6.4.10 Appendix D10: Stormwater Management Plan

RUCO PROPERTIES (PTY) LTD

STORM WATER CONTROL SYSTEM REPORT: EXPANSION TO ORE HANDLING FACILITY: ERF 893, SWARTKOPS, PORT ELIZABETH.

SYNOPSIS

This report deals with the investigation regarding the proposal of a storm water management system for the manganese and iron ore handling areas.

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STORM WATER CONTROL SYSTEM REPORT: EXPANSION TO ORE HANDLING FACILITY: ERF 893, SWARTKOPS, PORT ELIZABETH

1. TERMS OF REFERENCE

In terms of our appointment by CEN Integrated Environmental Management Unit on behalf of Ruco Properties (Pty) Ltd during November 2020, we have undertaken an investigation to prepare a storm water control system report that will address the storm water run-off from the active manganese and iron ore handling areas (current and planned expansion areas).

2. SCOPE

The scope of this report deals with the collection and analysis of data on and adjacent to Erf 893, Swartkops, concerning a functional efficient design for the mentioned storm water control system to accommodate and treat the storm water run-off from the existing and expanded manganese and iron ore handling areas in a responsible way.

3. DATA COLLECTION

3.1 Drawings

Cadastral information, aerial photos and contours of the relevant storm water catchment areas that drain to the surrounding Swartkops Estuarine Functional Zone and wetlands near Erf 893, Swartkops, were obtained from the Nelson Mandel Bay Municipality (**NMBM**), Port Elizabeth.

An aerial photo that indicates the 1 in 100 year and 1 in 50 year flood lines (as supplied by SRK Consulting Engineers on 8 November 2011), has been obtained electronically from the Professional Town Planners, Urban Dynamics.

The new site develop plan has been obtained electronically from the professional architect, RK Architects on 19 January 2021.

3.2 Land Surveyor details

A topographical aerial survey of the existing Swartkops Power Station and existing structures on and near Erf 893, Swartkops onto which the proposed expansion to ore handling sites will be located, has been obtained electronically from the Developer, Ruco Properties (Pty) Ltd.

A coordinated topographical survey of the area around the existing ore handling facility, tippler area and stormwater piped system west of the existing main power station building has been obtained electronically from Surplan.

3.3 Field records and observations

The areas on Erf 893, Swarkops that were identified for the current and expanded active manganese and iron load bay areas have a relative flat topography.

The ground surface on and near the proposed Shed 02 has a very flat fall from east to west and from south to north

The slope of the ground near the proposed Shed 01 has a flat gradient from south to north and from west to east.

The surface near the proposed dump shed has a very flat gradient from south to north and west to east.

The ground levels at the proposed Shed 01, Shed 02 and the dump shed are above the 1 in 100 year floodline.

Based on the survey of Surplan the ground level directly south of the main building and the floor level of the existing main building is above the 1 in 100 year floodline.
Based on visual observations of excavations in the vicinity of the site under discussion, it appears that the soil at active manganese and iron ore handling areas could mainly consist of fill underlain by clayey silty material with a very high groundwater table.

4. INVESTIGATION

4.1 Methodology

The methodology adopted in analysing a local storm water control system for the active and proposed manganese and iron ore handling facilities, consists of the following:

- Establishing acceptable objectives for the proposed system.

- Determine appropriate design standards for the purpose of analysis and report.

- Applying these criteria to the expected post-development conditions to confirm findings and recommendations regarding the proposed design.

4.2 Acceptable objectives

- To provide flood control measures to prevent loss of life and significant damage to property from the run-off from major rain storms.
- To provide effective sedimentation control of solids under frequent and major rain storm conditions.
- To provide economical control facilities and find solutions to storm water run-off to prevent contamination of the in situ ground layers and surrounding natural areas compatible with the physical and ecological environment.
- To implement procedures and practices consistent with the operating, maintenance and rehabilitation standards of the accountable authorities.

4.3 Appropriate design standards

A balance must be achieved between the objectives, intended land use and economic viability of the proposed operational activities of the active manganese load bay areas and eventually the rehabilitation of the site.

In accordance with the recommendations from the Hydrological Research Unit (HRU) of the University of the Witwatersrand: HRU report No. 1/72 - Design Flood Determination in S.A. and HRU report No. 2/78 additional information and improvements to Depth - Duration - Frequency diagram the so-called Rational Method will be used to determine the preliminary run-off for the relative small catchment areas on and adjacent to Erf 893, Swartkops.

