalling were identified on the summit of a low hill situated near the south-western end of the study area. The site straddles the study area boundary, with sections of its walling located outside the study area.

The origin and function of the site are not currently certain. It may be possible that the walling represents the remains of a British position dating from the South African War. This is, however, not certain at present.

Significance:

The exact origin and function of the site are not presently clear. If viewed in isolation, the structures from the site can be deemed to be of **Generally Protected B (GP. B)** or **Medium Significance.** However, the site forms part of a cultural landscape associated with the historic mine pit, and may not be destroyed.

Site Extent:

The site is approximately 50m x 50m in extent.

Impact Assessment and Mitigation*:*

See **Chapter 8** for impact assessment calculations and **Chapter 9** for required mitigation measures.

Figure 91 - General view of a section of site JAG 15. The mine pit can be seen in the background on the left.

Figure 92 – Closer view of one of the stone walls identified at site JAG 15. The scale is in 10cm increments.

6.2.16 JAG 16

GPS Coordinates:

S 29.767410
E 25.420993

Type: Historic Mine Structure

Description:

A historic mine structure comprising a rectangular brick building (± 27m x 8m) was identified here. The building was included as an 'Unidentified Redbrick Building' in the previous heritage study undertaken in 2009 (Philip, 2009).

Sections of the structure appear to have collapsed at an unknown time, subsequent to which they were rebuilt using modern bricks. The result is that sections of the building have walls built from old bricks using the so-called English Garden Wall bond. These old sections have decorative arches across the windows and doors. The modern sections comprise walling built of modern bricks using a less well-defined bond type. A modern annex built from clay and cement brick walls was added to the southern end of the building.

The building has a hipped roof construction. A roof ridge ventilator straddles a section of the roof and was installed to allow warm air to escape through the apex of the roof, thereby cooling the interior of the building down.

All windows and doors found from both the old and new sections have concrete lintels. The doors are all missing, whereas the window frames are all steel-framed. It is likely that the windows were replaced since the original construction.

The interior of the building is in a poor state of preservation with no evidence for the original floors. The interior walling is also recent and was built from cement bricks.

It seems more than likely for the building to have formed part of the historic mining activities at the mine. The building is at least 60 years old and possibly older than 100 years as well.

Significance:

The site represents one of the few remaining tangible remnants of historic mining activities at Jagersfontein. If viewed in isolation, the building can be deemed to be of **Generally Protected B (GP. B)** or **Medium Significance.** However, the site forms part of a cultural landscape associated

with the historic mine pit, and may not be destroyed.

Site Extent:

The site is approximately 50m x 50m in extent.

Impact Assessment and Mitigation*:*

See **Chapter 8** for impact assessment calculations and **Chapter 9** for mitigation measures.

Figure 93 - General view of the northern façade of the building identified at site JAG 16.

Figure 94 – Another view of the building at site JAG 16, showing the northern and eastern facades.

Figure 95 – Detail view of a section of the northern façade of the building at site JAG 16. The brickwork depicted at the centre and to the right provides examples of the older historic brick walling, whereas the brickwork shown on the left is more recent. The roof ridge ventilator that straddles the roof can clearly be seen.

Figure 96 – This view of the building at site JAG 16 shows a section of its southern façade. The clay and cement brick annex or lean-to can be seen.

6.2.17 JAG 17

GPS Coordinates:

S 29.762792
E 25.416499

Type: Historic Mine Dump

Description:

A possible historic mine dump was identified here. The site is currently 34m to the west of the pit's rim. It is important to note that this mine dump is not mentioned in the list of known historic mine dumps outlined in the previous heritage study (Philip, 2009). However, it possesses characteristics not unlike those identified during the previous heritage study at such historic dumps, including the remains of structures elevated above the surrounding ground surface and resting on and within these dumps.

The site may extend across some distance in the west by north-western section of the study area. It has been disturbed by the relatively recent construction of a road and drainage trench.

It seems likely for the historic dump at JAG 17 to have formed part of the historic mining activities associated with the opencast mining at the mine pit. With all mining activities associated with the mine pit halted in 1913, this site is certainly older than 100 years.

Significance:

The site represents one of the few remaining tangible remnants of historic mining activities at Jagersfontein. If viewed in isolation, the structure can be deemed to be of **Generally Protected B (GP. B)** or **Medium Significance.** However, the site forms part of a cultural landscape associated with the historic mine pit, and may not be destroyed.

Site Extent:

The site is approximately 200m x 120m in extent.

Impact Assessment and Mitigation*:*

See **Chapter 8** for impact assessment calculations and **Chapter 9** for required mitigation measures.

Figure 97 - General view of site JAG 17. Note the structural remains at the top of the possible historic mine dump. The continuation of the possible historic mine dump can be seen in the background on the left. Note the figure for scale.

Figure 98 - Closer view of the possible historic mine dump at site JAG 17.

6.2.18 JAG 18

GPS Coordinates:

S 29.764750
E 25.422728

Type: Historic Mine Structure

Description:

A historic mine structure comprising a one and a half storey rectangular brick building (± 26m x 10m) was identified here. The building has a stone foundation and was included as an 'Unidentified Building' in the previous heritage study undertaken in 2009 (Philip, 2009).

Sections of the structure's walling appear to have been replaced at an unknown time. The result is that sections of the building have walls built from old bricks using the so-called English Garden Wall bond, whereas the more modern sections comprise walling built of modern bricks using a stretcher bond type. Likely during the second phase of construction, when the newer brick walls were added, many of the original windows appear to have been built closed whereas a number of new windows were made. The newer windows have concrete lintels, whereas all the closed-up original windows had decorate brick arching. The existing window frames are all steel-framed.

It seems more than likely for the building to have formed part of the historic mining activities at the mine. The building is at least 60 years old and possibly older than 100 years as well.

Significance:

The site represents one of the few remaining tangible remnants of historic mining activities at Jagersfontein. If viewed in isolation, the building can be deemed to be of **Generally Protected B (GP. B)** or **Medium Significance.** However, the site forms part of a cultural landscape associated with the historic mine pit, and may not be destroyed.

Site Extent:

The site is approximately 50m x 50m in extent.

Impact Assessment and Mitigation*:*

See **Chapter 8** for impact assessment calculations and **Chapter 9** for mitigation measures.

Figure 99 - General view of the northern and eastern façades of the building identified at site JAG 18. Note the gablet roof design.

Figure 100 – Closer view of the gablet roof design observed on the building at site JAG 18.

Figure 101 – Detail view of a section of the western façade of the building identified at site JAG 18. A close inspection of the walling visible on this image reveals some of the windows and doors from the first construction that were closed-up during a later construction.

Figure 102 – Another detailed view of a section of walling from the building at site JAG 18. A closed-up window can be seen in the top centre of the image, whereas a newer window is shown below.

6.2.19 JAG 19

GPS Coordinates:

S 29.764137
E 25.422924

Type: Historic Mine Structure

Description:

A historic mine structure comprising a rectangular brick building (± 26m x 11m) was identified east of the main entrance to the mine. The building was included as the 'Engineers Office' in the previous heritage study undertaken in 2009 (Philip, 2009).

The Engineers Office is an elongated, rectangular building with a hipped roof construction. It has well-built brick walls that were constructed using English bond. The building has a number of original, wooden-framed sash windows supported by concrete lintels. Access to the building is by way of an open passage with arched entrances on both its northern and southern ends.

Although it was not possible to access the building's interior during the present fieldwork, the previous heritage survey (Philip, 2009) indicates that the building has wooden floors.

As an Engineers Office, the building formed part of the historic mining activities and historic landscape at the mine. It is at least 60 years old and possibly older than 100 years as well.

Significance:

The site represents one of the few remaining tangible remnants of historic mining activities at Jagersfontein. If viewed in isolation, the building can be deemed to be of **Generally Protected A (GP. A)** or **High/Medium Significance.** Additionally, the site also forms part of a cultural landscape associated with the historic mine pit, and may not be destroyed.

Site Extent:

The site is approximately 50m x 50m in extent.

Impact Assessment and Mitigation*:*

See **Chapter 8** for impact assessment calculations and **Chapter 9** for mitigation measures.

Figure 103 - General view of the Engineers Office identified at site JAG 19. The southern and eastern façades of the building are shown.

Figure 104 – Closer view of the eastern façade of the building at site JAG 19. Note the hipped roof construction and wooden-framed sash windows.

6.2.20 JAG 20

GPS Coordinates:

S 29.763765
E 25.422728

Type: Historic Mine Structure

Description:

A historic mine structure comprising a rectangular building (± 27m x 10m) was identified north-west of the main entrance to the mine. The building was included as 'Unidentified Building 1' in the previous heritage study undertaken in 2009 (Philip, 2009).

The building at site JAG 20 is an elongated, rectangular building with a hipped roof construction. It has plastered walls that were constructed on a stone foundation. The building has a number of wooden-framed sash windows and several doors. Annexes of brick were added at a more recent time to certain sides of the building.

The building formed part of the historic mining activities and historic landscape at the mine. It is at least 60 years old, and likely older than 100 years as well.

Significance:

The site represents one of the few remaining tangible remnants of historic mining activities at Jagersfontein. If viewed in isolation, the building can be deemed to be of **Generally Protected A (GP. A)** or **High/Medium Significance.** Additionally, the site also forms part of a cultural landscape associated with the historic mine pit, and may not be destroyed.

Site Extent:

The site is approximately 50m x 50m in extent.

Impact Assessment and Mitigation*:*

See **Chapter 8** for impact assessment calculations and **Chapter 9** for required mitigation measures.

Figure 105 - General view of the building identified at site JAG 20. The southern façade of the building is shown.

Figure 106 – Closer view of a section of the southern façade of the building at site JAG 20. Note the hipped roof construction, wooden-framed sash windows and stone foundation.

6.2.21 JAG 21

GPS Coordinates:

S 29.764354
E 25.422556

Type: Historic Mine Structure

Description:

A bridge is located here. The site was included in the previous heritage study undertaken in 2009 (Philip, 2009).

The bridge is located south-west of the Engineers Office at site JAG 19. The only sign of the bridge from the road is the remains of wooden railings. According to the previous heritage study undertaken in 2009 (Philip, 2009), the bridge comprises a retaining wall of stone and concrete.

The exact age of the bridge is not presently known.

Significance:

The site represents one of the few remaining tangible remnants of historic mining activities at Jagersfontein. If viewed in isolation, the building can be deemed to be of **Generally Protected B (GP. B)** or **Medium Significance.** Additionally, the site also forms part of a cultural landscape associated with the historic mine pit, and may not be destroyed.

Site Extent:

The site is approximately 30m x 30m in extent.

Impact Assessment and Mitigation*:*

See **Chapter 8** for impact assessment calculations and **Chapter 9** for required mitigation measures.

Figure 107 - General view of the bridge at site JAG 21. The wooden railing can be seen on the left.

6.2.22 JAG 22

GPS Coordinates:

S 29.761534
E 25.419659

Type: Historic Depositing Floor

Description:

A historic depositing floor appears to have been located across an extensive section of the study area located between the study area's northern boundary and the mine pit. Apart from the fact that this section of the study area had a very level appearance, the only evidence for the depositing floor that could be found is in the form of a historic photograph. Especially the western end of the site is partially disturbed by more recent mining-related activities.

As outlined in the desktop study, a crucial step in the historic mining and extraction of diamonds at Jagersfontein was that the excavated diamondiferous material had to go through a process of either weathering or crushing before it could proceed to the washing phase. From the very start of mining

activities at Jagersfontein, undisturbed level sections in the surroundings of the diggings were earmarked as so-called 'depositing floors.' These depositing floors were used at the Jagersfontein Mine from 1871 to its closure in 1931 (Philip, 2009).

The excavated material was transported to these areas in scotch carts and later by mechanical haulage. Once transported to the floors, the diamondiferous material was spread out on the floors at depths of roughly 16 inches to undergo a time-consuming process called 'weathering' whereby the material was constantly exposed to the elements for months on end, thereby assisting with it breaking up and deteriorating. This weathering process was augmented at Jagersfontein by watering and ploughing activities (Philip, 2009).

It seems likely for the historic depositing floor at JAG 22 to have formed part of the historic mining activities associated with the opencast mining at the mine pit. With all mining activities associated with the mine pit halted in 1913, this site is certainly older than 100 years.

Significance:

The site represents one of the few remaining tangible remnants of historic mining activities at Jagersfontein. If viewed in isolation, the structure can be deemed to be of **Generally Protected B (GP. B)** or **Medium Significance.** However, the site forms part of a cultural landscape associated with the historic mine pit, and may not be destroyed.

Site Extent:

The site is approximately 300m x 100m in extent.

Impact Assessment and Mitigation*:*

See **Chapter 8** for impact assessment calculations and **Chapter 9** for required mitigation measures.

Figure 108 - General view of a section of the area where the historic deposition floor was located.

Figure 109 – This historic photograph appears to have been taken during the first decade of the twentieth century and provides an early view of the mine. Although it is difficult to orientate this image accurately, it appears to have been taken from the north by north-east and depicts several houses from the town of Jagersfontein in the foreground. The deposition floor from site JAG 22 can be seen between the buildings in the front and the mine pit (Africana Library).

