CONTRACT No. TCTA 20-041
File No. 2A-M-111E-03

MEMORANDUM NO. 03		
SUBJECT	:	**SCOPE OF ADDITIONAL FIELD INVESTIGATION: GEOTECHNICAL SUB-TASK 1.1.1E (2)**
REVISION	:	**A**
TO	:	**S Kelefetswe (TCTA)**
FROM	:	**P du Plessis/P van Heerden/S Seath/R Tluczek**
DATE	:	**19 July 2019**

1 OBJECTIVE OF THIS TECHNICAL MEMORANDUM

The objective of this Technical Memorandum is to:

- Reflect on geotechnical investigations completed previously;
- Identify and define the extent of supplementary investigations to be undertaken; and
- Consider planning and logistics associated with the execution of the required additional field work.

2 GEOTECHNICAL INVESTIGATIONS UNDERTAKEN PREVIOUSLY

Data and reporting on previous geotechnical investigations along the pipeline routes and associated structures for MCWAP-2 are included in the Status Report of 2017. The overall pipeline route and associated structures were divided into four stages and a separate geotechnical report was prepared for each of the stages as defined below:

- Stage 1: Tarantaalpan to Operational Reservoir (55,3 km);
- Stage 2: Vlieëpoort to Tarantaalpan (Transnet railway line) (43 km);
- Stage 3: Operational Reservoir to Steenbokpan (29,3 km); and
- Stage 4: Steenbokpan to Matimba Power Station (37,8 km).

The geotechnical report for each of the above stages consists of the following three volumes:

- Volume 1: Geotechnical Data Report;
- Volume 2: Annexures supporting Volume 1; and
- Volume 3: Geotechnical Interpretive Report.

Each of the above mentioned four stages are considered separately in **Section 3** below.

3 CRITERIA FOR GEOTECHNICAL INVESTIGATIONS

3.1 Criteria for Centreline Investigations

The Scope of Services for Contract No. TCTA-20-041 prescribes pipeline centreline investigations to consist of auger holes at 100 m and test pits at 500 m intervals to a depth of 1,75 times the proposed pipe diameter or to refusal.

The Stage 1 to Stage 4 investigations were not done in line with the above. Test pits were done at 200 m nominal intervals to a depth of 4 m or to refusal using a 70 kW TLB with bucket breakout force not less than 60 kN. No auger holes at 100 m intervals were done.

To align any additional centreline investigations to be undertaken with that done previously it is recommended that the criteria that was adopted for the previous investigations be adopted for the additional investigations i.e. test pits at 200 m nominal intervals. Depending on the diameter of the pipeline in a particular section the depth of the test pits could be reduced. Recommended test pit depth are indicated in **Section 5**.

The pipeline alignment adopted for assessments in this memorandum is that of the Central Route for which Environmental Authorisation has been issued.

3.2 Criteria for Borrow Pit Investigations

Borrow pits were sought at nominal spacing of 5 km along the pipeline alignment and volumes were proven by digging test pits on a 30 m grid. Sufficient quantity of material were sought to provide for double the bedding and selected fill blanket material required for 2 m diameter pipeline. Suitable bedding and selected fill blanket material that may be available from the trench excavation have been ignored.

Borrow pit investigations were aimed at locating bedding and selected fill blanket material with the following minimum quality characteristics:

a) Maximum particle size of 19 mm;

b) Not more than 95% passing the 13,2 mm sieve;

c) Not more than 20% passing the 0.425 mm sieve; and

d) PI less than 12.

Backfill material was considered suitable for a compactability factor of equal to or less than 0,1. Material with a compactability factor of between 0,1 and 0,4 was considered suitable (except for flexible pipes that may be subject to waterlogged conditions) but will require extra care in compaction. Material with a compactability factor of more than 0,4 was considered unsuitable.

Where gravel was present below bedding material it was tested to determine its suitability for gravelling of haul and access roads.

Assessments on the quality of borrow pit material undertaken by GBN-JV are based on Specification Section 15, Backfilling and Bedding which was applied during the implementation of MCWAP-1. Potential adjustments to this specification will be considered as part of the design studies task of the Project.

Assessments in this memorandum, to identify areas where additional borrow pits are required, are based on a maximum spacing of 7,5 km between existing identified borrow pits. The previously adopted 5 km spacing will however be maintained between new borrow pits to be identified.

3.3 Criteria for Structures and Reservoirs

The Scope of Services for Contract No. TCTA-20-041 noted that further drilling investigations would be required at the diversion facilities and pump station. Other activities noted in the scope include test pits at pumping stations and geophysical investigations. No specific criteria was imposed, and the GBN-JV is required to identify gaps in previous geotechnical work and specify requirements for further investigations.

4 DETAILS OF PREVIOUS GEOTECHNICAL INVESTIGATIONS

4.1 Stage 1 Investigations – Tarantaalpan to Operational Reservoir

The Stage 1 pipeline alignment is reflected in **Annexure A, Figure 1.** The extent of geotechnical investigations that were undertaken includes test pits, boreholes, identification of potential spoil sites and borrow pit investigations. The locations of these investigations are also reflected in **Annexure A, Figure 1**. Arengo mining right application properties are also indicated.

4.1.1 Centreline Investigations – Test Pits

Test pits were dug at 200 m nominal intervals along the complete Stage 1. The pipeline servitude will be located next to the railway line reserve (western side) along the complete Stage 1.

From CH 0 m to CH 21 000 m the test pits were dug within the rail reserve on the western side of the railway line approximately 15 m to 25 m away from the pipeline centreline. Refer to **Detail Layout 1 in Figure 1** that reflects the typical test pit positions along this section. Also note that it appears as if the railway reserve is widened on the southern side of the road and this may require an adjustment to the pipeline alignment. This matter will be investigated further, when servitude and reserve boundary cadastral data has been obtained, as part of the design studies task (optimise and refine pipeline routes).

From CH 21 000 m to CH 55 300 m the test pits were dug within the rail reserve on the eastern side of the rail way line approximately 50 m to 55 m away from the pipeline centreline. Refer to **Detail Layout 2 in Figure 1** that reflects the typical test pit positions along this section.

The risk that the in situ material along the pipeline alignment may differ from that encountered in the test pits, due to the distance between test pits and the pipeline alignment, should be noted.

It was noted that some laboratory test results were still outstanding at the time when the geotechnical reports were finalized.