Intensity/Duration/Frequency Curves for Port Elizabeth Area for 100, 50 and 10 year recurrence intervals as issued by the Port Elizabeth City Engineer's Department, Roof drainage of Large Buildings in South Africa by H.I. Schwartz and P.T. Culligan, The Civil Engineer in South Africa, August 1976 and Department of Water Affairs, Technical Note No. 83, June 1978 and Flow

Capacity, Open Channels, Rough Turbulent Flows as compiled by Professors A. Rooseboom and E.E. van Zyl, will also contribute to practical design calculations.

The following references have been considered regarding the treatment of contaminated manganese water:

- Water Quality Criteria in South Africa. Technology SA, June 1990, 21-30 by P.J. Aucamp and F.S. Vivier 1990

- Water Quality Fitness for Use Curves for Domestic Water. Draft Internal Report, Hydrological Research Institute, DWAF, Pretoria, South Africa by P.L. Kempster and H.R. van Vliet 1991

- South African Bureau of Standards (SABS), 1984. Specification for Water for Domestic Supplies

- The importance of aeration in passive treatment schemes for manganese removal. Land Contamination & Reclamation 11 (2): by K.L. Johnson 2003

- Process for removing manganese from solutions including aqueous industrial fragment collection by W.J. Vail and R.K. Riley, 1995, 1996

- Oxidative passive treatment to remove manganese from mine water; what is best substrate by K.L. Johnson, 2003. 8th International Mine Water Association Congress, Johannesburg, South Africa

5. DISCUSSION AND PROPOSALS

As far as practical possible, the run-off of the stormwater on and near the ore handling facilities under discussion will be contained in a closed system on site and be recycled for dust control at the active ore handling facilities.

The Target Water Quality Range of Manganese by the South African **Department Water and Sanitation is defined as 0.00 - 0.05 mg/litre for drinking purposes** and will serve as a dominant guideline in this instance.

Staining can start to occur above this level of 0.05 mg/litre, but will not have an effect on human health until the concentration would reach a level of 5mg/litre. The main problem with manganese in water at typical values higher than 0.10 mg/litre is increasingly severe staining and tasting problems. Neurotoxic effects may occur at levels higher than 20mg/litre.

It is **highly unlikely that the storm water run-off from the ore handling areas would contain a high concentration of manganese considering the following.**

- The manganese ore would be washed at the mines.
- Most of the ore storage and handling will take place under cover.

- Enhance formation of insoluble non-toxic manganese oxide during wet conditions as far as practical possible

6. DESIGN: ANALYSIS AND RECOMMENDATIONS

In general the identified storm water management process will consist of the following. (Also see schematic layout as indicated on Drawing No. **SK-2021-01-SW-01**).

- Intercept, detain and recycle storm water on and from the manganese and iron ore handling areas to accommodate rain storms up to 1 in 100 year recurrence interval.

- Intercept the roof rainwater of the proposed ore handling facilities, store and recycle it.

- Manipulate the final formation levels on and near the proposed ore handling facilities to drain most of the storm water near the ore handling areas to the existing onsite reinforced concrete bunker reservoir.

- Intercept the piped stormwater from the weighbridge areas and main access roads and pump it back to the existing onsite reinforced concrete bunker reservoir.

- Construct the final formation layer of the open areas (which are not paved or tarred) on and near the ore handling areas with a calcrete layer to limit the risk of manganese contamination of the underlying soil layers.

- Construct the floors of the proposed ore handling facilities with dolomitic concrete to enhance the oxidation process of manganese during wet conditions to form insoluble non-toxic manganese oxide.

- Upgrade the floor of the blocked canal area with a layer of dolomitic stones to accommodate formation of insoluble non-toxic manganese oxide.

6.1 R1 – Area where SATS wagons are offloaded into tipplers

Based on the tacheometrical survey which we received from Surplan it is possible to drain the overland flow around the tippler area to the **bunker reservoir. Recycle the storm water from the bunker reservoir for dust control**.

Grade and construct a 150mm calcrete layer (compacted to 93% Mod AASHTO density) on the northern side of the tipplers to drain overland to the to the proposed storm water catchpit near the eastern end of the existing bunker reservoir.

The **limestone in the calcrete layer will assist to form insoluble non-toxic manganese oxide on the surface under wet conditions and will drastically limit the risk of the contamination of the underlying soil layers.**

6.2 R2 – Area south of the existing main ore handling facility and proposed Shed 01 and Dump Shed

Considering the mentioned survey which we received from Surplan it will be possible to drain the open areas around the proposed Shed 01 and the Dump Shed with a very flat gradient to the north-western corner of Shed 01.