6.2.23 JAG 23

GPS Coordinates:

S 29.767114
E 25.415611

Type: Historic Mine Structure

Description:

This site represents the position of one of the mine shafts associated with the Jagersfontein Mine. The site was included as 'No. 2 Rock Shaft Spray' in the previous heritage study undertaken in 2009 (Philip, 2009). During the fieldwork of the 2009 study, two structures were identified, namely a concrete foundation structure for the shaft gear and a rectangular brick structure that housed the winder. During the current fieldwork undertaken in 2020, only the brick structure could still be observed on site.

The headgear that once stood here was removed and placed in front of the gantry at the tourist visitor center on the northern end of the mine pit.

The exact age of the shaft and headgear is not presently known. Furthermore, the exact condition of the mine shaft is not known, although it is expected to have been capped when mining stopped.

The mine shaft at site JAG 23 is the second of the two mine shafts to be established and mined at Jagersfontein and would have followed on the first mine shaft that came into operation in 1911. However, it is not expected for the mine shaft from site JAG 23 to be as old as the original mine shaft. In fact, the brick building that remains at the site does not have the appearance of a very old structure.

Significance:

The site represents one of the few remaining tangible remnants of historic mining activities at Jagersfontein. If viewed in isolation, the building can be deemed to be of **Generally Protected C (GP. C)** or **Low Significance.** Additionally, the site also forms part of a cultural landscape associated with the historic mine pit, and may not be destroyed.

Site Extent:

The site is approximately 30m x 30m in extent.

Impact Assessment and Mitigation*:*

See **Chapter 8** for impact assessment calculations and **Chapter 9** for mitigation measures.

Figure 110 - General view of the area where the mine shaft and headgear at site JAG 23 would have been located. The blue and yellow overhead crane visible in the background marks the position of the original mine shaft.

Figure 111 – Closer view of site JAG 23. Note the brick building that is believed to have housed the winder for the shaft.

Figure 112 - General view of the headgear currently located at the tourist centre at the northern end of the mine pit. This headgear was removed from site JAG 23 and constructed here when the tourist centre was built.

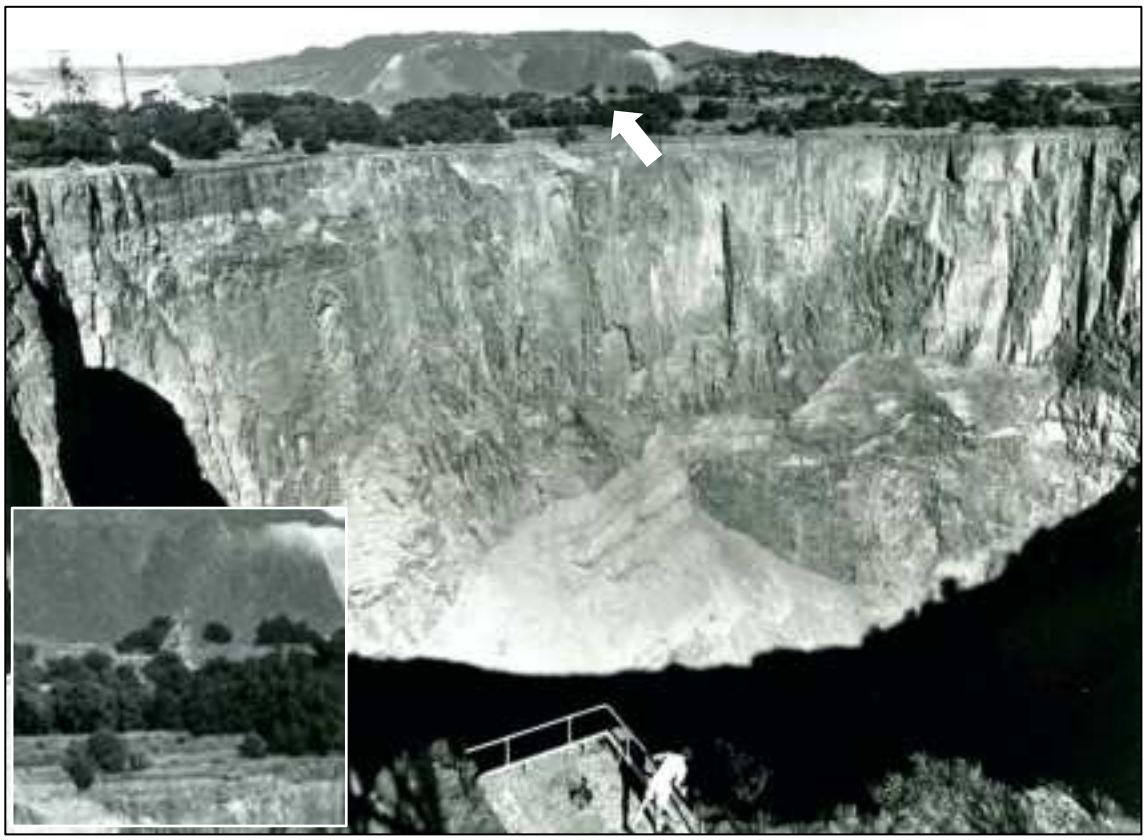


Figure 113 – Historic photograph of the mine pit at Jagersfontein (Africana Library). This photograph also depicts both mine shafts associated with the Jagersfontein Mine. On the left, the headgear from the original mine shaft can be seen. The headgear from the mine shaft at site JAG 23 is marked with a white arrow with a detailed view shown in the insert.

6.2.24 JAG 24

GPS Coordinates:

S 29.767827
E 25.419441

Type: Historic Mine Structure

Description:

This site represents the position of one of the mine shafts associated with the Jagersfontein Mine. The site was included as 'No. 1 Mine Rock Shaft' in the previous heritage study undertaken in 2009 (Philip, 2009). During the fieldwork of the 2009 study, the mine shaft was covered with a steel cover and enclosed by a fence. During the current fieldwork undertaken in 2020, a massive overhead crane was observed at the site.

In 1904, work commenced on the sinking of this mine shaft. The first skip was hoisted from this shaft in February 1911. During 1911 alone, several mining machines were installed to assist with the underground mining and new shaft, including a steam-driven rockhoist by the British company *Yates & Thom Limited* as well as a manhoist (Le Barrow, 1970).

The headgear that once stood here was removed and reconstructed at the Cullinan Diamond Mine near Pretoria. The exact condition of the mine shaft is not known, although it is expected to still be in existence, even though it was capped.

The mine shaft at site JAG 24 is the oldest of two mine shafts to be established and mined at Jagersfontein and is older than 100 years.

Significance:

Although the headgear had been removed, the site represents one of many tangible remnants of historic mining activities at Jagersfontein. If viewed in isolation, the site can be deemed to be of **Generally Protected B (GP. B)** or **Medium Significance.** However, the site forms part of a cultural landscape associated with the historic mine pit, and may not be destroyed.

Site Extent:

The site is approximately 30m x 30m in extent.

Impact Assessment and Mitigation*:*

See **Chapter 8** for impact assessment calculations and **Chapter 9** for mitigation measures.

Figure 114 - General view of the area where the mine shaft and headgear at site JAG 24 would have been located. The blue and yellow overhead crane visible in the background marks the position of the original mine shaft. In the foreground, the dam from site JAG 6 can be seen.

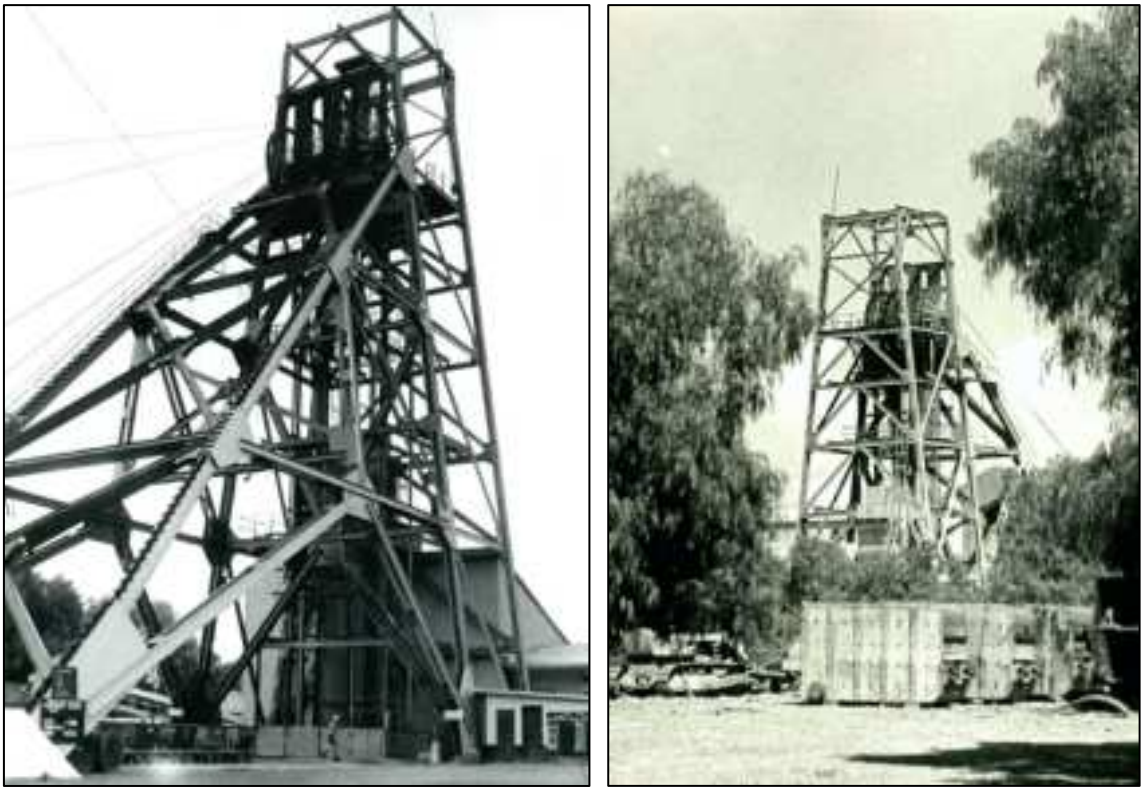


Figure 115 – Two photographs that were taken in 1967 depicting the headgear at the mine shaft at site JAG 24. Both photographs were obtained from the Africana Library. As indicated in the text, this headgear was relocated to the Cullinan Diamond Mine.

6.2.25 JAG 25

GPS Coordinates:

S 29.766220
E 25.421670

Type: Stone Age Site

Description:

A Stone Age site was identified here during the previous heritage study undertaken in 2009 (Philip, 2009). The site was included as a 'Stonetool Scatter' in the 2009 report.

The site was not visited during the present fieldwork. The reason for this is that the 2009 study indicated that all the Stone Age sites identified by them at the Jagersfontein Mine were given a **Generally Protected C (GP. C)** or **Low Significance** with no further mitigation required (Philip, 2009).

Significance:

As indicated in the previous heritage study (Philip, 2009), the site is deemed to be of **Generally Protected C (GP. C)** or **Low Significance**.

Site Extent:

The site is approximately 30m x 30m in extent.

Impact Assessment and Mitigation*:*

See **Chapter 8** for impact assessment calculations and **Chapter 9** for mitigation measures.

7 THE STUDY AREA AS A CULTURAL LANDSCAPE

The study area represents a relatively small section of the overall portion of land known historically as the Jagersfontein Mine. This said, it does contain all the key locations where historic excavation

activities took place over the course of the mine's history, namely the mine pit and the two underground mine shafts. Additionally, the perimeter and immediate surroundings of the mine pit and shafts represented the focal point for the construction of several structures and infrastructure relating to the transportation, crushing and washing of kimberlite. Nearly all the diamonds that were recovered from the Jagersfontein Mine, estimated at an incredible 9.526 million carats, would have been extracted from within the confines of the study area. These diamonds include the two record-breaking stones still known to this day as two of the finest diamonds ever recovered, namely the *Excelsior* and the *Reitz*. Additionally, the mine pit and underground shafts located within the study area were for many years known as the source of unique and sought-after white diamonds with a bluish tint referred to at the time as 'Jagers.'

The study area also sits significantly in a pivotal position that links the remainder of the mining property with the historic town of Jagersfontein, a town whose very *raison d'être* can be found within the study area as well. Without the discovery and mining of diamonds at Jagersfontein Mine, the town of Jagersfontein would never have been created. These three landscape elements of the wider mine property, the study area and the town of Jagersfontein form part of the same cultural landscape.

The preceding section suggests that the study area represents a place of great significance, both in its own right but also as part of the wider cultural landscape. While this is undoubtedly true, the current condition of the study area and the state of the tangible heritage features that have remained preserved within the study area diminish this significance.

The most significant historical element located within the study area, namely the min pit, cannot be considered a perfectly preserved representation of the mine pit as it appeared when opencast mining activities halted in 1913. For example, the walls of the mine pit have experienced break back and erosion to the extent that discernably differences in the size and shape can be observed on historical imagery (maps and aerial photographs) when compared with the current depictions of the pit. The report titled *Review of Jagersfontein Pit Stability and Backfilling Options* compiled by HAC Metinjes and Dr. GC Howell (SRK, 2012) states that the mine pit "…*is showing signs of ongoing break back of the side slopes*…" and adds that a review of the "…*open pit site conditions indicates that there will be ongoing break back of the side slopes of the open pit for a considerable period of time*."