4.1.2 Centreline Investigations - Boreholes

Boreholes were drilled at the Road R510, railway overpass, Road D2701 and Matlabas River crossings along the pipeline route. Boreholes were located within the rail reserve on the western side of the railway line approximately 15 m to 20 m away from the pipeline centreline. Refer to **Detail Layout 1** and **Detail Layout 3 in Figure 1** that reflects the typical borehole positions along Stage 1.

The risk that the in situ material along the pipeline alignment may differ from that encountered in the boreholes, due to the distance between boreholes and the pipeline alignment, should be noted.

4.1.3 Borrow Pits

Eight (8) borrow pits were investigated. The location of the borrow pits and the available quantity and quality of borrow material are summarized in **Table 1** below.

Table 1: Summary of borrow pit locations and borrow material quantity and quality

BP No.	CH(m)	Estimated volume (m^3)		Suitable as pipe bedding	
		Pipe Bedding	Road Gravel	Bedding	Selected fill blanket
28	700	-	-	No	No
33	10 300	200 000	>20 000	Yes	Yes
41	15 400	>100 000	>25 000	Yes	Yes
38	23 000	-	-	No	No
39	35 000	100 000	>10 000	No	Yes
42	40 500	>100 000	-	Yes	Yes
44	47 300	>100 000	>5 000	Yes	Yes
43	53 200	100 000	>5 000	Yes	Yes

BP28 and BP38 does not meet the specification for bedding or selected fill blanket material and alternatives will have to be identified to replace them.

Material from the six remaining borrow pits are suitable as bedding and selected fill blanket except BP39 which is not suitable for bedding material.

4.1.4 Potential Spoil Sites

Nine (9) potential spoil sites (D to L) were identified. Three of these sites (F, G and K) are located on the eastern side of the railway line and it may not be feasible to use them if access across the railway line is not available at convenient locations. Spoil sites will be assessed in more detail during the Design Studies task after the pipeline diameters have been confirmed.

4.2 Stage 2 Investigations – Vlieëpoort to Tarantaalpan (Transnet railway line)

The Stage 2 pipeline alignment is reflected in **Annexure A, Figure 2**. The extent of geotechnical investigations that were undertaken includes test pits, boreholes, identification of potential spoil sites, borrow pit investigations and a dolomitic stability investigation. The locations of these investigations are also reflected in **Annexure A, Figure 2**. EA appellant land owner properties and Arengo mining right application properties are also indicated.

4.2.1 Centreline Investigations – Test Pits

Test pits were dug at 200 m nominal intervals from CH 0 m to CH 8 500 m and from CH 16 500 m to CH 20 000 m. For the remainder of Stage 2 approximately every third test pit was skipped except between CH 19 800 m and CH 22 500 m where no test pits were done. This section of the pipeline alignment where no tests were done, approximately 2 700 m long, forms part of the recommended additional centreline investigations to be undertaken.

From CH 0 m to CH 5 500 m (low lift rising main) approximately 40% of the test pits are located some distance away from the pipeline alignment. As an example refer to **Detail Layout 1** in **Figure 2** that reflect two test pit positions respectively 80 m and 100 m away from the pipeline alignment. Also note the structure being traversed by the pipeline alignment. This matter will be investigated further, when servitude and reserve boundary cadastral data has been obtained, as part of the design studies task (optimise and refine pipeline routes).

The risk that the in situ material along the pipeline alignment may differ from that encountered in the test pits, due to the distance between test pits and the pipeline alignment, should be noted.

It was noted that some laboratory test results were still outstanding at the time when the geotechnical reports were finalized.

4.2.2 Centreline Investigations - Boreholes

Five (5) boreholes were drilled along the low lift pipeline alignment to investigate the risk of subsidence that may be associated with dolomitic rocks that occur in the area. Two boreholes were also drilled at both the Road D1649 Dwaalboom (CH 8 000) and Road R510 road crossings. The boreholes at the Road R510 crossing is located approximately 130 m away from the pipeline road crossing centreline. Refer to **Detail Layout 2 in Figure 2** that reflect the positions of the boreholes (BH47 and BH48) for the Road R510 crossing. The risk that the in situ material along the pipeline alignment may differ from that encountered in the boreholes, due to the distance between boreholes and the pipeline alignment, should be noted. It is recommended that the testing at the Road R510 crossing be redone at the correct location.

Two boreholes were drilled along the pipeline alignment between CH 36 000 m and CH 38 000 m to investigate whether dolomites are present in the area.

4.2.3 Borrow Pits

Four (4) borrow pits were investigated. The location of the borrow pits and the available quantity and quality of borrow material are summarized in **Table 2** below.

Table 2: Summary of borrow pit locations and borrow material quantity and quality

BP No.	CH(m)	Estimated volume (m^3)		Suitable as pipe bedding	
		Pipe Bedding	Road Gravel	Bedding	Selected fill blanket
SS1	0	8 000	0	Yes	Yes
BP25	16 000	>250 000	>30 000	Marginal	Marginal
BP30	27 000	>150 000	>20 000	Marginal	Yes
BP35	31 500	65 000	>20 000	No	No

It was noted that the coordinates of BP25 has incorrectly been tagged as BP28 in the EIA Report.

BP SS1 has limited quantity of material and access to the borrow pit, located on the western bank of the Crocodile River, will be constrained. Environmental constraints may complicate the development of the borrow pit further. It is recommended that an alternative for BP SS1 be identified.

The quality of material from BP25 and BP30 is marginal for use as pipe bedding, material from BP30 will however be suitable as selected fill blanket. It is recommended that an alternative borrow pit be identified to replace BP25.

Material from BP35 does not meet the specification and an alternative should be identified as replacement.

4.2.4 Potential Spoil Sites

Three (3) potential spoil sites (A, B and C) were identified. Spoil sites and potential utilization of excess material from pipeline trenches for the construction of the Abstraction Works and Balancing Reservoir will be assessed in more detail during the Design Studies task after the pipeline diameters have been confirmed.

4.2.5 Dolomitic Stability Investigation

The dolomitic stability investigation that has been carried out along the pipeline alignment has not been concluded. Further investigations will be required along the section of the pipeline which is suspected of being underlain by dolomite.

4.3 Stage 3 Investigations – Operational Reservoir to Steenbokpan

The Stage 3 pipeline alignment is reflected in **Annexure A, Figure 3.** The extent of geotechnical investigations that were undertaken includes test pits, identification of potential spoil sites and borrow pit investigations. No boreholes were drilled as part of the Stage 3 investigation. The locations where investigations were done are reflected in **Annexure A, Figure 3.**

4.3.1 Centreline Investigations – Test Pits

Test pits were dug along the pipeline alignment adopted previously and are remote from the current layout of the MCWAP-2 components. The results of these test pits will not be of any value during the design and construction of MCWAP-2 and no assessment was therefore done on these test pits other than an assessment of test pits within 5 km from the current MCWAP-2 alignment for the identification of potential borrow pit sites.

4.3.2 Centreline Investigations - Boreholes

No boreholes were drilled as part of the Stage 3 investigation.

4.3.3 Borrow Pits

Five (5) borrow pits were investigated. The location of the borrow pits and the available quantity and quality of borrow material are summarized in **Table 3** below.

Table 3: Summary of borrow pit locations and borrow material quantity and quality

BP No.	CH(m)	Estimated volume (m^3)		Suitable as pipe bedding	
		Pipe Bedding	Road Gravel	Bedding	Selected fill blanket
53*		50 000	18 000	Yes	Yes
52		100 000	12 000	Yes	Yes
50		100 000	8 000	Yes	Yes
48		100 000	45 000	Yes	Yes
49		100 000	5 000	Yes	Yes
* Only partly investigated (not included in EIA report)					

The quality of material from all five borrow pits is suitable for use as pipe bedding and selected fill blanket.

All five borrow pits are located remotely from the pipeline alignment. As the crow flies, BP53 is 1,1 km and BP52 4,5 km away from the pipeline alignment. Depending on the distance via access roads to these borrow pits it may be of use for MCWAP-2. The other three borrow pits are in excess of 7 km away from the pipeline alignment and will be adopted as standby, one or more of these borrow pits will only be developed if sufficient borrow pits cannot be identified along the pipeline alignment.

4.3.4 Potential Spoil Sites

Four (4) potential spoil sites (M, N, O and P) were identified. Spoil sites M and O are located respectively 3 km and 5 km away from the MCWAP-2 pipeline alignment and may be of use for MCWAP-2 construction if spoil sites closer to the pipeline alignment cannot be identified. Spoil site N is located along the MCWAP-2 pipeline alignment. Spoil site P is located at Steenbokpan and will not be of any value for the implementation of MCWAP-2.

Spoil sites and potential utilization of excess material from pipeline trenches for the construction of the Operational Reservoir will be assessed in more detail during the Design Studies task after the pipeline diameters have been confirmed.

4.4 Stage 4 Investigations – Steenbokpan to Matimba

The Stage 4 pipeline alignment is reflected in **Annexure A, Figure 4**. The extent of geotechnical investigations that were undertaken includes test pits, boreholes, identification of potential spoil sites and borrow pit investigations. The locations of these investigations are also reflected in **Annexure A, Figure 4.**

4.4.1 Centreline Investigations – Test Pits

Test pits that were dug between CH 0 m and CH 19 500 m along Stage 4 pipeline alignment are not relevant for the current MCWAP-2 pipeline alignment and were therefore not considered any further other than an assessment of test pits within 5 km from MCWAP-2 for the identification of potential borrow pits. For the remainder of Stage 4, test pits were dug at 200 m nominal intervals (CH 19 500 m to CH 37 800 m).

The MCWAP-2 pipeline alignment between the Operational Reservoir and the Steenbokpan-Matimba tee-point plus 2 000 m from the Steenbokpan-Matimba tee-point towards Matimba has not been investigated. This section of the MCWAP-2 pipeline alignment, approximately 20 500 m long, forms part of the recommended additional centreline investigations to be undertaken.

It was noted that some laboratory test results were still outstanding at the time when the geotechnical reports were finalized.

4.4.2 Centreline Investigations - Boreholes

Boreholes were drilled at the Road D1675 crossing, railway crossing and conveyor crossing. All three these crossings are located between the Medupi and Matimba Power Stations as reflected in **Figure 4**

Pipe jacking is likely to be required at the following crossings and will require further borehole or deep test pit investigations:

a) The pipeline from the Operational Reservoir must cross Road D1675 before the pipeline continues in an eastern direction towards Medupi/Matimba on the northern side of Road D1675;

b) At Medupi the take-off pipeline to the power station must cross Road D1675 in a southern direction;

c) The pipeline from the Operational Reservoir must cross a new railway line that is being constructed towards Steenbokpan; and

d) The new conveyor feeding coal to Medupi must be crossed.

4.4.3 Borrow Pits

Eight (8) borrow pits were investigated. The location of the borrow pits and the available quantity and quality of borrow material are summarized in **Table 4** below.

Table 4: Summary of borrow pit locations and borrow material quantity and quality

BP No.	CH(m)	Estimated volume (m^3)		Suitable as pipe bedding	
		Pipe Bedding	Road Gravel	Bedding	Selected fill blanket
15	0	100 000	15 000	Yes	Yes
46	7 500	90 000	0	Yes	Yes
59	14 000	100 000	10 000	Yes	Yes
13	22 000	80 000	12 000	Yes	Yes
14	25 200	>100 000	18 000	Marginal	Yes
12	29 500	>100 000	10 000	Marginal	Yes
51	32 200	90 000	12 000	Yes	Yes
11*	36 000	45 000	5 000	Marginal	Yes
* Common borrow pit with MCWAP-1					

The quality of material from BP11, BP12 and BP14 is marginal for use as pipe bedding, material from all eight borrow pits are suitable as selected fill blanket.

BP15, BP46 and BP59 are located remotely from the pipeline alignment. These three borrow pits will be adopted as standby and one or more of these borrow pits will only be developed if sufficient borrow pits cannot be identified along the pipeline alignment.

BP11 has been covered by the Matimba ash dam and BP12 has been covered by the Medupi ash dam. These two borrow pits will not be available for use on MCWAP-2. The distance between BP14 and BP51 is 7 km – slightly more than the targeted 5 km. An additional borrow pit to reduce the 7 km distance will however not be investigated. Material from BP51 will be used in a downstream direction for a distance of 5,5 km.

4.4.4 Potential Spoil Sites

Three (3) potential spoil sites (M, N and P) were identified. It should be noted that the same spoil site identification symbols were also used for Stage 3 spoil sites. Spoil site M is located approximately 1,8 km away from the pipeline alignment and depending on the distance of road access to the spoil site it may be of use for MCWAP-2. Spoil site N is located next to the ash dam within the Medupi Power Station site and spoil site P is located under high voltage Eskom power lines. It appears unlikely that sites N and P will be available for use on MCWAP-2.

Spoil sites will be assessed in more detail during the Design Studies task after the pipeline diameters have been confirmed.

4.5 Structures

The project structures are defined by the four sites:

a) Abstraction Weir and Low-Lift Pumping Station,

b) High-Lift Pumping Station, Balancing Reservoir and Sedimentation Works,

c) Break Pressure Reservoir,

d) Operational Reservoir.

4.5.1 Abstraction Weir and Low-Lift Pumping Station

A geophysical survey was undertaken at the Abstraction Weir and Low-Lift Pumping Station site. The results of the geophysical surveys, supplemented by the findings of a Radon Emanation Survey, identified the position of a presumed fault. The geophysical survey was used to define the requirement for borehole drilling.

The following boreholes were drilled around the approximate position of the Abstraction Weir and Low-Lift Pumping Station:

a) 3 Monitoring Boreholes (percussion);

b) 6 Percussion boreholes; and

c) 18 Rotary boreholes.

The results from these boreholes showed very hard rock (banded ironstone) under the proposed weir position at a depth varying between 25 m and 40 m below ground, overlain by alluvium. At the Low-Lift Pumping Station, hard rock (banded ironstone) was found at approximately 30 m deep, overlain by alluvium and colluvium.

4.5.2 High-Lift Pumping Station, Balancing Reservoir and Sedimentation Works

As part of the initial investigation, the following geotechnical investigations were done at the position of the High-Lift Pumping Station, Balancing Reservoir and Sedimentation Works:

a) Geophysical investigation over a portion of the site;

b) 15 test pits;

c) 11 Boreholes;

d) CBR tests; and

e) Sieve and hydrometer analysis.

These investigations identified medium hard rock at depths varying between 1.5 m and 6 m. Discontinuity between the rock levels in a few boreholes was observed.

4.5.3 Break Pressure Reservoir

As part of the initial investigation, the following geotechnical investigations were done at the position of the Break Pressure Reservoir:

a) 9 test pits;

b) 5 Boreholes;

c) CBR tests; and

d) Sieve and hydrometer analysis.

These investigations identified soft to medium hard rock (sandstone) at about 2.8m deep.

4.5.4 Operational Reservoir

The initial investigation included 3 boreholes and 3 test pits adjacent to the site (along the pipe route). These show soft rock (sandstone) at approximately 2.6 m deep.

5 RECOMMENDED SUPPEMENTARY INVESTIGATIONS

Recommended additional geotechnical investigations to be undertaken are indicated in **Figure 5** below and are summarized in **Sections 5.1** and **5.2** below.

5.1 Pipelines

Recommended additional investigations related to the pipeline alignment are as follows:

a) Test pitting along a total of 23 200 m of the pipeline alignment where no previous investigations have been done. Test pitting to be done to a depth of 3,5 m.

   Where previous test pitting were done some distance away from the pipeline alignment the risk that the in situ material along the pipeline alignment may differ from that encountered in the test pits should be noted. It should further be noted that where test pits were skipped along alignment sections (Stage 2) no geotechnical information will be available for such skipped locations. Mitigation measures for these risks may include additional allowances in quantities or other measures to be decided on.

b) Identify 15 to 16 additional borrow pits in areas where insufficient (material quality and quantity) borrow material sources have been identified previously (pipe bedding and gravel for haul and access roads);

c) It is recommended that the testing at the Road R510 crossing (Stage 2, downstream from Break Pressure Reservoir) be redone at the correct location. Four additional crossing investigations should be undertaken in the area west of Medupi; and

d) The dolomitic stability investigation which has not been concluded should be completed (to obtain Council of Geoscience approval for construction over these areas).

   i. Continuous gravity survey along dolomitic sections with readings every 30 m; and

   ii. Percussion boreholes (3No/km) to an average depth of 20 m to 50 m.

5.2 Structures

5.2.1 Abstraction Weir and Low-Lift Pumping Station

A geotechnical fault line downstream of the proposed Abstraction Weir and Low-Lift Pumping Station was indicated during the initial investigations. Although geophysical and radon emanation studies were undertaken there is still uncertainty about the extent of the fault. Furthermore, it is uncertain whether this fault may be a geohydrological fissure, e.g. connected to boreholes in the vicinity.

Based on the current geotechnical information, especially the position of the fault and the depth to rock, it may be beneficial to move the Abstraction Weir some distance upstream or downstream.

However, the areas upstream and downstream have not been sufficiently investigated and will require additional boreholes.

Additional field investigations will include one or more of the following (to be confirmed as investigations progress):

a) Monitoring boreholes (for water level, water quality and geohydrological modelling);

b) Rotary core boreholes;

c) Cone Penetration Test including pore pressure measurements (CPTu);

d) Geohydrological modelling; and

e) Geophysical surveys at the position of potential new weir location.

It is proposed that the rotary core boreholes be drilled at least 10 m into the underlying rock, to confirm whether the thickness of the upper ironstone layer is sufficient over the underlying dolomites, i.e. that the dolomites do not have to be considered in the project design.

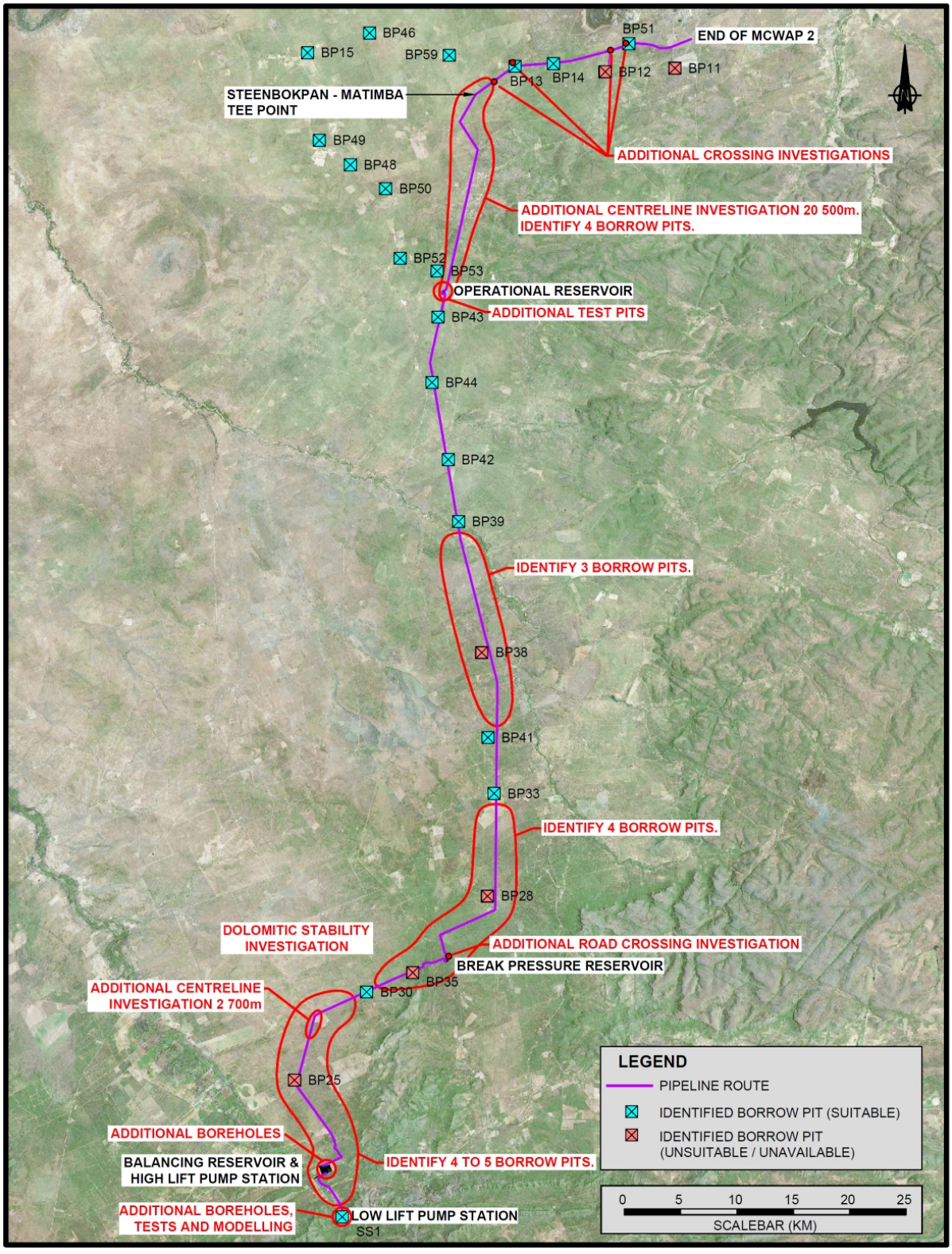


Figure 5: Extent of Required Additional Geotechnical Field Investigations

5.2.2 High-Lift Pumping Station, Balancing Reservoir and Sedimentation Works

Based on the identified discontinuity in a few boreholes on the site, an additional five rotary core boreholes are required on the site and additional geophysical surveys.

5.2.3 Break Pressure Reservoir

Based on the previous geotechnical investigations undertaken, no additional field investigations are required at the Break Pressure Reservoir.

5.2.4 Operational Reservoir

As no test pits, with material analysis, has been done at the Operational Reservoir site, it is proposed to undertake nine test pits, including CBR tests, sieve and hydrometer analysis.

6 PROCUREMENT

The required additional geotechnical field investigations as described in **Section 5** above is of a specialist nature. It is recommended that specialist service providers be invited to tender for the required investigations. Service providers will be proposed when tender documents are completed.

Preferential procurement, programming, access, environmental, social, safety and security aspects etc. will be addressed in the tender document for the additional geotechnical field investigations that are currently being prepared. The tender document together with a cost estimate shall be submitted to the Client for approval in accordance with the Baseline Programme.

The cost for this sub-contract is provided for in item 6.1 (Provisional Items entered by the Client) in Schedule C-1 of the Agreement between the Client and the Consultant.

Annexure A

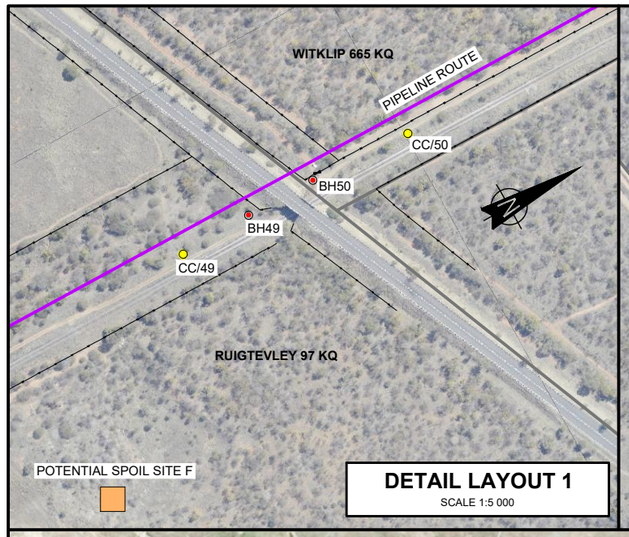
The following figures are attached herewith:

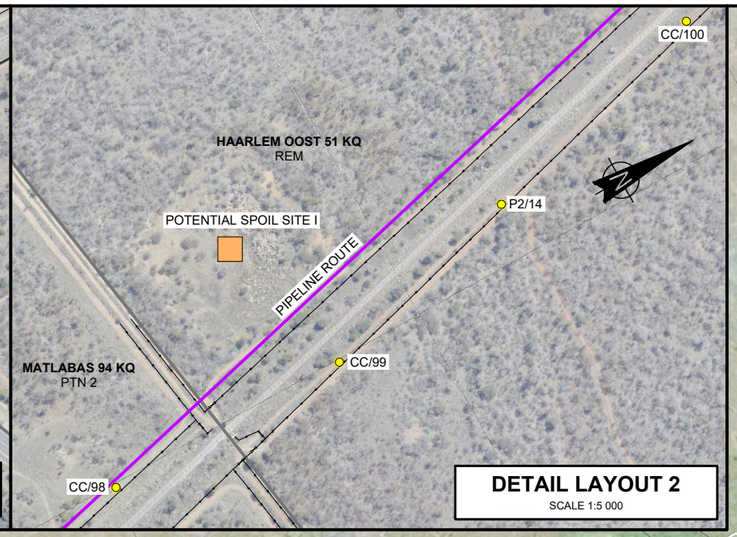
Figure 1: Extent of previous geotechnical work: Stage 1 Investigation – Tarantaalpan to Operational Reservoir

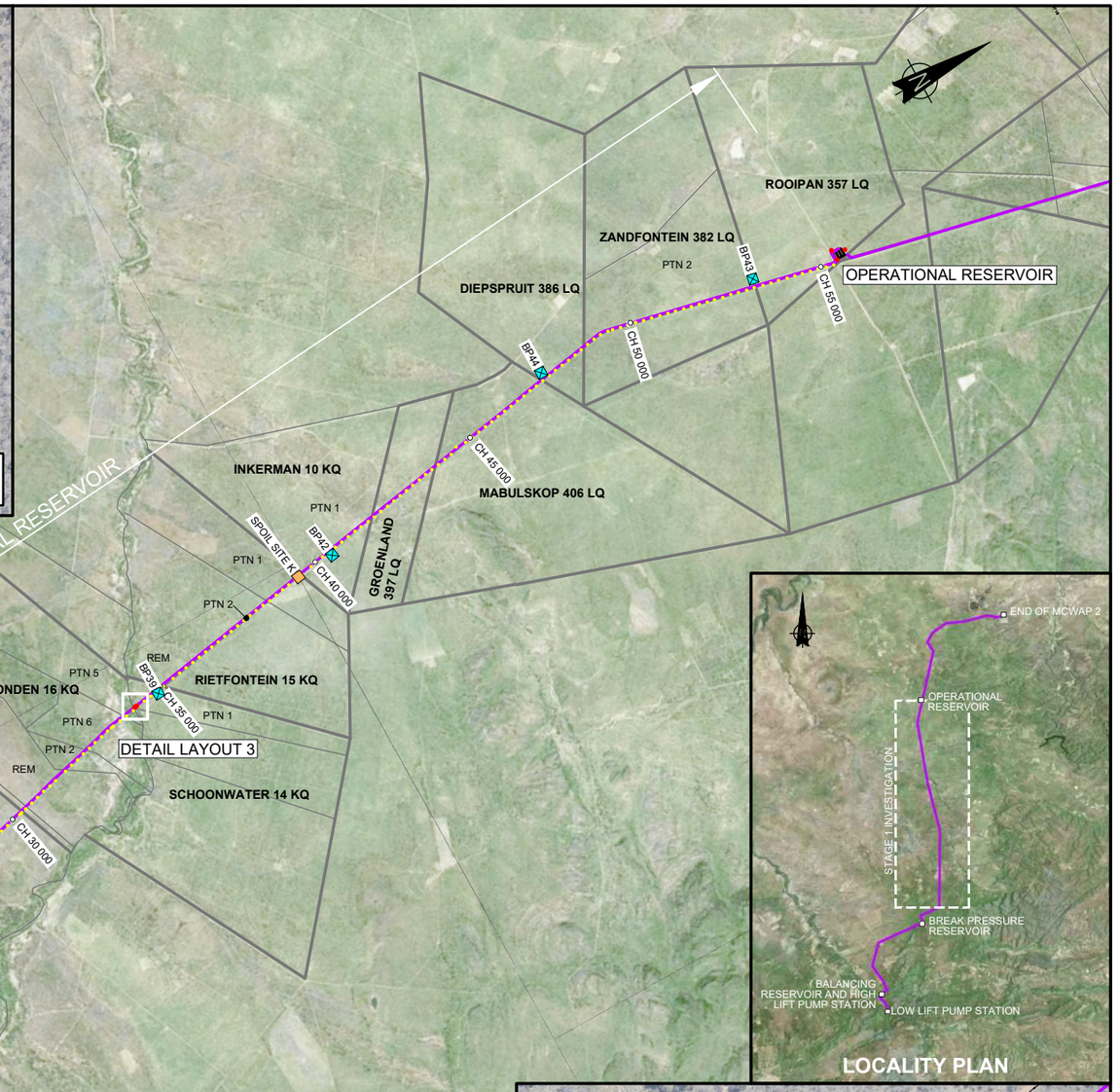
Figure 2: Extent of previous geotechnical work: Stage 2 Investigation – Vlieëpoort weir to Tarantaalpan

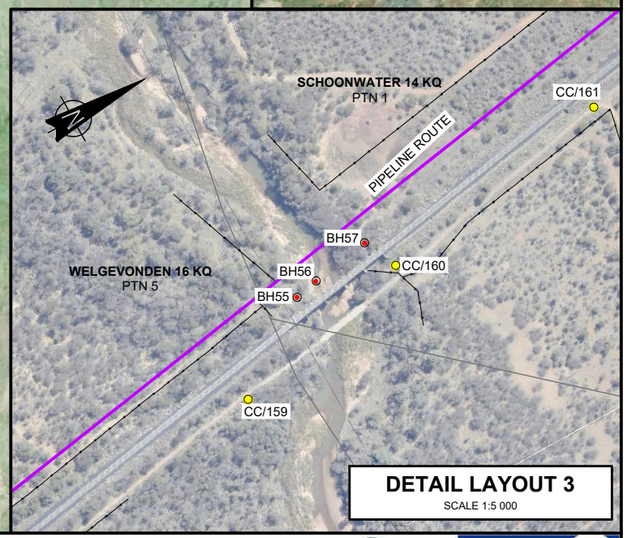
Figure 3: Extent of previous geotechnical work: Stage 3 Investigation – Operational reservoir to Steenbokpan

Figure 4: Extent of previous geotechnical work: Stage 4 Investigation – Steenbokpan to Matimba









LEGEND
- PIPELINE ROUTE
- TEST PIT
- BOREHOLE
- POTENTIAL SPOIL SITE
- BORROW PITS
- ARENGO MINING RIGHTS APPLICATION PROPERTIES

FIGURE 1: EXTENT OF PREVIOUS GEOTECHNICAL WORK - STAGE 1 INVESTIGATION - TARANTAALPAN TO OPERATIONAL RESERVOIR

Revision A

GBN JOINT VENTURE

TCTA A new word for water

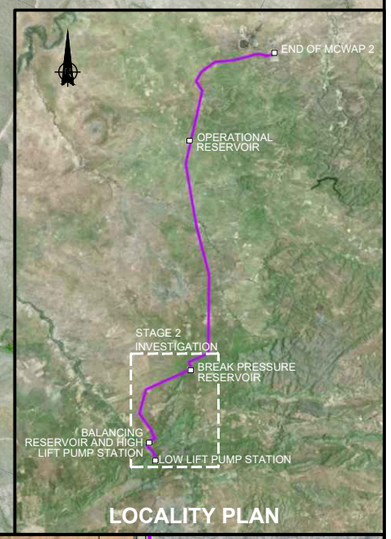
STAGE 2 INVESTIGATION - VLIEEPOORT WEIR TO TARANTAALPAN

AMSTERDAM 123 KQ
REM
BUFFELSVLEY 127 KQ
ZONDAGSKUIL 130 KQ
REM
TARANTAALPAN 132 KQ
BLAAUWPAN 133 KQ
REM
PTN 2
PTN 3
PTN 1
PTN 4
DIEPKUIL 135 KQ
LEEUWBOSCH 129 KQ
BRIDGEWATER 307 KQ
REM
PTN 7
REM
PAARL 124 KQ
PTN 6
MEKLENBURG 310 KQ
PTN 1
STRATFORD 462 KQ
MEKLENBERG 311 KQ
PTN 1
HAMPTON 320 KQ
REM
NOOITGEDACHT 339 KQ
PTN 1
PTN 2
PTN 3
NOOITGEDACHT 338 KQ
PTN 3
PTN 4
PTN 5
PTN 6
PTN 7
PTN 8
PTN 9
PTN 10
REM
MOOIVALLEI 342 KQ
HANOVER 667 KQ
PTN 10
DONKERPOORT 344 KQ

CH 0
CH 2 000
CH 4 000
CH 6 000
CH 8 000
CH 10 000
CH 12 000
CH 14 000
CH 16 000
CH 18 000
CH 20 000
CH 22 000
CH 24 000
CH 26 000
CH 28 000
CH 30 000
CH 32 000
CH 34 000
CH 36 000
CH 38 000
CH 40 000
CH 42 000

SS1
BP25
BP30
BP35
SPOIL SITE A
SPOIL SITE B
SPOIL SITE C
SPOIL SITE D

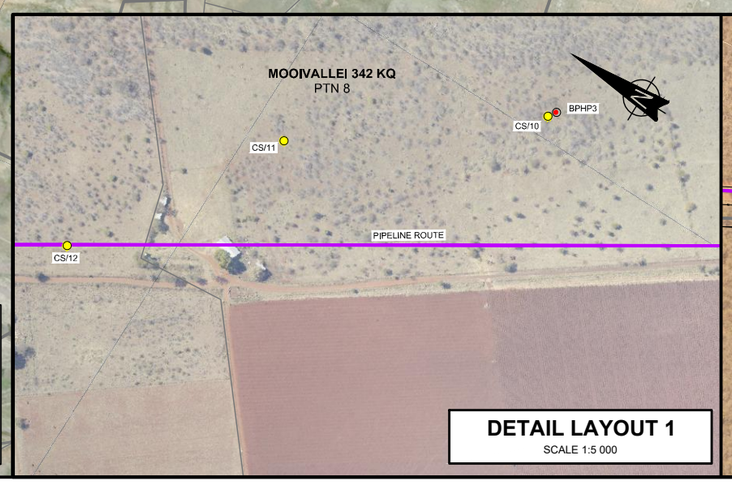
BALANCING RESERVOIR AND HIGH LIFT PUMP STATION
LOW LIFT PUMP STATION
DETAIL LAYOUT 1
DETAIL LAYOUT 2
BREAK PRESSURE RESERVOIR



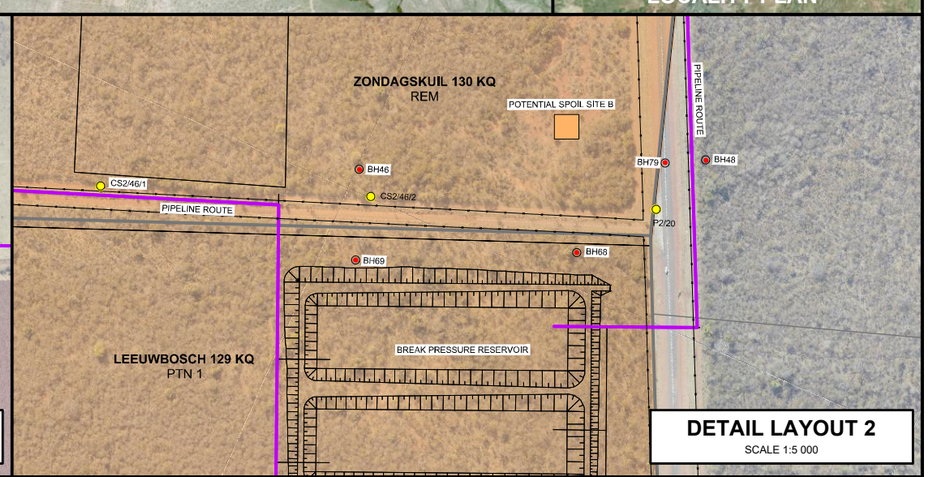
LOCALITY PLAN

LEGEND
- PIPELINE ROUTE
- TEST PIT
- BOREHOLE
- POTENTIAL SPOIL SITE
- BORROW PITS
- APPELLANT LAND OWNER PROPERTIES
- ARENGO MINING RIGHTS APPLICATION PROPERTIES

LAYOUT
SCALE 1:100 000



DETAIL LAYOUT 1
SCALE 1:5 000



DETAIL LAYOUT 2
SCALE 1:5 000

FIGURE 2: EXTENT OF PREVIOUS GEOTECHNICAL WORK - STAGE 2 INVESTIGATION - VLIEEPOORT WEIR TO TARANTAALPAN

Revision A

GBN JOINT VENTURE

TCTA A new word for water

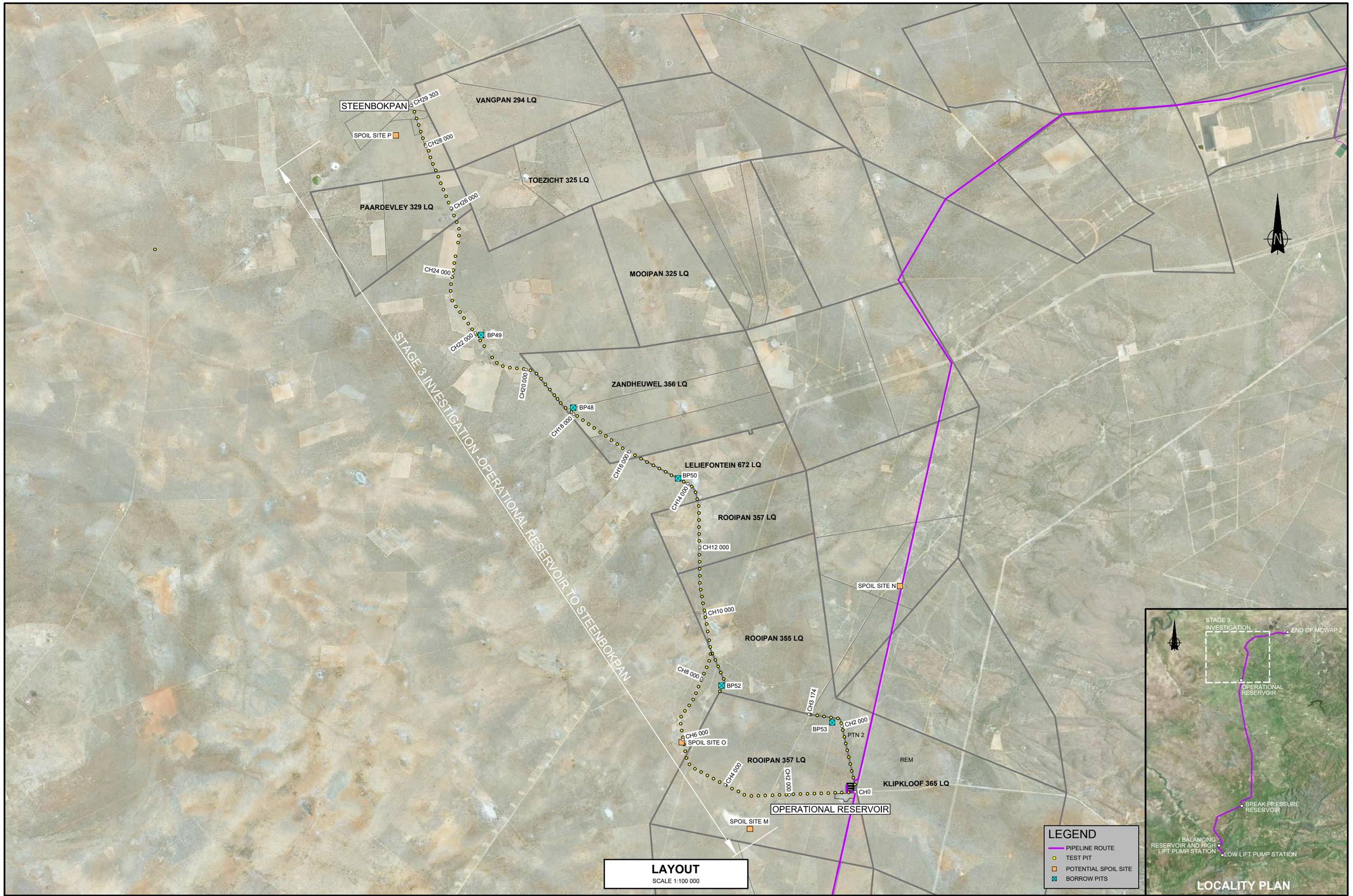


FIGURE 3: EXTENT OF PREVIOUS GEOTECHNICAL WORK - STAGE 3 INVESTIGATION - OPERATIONAL RESERVOIR TO STEENBOKPAN

Revision A

GBN JOINT VENTURE

TCTA A new word for water

STAGE 4 INVESTIGATION - STEENBOKPAN TO MATIMBA

BP46
ZANDBULT 300 LQ
LOOPLEEGTE 302 LQ
BP15
STEENBOKPAN
CH 0
VANGPAN 294 LQ
CH 2 000
CH 4 000
CH 6 000
CH 8 000
CH 10 000
MINNAARSPAN 322 LQ
CH 12 000
CH 14 000
BONTES ESTATE 699 LQ
CH 16 000
CH 18 000
CH 20 000
STEENBOKPAN-MATIMBA TEE POINT
PAARDEVLEY 329 LQ
TOEZICHT 323 LQ
TAAIBOSCHPAN 320 LQ
ENKELDRAAI 718 LQ
BP59
HOOIKRAAL 315 LQ
SPOIL SITE M
VAALPENSLOOP 313 LQ
PTN 1
BP13
CH 22 000
CH 24 000
BP14
CH 26 000
CH 28 000
HIEROMTRENT 460 LQ
EENZAAMHEID 687 LQ
SPOIL SITE N
BP12
CH 30 000
SPOIL SITE P
DETAIL LAYOUT
BP51
CH 32 000
CH 34 000
NAAUW ONTKOMEN 509 LQ
HANGKLIP 508 LQ
PTN 3
REM
CH 36 000
END OF MCWAP 2
PTN 1
BP11
N
ZANDNEK 358 LQ
PTN 1
PTN 1
RHENOSTERPAN 361 LQ
PTN 3
ROOIPAN 355 LQ
NAAUWPOORT 363 LQ
ROOIPAN 357 LQ
OPERATIONAL RESERVOIR

LAYOUT
SCALE 1:100 000

STAGE 4 INVESTIGATION
END OF MCWAP 2
OPERATIONAL RESERVOIR
BREAK PRESSURE RESERVOIR
BALANCING RESERVOIR AND HIGH LIFT PUMP STATION
LOW LIFT PUMP STATION

LOCALITY PLAN

NAAUW ONTKOMEN 509 LQ
N
PIPELINE ROUTE
C14/25A
C14/24A
C14/23A

DETAIL LAYOUT
SCALE 1:5 000

LEGEND
- PIPELINE ROUTE
- TEST PIT
- BOREHOLE
- POTENTIAL SPOIL SITE
- BORROW PITS

FIGURE 4: EXTENT OF PREVIOUS GEOTECHNICAL WORK - STAGE 4 INVESTIGATION - STEENBOKPAN TO MATIMBA

Revision A

GBN JOINT VENTURE

TCTA A new word for water