Grade and construct a 150mm calcrete layer (compacted to 93% Mod AASHTO density) on the last-mentioned open areas to drain overland to the to the north western corner of Shed 01 subject to the design specifications of the professional civil engineer.

Upgrade and intercept the existing piped stormwater system near the south-western corner of the existing ore handling facility to drain directly to the proposed storm water catchpit near the eastern end of the bunker reservoir.

Design the gutters of Shed 01 to drain to rainwater tanks which can be located near the south-western corner of the existing ore handling facility. The water can be recycled and used for dust control. The overflow from the said tanks shall be directed to the new storm water catch pit near the mentioned corner which shall drain to the bunker reservoir.
Construct the floor of Shed 01 with a dolomitic concrete subject to the specifications of the professional structural engineer.

6.3 R3 – Area around Shed 02

Based on the aerial contours which we received from the Developer it will be possible to drain the open areas around Shed 02 to the bunker reservoir.

Grade and construct a 150mm calcrete layer (compacted to 93% Mod AASHTO density) on the last-mentioned open areas to drain overland to the to the north eastern corner of Shed 01 subject to the design specifications of the professional civil engineer. Discharge the said overland flow to the proposed catchpit near the eastern end of the bunker reservoir.

Design the gutters of Shed 02 to drain to rainwater tanks which can be located near the north-eastern corner of Shed 02. The water can be recycled and used for dust control. The overflow from the said tanks shall be directed to the storm water catch pit near the eastern side of the bunker reservoir.

Construct the floor of Shed 02 with a dolomitic concrete subject to the specifications of the professional structural engineer.

6.4 R4 – Area where Conveyer 3 comes to the surface, weighbridges, inspection area for trucks and access roads near the north western corner of the existing main building

Most of the overland storm water on Area R4 will drain to the existing piped storm water system. The said piped storm system drains drain to the south western corner of the existing canal which runs in a north-west direction. The afore-mentioned canal does not have a gravity connection with the existing incoming canal which is running from east to west (i.e. the canal is not a throughflow system from the estuary, through the site, and back into the estuary).

Block-off and isolate the south-eastern part of the north-east canal to intercept the flow from the storm water piped system from Area R4.

Line the blocked-off part of the said reinforced concrete canal with a layer of 300mm deep dolomitic stones. The dolomitic stones will be coated with insoluble non-toxic manganese oxides (thicknesses 0.2mm to 0.5mm) that will not cause further contamination. At the same time the dolomite (calcium magnesium carbonate) will increase the pH and decrease the acidity of the storm water run-off from the expansion to ore handling areas. The pore space of the 20mm to 50mm dolomitic gravel bed will accommodate more than 30 years of manganese oxide precipitation for typical manganese concentrations.

Construct a pump sump near the north-western corner of the blocked-off canal portion. Pump the intercepted storm water from Area R4 to the bunker reservoir. Recycle the water from the bunker reservoir to the ore handling areas for dust control.

Grade and construct a 150mm calcrete layer (compacted to 93% Mod AASHTO density) on the R4 open areas to drain to the existing piped storm water system subject to the design specifications of the professional civil engineer to prevent the manganese contamination of the underlying ground layers.

The typical pump sump will consist of a water tight dolomitic concrete structure. In order to handle unexpected solids that could reach the pump sump, the inlet to the pump suction pipe shall be designed to only allow solids to the pump that are not bigger than 40mm diameter. Choose a duty and standby pump that can handle solids up to 65mm diameter.

The pumping system shall be designed to have a minimum self-cleansing velocity of 1.3 m/s to accommodate the reasonable transport of the higher density suspended solids in the contaminated storm water effluent in the pumping main to the oxidation/precipitation pond. If needed, the sump shall be cleared of plastic objects, sand etc after high winds and heavy rain conditions. On average it is reasonable to do a visual inspection once a month.

Based on our preliminary calculations, the pumping main can be a 160mm diameter pumping main.