Furthermore, the depth of the mine pit as depicted on the sign at the tourist centre (see **Figure 116**), and as indicated in more contemporary sources (see SRK, 2019) is certainly much deeper than the depths revealed by the available historical research. The research undertaken by Steve Lunderstedt and presented by him during a lecture to the Historical Society of Kimberley and the Northern Cape on Thursday, 19 May 2005 (refer to **Appendix D**), indicates that the mine pit reached a depth of 660ft (201.17m) in 1911 and likely a depth of 720ft (219.46m) at the end of opencast mining in 1913. These historic depths for the mine pit differ considerably from the depth

of 341m indicated on the sign mentioned above. Additionally, the specialist report compiled by Dr. GC Howell et al. (SRK, 2019) states that the depth of the debris surface at the base of the pit in 2019 was 268m below the surface, roughly 48m deeper than the historic depth recorded in 1913 when opencast operations were believed to have been halted.

It is not certain why the mine pit is currently significantly deeper than the historic depths recorded in 1911 and 1913. One possibility may be that the block caving mining method introduced in the underground workings at Jagersfontein Mine during the late 1940s may have impacted the depth of the mine pit. Alternatively, opencast operations may have continued after 1913 inside the mine pit. Whatever the reasons for the mine pit's deeper depth, it certainly shows that modification and impacts to the mine pit occurred after 1913.

The research on the history of Jagersfontein Mine undertaken for the current study has revealed that the mining property located outside of the study area formed part of the historic mining activities at Jagersfontein. It is known, for example, that material excavated from the mine pit and later the underground shafts were transported to deposition floors. While such a deposition floor also appears to have been located within the study area, more extensive deposition floors were identified during the previous heritage study some distance south of the study area (Philip, 2009). Similarly, the dimondiferous material was transported from the deposition floors to 14 washing plants distributed across the mining property, where the washing of the diamondiferous material took place. Other significant tangible remains of historic mining activities located on the mine property, but outside the study area, include the old miner cemetery, the compound and the various buildings located between the study area and the town of Jagersfontein. These buildings and structures include the historic mine manager's residence, the mine offices, survey offices and even tennis courts and a swimming pool that formed part of the amenities that the mine built for its staff.

In terms of the other key locations where the mine's historic excavation activities took place, namely the two underground mine shafts, they were both sealed off before the previous heritage study was undertaken (Philip, 2009). The exact condition of these two mine shafts is not known. The steel headgear that replaced the original wooden headgear at the old mine shaft (JAG 24), was relocated to the Cullinan Diamond Mine at an unknown time. This relocation likely took place after the closure of the mine in 1969. A massive overhead crane had since been erected on the site of the old mine shaft. Although the steel headgear erected at the second mine shaft (JAG 23) was also removed, it was rebuilt at the tourist centre located north of the mine pit and to this day remains preserved. The remainder of the study area can be described as primarily disturbed. This disturbance can essentially be attributed to historic mining activities associated with this parcel of land for many years, which resulted in the presence of several historic mining-related heritage sites and features located within the study area.

Since the original mining activities associated with the mine pit were halted in 1913, many historic structures and buildings that would have been directly associated with the opencast operations

were removed from the landscape. These include the original timber hoists that would have lined the perimeter of Jagersfontein's open pit, as well as the structures that housed the steam-driven engines that powered these hoists and mechanical haulage systems across the mine. The removal and destruction of many of these early structures appear not to have taken place very long after the cessation of opencast operations in 1913. In fact, by the time the 1948 aerial photograph was taken, very little evidence for the historic structures and features as depicted on earlier postcards and photographs could still be seen within the study area. During the late 1940s, the mine became a hub of activity when a new plant for the crushing and washing of material was built south of the mine pit. The site chosen for this new plant was naturally located very close to the main underground shaft, and as a result, would have played a role in the disturbance and destruction of at least some of the original mining buildings and infrastructure.

Of course, tangible elements of the older and more recent mining activities still exist within the study area. Many of these sites and features were identified during a previous heritage study (Philip, 2009), with some of these sites, with a small number of additional sites, identified during the present fieldwork. Unfortunately, a comparison between the fieldwork findings of the previous heritage study (Philip, 2009) and the fieldwork undertaken for the present study has revealed that a high number of the heritage sites identified in that previous study had been destroyed or irreparably damaged in the 12 years since that study was completed. This destruction of previously identified sites was by way of desktop study analysis found to have taken place both within the current study area and the mine property as a whole. This wanton destruction of identified heritage sites is of great concern.

Additionally, evidence for recent disturbances was also observed within the study area. These recent disturbances include the excavation of drainage trenches in areas north-west, south and south-east of the mine pit, the construction of several roads and the dumping and excavation of material north-west and north by north-west of the mine pit. Furthermore, an extensive area situated in the southern and south-eastern sections of the study area was disturbed by earth-moving machinery at an unknown time between 2010 and 2017.

All these more recent disturbances have significantly impacted the cultural landscape located within the study area. This said, elements of this landscape still exist, including the mine pit (in a modified form), historic buildings such as the Engineers Office and mining-related structures such as old bridges, tramways and tunnels built for the drainage of water. Walkthroughs of the study area's perimeter also still revealed discarded cocopans, spades, horseshoes and the like. It is therefore believed that if the level of protection and management of the cultural heritage from within the study area and surrounding mine property is significantly improved in the years to come, the cultural landscape associated with the Jagersfontein Mine can be linked in a better way to its associated landscape elements such as the town of Jagersfontein.

8 IMPACT OF PROPOSED DEVELOPMENT ON HERITAGE

8.1 General Observations

In this section, an assessment will be made of the impact of the proposed development on the identified heritage sites.

The following general observations will apply for the impact assessment undertaken in this report:

- The impact assessment methodology of PGS Heritage (Pty) Ltd will be utilised in this section. This methodology is outlined and explained in more detail in **Section 3.2** of this report.

- An assessment of the impact of the proposed rehabilitation or backfilling of the mine pit will be undertaken first. This section of the impact assessment will be divided into the assessment of the impact of the proposed rehabilitation or backfilling on the mine pit at JAG 1, followed by an assessment of the impact of this same development component on the other sites located in proximity to the rim or perimeter of the mine pit. Pre-mitigation and post-mitigation impact assessment calculations will be provided.

- An assessment of the impact of the proposed construction of a conveyor through the study area and the establishment of two deposition points on the perimeter of the mine pit will also be undertaken. This impact assessment was based on an overlay made by the author of the identified heritage sites over the development layout plan provided by the client using the overlay function of Google Earth. Only the sites located within 50m of the proposed conveyor and deposition points will be included here. These are sites JAG 6, JAG 8, JAG 9, JAG 10, JAG 11 & JAG 24. Pre-mitigation and post-mitigation impact assessment calculations will be provided.

8.2 Risk Calculation for the Pre-Mitigation Impact of the Proposed Development

8.2.1 Risk Calculation for the Pre-Mitigation Impact of the Proposed Backfilling

8.2.1.1 Risk Calculation for the Pre-Mitigation Impact of the Proposed Backfilling on JAG 1

In this section the pre-mitigation impact of the proposed backfilling or rehabilitation on the mine pit at site JAG 1 will be assessed.

The current proposal is for the mine pit to be rehabilitated by filling it with tailings. It is estimated that the pit will be backfilled to a depth of approximately 30m from the top, but this depth may vary according to the available volume of tailings (Turn 180 Environmental Consultants, 2019).
It is important to note that the proposed rehabilitation of the pit is expected to be an irreversible process in that it would not be economically feasible to reverse this process once completed. The proposed impact can therefore be considered permanent.

Another consideration included in this assessment is the significance of the mine pit. The research undertaken by Steve Lunderstedt and presented by him during a lecture to the Historical Society of Kimberley and the Northern Cape on Thursday, 19 May 2005 (refer **Appendix D**), the pit at Jagersfontein is the deepest pick-and-shovel excavation anywhere in the world. With the introduction and development of excavation machinery during the twentieth century, this is a record not expected to be broken anytime in the future. The mine pit also represents a monument to the

ingenuity, determination and labour of the miners and mine workers of all races and backgrounds at Jagersfontein. A monument that still stands today. Additionally, the mine pit represents the site where two record-breaking diamonds were discovered, namely the *Excelsior* and the *Reitz*. Even today, these diamonds are mentioned as part of the select group considered to be the finest diamonds ever discovered. This very mine, with its associated mine pit, was for many years known the world over as the source of unique and sought after white diamonds with a bluish tint referred to at the time as 'Jagers.'

As a result, the mine pit at Jagersfontein possesses very high levels of aesthetic, historic and scientific significance and is deemed to be of **Local Significance (LS).** This said, the site even has the potential to be considered of **Provincial Significance (PS)** as well.

From a heritage point of view, the near complete backfilling of the mine pit would have an incredibly negative impact on its aesthetic appeal. A pit with a depth of approximately 30m would certainly not be appealing to visitors or tourists to the site. One of the draw-cards of the mine pit is its sheer volume and depth and its steep-sided walls, which all tie in with its world record status. The filling up of this historic landmark so that the majority of its volume is taken up by tailings, in a process that is furthermore irreversible, would result in an immense negative impact.

A Socio-economic Impact Assessment (SEIA) for the proposed rehabilitation of the mine pit was undertaken by SES Consulting (2019). This study identified the socio-economic impacts of the proposed development through a public consultation meeting and a socio-economic baseline study, which included a household survey and interviews with key informations. As will be shown in the quotation from this study below, the SEIA revealed that a significant section of the community adjoining the mine is against the proposed development. In the quoted section from this study provided below, Jagersfontein Developments (Pty) Ltd is referred to as JD. The draft report for this study that was made available to the author, observed that "…*overall community members are not in favour of the Project. In the public consultation meeting held at the Mayibuye Hall on the 26th November 2019, it was strongly suggested (by the few attendees) that JD build another TSF rather than destroying the heritage value of the Pit, and any potential tourism opportunities in the area. These sentiments were strongly echoed in the household survey where 72.46% of the households felt that the proposal by JD to backfill and rehabilitate the Pit would negatively affect their households. This is mainly attributed to the perception that backfilling the Pit will destroy the heritage value of the Pit rather than rehabilitate the Pit, which is strongly viewed by the communities in Jagersfontein as a community heritage resource. It is believed that the proposal by JD to backfill the Pit would in the long-term destroy any potential for tourism in the area. According to the communities in Jagersfontein the negative impacts of backfilling the Pit far outweigh the value of JD continuing its operations for another eight years in the area. These sentiments stem primarily from poor relations between JD and the neighbouring communities. Even though JD established the Itumeleng Community Trust (ICT) in 2012, the Trust is accused of not serving the needs and interests of the communities.*" (SES Consulting, 2019:ii).

The assessment of the pre-mitigation impact on the mine pit, is calculated in the section that follows.

$$\text{Impact Risk} = \frac{(\text{Significance} + \text{Spatial} + \text{Temporal})}{3} \times \frac{\text{Probability}}{5}$$

$$\text{Impact Risk} = \frac{(5 + 4 + 5)}{3} \times \frac{5}{5}$$

IMPACT RISK = 4.67

Table 14 - Risk Calculation for the Pre-Mitigation Development Impact on JAG 1

IMPACT	SIGNIFICANCE	SPATIAL SCALE	TEMPORAL SCALE	PROBABILITY	RATING
-	Very High	Regional/Provincial	Permanent	Going to Happen	**Very High**
Pre-Mitigation Impact on JAG 1	5	4	5	5	**4.67**

This calculation has revealed that the pre-mitigation impact risk of the proposed development on site JAG 1 falls within Impact Class 5, which represents a Very High Impact Risk.

8.2.1.2 Risk Calculation for the Pre-Mitigation Impact of Backfilling on the Other Sites

During the fieldwork undertaken for this study, a total of 25 heritage sites were identified within the study area. A few of these sites were identified close to the perimeter of the mine pit. Such sites include JAG 7, JAG 8, JAG 9, JAG 10 and JAG 13.
Should the proposed backfilling not be allowed, it is expected that further break back along the slopes of the pit will take place. Such break back has the potential of pulling one or more of these sites down the mine pit, resulting in the destruction of these sites. In fact, it is expected that incidents of break back have occurred over a long period in time, and during this extended period would have resulted in the destruction of a number of features and sites associated with the mining of the pit.

The pre-mitigation rehabilitation of the mine pit in the form of backfilling is expected to stabilise the mine pit. Refer the specialist reports by HAC Meintjes and Dr GC Howell (SRK, 2012), Dr GC Howell (SRK, 2019) and L de Villiers (Turn 180 Environmental Consultants) for more information on the use of tailings and backfilling to stabilise the mine pit.

The improved stabilisation of the mine pit is expected to have a positive impact on the preservation

of the heritage fabric located on the perimeter of the pit. The pre-mitigation impact of the proposed backfilling of the mine pit would result in a positive impact on the above-mentioned five sites. Additionally, a positive impact is also expected on the yet unidentified heritage fabric which is likely located on the perimeter of the mine pit.

The assessment of the pre-mitigation impact on the heritage sites identified on the rim of the mine pit, is calculated in the section that follows.

$$\text{Impact Risk} = \frac{(\text{Significance} + \text{Spatial} + \text{Temporal})}{3} \times \frac{\text{Probability}}{5}$$

$$\text{Impact Risk} = \frac{(3 + 4 + 5)}{3} \times \frac{3}{5}$$

IMPACT RISK = 2.4

Table 15 - Risk Calculation for the Pre-Mitigation Impact of Backfilling on the Other Sites

IMPACT	SIGNIFICANCE	SPATIAL SCALE	TEMPORAL SCALE	PROBABILITY	RATING
+	Moderate	Regional/Provincial	Permanent	Could Happen	**Moderate**
Pre-Mitigation Impact on Other Sites	3	4	5	3	**2.4**

This calculation has revealed that the pre-mitigation impact risk of the proposed development on sites JAG 7, JAG 8, JAG 9, JAG 10 AND JAG 13 falls within Impact Class 3, which represents a Moderate Impact Risk. This impact is expected to be a positive impact.

8.2.2 Risk Calculation for the Pre-Mitigation Impact of the Conveyors and Deposition Points

8.2.2.1 Risk Calculation for the Pre-Mitigation Impact on JAG 8, JAG 9 and JAG 10

In this section the pre-mitigation impact of the proposed construction of a conveyor and establishment of two deposition points on sites JAG 8, JAG 9 and JAG 10 will be discussed. These three sites are all foundation remains of historic mining structures and it seems possible for these structures to have formed part of the historic hoisting or haulage system associated with the opencast mining at the mine pit. With all mining activities associated with the mine pit halted in 1913, these structures are certainly older than 100 years.

The available development layout plan indicates that the proposed Conveyor Dump Position will be established at distances of between approximately 45m (for sites JAG 8 & JAG10) and approximately 32m (for site JAG 9) from these identified heritage sites.

At the moment it is not known whether the vibration associated with the conveyor or activities associated with the Conveyor Dump Position are expected to result in break back in the slope and the eventual destruction of one or more of these three sites. The impact assessment calculations shown below did not address or include this possible risk.

$$\text{Impact Risk} = \frac{(\text{Significance} + \text{Spatial} + \text{Temporal})}{3} \times \frac{\text{Probability}}{5}$$

$$\text{Impact Risk} = \frac{(4 + 4 + 3)}{3} \times \frac{3}{5}$$

IMPACT RISK = 2.2

Table 16 - Risk Calculation for the Pre-Mitigation Impact on JAG 8, JAG 9 & JAG 10

IMPACT	SIGNIFICANCE	SPATIAL SCALE	TEMPORAL SCALE	PROBABILITY	RATING
-	High	Regional/Provincial	Medium-Term	Could Happen	**Moderate**
Pre-Mitigation Impact on JAG 8, JAG 9 & JAG 10	4	4	3	3	**2.2**

This calculation has revealed that the pre-mitigation impact risk of the proposed development on JAG 8, JAG 9 and JAG 10 falls within Impact Class 3, which represents a Moderate Impact Risk.

8.2.2.2 Risk Calculation for the Pre-Mitigation Impact on JAG 6, JAG 11 and JAG 24

In this section the pre-mitigation impact of the proposed construction of a conveyor and establishment of two deposition points on sites JAG 6, JAG 11 and JAG 24 will be discussed. These three sites include two historic mine structures and the position where the original mine shaft was located. All these sites are expected to be older than 100 years. Please note that no headgear or surface marking for site JAG 24 exists, however the actual shaft is still believed to be located here.

The available development layout plan indicates that the proposed conveyor will be built through the southern end of the site, passing the three identified sites at varying distances *en route* to the mine pit. The conveyor will be located approximately 39m from JAG 6, roughly 48m from site JAG 11 and immediately adjacent to JAG 24.

$$\text{Impact Risk} = (\text{Significance} + \text{Spatial} + \text{Temporal}) \times \text{Probability}$$

$$\text{Impact Risk} = \frac{\frac{(4+4+3)}{3}}{3} \times \frac{\frac{3}{5}}{5}$$

IMPACT RISK = 2.2

Table 17 - Risk Calculation for the Pre-Mitigation Impact on JAG 6, JAG 11 & JAG 24

IMPACT	SIGNIFICANCE	SPATIAL SCALE	TEMPORAL SCALE	PROBABILITY	RATING
-	High	Regional/Provincial	Medium-Term	Could Happen	**Moderate**
Pre-Mitigation Impact on JAG 6, JAG 11 & JAG 24	4	4	3	3	**2.2**

This calculation has revealed that the unmitigated impact risk of the proposed development on sites JAG 6, JAG 11 and JAG 24 falls within Impact Class 3, which represents a Moderate Impact Risk.

8.3 Risk Calculation for the Post-Mitigation Impact of the Proposed Development

8.3.1 Risk Calculation for the Post-Mitigation Impact of the Proposed Backfilling

8.3.1.1 Risk Calculation for the Post-Mitigation Impact of the Proposed Backfilling on JAG 1

In this section the post-mitigation impact of the proposed backfilling or rehabilitation on the mine pit at site JAG 1 will be assessed.

The recommended mitigation for the rehabilitation of the mine pit is for the backfilling of the pit to be undertaken up to a point just below the measured depth of the water as indicated on the sign mentioned above. In other words, the pit should be backfilled to a point roughly 168m below the ground surface at the pit's rim. With an estimated depth of approximately 268m between the ground surface at the mine pit's rim and the debris surface at the base of the pit, this would allow for backfilling to be undertaken to a depth of roughly 100m when measured from the base of the pit to the tailings surface. The difference in depth of the backfilled tailings of 168m as measured from the surface rim of the mine pit versus the historic water depth of 165m below the surface rim, can be used for adding a layer of water to hide the surface of the rehabilitated mine pit. This section of approximately 3m in depth can then be used for this purpose. In other words, once the backfilling is complete and has dried, the surface of the tailings that was pumped into the mine pit (which would be located at a depth of 168m below the surface of the mine pit's rim), can then be filled with 3m of water to cover the surface of the tailings. This would make the mine pit appear in exactly the

same way as recorded historically on the sign, with a water level at a depth of 165m below the surface of the rim of the pit.

The proposed mitigation measure would allow for the aesthetic character of the volume and depth of the excavated mine pit to be better preserved than what the case would have been in terms of the pre-mitigation impact. Additionally, if the surface of the backfilled pit is covered by a few meters of water, the aesthetic effect would be enhanced. Any visitors or tourists to the mine pit will be able to view the pit exactly in the way it would have been viewed historically before the water in the mine pit was pumped out.

At the same time, the mitigated backfilling is expected to also stabilise the slopes of the mine pit to the extent that the visible portion of the mine pit can be preserved into the future. It is important to note, however, that the question as to whether this more limited backfilling would have any significant impact on the stability of the pit slopes, must be assessed by a geotechnical or structural engineering or geological specialist. For the moment, the post-mitigation impact assessment calculations shown below, were undertaken on the assumption that the mitigated backfilling would result in stabilising the slopes of the mine pit.

$$\text{Impact Risk} = \frac{(\text{Significance} + \text{Spatial} + \text{Temporal})}{3} \times \frac{\text{Probability}}{5}$$

$$\text{Impact Risk} = \frac{(4 + 4 + 5)}{3} \times \frac{4}{5}$$

IMPACT RISK = 3.47

Table 18 - Risk Calculation for the Post-Mitigation Development Impact on JAG 1

IMPACT	SIGNIFICANCE	SPATIAL SCALE	TEMPORAL SCALE	PROBABILITY	RATING
-	High	Regional/Provincial	Permanent	Very Likely	**High**
Post-Mitigation Impact on JAG 1	4	4	5	4	**3.47**

This calculation has revealed that the post-mitigation impact risk of the proposed development on site JAG 1 falls within Impact Class 4, which represents a High Impact Risk.

8.3.1.2 Risk Calculation for the Post-Mitigation Impact of Backfilling on the Other Sites

During the fieldwork undertaken for this study, a total of 25 heritage sites were identified. A few of

these sites were identified close to the perimeter of the mine pit. Such sites include JAG 7, JAG 8, JAG 9, JAG 10 and JAG 13.

Should the proposed backfilling not be allowed, it is expected that further break back along the slopes of the pit will take place. Such break back has the potential of pulling one or more of these sites down the mine pit, resulting in the destruction of these sites. In fact, it is expected that incidents of break back have occurred over a long period in time, and during this extended period would have resulted in the destruction of a number of features and sites associated with the mining of the mine pit. Refer the specialist reports by HAC Meintjes and Dr GC Howell (SRK, 2012), Dr GC Howell et al. (SRK, 2019) and L de Villiers (Turn 180 Environmental Consultants) for more information on the use of tailings and backfilling to stabilise the mine pit.

The post-mitigation rehabilitation of the mine pit in the form of backfilling is expected to stabilise the mine pit. However, this must be assessed and confirmed by a geotechnical or structural engineering or geological specialist.

Based on the available information, which is to be confirmed by the above-mentioned specialist, the improved stabilisation of the mine pit is expected to have a positive impact on the preservation of the heritage fabric located on the perimeter of the pit. The post-mitigation impact of the proposed backfilling of the mine pit is expected to resultin a positive impact on the above-mentioned five sites. Additionally, a positive impact is also expected on the yet unidentified heritage fabric which is likely located on the perimter of the mine pit.

$$\text{Impact Risk} = \frac{(\text{Significance} + \text{Spatial} + \text{Temporal})}{3} \text{ X } \frac{\text{Probability}}{5}$$

$$\text{Impact Risk} = \frac{(3 + 4 + 5)}{3} \text{ X } \frac{4}{5}$$

IMPACT RISK = 2.4

Table 19 - Risk Calculation for the Post-Mitigation Impact of Backfilling on the Other Sites

IMPACT	SIGNIFICANCE	SPATIAL SCALE	TEMPORAL SCALE	PROBABILITY	RATING
+	Moderate	Regional/Provincial	Permanent	Could Happen	**Moderate**
Post-Mitigation Impact on Other Sites	3	4	5	3	**2.4**

This calculation has revealed that the post-mitigation impact risk of the proposed development on sites JAG 7, JAG 8, JAG 9, JAG 10 AND JAG 13 falls within Impact Class 3, which represents a Moderate Impact Risk. This impact is expected to be a positive impact.

8.3.2 Risk Calculation for the Post-Mitigation Impact of the Conveyor and Deposition Points

8.3.2.1 Risk Calculation for the Post-Mitigation Impact on JAG 8, JAG 9 and JAG 10

In this section the post-mitigation impact of the proposed construction of a conveyor and establishment of two deposition points on sites JAG 8, JAG 9 and JAG 10 will be discussed. These three sites are all foundation remains of historic mining structures and it seems possible for these structures to have formed part of the historic hoisting or haulage system associated with the opencast mining at the mine pit. With all mining activities associated with the mine pit halted in 1913, these structures are certainly older than 100 years.

The available development layout plan indicates that the proposed Conveyor Dump Position will be established at distances of between approximately 45m (for sites JAG 8 & JAG10) and approximately 32m (for site JAG 9).

At the moment it is not known whether the vibration associated with the conveyor or activities associated with the Conveyor Dump Position is expected to result in break back in the slope and the eventual destruction of one or more of these three sites. The impact assessment calculations shown below did not address or include this possible risk.

$$\text{Impact Risk} = \frac{(\text{Significance} + \text{Spatial} + \text{Temporal})}{3} \times \frac{\text{Probability}}{5}$$

$$\text{Impact Risk} = \frac{(4 + 4 + 3)}{3} \times \frac{2}{5}$$

IMPACT RISK = 1.47

Table 20 - Risk Calculation for the Post-Mitigation Impact on JAG 8, JAG 9 & JAG 10

IMPACT	SIGNIFICANCE	SPATIAL SCALE	TEMPORAL SCALE	PROBABILITY	RATING
-	High	Regional/Provincial	Medium-Term	Unlikely	**Low**
Post-Mitigation Impact on JAG 8, JAG 9 & JAG 10	4	4	3	2	**1.47**

This calculation has revealed that the unmitigated impact risk of the proposed development on sites JAG 8, JAG 9 and JAG 10 falls within Impact Class 2, which represents a Low Impact Risk.

8.3.2.2 Risk Calculation for the Post-Mitigation Impact on JAG 6, JAG 11 and JAG 24

In this section the post-mitigation impact of the proposed construction of a conveyor and establishment of two deposition points on sites JAG 6, JAG 11 and JAG 24 will be discussed. These sites include two historic mine structures and the position where the original mine shaft was located. All three these sites are expected to be older than 100 years. Please note that no headgear or surface marking for site JAG 24 exists, however the actual shaft is still believed to be located here.

The mitigated development layout entails building the conveyor along a line approximately 55m east of site JAG 24. Incidentally, this new layout will be located approximately 95m west of another site, namely JAG 16. However, no impact is expected on this latter site. This proposed new conveyor route will also be approximately 83m east of site JAG 6 and approximately 70m east of site JAG 11.

$$\text{Impact Risk} = \frac{(\text{Significance} + \text{Spatial} + \text{Temporal})}{3} \times \frac{\text{Probability}}{5}$$

$$\text{Impact Risk} = \frac{(4 + 4 + 3)}{3} \times \frac{2}{5}$$

IMPACT RISK = 1.47

Table 21 - Risk Calculation for the Post-Mitigation Impact on JAG 6, JAG 11 & JAG 24

IMPACT	SIGNIFICANCE	SPATIAL SCALE	TEMPORAL SCALE	PROBABILITY	RATING
-	High	Regional/Provincial	Medium-Term	Unlikely	**Low**
Post-Mitigation Impact on JAG 6, JAG 11 & JAG 24	4	4	3	2	**1.47**

This calculation has revealed that the post-mitigation impact risk of the proposed development on sites JAG 6, JAG 11 and JAG 24 falls within Impact Class 2, which represents a Low Impact Risk.

9 REQUIRED MITIGATION MEASURES

9.1 Introduction

In this chapter, required mitigation measures for each of the sites affected by the proposed development will be outlined. As shown in **Chapter 7**, mitigation would be required for the following:

- Impact of Proposed Rehabilitation on the Mine Pit at JAG 1;
- Impact of the Proposed Deposition Point on sites JAG 8, JAG 9 & JAG 10; and
- Impact of the Proposed Conveyor on sites JAG 6, JAG 11 & JAG 24.

9.2 Required Mitigation Measures

9.2.1 Mitigation Measures required for the Proposed Rehabilitation on the Mine Pit at JAG 1

The assessment undertaken of the pre-mitigation impact of the proposed rehabilitation of the mine pit at JAG 1 is expected to result in a very high negative impact. Due to the nature of the proposed development, this impact will also be non-reversible.

With such a high negative and permanent impact, the considerations of alternatives would be the first choice. An assessment of the development alternatives is provided in the Integrated Water and Waste Management Plan (IWWMP) compiled by Louis de Villiers (Turn 180 Environmental Consultants, 2019). This report indicates that the so-called no-go option would require the

construction of a new Fine Tailings Storage Facility (FTST), which may not be economically feasible for the mine to do. Furthermore, the construction of such a facility "…*will result in impacts on the exploitable upper aquifer and create a further loss of land due to the FTSF's footprint. A new FTSF will also likely have a negative impact on hydrology and surface water quality. The quantity of natural runoff will also be reduced, as it (i.e. rainfall) will be retained in the FTSF*." (Turn 180 Environmental Consultants, 2019).

The report titled *Review of Jagersfontein Pit Stability and Backfilling Options* compiled by HAC Metinjes and Dr. GC Howell (SRK, 2012) states that the mine pit "…*is showing signs of ongoing break back of the side slopes*…" and adds that a review of the "…*open pit site conditions indicates that there will be ongoing break back of the side slopes of the open pit for a considerable period of time*." This report recommended only two alternate options, namely to peg the proposed break back area on the ground and fence this zone of break back in perpetuity or alternatively backfill the pit.

These are the only two options available to the mine. As indicated in the IWWMP compiled by Louis de Villiers (Turn 180 Environmental Consultants, 2019:13), the "…*Pit's instability will persist, with the potential risk that vibrations and break-back of the Pit's walls might cause injuries to trespassers or damage to surrounding property and the fence itself. Break-back episodes are intermittent and unpredictable. Regular survey and drone surveys are performed. Current activity is only a minor erosional process, but large block-break back can always be expected and has occurred in the form of boulders falling into the Pit during heavy rain events*."

On the point of back break at the mine pit, an overlay of the depictions of the perimeter of the pit on the 1948 and 1973 topographical maps over a recent satellite image clearly show changes in the general appearance and position of sections of the mine pit's perimeter. These changes also occur in the 'correct' way over time, meaning the earliest depiction of the pit perimeter is smaller than the one depicted on the 1973 which in turn is smaller than the depiction of the pit on the more recent satellite image. Therefore, unless the perimeters of the mine pit were inaccurately surveyed at the time that these maps were compiled, it would be difficult not to interpret these changes in the mine pit perimeter and appearance over time to break back of the pit walls. Refer **Figure 42.**

With this as background, it is clear the in this scenario of unpredictability in the stability of the mine pit, coupled with the risks identified with the construction of a new FTST, with the possibility of the mine closing down as a result of not being able to build such a facility, strongly suggest that the no-go option is not viable. Additionally, the risks associated with the questionable and unpredictable stability of the mine pit walls would make the provision of access to visitors and tourists to the mine pit difficult, if not impossible. A middle ground between the currently proposed development on the one hand, and the no-go option on the other, is therefore required.

A sign that was observed at the tourist centre located on the southern end of the mine pit, provides a cross-section plan of the mine pit and associated geology. This sign appears to be derived from

a surveyed mine plan that was in all likelihood compiled by De Beers. As the De Beers Archive in Kimberley was not open to researchers at the time of this study, the exact origin and date of the information contained on the sign could not be verified. This said, the sign shows that the mine pit was at the time covered in water, and that the depth of the water as measured between the ground surface at the pit's rim and the surface of the water, was 165m. Additionally, this sign also indicates that the depth of the water, as measured between the base of the pit and surface of the water, was 176m. This means that the depth of the entire mine pit was calculated to be 341m. According to the report by Dr GC Howell (SRK, 2019), the depth of the debris surface at the base of the pit in 2019 was 268m below the surface.

The recommended mitigation for the rehabilitation of the mine pit is for the backfilling of the pit to be undertaken up to a point just below the measured depth of the water as indicated on the sign mentioned above. In other words, the pit should be backfilled to a point roughly 168m below the ground surface at the pit's rim. With an estimated depth of approximately 268m between the ground surface at the mine pit's rim and the debris surface at the base of the pit, this would allow for backfilling to be undertaken to a depth of roughly 100m when measured from the base of the pit to the tailings surface. The difference in depth of the backfilled tailings of 168m as measured from the surface rim of the mine pit versus the historic water depth of 165m below the surface rim, can be used for adding a layer of water to hide the surface of the rehabilitated mine pit. This section of approximately 3m in depth can then be used for this purpose. In other words, once the backfilling is complete and has dried, the surface of the tailings that was pumped into the mine pit (which would be located at a depth of 168m below the surface of the mine pit's rim), can then be filled with 3m of water to cover the surface of the tailings. This would make the mine pit appear in exactly the same way as recorded historically on the sign, with a water level at a depth of 165m below the surface of the rim of the pit.

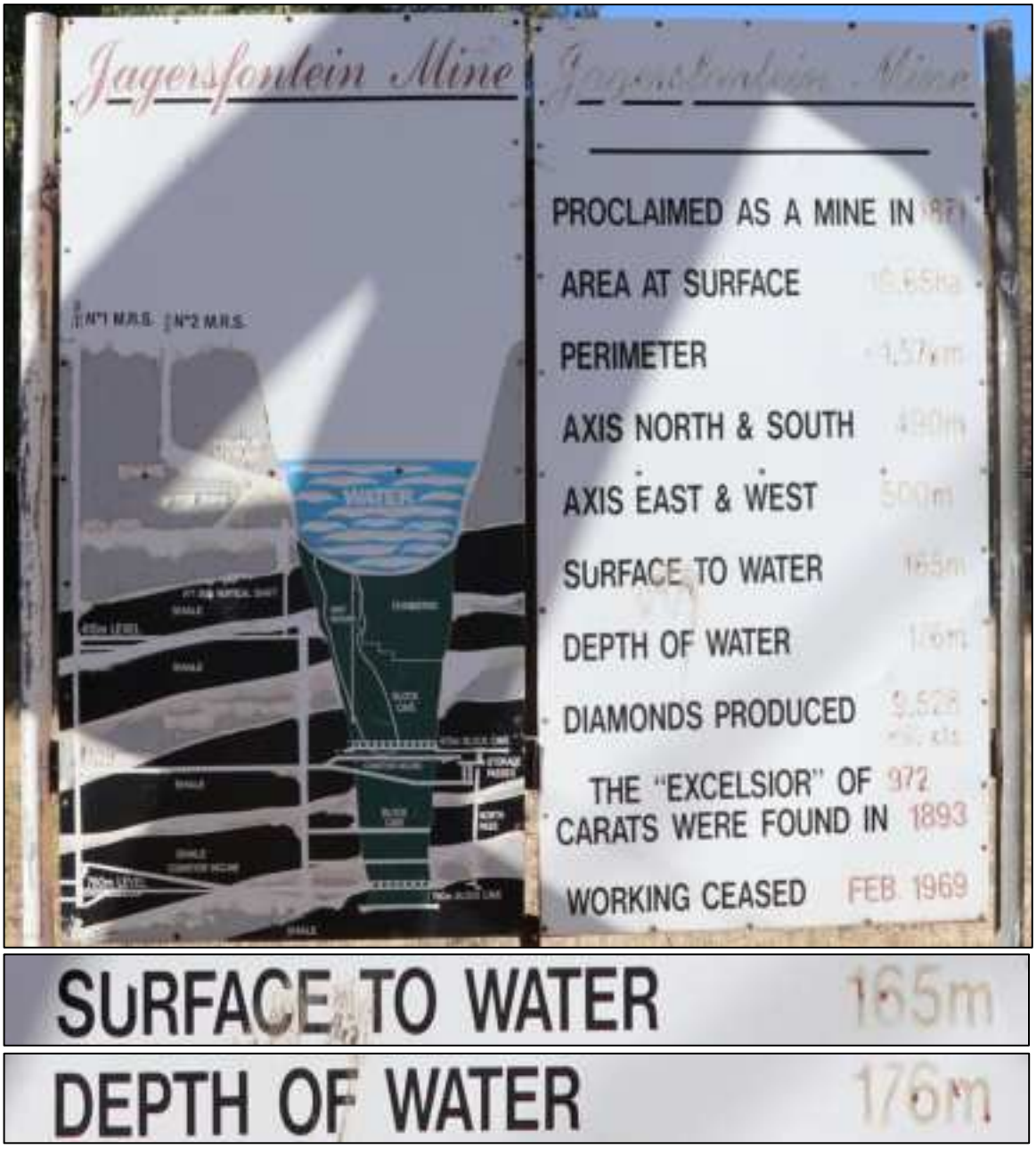


Figure 116 – These two images depict the sign located at the tourist centre at the northern end of the mine pit. The lower images provide detailed views of the sections indicating the distance between the ground surface and the historic water level and secondly the depth of the historic water level inside the mine pit as recorded at the time.

The proposed mitigation measure outlined above is expected to improve the stability of the walls of the mine pit. However, this must be assessed by geotechnical or structural engineering specialist. The mine will be able to continue its operations for at least a while, providing at least short-term socio-economic benefit to its employees during the economic downturn experienced as a result of the COVID-19 pandemic. Additionally, the possible risks associated with the construction of a FTSF as outlined in the IWWMP can be avoided.

At the same time, quite a significant depth of the historic mine pit can be preserved. With the improved stability expected as a result of the proposed mitigated development, the tourist centre and gantry can be refurbished and re-used to allow for tourists and interested visitors to enjoy the

mine pit and its history.

This mitigation development proposal is dependant on the following heritage-related conditions:

- A heritage management plan must be compiled by Jagersfontein Developments (Pty) Ltd to improve the protection and management of all the heritage resources located within the mine; and

- Jagersfontein Developments (Pty) Ltd must undertake to refurbish the tourist centre and gantry and with the assistance of provincial museums establish a site museum where the significant history of the mine can be memmorialised. Furthermore, the mine must train local community members to act as site guides to assist visitors in the interpretation and enjoyment of the mine and its history. Additionally, the mine must purposefully re-engage all possible stakeholders from national and provincial government, private entities and *De Beers Consolidated Mines Limited* to find a lasting solution for the preservation of the mine and its history, including the marketing of the site to both local and foreign visitors.

9.2.2 Mitigation Measures required for the Deposition Point on JAG 8, JAG 9 and JAG 10

The assessment undertaken of the pre-mitigation impact of the establishment and operation of the Conveyor Dump Position on the rim of the mine pit is expected to result in a moderate negative impact.

The following mitigation measures are required:

- An archaeological watching brief is required during the construction of the nearby coveyor and two deposition points. This watching brief would allow for a professional archaeologist to monitor the construction activities to ensure no impacts occur to the nearby sites. Additionally, this watching brief would assist in the identification of archaeological and heritage sites not yet identified; and
- An archaeological monitoring protocol is required during the expected duration of the use of the nearby conveyor and deposition points. This monitoring protocol would check whether any impacts on the nearby sites can be identified, and if such impacts are indeed identified, the activities can be amended to mitigate such identified impacts.

9.2.3 Mitigation Measures required for the Deposition Point on JAG 6, JAG 11 and JAG 24

The assessment undertaken of the pre-mitigation impact of the proposed construction and operation of a conveyor through the southern end of the study area to the proposed Conveyor Dump Position on the rim of the mine pit has indicated that a moderate impact risk can be identified.

The following mitigation measures are required:

- The route for the proposed conveyor must be altered to allow an increased buffer area between it and the identified heritage sites at JAG 6, JAG 11 and JAG 24. A recommended amended route for the conveyor through the southern end of the study area is depicted in **Figure 117** below;

- As this study did not include any assessments or work outside of the study area, the proposed conveyor route located outside of the study area, including any amendments that would be required outside the study area to change its route to the one depicted in **Figure 117** below, must be assessed by a heritage specialist; and

- The exact layout and position of the link (pipeline) between the conveyor and the proposed Slimes Deposition Point is not depicted on the final development layout plan made available for this project. It is recommended that this pipeline be built as far as possible across and along recently disturbed areas, such as along the access road and across the extensively disturbed section on the southern end of the study area. The pipeline must also be kept more than 50m away from all identified heritage sites. The above-mentioned archaeological watching brief would also apply for the construction of this pipeline.

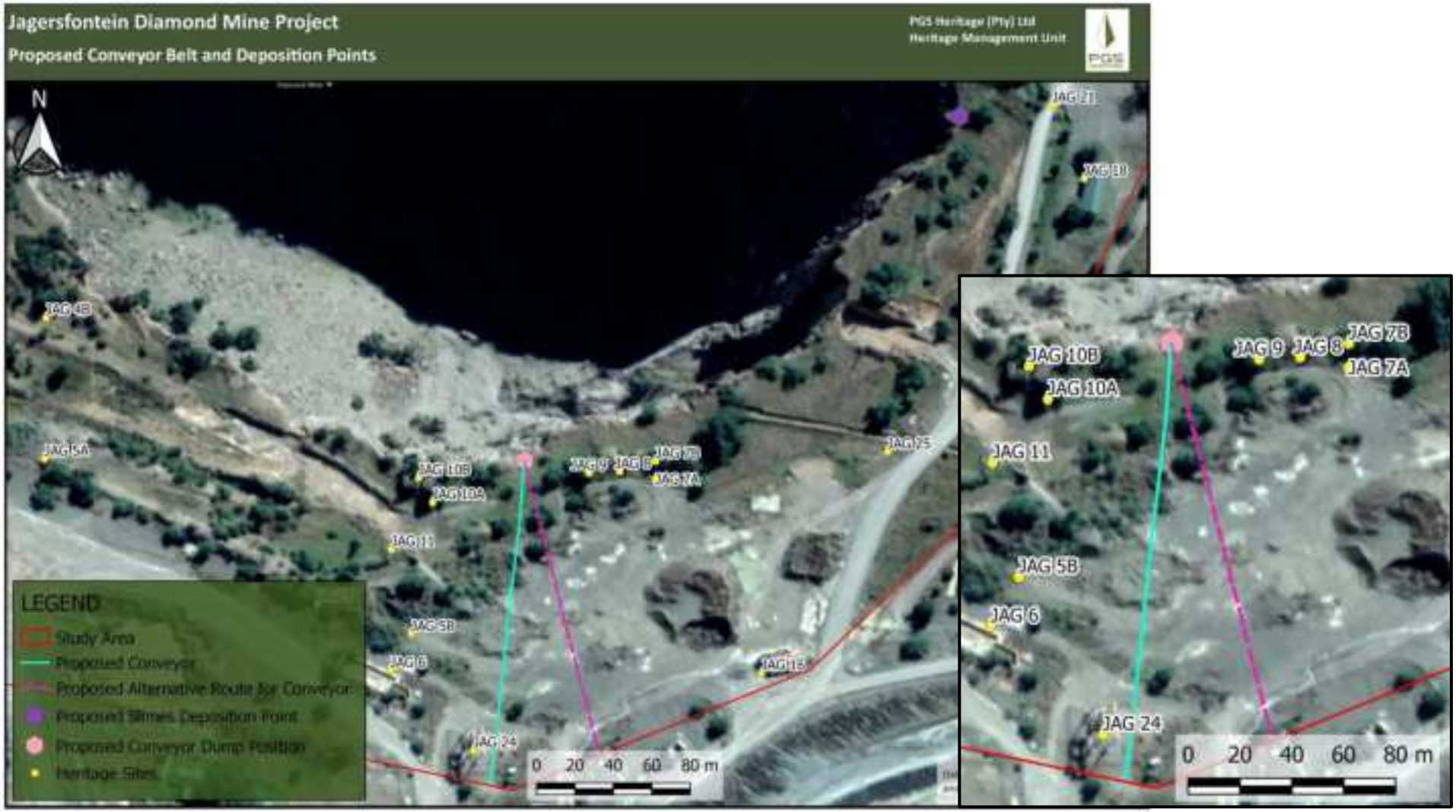


Figure 117 – Google Earth image depicting the conveyor that is currently proposed (light blue line) and the amended route that is recommended as part of the mitigation measures (purple line). The insert provides a closer view of the two conveyor routes.

10 CONCLUSIONS

Introduction

PGS Heritage (Pty) Ltd (PGS) was appointed by Jagersfontein Developments Pty (Ltd) to undertake a Phase 1 Heritage Impact Assessment (HIA) for the Proposed Rehabilitation of the Old Jagersfontein Mine Pit located on Portion 15 of the Farm Jagersfontein 14 IS, Kopanong Local Municipality, Xhariep District Municipality, Free State Province. The applicant is Jagersfontein Developments (Pty) Ltd.

General Desktop Study

An archaeological and historical desktop study of the study area and surroundings was undertaken. This revealed the depth of history associated with the study area and Jagersfontein Mine. It showed that mining activities at what is today known as the old Jagersfontein Mine Pit already started during the 1870s and continued until 1913, when all opencast mining was halted and only underground mining continued. The desktop study also illustrated the webb and flow of the mine's history, with closures, floods and strikes interposed by incredible highs, such as the recovery of the *Excelsior* and *Reitz* diamonds in 1893 and 1895 respectively.

As part of the above-mentioned desktop study a description of the mining methods utilised at the Jagersfontein Mine was also also provided. This outline of the mining methods and process components included the excavation of kimberlite from the ground, followed by the crushing or weathering of the excavated material, then the separation of the larger diamondiferous material from the smaller non-diamondiferous material through a process of washing and the screening and sorting of the diamondiferous material to finally take possession of the stones. Where possible, the tangible tools and equipment used during each of these process phases were also discussed.

This was augmented by a study of available early editions of topographic maps and old aerial photographs, which provided information on the historic layering of the study area and assisted with the identification and interpretation of archaeological and heritage sites. Interestingly, comparisons between the outlines of the mine pit as depicted on the two early editions of the topographic sheets with its current outline as depicted on a recent Google Earth satellite image, indicate that its current outline is quite a bit wider than the pit outlines indicated on the older topographical map sheets. It seems likely for this disparity to be attributable to break back along the pit walls.

An assessment of previous archaeological and heritage reports undertaken within and in the surroundings of the study area was undertaken. It also revealed a number of sites identified during previous archaeological and heritage studies. The heritage impact assessment report compiled by Loudine Philip (2009) was especially enlightening in that her study assessed the entire property of

the Jagersfontein Mine, including the study area. A high number of archaeological and heritage sites were identified during this previous study, including a number of sites that were identified within the current study area.

Palaeontology

Ms. Elize Butler of Banzai Environmental was commissioned to undertake a Palaeontological Desktop Assessment (PDA). Her report and findings are attached in full in **Appendix C**.

Ms. Butler found that the study area "…*is underlain by the Tierberg Formation, of the Ecca Group (Karoo Supergroup) as well as Quaternary superficial deposits. These superficial sediments mantle the underlaying older deposits. According to the PalaeoMap on the South African Heritage Resources Information System (SAHRIS) database, the Palaeontological Sensitivity of the Tierberg Formation is High, while that of the Quaternary deposits is Low, but locally High (Almond and Pether, 2009; Almond et al., 2013, SAHRIS website)." (Banzai Environmental, 2021:vii).*

*T*he palaeontological report concludes that the *"…the proposed Rehabilitation of the Old Jagersfontein Mine Pit will not comprise of any new mining activities and thus a* ***low*** *palaeontological* ***significance*** *is allocated to the proposed development. It is therefore considered that the proposed Rehabilitation of the Old Jagersfontein Mine Pit is deemed appropriate and feasible and will not lead to detrimental impacts on the palaeontological resources of the area." (Banzai Environmental, 2021:vii).*

The following recommendations are made in the palaeontological report:

- If fossil remains are discovered during any phase of construction, on the surface or exposed by excavations the **Chance Find Protocol** must be implemented by the ECO in charge of these developments. These discoveries ought to be protected (*in situ*) and the ECO must report to SAHRA (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Tel: 021 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za) so that correct mitigation (recording and collection) can be carried out; and

- Preceding any collection of fossil material, the palaeontologist would need to apply for a collection permit from SAHRA. Fossil material must be curated in an accredited collection (museum or university collection), while all fieldwork and reports should meet the minimum standards for palaeontological impact studies suggested by SAHRA (Banzai Environmental, 2021).

Fieldwork

The fieldwork component of the study was aimed at identifying tangible remains of archaeological, historical and heritage significance. This component was undertaken by way of walkthroughs by an

experienced archaeological fieldwork team on Tuesday, 23 June 2020 and Wednesday, 24 June 2020. The fieldwork team consisted of an experienced archaeologist and heritage specialist (Polke Birkholtz) and a fieldwork assistant (Derrick James).

The team used hand-held GPS devices throughout the fieldwork. These devices were used to record tracklogs showing the routes followed by the e archaeological fieldwork team during the fieldwork. All sites identified were photographically and qualitatively recorded, and their respective localities documented using a hand-held GPS device.

The fieldwork resulted in the identification of a total of twenty-five (25) sites. These were numbered from JAG 1 to JAG 25. The prefix used in this numbering system was derived from the farm name, namely Jagersfontein. The following sites were identified:

- Old Jagersfontein Mine Pit (JAG 1);
- Historic mine structures which may have formed part of the historic hoisting and haulage activities at the pit (JAG 2, JAG 4, JAG 7, JAG 8, JAG 9, JAG 10 & JAG 13);
- Historic mine structures that were used for mine infrastructure such as bridges, dams and tunnels (JAG 3, JAG 5, JAG 6, JAG 11 & JAG 21);
- Historic structures (JAG 12 & JAG 15);
- Historic middens (JAG 14);
- Historic mine structures used for offices and accommodation (JAG 16, JAG 18, JAG 19 & JAG 20);
- Old mine dumps and deposition floors (JAG 17 & JAG 22);
- Historic mine shafts (JAG 23 & JAG 24); and
- Stone Age sites (JAG 25);

It should be noted that due to safety concerns, no intensive walkthroughs were possible along the close perimeter of the mine pit. Additionally, the focus during the fieldwork was placed on areas where heritage sites were believed to be located, with less attention placed on areas which had been disturbed by more recent developments and activities.

Unfortunately, a comparison between the fieldwork findings of the previous heritage study (Philip, 2009) and the fieldwork undertaken for the present study, has revealed that a high number of the heritage sites identified in the previous study had been destroyed or irreparably damaged in the 12 years since that study was completed. This destruction of previously identified sites was found to have taken place both within the current study area as well as the mine property as a whole. This wanton destruction of identified heritage sites is of great concern. However, the heritage management plan recommended for the entire mine is expected to at least ensure that the heritage sites still located within this property will be better managed and preserved into the future.

Impact Assessment

An overlay of the identified archaeological and heritage sites over the proposed development footprint areas was made to assess the impact of the proposed development on these identified archaeological and heritage sites. Both pre-mitigation and post-mitigation impact assessments were undertaken.

Assessment of the Heritage Impact of the Proposed Backfilling of the Mine Pit

An assessment of the impact of the proposed rehabilitation or backfilling of the mine pit (JAG 1) was undertaken first. This section of the impact assessment was divided into the assessment of the impact of the proposed rehabilitation or backfilling on the mine pit itself, followed by an assessment of the impact of this same development component on the other sites located in proximity to the rim or perimeter of the mine pit.

The current proposal is for the mine pit to be rehabilitated by filling it with tailings. It is estimated that the pit will be backfilled to a depth of approximately 30m from the top, but this depth may vary according to the available volume of tailings (Turn 180 Environmental Consultants, 2019).
It is important to note that the proposed rehabilitation of the pit is expected to be an irreversible process in that it would not be economically feasible to reverse this process once completed. The proposed impact can therefore be considered permanent.

Another consideration included in this assessment is the significance of the mine pit. The research undertaken by Steve Lunderstedt and presented by him during a lecture to the Historical Society of Kimberley and the Northern Cape on Thursday, 19 May 2005 (refer to **Appendix D**), indicates that the pit at Jagersfontein is the deepest pick-and-shovel excavation anywhere in the world. With the introduction and development of excavation machinery during the twentieth century, this is a record not expected to be broken anytime in the future. The mine pit also represents a monument to the ingenuity, determination and labour of the miners and mine workers of all races and backgrounds at Jagersfontein. A monument that still stands today. Additionally, the mine pit represents the site where two record-breaking diamonds were discovered, namely the *Excelsior* and the *Reitz*. Even today, these diamonds are mentioned as part of the select group considered to be the finest diamonds ever discovered. This very mine, with its associated mine pit, was for many years known the world over as the source of unique and sought after white diamonds with a bluish tint referred to at the time as 'Jagers.'

As a result, the mine pit at Jagersfontein possesses very high levels of aesthetic, historic and scientific significance and is deemed to be of **Local Significance (LS).** This said, the site even has the potential to be considered of **Provincial Significance (PS)** as well.

From a heritage point of view, the near complete backfilling of the mine pit would have an incredibly negative impact on its aesthetic appeal. A pit with a depth of approximately 30m would certainly

not be appealing to visitors or tourists to the site. One of the draw-cards of the mine pit is its sheer volume and depth and its steep-sided walls, which all tie in with its world record status. The filling up of this historic landmark so that the majority of its volume is taken up by tailings, in a process that is furthermore irreversible, would result in an immense negative impact.

A Socio-economic Impact Assessment (SEIA) for the proposed rehabilitation of the mine pit was undertaken by SES Consulting (2019). This study identified the socio-economic impacts of the proposed development through a public consultation meeting and a socio-economic baseline study, which included a household survey and interviews with key informations. As will be shown in the quotation from this study below, the SEIA revealed that a significant section of the community adjoining the mine is against the proposed development. In the quoted section from this study provided below, Jagersfontein Developments (Pty) Ltd is referred to as JD. The draft report for this study that was made available to the author, observed that "…*overall community members are not in favour of the Project. In the public consultation meeting held at the Mayibuye Hall on the 26th November 2019, it was strongly suggested (by the few attendees) that JD build another TSF rather than destroying the heritage value of the Pit, and any potential tourism opportunities in the area. These sentiments were strongly echoed in the household survey where 72.46% of the households felt that the proposal by JD to backfill and rehabilitate the Pit would negatively affect their households. This is mainly attributed to the perception that backfilling the Pit will destroy the heritage value of the Pit rather than rehabilitate the Pit, which is strongly viewed by the communities in Jagersfontein as a community heritage resource. It is believed that the proposal by JD to backfill the Pit would in the long-term destroy any potential for tourism in the area. According to the communities in Jagersfontein the negative impacts of backfilling the Pit far outweigh the value of JD continuing its operations for another eight years in the area. These sentiments stem primarily from poor relations between JD and the neighbouring communities. Even though JD established the Itumeleng Community Trust (ICT) in 2012, the Trust is accused of not serving the needs and interests of the communities*." (SES Consulting, 2019:ii).

This calculation has revealed that the pre-mitigation impact risk of the proposed development on site JAG 1 falls within Impact Class 5, which represents a Very High Impact Risk.

Assessment of the Heritage Impact of the Proposed Conveyors and Deposition Points

Assessment of the Heritage Impact on sites JAG 8, JAG 9 and JAG 10

An assessment of the pre-mitigation impact of the proposed construction of a conveyor and establishment of two deposition points on sites JAG 8, JAG 9 and JAG 10 was calculated. These three sites are all foundation remains of historic mining structures and it seems possible for these structures to have formed part of the historic hoisting or haulage system associated with the opencast mining at the mine pit. With all mining activities associated with the mine pit halted in 1913, these structures are certainly older than 100 years.

The available development layout plan indicates that the proposed Conveyor Dump Position will be established at distances of between approximately 45m (for sites JAG 8 & JAG10) and approximately 32m (for site JAG 9) from these identified heritage sites.

At the moment it is not known whether the vibration associated with the conveyor or activities associated with the Conveyor Dump Position are expected to result in break back in the slope and the eventual destruction of one or more of these three sites. The impact assessment calculations shown below did not address or include this possible risk.

This calculation has revealed that the pre-mitigation impact risk of the proposed development on JAG 8, JAG 9 and JAG 10 falls within Impact Class 3, which represents a Moderate Impact Risk.

Assessment of the Heritage Impact on sites JAG 6, JAG 11 and JAG 24

The pre-mitigation impact of the proposed construction of a conveyor and establishment of two deposition points on sites JAG 6, JAG 11 and JAG 24 was calculated. These three sites include two historic mine structures and the position where the original mine shaft was located. All these sites are expected to be older than 100 years. Please note that no headgear or surface marking for site JAG 24 exists, however the actual shaft is still believed to be located here.

The available development layout plan indicates that the proposed conveyor will be built through the southern end of the site, passing the three identified sites at varying distances *en route* to the mine pit. The conveyor will be located approximately 39m from JAG 6, roughly 48m from site JAG 11 and immediately adjacent to JAG 24.

This calculation has revealed that the unmitigated impact risk of the proposed development on sites JAG 6, JAG 11 and JAG 24 falls within Impact Class 3, which represents a Moderate Impact Risk.

Mitigation

Due to the moderate to very high levels of development impact revealed during the impact assessment calculations, extensive mitigation measures would be required.

Mitigation Measures Required for the Proposed Backfilling of the Mine Pit

The assessment undertaken of the pre-mitigation impact of the proposed rehabilitation of the mine pit at JAG 1 is expected to result in a very high negative impact. Due to the nature of the proposed development, this impact will also be non-reversible.

With such a high negative and permanent impact, the considerations of alternatives would be the first choice. An assessment of the development alternatives is provided in the Integrated Water and

Waste Management Plan (IWWMP) compiled by Louis de Villiers (Turn 180 Environmental Consultants, 2019). This report indicates that the so-called no-go option would require the construction of a new Fine Tailings Storage Facility (FTST), which may not be economically feasible for the mine to do. Furthermore, the construction of such a facility "…*will result in impacts on the exploitable upper aquifer and create a further loss of land due to the FTSF's footprint. A new FTSF will also likely have a negative impact on hydrology and surface water quality. The quantity of natural runoff will also be reduced, as it (i.e. rainfall) will be retained in the FTSF*." (Turn 180 Environmental Consultants, 2019).

The report titled *Review of Jagersfontein Pit Stability and Backfilling Options* compiled by HAC Metinjes and Dr. GC Howell (SRK, 2012) states that the mine pit "…*is showing signs of ongoing break back of the side slopes*…" and adds that a review of the "…*open pit site conditions indicates that there will be ongoing break back of the side slopes of the open pit for a considerable period of time*." This report recommended only two alternate options, namely to peg the proposed break back area on the ground and fence this zone of break back in perpetuity or alternatively backfill the pit.

These are the only two options available to the mine. As indicated in the IWWMP compiled by Louis de Villiers (Turn 180 Environmental Consultants, 2019:13), the "…*Pit's instability will persist, with the potential risk that vibrations and break-back of the Pit's walls might cause injuries to trespassers or damage to surrounding property and the fence itself. Break-back episodes are intermittent and unpredictable. Regular survey and drone surveys are performed. Current activity is only a minor erosional process, but large block-break back can always be expected and has occurred in the form of boulders falling into the Pit during heavy rain events*."

On the point of back break at the mine pit, an overlay of the depictions of the perimeter of the pit on the 1948 and 1973 topographical maps over a recent satellite image clearly show changes in the general appearance and position of sections of the mine pit's perimeter. These changes also occur in the 'correct' way over time, meaning the earliest depiction of the pit perimeter is smaller than the one depicted on the 1973 which in turn is smaller than the depiction of the pit on the more recent satellite image. Therefore, unless the perimeters of the mine pit were inaccurately surveyed at the time that these maps were compiled, it would be difficult not to interpret these changes in the mine pit perimeter and appearance over time to break back of the pit walls.

With this as background, it is clear the in this scenario of unpredictability in the stability of the mine pit, coupled with the risks identified with the construction of a new FTST, with the possibility of the mine closing down as a result of not being able to build such a facility, strongly suggest that the no-go option is not viable. Additionally, the risks associated with the questionable and unpredictable stability of the mine pit walls would make the provision of access to visitors and tourists to the mine pit difficult, if not impossible. A middle ground between the currently proposed development on the one hand, and the no-go option on the other, is therefore required.

A sign that was observed at the tourist centre located on the southern end of the mine pit, provides a cross-section plan of the mine pit and associated geology. This sign appears to be derived from a surveyed mine plan that was in all likelihood compiled by De Beers. As the De Beers Archive in Kimberley was not open to researchers at the time of this study, the exact origin and date of the information contained on the sign could not be verified. This said, the sign shows that the mine pit was at the time covered in water, and that the depth of the water as measured between the ground surface at the pit's rim and the surface of the water, was 165m. Additionally, this sign also indicates that the depth of the water, as measured between the base of the pit and surface of the water, was 176m. This means that the depth of the entire mine pit was calculated to be 341m. According to the report by Dr GC Howell (SRK, 2019), the depth of the debris surface at the base of the pit in 2019 was 268m below the surface.

The recommended mitigation for the rehabilitation of the mine pit is for the backfilling of the pit to be undertaken up to a point just below the measured depth of the historic water level inside the mine pit as indicated on the sign mentioned above. In other words, the pit should be backfilled to a point roughly 168m below the ground surface at the pit's rim. With an estimated depth of approximately 268m between the ground surface at the mine pit's rim and the debris surface at the base of the pit, this would allow for backfilling to be undertaken to a depth of roughly 100m when measured from the base of the pit to the tailings surface. The difference in depth of the backfilled tailings of 168m as measured from the surface rim of the mine pit versus the historic water depth of 165m below the surface rim, can be used for adding a layer of water to hide the surface of the rehabilitated mine pit. This section of approximately 3m in depth can then be used for this purpose. In other words, once the backfilling is complete and has dried, the surface of the tailings that was pumped into the mine pit (which would be located at a depth of 168m below the surface of the mine pit's rim), can then be filled with 3m of water to cover the surface of the tailings. This would make the mine pit appear in exactly the same way as recorded historically on the sign, with a water level at a depth of 165m below the surface of the rim of the pit.

The proposed mitigation measure outlined above is expected to improve the stability of the walls of the mine pit. However, this must be assessed by geotechnical or structural engineering specialist. The mine will be able to continue its operations for at least a while, providing at least short-term socio-economic benefit to its employees during the economic downturn experienced as a result of the COVID-19 pandemic. Additionally, the possible risks associated with the construction of a FTSF as outlined in the IWWMP can be avoided.

At the same time, quite a significant depth of the historic mine pit can be preserved. With the improved stability expected as a result of the proposed mitigated development, the tourist centre and gantry can be refurbished and re-used to allow for tourists and interested visitors to enjoy the mine pit and its history.

This mitigation development proposal is dependant on the following heritage-related conditions:

- A heritage management plan must be compiled by Jagersfontein Developments (Pty) Ltd to improve the protection and management of all the heritage resources located within the mine; and

- Jagersfontein Developments (Pty) Ltd must undertake to refurbish the tourist centre and gantry and with the assistance of provincial museums establish a site museum where the significant history of the mine can be memmorialised. Furthermore, the mine must train local community members to act as site guides to assist visitors in the interpretation and enjoyment of the mine and its history. Additionally, the mine must purposefully re-engage all possible stakeholders from national and provincial government, private entities and *De Beers Consolidated Mines Limited* to find a lasting solution for the preservation of the mine and its history, including the marketing of the site to both local and foreign visitors.

Mitigation Required for the Construction and Operation of the Conveyor Dump Position

The assessment undertaken of the pre-mitigation impact of the establishment and operation of the Conveyor Dump Position on the rim of the mine pit on sites JAG 8, JAG 9 and JAG 10 is expected to result in a moderate negative impact.

The following mitigation measures are required:

- An archaeological watching brief is required during the construction of the nearby coveyor and two deposition points. This watching brief would allow for a professional archaeologist to monitor the construction activities to ensure no impacts occur to the nearby sites. Additionally, this watching brief would assist in the identification of archaeological and heritage sites not yet identified; and

- An archaeological monitoring protocol is required during the expected duration of the use of the nearby conveyor and deposition points. This monitoring protocol would check whether any impacts on the nearby sites can be identified, and if such impacts are indeed identified, the activities can be amended to mitigate such identified impacts.

Mitigation Required for the Construction of the Conveyor

The assessment undertaken of the pre-mitigation impact of the proposed construction and operation of a conveyor through the southern end of the study area to the proposed Conveyor Dump Position on the rim of the pit has indicated that a moderate impact risk can be identified.

The following mitigation measures are required:

- The route for the proposed conveyor must be altered to allow an increased buffer area between it and the identified heritage sites at JAG 6, JAG 11 and JAG 24. A recommended amended route for the conveyor through the southern end of the study area is depicted in **Figure 117**;

- As this study did not include any assessments or work outside of the study area, the proposed conveyor route located outside of the study area, including any amendments that would be required outside the study area to change its route to the one depicted in **Figure 117** below, must be assessed by a heritage specialist; and

- The exact layout and position of the link (pipeline) between the conveyor and the proposed Slimes Deposition Point is not depicted on the final development layout plan made available for this project. It is recommended that this pipeline be built as far as possible across and along recently disturbed areas, such as along the access road and across the extensively disturbed section on the southern end of the study area. The pipeline must also be kept more than 50m away from all identified heritage sites. The above-mentioned archaeological watching brief would also apply for the construction of this pipeline.

Conclusions

The unmitigated impact of the proposed development is expected to result in Medium to Very High negative impacts in terms of the identified heritage fabric of the study area. However, if the mitigation measures proposed in this report are successfully completed, the impact of the proposed development on the identified heritage sites can be reduced. In terms of the mine pit, this reduction of impacts will still mean that the proposed development can be considered to be of a high impact risk. However, the implementation of the proposed mitigation measures is expected to improve the stability of the mine pit without destroying the entire pit, which in turn would allow for the re-utilisation of the mine pit, mine and associated town, for tourism and educational purposes. Coupled with the positive socio-economic effects on the mining staff, the proposed mitigated development will ensure that enough of the pit and the mine's incredible heritage is preserved to allow for its utilisation for the socio-economic upliftment of the community that adjoins Jagersfontein Mine.

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Africana Library, Photographs, Jagersfontein Mine Mechanical Haulage (1910)
Africana Library, Photographs, Jagersfontein Mine Morning Breakfast at Bottom (1915)
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11.4 Private Collections

Richard Oliver Postcard Collection. With the kind permission of Mr. Richard Oliver.

11.5 Historical Topographic Maps

All the historic topographical maps used in this report were obtained from the Directorate: National

Geo-spatial Information of the Department of Rural Development and Land Reform in Cape Town.

11.6 Aerial Photographs

All the historic aerial photographs used in this report were obtained from the Directorate: National Geo-spatial Information of the Department of Rural Development and Land Reform in Cape Town.

11.7 Internet

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www.sanbi.org
www.wikipedia.org

11.8 Google Earth

At least some of the aerial depictions of the study área were obtained using Google Earth.

Appendix A

HERITAGE MANAGEMENT GUIDELINES

1. General Management Guidelines

1. The National Heritage Resources Act (Act 25 of 1999) states that, any person who intends to undertake a development categorised as-

   (a) the construction of a road, wall, transmission line, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length;
   (b) the construction of a bridge or similar structure exceeding 50m in length;
   (c) any development or other activity which will change the character of a site-

      (i) exceeding 5 000 m^2 in extent; or
      (ii) involving three or more existing erven or subdivisions thereof; or
      (iii) involving three or more erven or divisions thereof which have been consolidated within the past five years; or
      (iv) the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority;

   (d) the re-zoning of a site exceeding 10 000 m^2 in extent; or
   (e) any other category of development provided for in regulations by SAHRA or a provincial heritage resources authority, must at the very earliest stages of initiating such a development, notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development.

In the event that an area previously not included in an archaeological or cultural resources survey is to be disturbed, the SAHRA needs to be contacted. An enquiry must be lodged with them into the necessity for a Heritage Impact Assessment.

2. In the event that an additional heritage assessment is required, it is advisable to utilise a qualified heritage practitioner, preferably registered with the Cultural Resources Management Section (CRM) of the Association of Southern African Professional Archaeologists (ASAPA). This survey and evaluation must include:

   (a) The identification and mapping of all heritage resources in the area affected;
   (b) An assessment of the significance of such resources in terms of the heritage assessment criteria set out in section 6 (2) or prescribed under section 7 of the National Heritage Resources Act;
   (c) An assessment of the impact of the development on such heritage resources;
   (d) An evaluation of the impact of the development on heritage resources relative to the sustainable social and economic benefits to be derived from the development;
   (e) The results of consultation with communities affected by the proposed development and other interested parties regarding the impact of the development on heritage resources;

(f) If heritage resources will be adversely affected by the proposed development, the consideration of alternatives; and

(g) Plans for mitigation of any adverse effects during and after the completion of the proposed development.

3. In the event that a possible find is discovered during construction, the following steps must be taken:

   (a) All activities must be halted in the area of the discovery and a qualified archaeologist contacted;

   (b) The archaeologist needs to evaluate the finds on site and make recommendations towards possible mitigation measures;

   (c) If mitigation is necessary, an application for a rescue permit must be lodged with SAHRA; and

   (d) After mitigation, an application must be lodged with SAHRA for a destruction permit. This application must be supported by the mitigation report generated during the rescue excavation. Only after the permit is issued may such a site be destroyed.

4. In the case where a grave is identified during construction, the following measures must be taken:

   a. Upon the accidental discovery of graves, a buffer of at least 20 meters should be implemented;

   b. If graves are accidentally discovered during construction, activities must cease in the area and a qualified archaeologist be contacted to evaluate the find;

   c. To remove the remains, a permit must be applied for from SAHRA and other relevant authorities. The local South African Police Services must immediately be notified of the find; and

   d. Where it is recommended that the graves be relocated, a full grave relocation process that includes a comprehensive social consultation must be followed. Such a grave relocation process must include the following:

      (i) A detailed social consultation process that aims to trace the next-of-kin and obtain their consent for the relocation of the graves, that will be at least 60 days in length;

      (ii) Site notices indicating the intent of the relocation;

      (iii) Newspaper notices indicating the intent of the relocation;

      (iv) Permits from the relevant permitting authorities, including the local authority; the Provincial Department of Health; the South African Heritage Resources Agency (SAHRA) (if the graves are older than 60 years or unidentified and thus presumed older than 60 years) etc.

(vii) An exhumation process that keeps the dignity of the remains intact;

(viii) The whole process must be done by a reputable company that is well versed in relocations; and

(ix) The exhumation process must be conducted in such a manner as to safeguard the legal rights of the families as well as that of the mining company.

PGS Heritage can be contacted on the way forward in this regard.

Table 22: Roles and responsibilities of archaeological and heritage management.

ROLE	RESPONSIBILITY	IMPLEMENTATION
A responsible specialist needs to be allocated and should attend all relevant meetings, especially when changes in design are discussed, and liaise with SAHRA.	The client	Archaeologist and a competent archaeological support team
If chance finds and/or graves or burial grounds are identified during construction or operational phases, a specialist must be contacted for evaluation.	The client	Archaeologist and a competent archaeological support team
Comply with defined national and local cultural heritage regulations on management plans for identified sites.	The client	Environmental Consultancy and the Archaeologist
Consult the managers, local communities and other key stakeholders on mitigation of archaeological sites.	The client	Environmental Consultancy and the Archaeologist
Implement additional programs, as appropriate, to promote the safeguarding of our cultural heritage.	The client	Environmental Consultancy and the Archaeologist
If required, conservation or relocation of burial grounds and/or graves according to the applicable regulations and legislation.	The client	Archaeologist, and/or competent authority for relocation services
Ensure that recommendations made in the Heritage Report are adhered to.	The client	The client
Provision of services and activities related to the management and monitoring of significant archaeological sites.	The client	Environmental Consultancy and the Archaeologist
After the specialist/archaeologist has been appointed, comprehensive feedback reports should be submitted to relevant authorities during each phase of development.	Client and Archaeologist	Archaeologist

Appendix B

Project team CV's

Name: *Polke Doussy Birkholtz*

Date & Place of Birth: *9 February 1975 – Klerksdorp, North West Province, South Africa*

Place of Tertiary Education & Dates Associated:

Institution: University of Pretoria
Qualification: BA (Cum Laude) - Bachelor of Arts Specializing in Archaeology, History & Anthropology
Date: 1996

Institution: University of Pretoria
Qualification: BA Hons (Cum Laude) - Bachelor of Arts with Honours Degree Specializing in Archaeology
Date: 1997

Qualifications:

BA	-	Degree specialising in Archaeology, History and Anthropology
BA Hons	-	Professional Archaeologist

Memberships:

Association of Southern African Professional Archaeologists (ASAPA)
Professional Member of the CRM Section of ASAPA

Overview of Post Graduate Experience:

1997 – 2000 – Member/Archaeologist – Archaeo-Info
2001 – 2003 – Archaeologist/Heritage Specialist – Helio Alliance
2000 – 2008 – Member/Archaeologist/Heritage Specialist – Archaeology Africa
2003 - Present – Director / Archaeologist / Heritage Specialist – PGS Heritage

Languages: English: Speak, Read & Write & Afrikaans: Speak, Read & Write

Total Years' Experience: 19 Years

Experience Related to the Scope of Work:

- Polke has worked as a **HERITAGE SPECIALIST / ARCHAEOLOGIST / HISTORIAN** on more than 300 projects and acted as **PROJECT MANAGER** on almost all of these projects. His experience includes the following:

  - Development of New Sedimentation and Flocculation Tanks at Rand Water's Vereeniging Pumping Station, Vereeniging, Gauteng Province. Heritage Impact Assessment for *Greenline*.
  - EThekwini Northern Aqueduct Project, Durban, KwaZulu-Natal. Heritage Impact Assessment for *Strategic Environmental Focus*.
  - Johannesburg Union Observatory, Johannesburg, Gauteng Province. Heritage Inventory for *Holm Jordaan*.
  - Development at Rand Water's Vereeniging Pumping Station, Vereeniging, Gauteng Province. Heritage Impact Assessment for *Aurecon*.
  - Comet Ext. 8 Development, Boksburg, Gauteng Province. Phase 2 Heritage Impact Assessment for *Urban Dynamics*.
  - Randjesfontein Homestead, Midrand, Gauteng Province. Baseline Heritage Assessment with Nkosinathi Tomose for Johannesburg City Parks.
  - Rand Leases Ext. 13 Development, Roodepoort, Gauteng Province. Heritage Impact Assessment for *Marsh*.
  - Proposed Relocation of the Hillendale Heavy Minerals Plant (HHMP) from Hillendale to Fairbreeze, KwaZulu-Natal. Heritage Impact Assessment for *Goslar Environmental*.
  - Portion 80 of the farm Eikenhof 323 IQ, Johannesburg, Gauteng Province. Heritage Inventory for *Khare Incorporated*.
  - Comet Ext. 14 Development, Boksburg, Gauteng Province. Heritage Impact Assessment for *Marsh*.
  - Rand Steam Laundries, Johannesburg, Gauteng Province. Archival and Historical Study for *Impendulo* and *Imperial Properties*.
  - Mine Waste Solutions, near Klerksdorp, North West Province. Heritage Inventory for *AngloGold Ashanti*.
  - Consolidated EIA and EMP for the Kroondal and Marikana Mining Right Areas, North West Province. Heritage Impact Assessment for *Aquarius Platinum*.
  - Wilkoppies Shopping Mall, Klerksdorp, North West Province. Heritage Impact Assessment for the *Center for Environmental Management*.
  - Proposed Vosloorus Ext. 24, Vosloorus Ext. 41 and Vosloorus Ext. 43 Developments, Ekurhuleni District Municipality, Gauteng Province. Heritage Impact Assessment for *Enkanyini Projects*.
  - Proposed Development of Portions 3, 6, 7 and 9 of the farm Olievenhoutbosch 389 JR, City of Tshwane Metropolitan Municipality, Gauteng Province. Heritage Impact Assessment for *Marsh*.
  - Proposed Development of Lotus Gardens Ext. 18 to 27, City of Tshwane Metropolitan Municipality, Gauteng Province. Heritage Impact Assessment for *Pierre Joubert*.

- Proposed Development of the site of the old Vereeniging Hospital, Vereeniging, Gauteng Province. Heritage Scoping Assessment for *Lekwa*.
- Proposed Demolition of an Old Building, Kroonstad, Free State Province. Phase 2 Heritage Impact Assessment for *De Beers Consolidated Mines*.
- Proposed Development at Westdene Dam, Johannesburg, Gauteng Province. Heritage Impact Assessment for *Newtown*.
- West End, Central Johannesburg, Gauteng Province. Phase 1 Heritage Impact Assessment for the *Johannesburg Land Company*.
- Kathu Supplier Park, Kathu, Northern Cape Province. Heritage Impact Assessment for *Synergistics*.
- Matlosana 132 kV Line and Substation, Stilfontein, North West Province. Heritage Impact Assessment for *Anglo Saxon Group* and *Eskom*.
- Marakele National Park, Thabazimbi, Limpopo Province. Cultural Resources Management Plan for *SANParks*.
- Cullinan Diamond Mine, Cullinan, Gauteng Province. Heritage Inventory for *Petra Diamonds*.
- Highveld Mushrooms Project, Pretoria, Gauteng Province. Heritage Impact Assessment for *Mills & Otten*.
- Development at the Reserve Bank Governor's Residence, Pretoria, Gauteng Province. Archaeological Excavations and Mitigation for the *South African Reserve Bank*.
- Proposed Stones & Stones Recycling Plant, Johannesburg, Gauteng Province. Heritage Scoping Report for *KV3*.
- South East Vertical Shaft Section of ERPM, Boksburg, Gauteng Province. Heritage Scoping Report for *East Rand Proprietary Mines*.
- Proposed Development of the Top Star Mine Dump, Johannesburg, Gauteng Province. Detailed Archival and Historical Study for *Matakoma.*
- Soshanguve Bulk Water Replacement Project, Soshanguve, Gauteng Province. Heritage Impact Assessment for *KWP*.
- Biodiversity, Conservation and Participatory Development Project, Swaziland. Archaeological Component for *Africon*.
- Camdeboo National Park, Graaff-Reinet, Eastern Cape Province. Cultural Resources Management Plan for *SANParks*.
- Main Place, Central Johannesburg, Gauteng Province. Phase 1 Heritage Impact Assessment for the *Johannesburg Land Company*.
- Modderfontein Mine, Springs, Gauteng Province. Detailed Archival and Historical Study for *Consolidated Modderfontein Mines.*
- Proposed New Head Office for the Department of Foreign Affairs, Pretoria, Gauteng Province. Heritage Impact Assessment for *Holm Jordaan Group*.
- Proposed Modification of the Lukasrand Tower, Pretoria, Gauteng Province. Heritage Assessment for IEPM.

- Proposed Road between the Noupoort CBD and Kwazamukolo, Northern Cape Province. Heritage Impact Assessment for *Gill & Associates*.
- Proposed Development at the Johannesburg Zoological Gardens, Johannesburg, Gauteng Province. Detailed Archival and Historical Study for *Matakoma.*

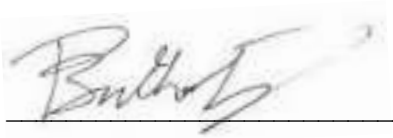
- Polke's **KEY QUALIFICATIONS:**

  - Project Management
  - Archaeological and Heritage Management
  - Archaeological and Heritage Impact Assessment
  - Archaeological and Heritage Fieldwork
  - Archival and Historical Research
  - Report Writing

- Polke's **INFORMATION TECHNOLOGY EXPERIENCE:**

  - *MS Office – Word, Excel, & Powerpoint*
  - *Google Earth*
  - *Garmin Mapsource*
  - *Adobe Photoshop*
  - *Corel Draw*

I, Polke Doussy Birkholtz, hereby confirm that the above information contained in my CV is true and correct.



PD Birkholtz

28 September 2020
Date

Appendix C

Palaeontological Desktop Assessment

Appendix D

Mr. Steve Lunderstedt's Address to the

Historical Society of Kimberley and the Northern Cape

Thursday, 19 May 2005