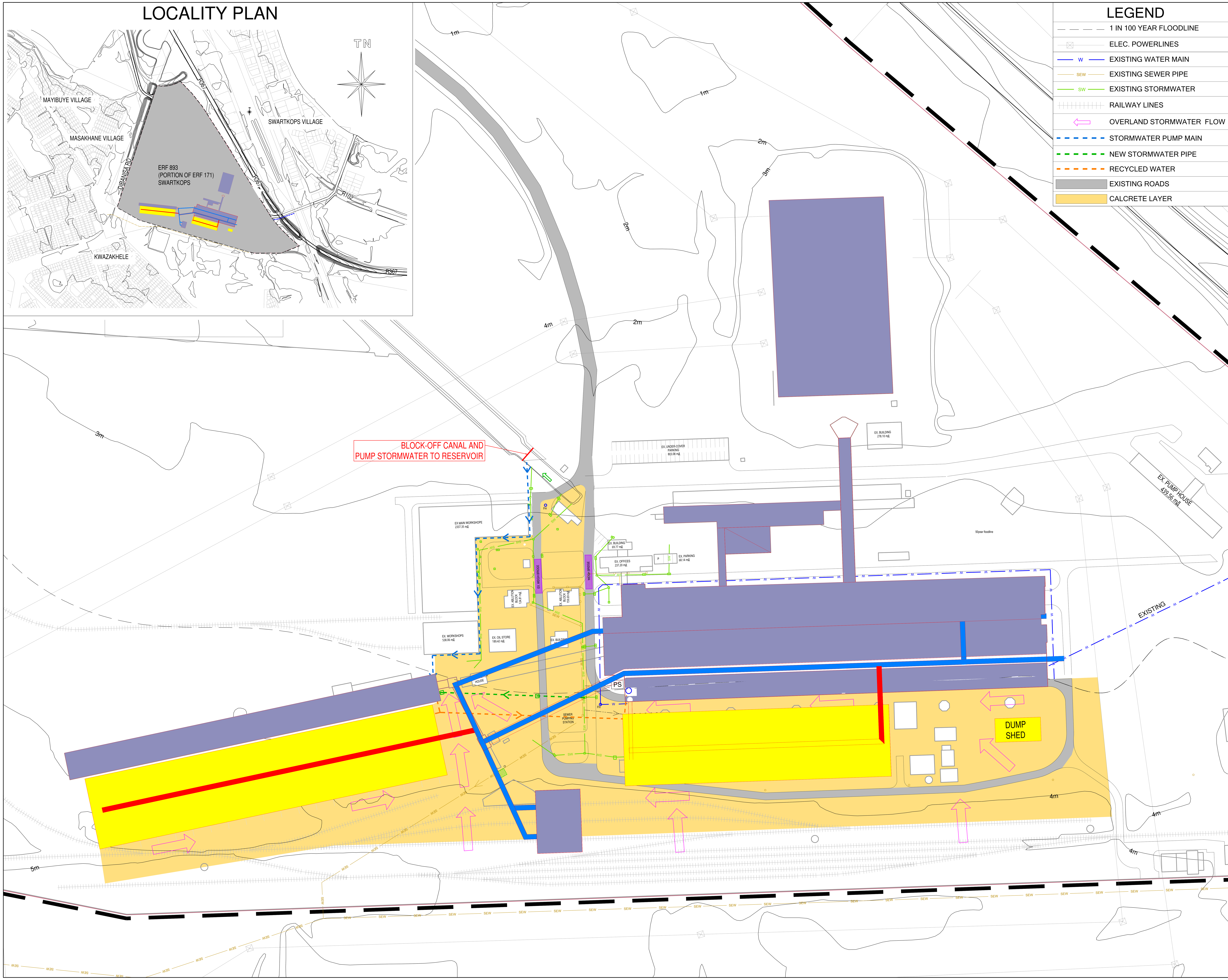
7. CONCLUSION

A cautious approach in the preliminary design of the **closed storm water management system** (where the intercepted storm water will be recycled for dust control at manganese and iron ore handling areas on site) has been adopted to limit the risk of manganese contamination of underground soil and natural water courses within reasonable limits.

In strict adherence to the detailed design and execution of layer works, structural concrete work, upgraded piped storm water line, blocked canal portion and pump system as indicated in this report, we are convinced that the **storm water** run-off from the mentioned ore handling facilities could be **effectively handled and controlled as a closed system** from a civil engineering perspective.

8.0 APPENDIX

8.1 Drawings



NO / NR	DATE / DATUM	REVISION / WYSIGING

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Project/Projek:

ERF 893 (PORTION OF ERF 171)
SWARTKOPS
INTERIM MANGANESE AND IRON
ORE HANDLING FACILITIES

Drawing/Tekening:

STORMWATER
MANAGEMENT PLAN

Scale/Skaal:	Date/Datum:	Drawn/Geteken:	Checked/Nagesien:
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Drawing No./Tekening Nr.: SK-2021-01-SW-01

Rev/Wys: