REPORT TO ESKOM

by

WSM GROUP

on

DESIGN OF NEW GENERAL WASTE DISPOSAL SITE

at

MAJUBA POWER STATION

March 2022

Design and report prepared on behalf of WSM Group by

Clive Wilson Professional Engineer; ECSA Registration Number 790253

1. INTRODUCTION

A new solid waste disposal facility is to be constructed at Majuba Power Station to receive general waste[1] from the power station.

A report entitled "Final Scoping Report for Development of a New General Waste Disposal Site at Majuba Power Station", dated September 2019, was prepared by BTW & Associates on behalf of Eskom, for submission to the Department of Environmental Affairs, as required in terms of the National Environmental Management Waste Act (Act No 58 of 2008).

2. WSM GROUP CONTRACT

A contract[2] exists between Eskom and WSM Group, concluded in September 2021, in terms of which WSM shall provide detailed design for the new landfill, as described herein and illustrated on drawings attached hereto.

3. GENERAL REQUIREMENTS

According to BTW's above Final Scoping Report, the new waste disposal facility is to be classified as a Class B landfill, or more specifically as a Class **G:C:B+** landfill in accordance with criteria stipulated in "National Norms and Standards for Disposal of Waste to Landfill" [3], permitted to receive Type 2 waste (i.e. general waste) wherein:

- **G** refers to the type of waste to be landfilled (i.e. "General waste"),

[1] "General waste" as specified in "Waste Classification and Management Regulations" published in the Gov Gazette dated 23 August 2013 in terms of the National Environmental Management: Waste Act, 2008 (Act No 59 of 2008), may comprise domestic, garden and business waste, non-infection carcasses, packaging, tyres, building rubble and excavated earth, excluding hazardous waste or chemicals.

[2] Eskom's Alternative Reference Number 23090081(ECN) and Eskom Purchase Order Number PO 4503122176.

[3] Published in the Gov Gazette dated 23 August 2013 in terms of the National Environmental Management: Waste Act, 2008 (Act No 59 of 2008).

- **C** refers to a "Communal" facility that receives less than 25 tons of waste per day[4], and

- **B+** refers to the prevailing "climatic balance" in the given region, corresponding to a relationship between the averages of annual rainfall and evaporation per unit area of land applicable to the given locality that requires careful management of "leachate" [5].

Neither any hazardous waste nor any waste generated by operation of the power station will be disposed of to the proposed new landfill facility[6].

4. DIMENSIONS

It is stipulated in BTW's Final Scoping Report that *"the new general waste site will consist of nine (9) cells with an estimated capacity of 26850 m^3 for each cell"* [7], corresponding therefore to a total volume of waste equal to 241 650 m^3 evidently expected to be generated from the power station and required to be disposed of over about the forthcoming 45 years.

A tract of land measuring 300m x 200m (i.e. 6 hectares), located immediately adjacent to and on the east side of the prior, now closed landfill that was previously utilized for the disposal of general waste from Majuba Power Station, was identified in BTW's Final Scoping Report as the preferred site for the proposed new facility.

WSM's design for the proposed new facility, illustrated in drawings attached hereto, provides for placement of waste over a 260m x 115m portion of such preferred site. The maximum height of the waste body over that area will be approximately 17m to accommodate the total quantity of waste

[4] "Minimum Requirements for Waste Disposal by Landfill", Draft, 3rd edition 2005, published by the Department of Water Affairs and Forestry, page 24

[5] "Leachate" refers to potentially contaminated water that drains through and out of waste.

[6] Page 8, BTW Final Scoping Report.

[7] Page 19, BTW Final Scoping Report

identified in BTW's Final Scoping Report that the facility is required ultimately to provide for (i.e. 241 650 cubic metres).

5. SITE CONDITIONS

5.1. Topography

Ground surface survey carried out on behalf of WSM reveals that the site comprises a broad, gently sloping ridge that rises from an elevation of 1750m above mean sea level (MSL) along an existing access road aligned west-east along the northern boundary of the designated facility area, up to an elevation of 1763m along the southern boundary thereof.

Spot heights measured by the survey and elevation contours derived therefrom are illustrated on drawing number wsm-maj-01 depicting the proposed General Arrangement for the facility.

Stormwater runoff currently drains onto the facility site along its southern boundary and off it across its other boundaries.

No watercourses cross the designated facility site.

5.2. Weather

According to BTW's Final Scoping Report, *"the average annual rainfall for the Volksrust area is 795 mm"*, over 90% of which falls in the summer months between September and April [8].

Mean Annual Pan Evaporation in the province of Mpumalanga is approximately 1950mm per annum.

[8] Page 45, BTW Final Scoping Report

5.3. Vegetation

According to BTW's Final Scoping Report[9], current vegetation on the site consists exclusively of grass (i.e. excluding trees), characterized as the Amersfoort Highveld Clay Grassland.

5.4. Geology

Geotechnical investigation of the site was carried out during May 2018 by Messrs Engeolab cc on behalf of BTW & Associates. It is noted in the corresponding report that bedrock below different parts of the site comprises:

a) Shale and sandstone identified with the coal-bearing, Vryheid Formation of the Ecca Group, which strata are in turn incorporated within the Karoo Supergroup, and

b) Dolerite intruded as dykes and/or sills into those sedimentary strata.

The detailed distribution of the above different bedrock types beneath the site was not however determined.

Investigation pits revealed hard bedrock at depths varying between 0.5m to over 2.6m below the existing ground surface, covered by a soil profile that comprises a superficial layer of transported[10], clayey sand (i.e. "hillwash" soil) that is generally less than 0.4m deep, over up to 2m of predominantly clayey, residual soil [11].

[9] Page 53, BTW Final Scoping Report

[10] Transported soil is soil that has been shifted over the ground surface by wind, gravity and water.

[11] Residual soil is soil derived by insitu chemical decomposition of the bedrock without, or prior to subsequent transportation elsewhere.

5.5. Hydrogeological Conditions

No seepage to the ground surface was observed anywhere across the proposed new landfill site during the above geotechnical investigation thereof [12].

That the site straddles the sloping crest of a ridge some considerable height above the nearest perennial streams indicates that the permanent water table will be relatively deep below the site, although "perched" groundwater may develop in places above the bedrock during wetter periods.

BTW anticipate that a hydrogeological study will be undertaken as part of an intended Environmental Impact Assessment of the proposed new landfill.

6. DETAILED DESIGN

6.1. Design Drawings

6.1.1. WSM Group's proposed design of the new landfill is illustrated on the attached drawings.

6.2. Operational Facilities

6.2.1. It is proposed to locate a guardhouse, office, covered parking and recycle facilities all in the northeast portion of the site, close to an entrance gate so as to reserve the lowest portion of the site (i.e. the northwest corner) for the storage and evaporation of leachate and the attenuation of stormwater runoff.

[12] Page 31, BTW Final Scoping Report.

6.3. Earthworks

6.3.1. It is proposed to create a single earthworks platform that will slope 4m down from its southeast corner to its lowest point at its northwest corner over about 280m, corresponding to an overall grade of 1 in 70, such as to drain leachate under the waste body to the proposed Leachate Evaporation Pond, as illustrated on drawing numbers wsm-maj-01, -02 and -03.

6.3.2. Formation of such Landfilling Platform will require bulk excavation up to 3.5m deep below the highest point of the existing ridge and fill up to 7m high where the existing ground surface is lowest under the platform (the north east corner thereof).

6.3.3. The relatively shallow bedrock determined in the geotechnical investigation implies that the necessary earthworks will require a significant volume of rock excavation, possibly requiring blasting for a portion thereof.

6.4. Access

6.4.1. It is proposed to gain access onto the site at the northeast corner thereof from the existing gravel road that is aligned parallel and close to the site's northern boundary.

6.4.2. A 6m wide Ring Road is proposed around and generally about 1.5m above the sloping Landfilling Platform.

6.4.3. Ramps up the sides of the fill embankment around the north-east corner of the Landfilling Platform will provide access onto and off the Ring Road.

6.4.4. Because there is some risk of spillage of waste onto the Ring Road, it shall crossfall inwards towards the waste body at all points in order to cause potentially contaminated stormwater runoff from the road to drain into the waste body.

6.4.5. Temporary berms are proposed across the Landfilling Platform to provide access and to confine areas of active waste placement and leachate generation. Such berms may be removed before being covered by waste to allow the soil fill to be re-used elsewhere.

6.5. Leachate Management

6.5.1. It is proposed to dispose of leachate by evaporation as far as possible. Excess leachate that may collect during or following periods of greater than usual rainfall and/or of reduced rates of evaporation and may threaten to overtop the available storage should be removed from the site by road tanker or otherwise for purification elsewhere.

6.5.2. The overall grade of the Landfilling Platform will cause leachate generated in each cell, once landfilling commences therein, to drain down towards the low end thereof (i.e. the northwest corner) where it will collect as a wide shallow pool to evaporate. The area available on the low, western end of the platform to accommodate leachate while it evaporates will diminish as the waste body is progressively enlarged from the eastern end, as illustrated in drawing wsm-maj-03.

6.5.3. The rate of generation and therefore rate of flow of leachate will be proportional to the area of waste exposed to rainfall (i.e. the area of the waste body that has not yet been capped). It is therefore envisaged that the final surfaces of the waste body will be capped as soon as possible after having been raised to the envisaged height to limit the generation of leachate.

6.5.4. Intermediate surfaces within the waste body will also require capping in places (over Cells C4a, C4b and C4c) to limit the area exposed to rainfall as the area available for evaporation on the Landfilling Platform reduces to limit the rate of leachate generation to that which can be evaporated therefrom.

6.5.5. Leachate generation should progressively diminish to practically nil after landfilling is complete and the waste body has been suitably graded and capped, preparatory to closure and rehabilitation of the facility.

6.5.6. The rate at which leachate will be generated (R) by either infiltration of rainwater into the uncapped exposed portions of the waste body, or by stormwater runoff therefrom where it has not yet been capped will equal the product of the depth of rainfall (I = 795mm/annum on average for Majuba), and the exposed surface area of the waste (Aw).

i.e. $R = I \cdot Aw$ (neglecting evaporation from the surface of the waste)

6.5.7. The rate at which leachate exposed to the atmosphere can be expected to evaporate (E) will equal the product of the Pan Evaporation applicable to the given region (Ep = 1950mm/annum for Mpumalanga) and the exposed surface area of the leachate (Ae).

i.e. $E = Ep \cdot Ae$

6.5.8. The net rate at which leachate can be expected to be effectively disposed of by evaporation (En) can be taken as the product of the excess of evaporation over rainfall and the surface area of leachate (Ae) exposed to the atmosphere.

i.e. $En = (Ep - I) \cdot Ae$

6.5.9. Such net rate of evaporation should exceed the rate of generation of leachate in order to avoid accumulation of an excess thereof that must be tankered off the site for purification elsewhere.

i.e. $En > R$

$(Ep - I) \cdot Ae > I \cdot Aw$

$Aw/Ae < (Ep - I) / I$

For Pan Evaporation Ep = 1950 mm/annum; and Rainfall I = 795 mm/annum

$$Aw / Ae < 1.45$$

6.5.10. The total surface area of waste exposed to rainfall should never therefore exceed 1.45x the available leachate storage surface area exposed to the atmosphere.

6.5.11. The surface area of the proposed Leachate Evaporation Pond, equal to 2480 m^2, is too small by itself to rely upon for disposal of leachate by evaporation because the corresponding permissible areas of exposed waste would in that case always have to be less than only 3600 m^2. Such small areas of permissible uncapped waste would require excessive and costly intermediate capping in order to build the landfill up to its envisaged necessary height, plus would result in practically insuperable difficulties to avoid contamination of stormwater runoff from the partially-filled waste body.

6.5.12. It is therefore proposed to limit placement of uncapped waste to selected portions of the Landfilling Platform separated by berms (i.e. “cells”) while leachate is stored downslope on the balance thereof, such that the area of exposed waste in each stage of filling is always less than 1.45x the portion of the Landfilling Platform available to store and evaporate leachate, as illustrated on drawing number wsm-maj-03.

6.5.13. The Leachate Evaporation Pond should only be relied upon to evaporate leachate after commencement of waste placement in Cell C4c and of final and/or intermediate capping of the balance of the waste body, such as to limit the area of waste exposed to rainfall at all stages to not more than 3600m^2.

6.6. Containment Barrier (or Floor Lining)

6.6.1. The third edition of “Minimum Requirements for Waste Disposal by Landfill” published by the Department of Water Affairs and Forestry dated 2005 stipulates requirements for

practically impervious lining of ground beneath landfills[13] classified according to the characteristics of the waste to be disposed of, the amount thereof, and the local weather[14].

6.6.2. Lining requirements for the smallest, Class G:C:B+ (i.e. "C" for "Communal") landfills, which classification is stated in BTW's Final Scoping Report to be applicable to the Majuba facility, are not stipulated in such "Minimum Requirements". Lining requirements for G:S:B+ (i.e. "Small") landfills are however taken to be applicable to the new facility at Majuba.

6.6.3. Requirements for such linings below solid waste disposal facilities were revised in "National Norms and Standards for Disposal of Waste to Landfill" published in 2013 [15], in terms of which "Containment Barriers" beneath Class B landfills receiving "General" or "Type 2" waste should comply with Figure 1.

6.6.4. Procurement of sufficient volumes of readily accessible clay that exhibits the necessary grading and low permeability properties required for the Compacted Clay Layer specified in Figure 1 may be difficult or impractical close to the site. Geosynthetic Clay Liner (GCL)[16] is consequently proposed as a permissible alternative.

[13] Pages 239-243

[14] Class G:L:B+ corresponds to General: Large: Type B+ or B- landfills in wetter and drier regions respectively;

C, S, M and L refer to Communal, Small, Medium and Large facilities that receive <25, 25-150, 150-500, and >500 tonnes or waste per day respectively.

B+ or B- refers to landfills in wetter and drier regions respectively

[15] Gov Gazette dated 23 August 2013 in terms of the National Environmental Management: Waste Act, 2008 (Act No 59 of 2008).

[16] Geosynthetic Clay Liner or GCL comprises a thin layer (a few millimetres thick) of dehydrated bentonite clay in powder form sandwiched between 2 sheets of synthetic, polyethylene geotextile, needle-punched to bind the opposing sheets together. Such GCL is rendered watertight when the bentonite clay becomes hydrated by contact with water.

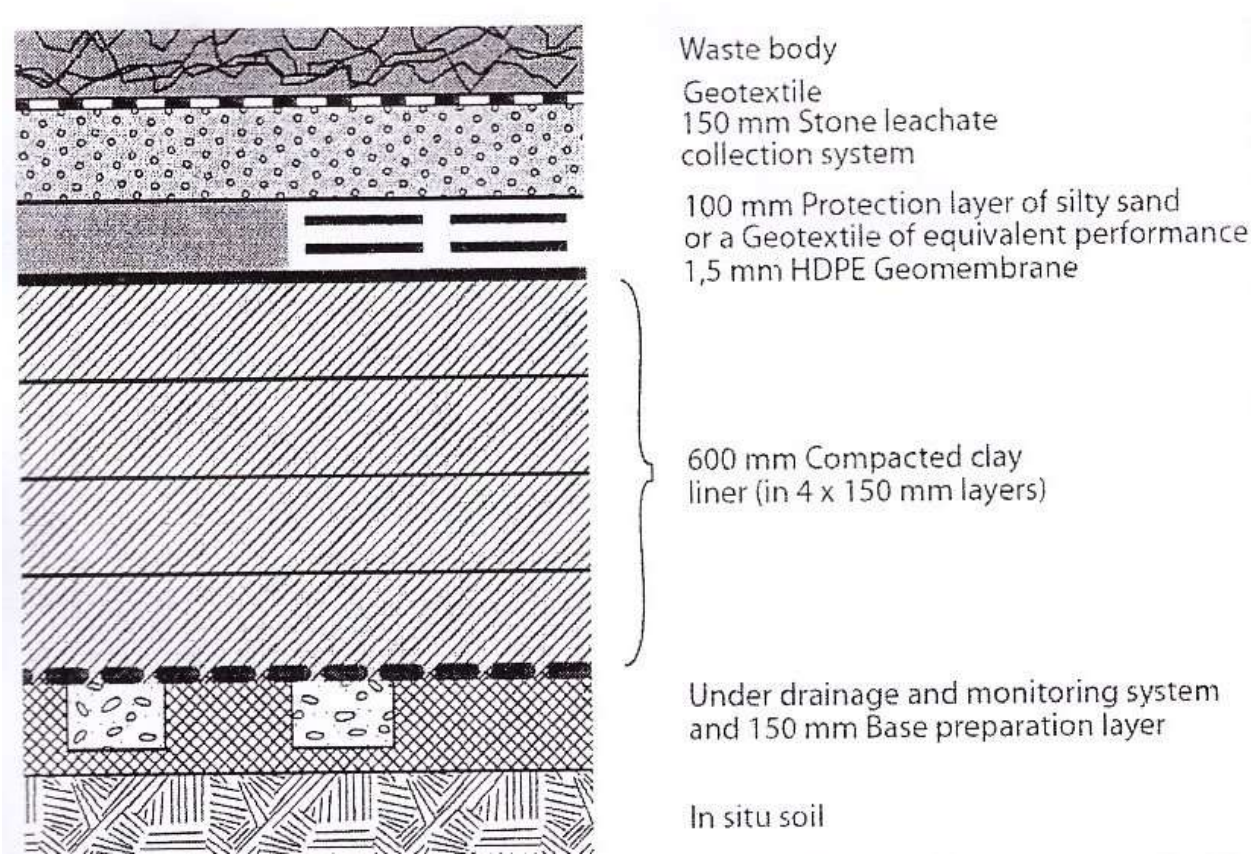

Figure 1

6.6.5. Both lining options are indicated as permissible on drawing number wsm-maj-02. Decision regarding which is to be implemented is postponed to the construction phase because issues of cost and materials procurement are outside the scope of this report.

6.6.6. It is proposed to stabilize the silty sand envisaged for the Protection Layer specified in Figure 1 by the addition of a small proportion of cement to render it more conveniently trafficable and thereby to reduce the risk of puncturing the HDPE Geomembrane below, (i.e. the principle impervious element incorporated in the barrier), particularly while placing crushed stone aggregate to comprise the overlying Stone Leachate Collection Layer.

6.6.7. It is proposed to provide a separate Under-drainage Layer beneath the impervious elements of the Barrier to be comprised of clean, free-draining sand, as specified on drawing number wsm-maj-02, rather than the excessively complex “finger-drain” detail suggested for this layer in Figure 1.

6.6.8. Such Under-drainage Layer shall be divided into 6 compartments corresponding to the landfilling cells for the purpose of detection of possible leakage through the Containment Barrier, if any, by substitution of the sand within the layer with clay in 300mm wide “bands”, as illustrated in drawing number wsm-maj-11, to cause any leachate leakage flow to be channelled to pipes that will exit the landfill to discharge through corresponding Leak Detection Walls where any such leakage can be monitored.

6.7. Phases of Waste Landfilling and Capping

6.7.1. Landfilling is proposed to be carried out in 6 phases as illustrated on drawing number wsm-maj-03, so as to provide, during each phase:

a) 6m wide ramps up the sides of the waste body in Cells C1 and C2 that are not steeper than 1 : 6 to allow delivery of waste up to the envisaged top thereof, which requires that cells C1 and C2 must cover the full width of the Landfilling Platform,

b) sufficiently wide surface areas for storage and effective evaporation of leachate on the lower, eastern part of the Landfilling Platform, such that the area of exposed uncapped waste is never more than 1.45x such available evaporation area, and

c) adequate storage volume, also on the lower portion of the Landfilling Platform, to accommodate excess leachate during periods of greater rainfall and/or reduced evaporation.

6.7.2. As noted above, the waste body will have to be about 17m high to accommodate the total volume of waste envisaged to be required to be disposed of over the intended

lifespan of the facility. The waste body should not therefore be capped at a lesser height unless and until it is determined that a lesser total volume of waste will after all need to be accommodated.

6.7.3. The areas of uncapped waste exposed to rainfall (Aw) during each of placement phases 1 to 4 illustrated on drawing number wsm-maj-03 will be not exceed 1.45x the area available on the lower part of the Landfilling Platform for the storage and evaporation of leachate (Ae), as confirmed in the following table:

Phase	Area of Waste Body exposed to rainfall (m^2)	Area available for Evaporation of Leachate (m2)	Aw / Ae
	Aw	Ae	
1	13503	16514	0.82
2	10869	10413	1.04
3	8021	7082	1.13
4	6812	4848	1.41
5	2452	2079	1.18

6.7.4. It will be necessary after completion of Phase 4 to place an intermediate capping[17] over the partial waste filling over cells C3 and C4a, as also illustrated on the above drawing, before proceeding to place waste over Cell C4b.

6.7.5. Although not illustrated on the above drawing it will similarly be necessary subsequently to place such intermediate capping over the partially filled Cell C4b before waste is

[17] An intermediate capping is one that is placed on a temporary surface within the waste body and subsequently covered by further waste.

placed in Cell C4c while leachate is released to and evaporated from the Leachate Evaporation Pond.

6.7.6. A valve in a 250mm diameter pipe leading from the stone Leachate Drainage Layer below Cell C4c beneath the lowest point of the Landfilling Platform (the northeast corner) to the Leachate Evaporation Pond will be opened when waste placement commences in Cell C4c, to allow leachate to flow thereto. The valve might also temporarily be opened at earlier stages if necessary to allow excess leachate on the Landfilling Platform to drain to the Leachate Evaporation Pond to take advantage of its additional evaporation area to avoid the necessity to tanker leachate off site.

6.7.7. As only the Leachate Evaporation Pond will be available to store and evaporate leachate once waste placement commences in Cell C4c, it will therefore be necessary thereafter to limit the area of waste exposed to rainfall over cells C4a, C4b and C4c to less than the area of the Leachate Evaporation Pond (2480 m^2) x 1.45 = 3600m^2, as the waste is raised over those cells to the envisaged final height.

6.8. Under-drainage and Leachate Leak Detection

6.8.1. Leachate that potentially leaks (if any) through the Containment Barrier will drain within the Under-drainage Layer down to the inlets of pipes under the low points of each cell and become evident where it discharges through the various Leak Detection Walls illustrated on drawing number wsm-maj-11.

6.8.2. The integrity of the Containment Barrier below each cell should be confirmed prior to placement of waste therein by flooding it for periods sufficient for any leaks to become evident to observation at its corresponding Leak Detection Wall.

6.8.3. Defects in the Containment Barrier, if any, corresponding to such leaks, should be rectified prior to placement of waste in the cell concerned.

6.9. Capping over the Waste Body

6.9.1. Requirements for either intermediate and/or final capping over the waste body are not stipulated in the "National Norms and Standards for Disposal of Waste to Landfill"[18] published in 2013. Reference may however be made to the earlier, "Minimum Requirements for Waste Disposal by Landfill" published in 2005[19], which recommends Figure 2 below as appropriate final capping of Class G:S:B+ landfills, as is taken to be applicable to the proposed new Majuba landfill.

FIGURE A.8.12
Cover: G:S:B+ , G:M:B⁻ and G:L:B⁻ Landfills

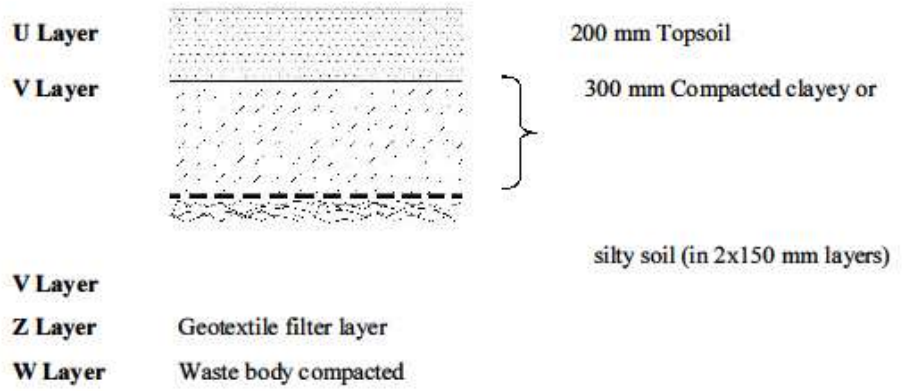

Figure 2

6.9.2. The respective purposes of the layers stipulated in Figure 2 are:

a) Topsoil – growth of vegetation;

[18] Published in the Gov Gazette dated 23 August 2013 in terms of the National Environmental Management: Waste Act, 2008 (Act No 59 of 2008)

[19] "Minimum Requirements for Waste Disposal by Landfill", Draft, 3rd edition 2005, published by the Department of water Affairs and Forestry

b) Compacted clay layer - to limit infiltration and the consequent generation of leachate; and

c) Geotextile – to avoid internal erosion of the capping soil down into the waste.

6.9.3. Procurement of sufficient volumes of readily accessible clay that exhibits the necessary grading and low permeability properties required for the Compacted Clay Layer specified in Figure 2 may again be difficult or impractical close to the site. Geosynthetic Clay Liner (GCL) is consequently proposed as a permissible alternative because it can substitute for both the clay layer and the geotextile as it can serve both purposes.

6.9.4. Both capping options are indicated as permissible on drawing number wsm-maj-02. Decision regarding which is to be implemented is postponed to the construction phase because issues of cost and materials procurement are outside the scope of this report.

6.9.5. Leachate may initially seep out of the sloping sides of the waste body in places, although this should cease soon after effective capping. To avoid such seepage causing the capping on those sides becoming saturated and slumping, it must, where it appears, be accommodated in a subsurface drainage layer below the capping as illustrated on drawing number wsm-maj-02.

6.9.6. With the exception of the above references and illustrations, the detailed design of such capping, including the locations, widths and heights of such subsurface drainage layers must be excluded herefrom because such design will depend upon the final detailed geometry of the waste body which cannot realistically be anticipated at this point.

6.10. Stormwater Drainage

6.10.1. Potentially contaminated stormwater runoff from uncapped portions of the waste body and the ring road will be retained on the Landfill Platform to evaporate as for leachate.

6.10.2. Stormwater runoff from ground outside the Landfilling Platform and ring road should not be contaminated and may therefore be allowed to drain off the site either onto the natural ground (along the eastern boundary) or onto the existing gravel roads along the western and northern boundaries.

6.10.3. Runoff onto the site from the neighbouring land along the southern boundary will be diverted around the site as illustrated on drawing number wsm-maj-01.

6.10.4. Concentrated, uncontaminated, runoff from capped portions of the waste body should be drained through the Stormwater Attenuation Pond to reduce the rate of flow off the facility site and therefore potential erosion where it is finally discharged (i.e. onto the gravel road along the northern boundary of the site from the Attenuation Pond).

6.10.5. It is therefore proposed to drain such runoff from the capped portions of the waste body along an open channel to be formed in conjunction with capping between the toe thereof and the Ring Road, which channel will discharge at various points into precast concrete drainage pipes under that road (into Inlet SW01 to SW10, plus into Inlet SW11 to SW8), and thence to the Stormwater Attenuation Pond.

6.10.6. The rate of such discharge will be limited by the relatively small diameter (450mm) of the outlet pipe from the Pond, plus by temporary storage of excess volume therein.

6.11. Stages of Construction

6.11.1. The necessary, impervious, “Containment Barrier”, should be placed over the entire Landfilling Platform at the outset before any waste placement commences.

6.11.2. The Stone Leachate Collection System Layer may however be placed only over Cell C1 initially and be extended over the subsequent cells in succession prior to commencement of waste placement in each thereof.

End of report

A P P E N D I X A

WSM Design Drawings

NORTH

250 thick gabion mattress lined Emergency Spillway

450 dia stormwater outlet pipe to drain onto gabion mattress

Leachate Evaporation Pond
Crest 53.0m
Water level 52.5m
Bottom 51.0m

Stormwater Attenuation Pond
Crest 55.0m
Spillway 54.75m
Bottom 54.0m

Recylcable waste unload, & sort bins

Office

Carports

Guardhouse

Carports

Recylcable waste sort & reload bins

Plant parking, maintenance and washbay

250 dia PVC leachate drainage pipe

450 dia PC stormwater pipe

Gate valve in Manhole L1

Ramp B

Manhole SW9

Manhole SW10

450 dia PC stormwater pipe

Ring road

Manhole SW8

Manhole SW14

Manhole SW13

Manhole SW12

450 dia PC stormwater pipe

Manhole SW11

Manhole SW7

Surface channel at toe of capping

Drop from surface channel to buried pipe

Drop from surface channel to buried pipe

Drop from surface channel to buried pipe

Cell C3

Drop from surface channel to buried pipe

Surface channel at toe of capping

Cell C4c

266.6

56.00

56.00

Stormwater surface channel at toe where waste has been capped

Berm 4bc

Cell C3

Cell C2

CUT

FILL

Cell C1

Manhole SW6

Cell C4b

450 dia PC stormwater pipe to drain runoff from capped waste to Stormwater Attenuation Pond

Berm 4ab

Finished Top of Liner Level 57.00

Berm 3/4

Berm 2/3

Berm 1/2

58.00

59.00

114.5

Surface channel at toe of capping

Ring road

Ramp A

Boundary fence

LANDFILL PLANFORM

Manhole SW5

Cell C4a

Ring road

60.00

Drop from surface channel to buried pipe

Drop from surface channel to buried pipe

Drop from surface channel to buried pipe

Surface channel at toe of capping

Manhole SW4

Ring road

Manhole SW3

Manhole SW2

450 dia PC stormwater pipe

Manhole SW1

Ring road

Boundary security fence

Stormwater diversion berm and channel

Stormwater diversion berm and channel

Shaded area indicates lining

0m 10m 20m 30m 40m 50m 100m

PLAN

Cells C1 to C4 to be landfilled in sequence. Cells being landfilled to be separated from unfilled area by temporary internal berms that are to be removed for reuse of the soil fill as landfilling is extended to cover their locations.

PRELIMINARY FOR ESKOM CONSIDERATION

Consulting Company: WSM Geotechnical Engineering, A Division of WSM Group

The Employer: Eskom

Project: **NEW GENERAL WASTE DISPOSAL FACILITY AT MAJUBA POWER STATION**

Drawing Title: **GENERAL ARRANGEMENT**

Drawing Number: wsm-maj-01

Revision: D

Date: 16 March 2022

D.O.	REV.	DATE	
D.O.	0		FIRST ISSUE
			** REVISION **
			INDEX REFERENCE

REV BY | CHKD BY | AUTH BY | KKS APP | 0·__ REFERENCE DRAWINGS

DRG REGISTR | APPROVED BY | AUTHORISED BY | KKS APP | AUTH BY | CHKD BY | DRAWN BY | SCALE

ESKOM HOLDINGS LTD. REG. No. 2002/015527/06

Eskom 0·__/_____ REV __

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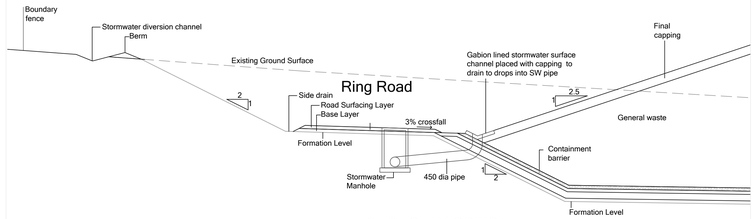
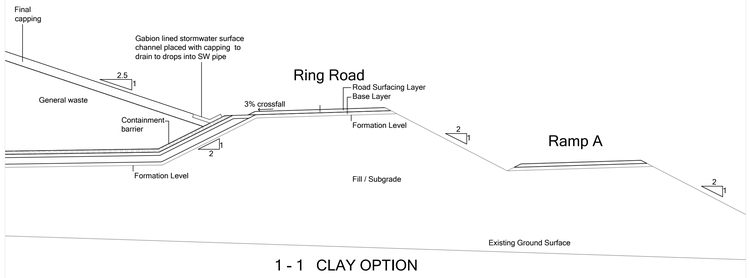
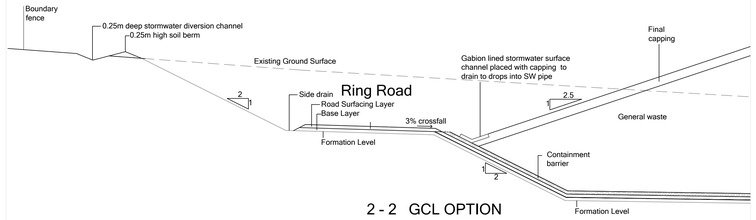


2 - 2 CLAY OPTION

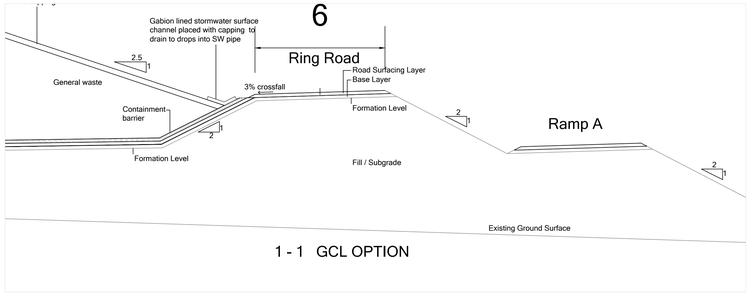
Capping and stormwater drainage elements only placed after corresponding cell has been filled



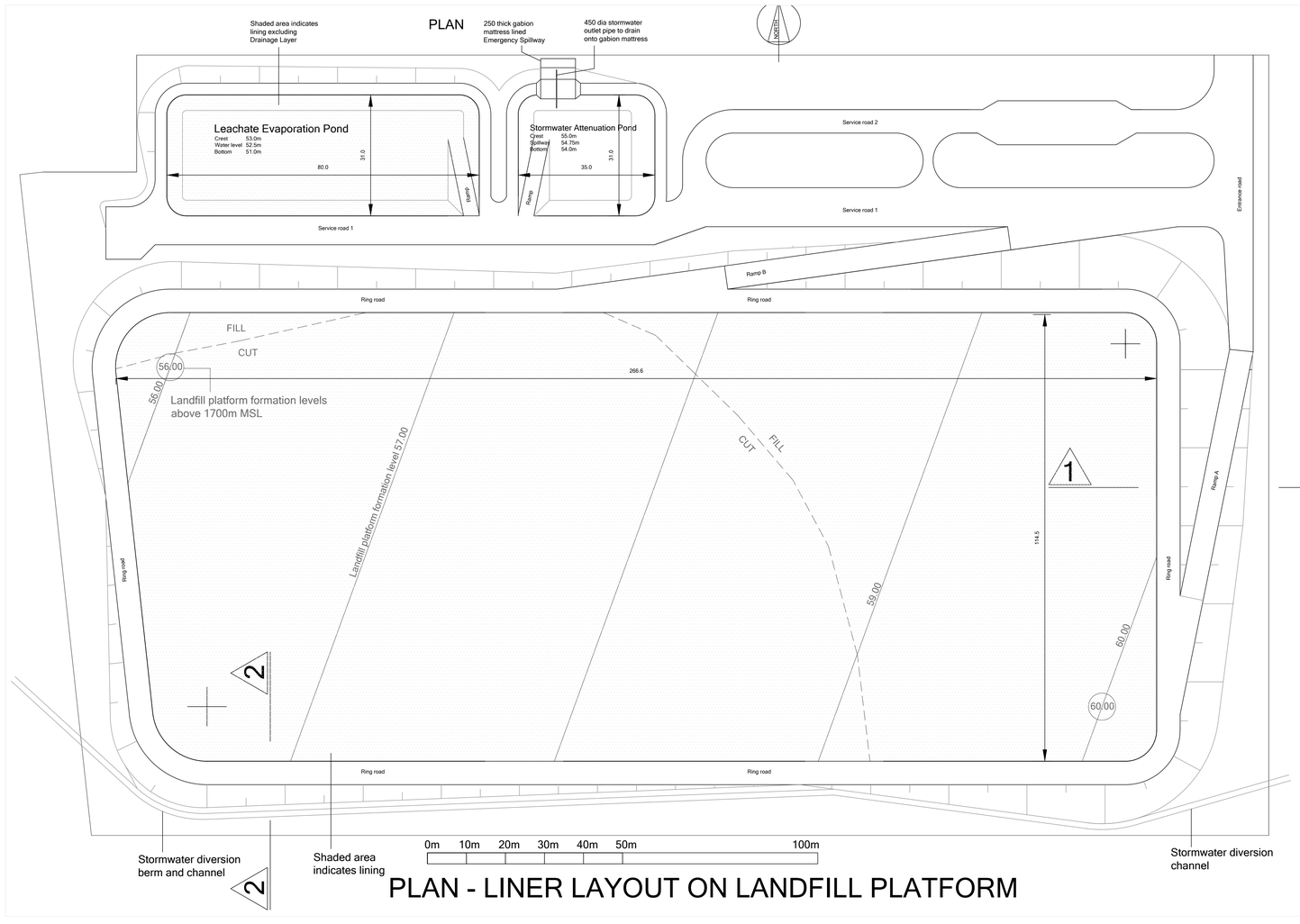
1 - 1 CLAY OPTION



2 - 2 GCL OPTION

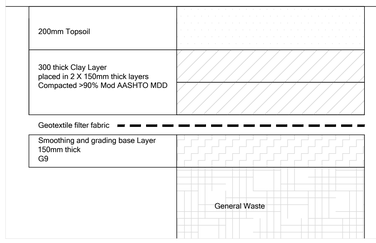


1 - 1 GCL OPTION

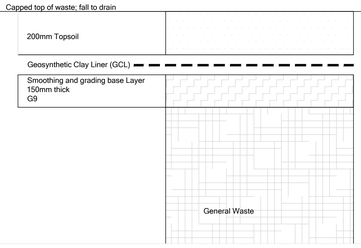


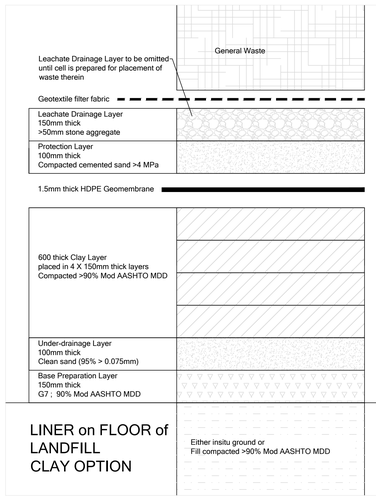
PLAN - LINER LAYOUT ON LANDFILL PLATFORM

CAPPING OVER WASTE FILLED CELLS CLAY OPTION

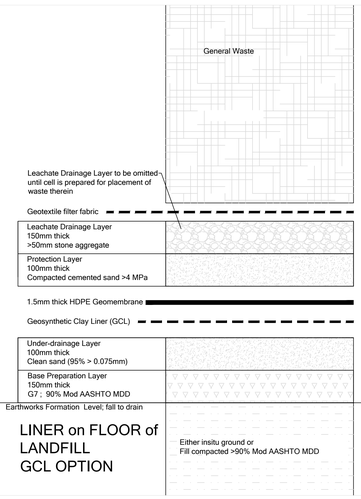


CAPPING OVER WASTE FILLED CELLS GCL OPTION

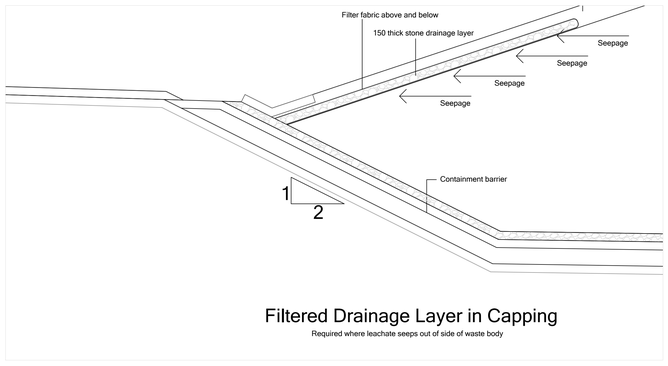




LINER on FLOOR of LANDFILL CLAY OPTION

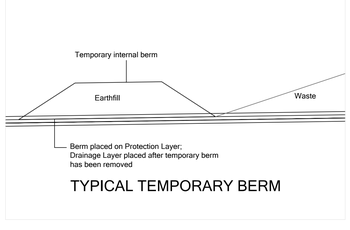


LINER on FLOOR of LANDFILL GCL OPTION



Filtered Drainage Layer in Capping

Required where leachate seeps out of side of waste body



TYPICAL TEMPORARY BERM

PRELIMINARY FOR ESKOM CONSIDERATION

Consulting Company

WSM GEOTECHNICAL ENGINEERING A DIVISION OF WSM GROUP

The Employer

Eskom

Project

NEW GENERAL WASTE DISPOSAL FACILITY AT MAJUBA POWER STATION

Drawing Title

CONTAINMENT BARRIER LAYOUT AND DETAILS

Drawing Number	Revision
wsm-maj-02	D
Date: 16 March 2022	

REV	DATE	INDEX REFERENCE	REV BY	CHKD BY	AUTH BY	KKS APP
00	D	FIRST ISSUE				
0.0	REV	** REVISION **				

REFERENCE DRAWINGS: 0-__

DRG REGISTR: —
KKS APP: —
AUTH BY: —
CHKD BY: —
DRAWN BY: —
SCALE: —

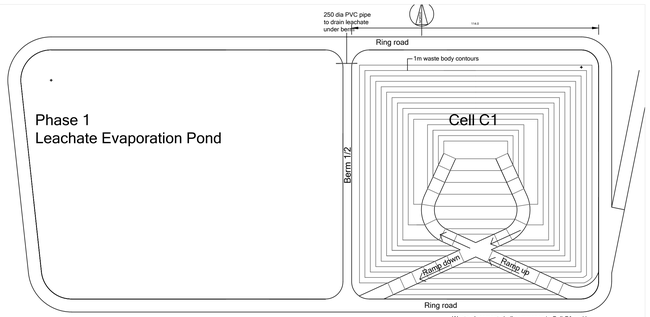
APPROVED BY: —
AUTHORISED BY: —

ESKOM HOLDINGS LTD.
REG. No. 2002/015527/06

Eskom

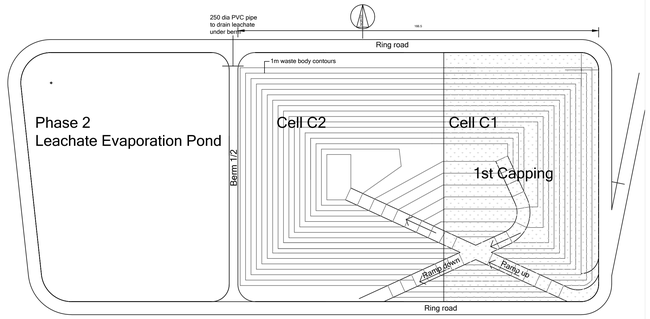
0-__/_____ __ REV

SIZE A1

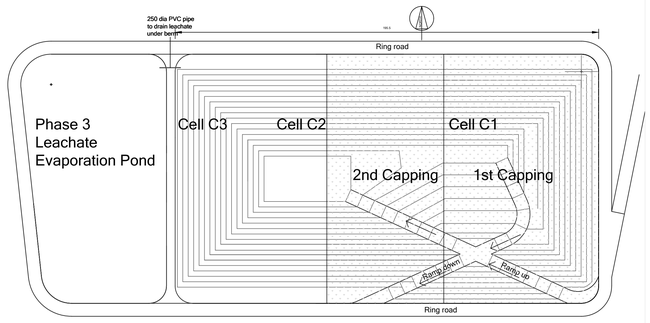


PHASE 1 - Fill Cell C1

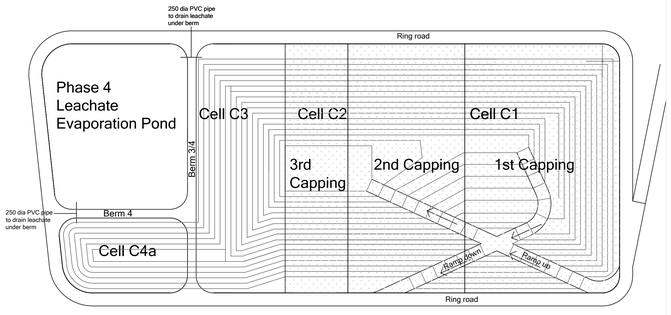
Waste placement shall commence in Cell C1 and be confined thereto until that cell is full to the envisaged top level, whereafter the slopes thereof that are permanent shall be capped ; waste shall then be extended into Cell C2



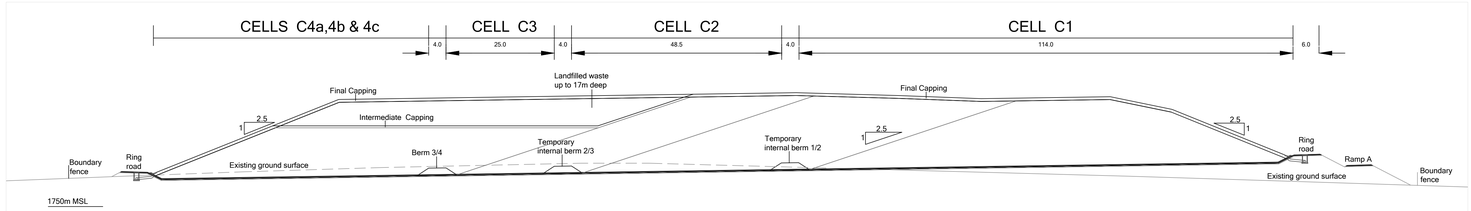
PHASE 2 - Extend Fill over Cell C2 after capping final waste slopes



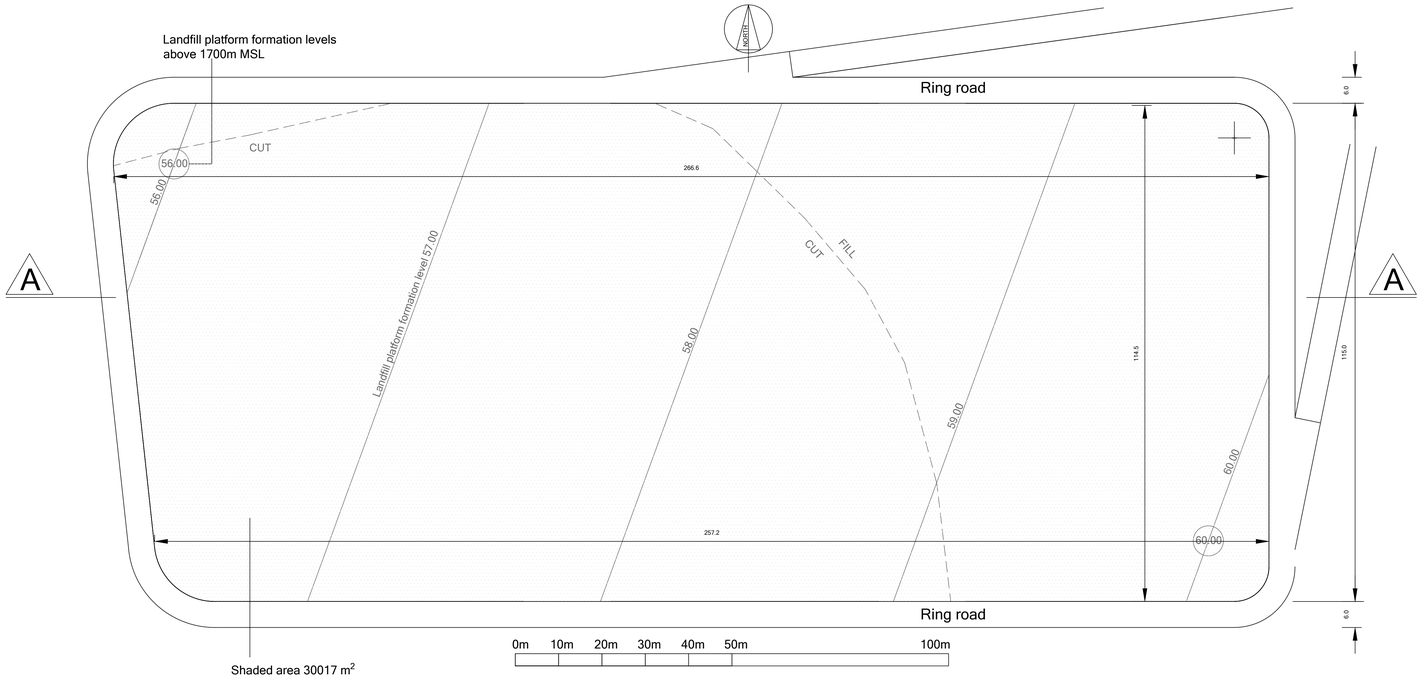
PHASE 3 - Extend fill over Cell C3 after capping additional final waste surfaces



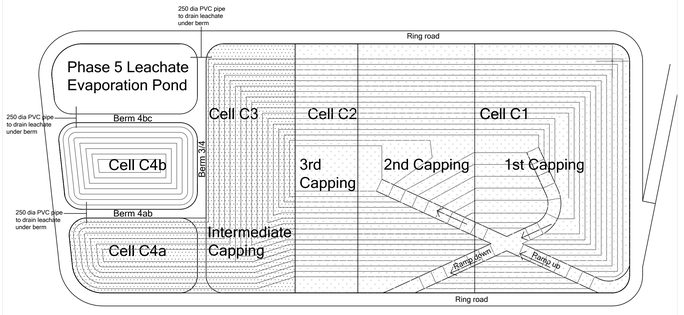
PHASE 4 - Extend fill over Cell C4a after capping additional final waste surfaces



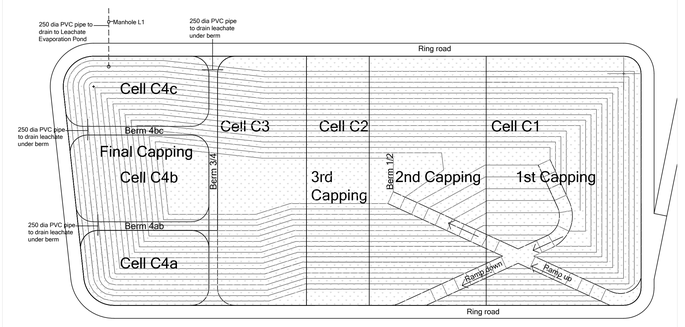
A - A



PLAN - LANDFILL PLATFORM



PHASE 5 - Extend fill over Cell C4b after intermediate capping



Phase 6 - Complete filling and capping

Phase	1	2	3	4	5	6	
Waste body volume	76438	140698	176194	183238	190664	250000	m3
Uncapped waste area	13053	10878	8015	6893	2556	0	m2
Evaporation area	16603	10534	7282	4974	2174	2480	m2
Leachate generated	10377	8648	6372	5480	2032	0	m3/year
Rain on evaporation area	13199	8375	5789	3954	1728	1972	m3/year
Necessary evaporation	23576	17022	12161	9434	3760	1972	m3/year
Feasible evaporation	32375	20541	14200	9699	4239	4836	m3/year

Where the Leachate Drainage Layer has been temporarily omitted below internal berms 1/2, and 2/3) those berms shall be removed before waste is placed over their locations to allow such Drainage Layer to be laid.

Berms 3/4, 4ab, and 4bc, must be placed over the Drainage Layer and must remain in order to facilitate placement of intermediate capping while waste placement continues.

PRELIMINARY FOR ESKOM CONSIDERATION

Consulting Company

WSM GEOTECHNICAL ENGINEERING A DIVISION OF WSM GROUP

The Employer

Eskom

Project

NEW GENERAL WASTE DISPOSAL FACILITY AT MAJUBA POWER STATION

Drawing Title

WASTE PLACEMENT

Drawing Number: wsm-maj-03

Revision: D

Date: 16 March 2022

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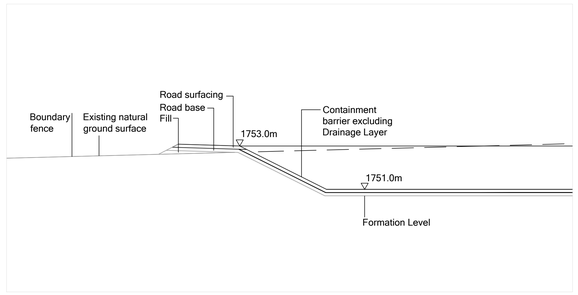
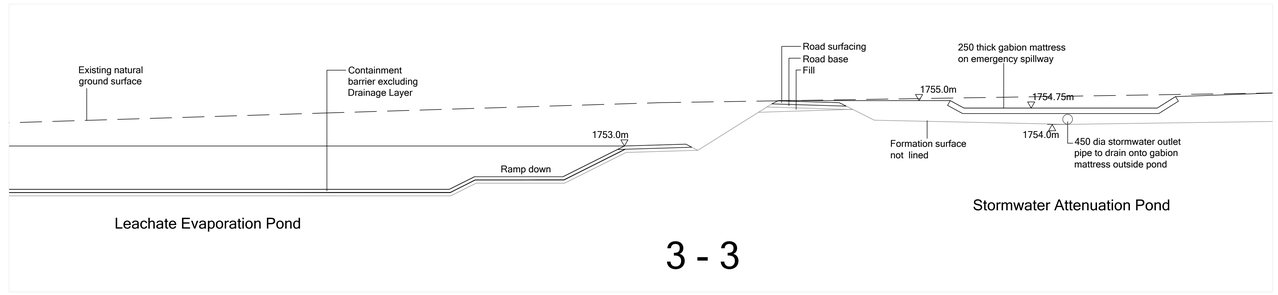
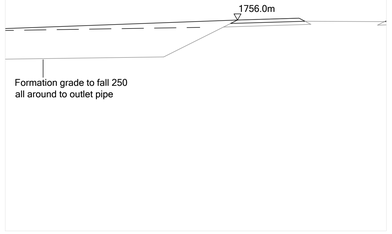
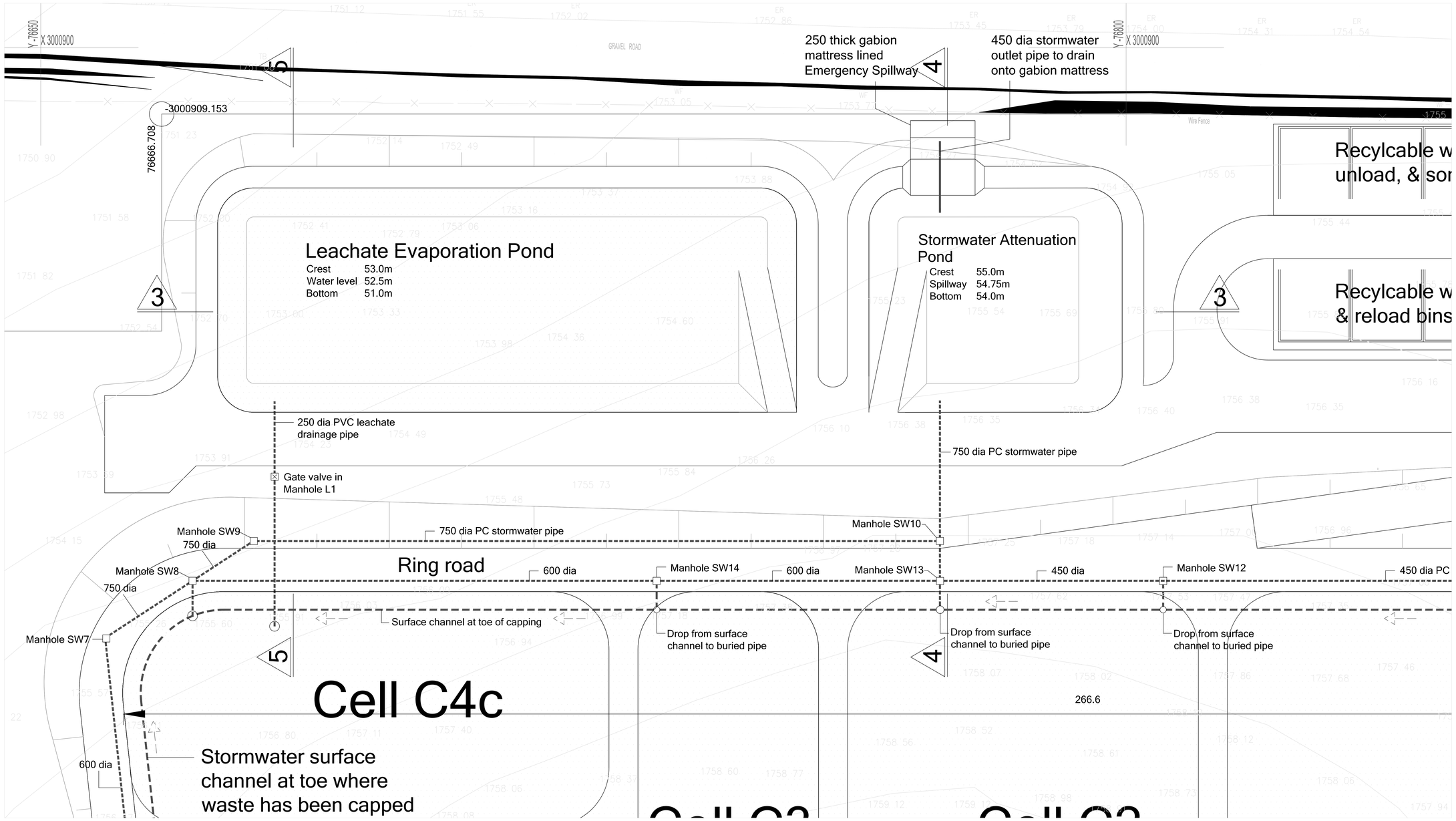
S/S	REV.	DATE	FIRST ISSUE	REV BY	CHKD BY	AUTH BY	KKS APP	0-__	REFERENCE DRAWINGS	
DRG REG/STR			** REVISION **							
			INDEX REFERENCE	APPROVED BY						
KKS APP				AUTHORISED BY						
AUTH BY			ESKOM HOLDINGS LTD. REG. No. 2002/015527/06							
CHKD BY										
DRAWN BY										REV
SCALE			Eskom	0-__/_____						





3 - 3





PRELIMINARY FOR ESKOM CONSIDERATION

Consulting Company
WSM GEOTECHNICAL ENGINEERING A DIVISION OF WSM GROUP

The Employer
Eskom

Project
NEW GENERAL WASTE DISPOSAL FACILITY AT MAJUBA POWER STATION

Drawing Title
LEACHATE EVAPORATION POND and STORMWATER ATTENUATION POND DETAILS 1

Drawing Number	Revision
wsm-maj-04	D
Date: 16 March 2022	

CO.	0	FIRST ISSUE				
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DRG REGSTR		INDEX REFERENCE				0 - __ REFERENCE DRAWINGS
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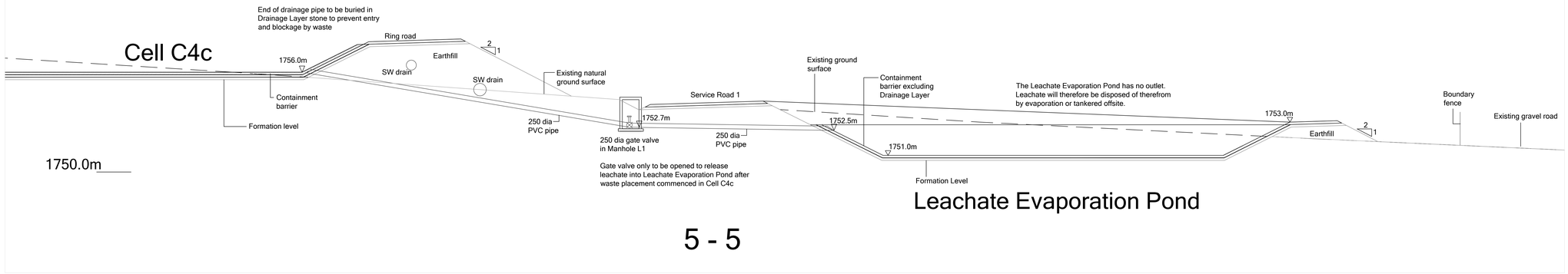
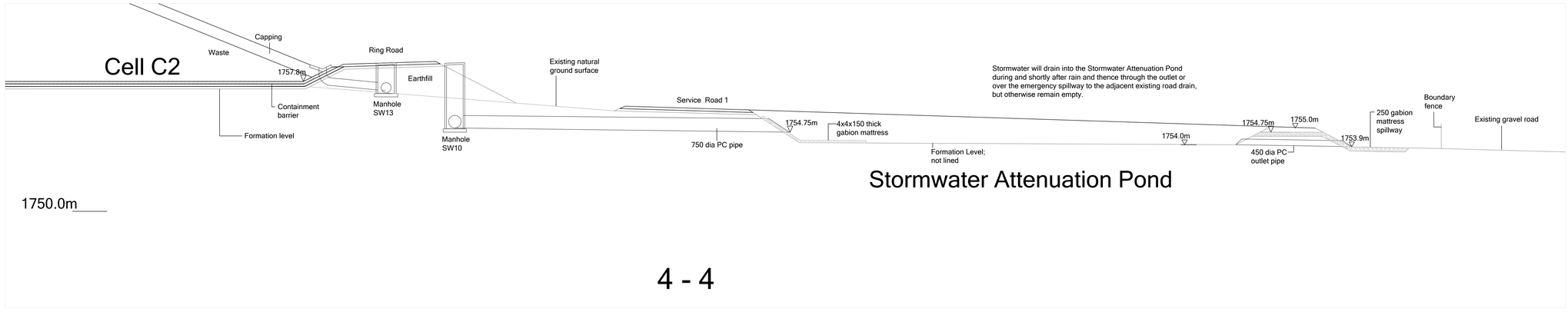
AUTH BY		AUTHORISED BY				
CHKD BY		ESKOM HOLDINGS LTD. REG. No. 2002/015527/06				
DRAWN BY						REV
SCALE		Eskom	0 - __/ _____			__





PRELIMINARY FOR ESKOM CONSIDERATION

Consulting Company

WSM GEOTECHNICAL ENGINEERING A DIVISION OF WSM GROUP

The Employer

Eskom

Project

NEW GENERAL WASTE DISPOSAL FACILITY AT MAJUBA POWER STATION

Drawing Title

LEACHATE EVAPORATION POND and STORMWATER ATTENUATION POND DETAILS 2

Drawing Number	Revision
wsm-maj-05	D
Date: 16 March 2022	

00	0	FIRST ISSUE					
0.0	REV	DATE	** REVISION **	REV BY	CHKD BY	AUTH BY	KKS APP
			INDEX REFERENCE				0·__ REFERENCE DRAWINGS

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Eskom 0·__/_____ REV __

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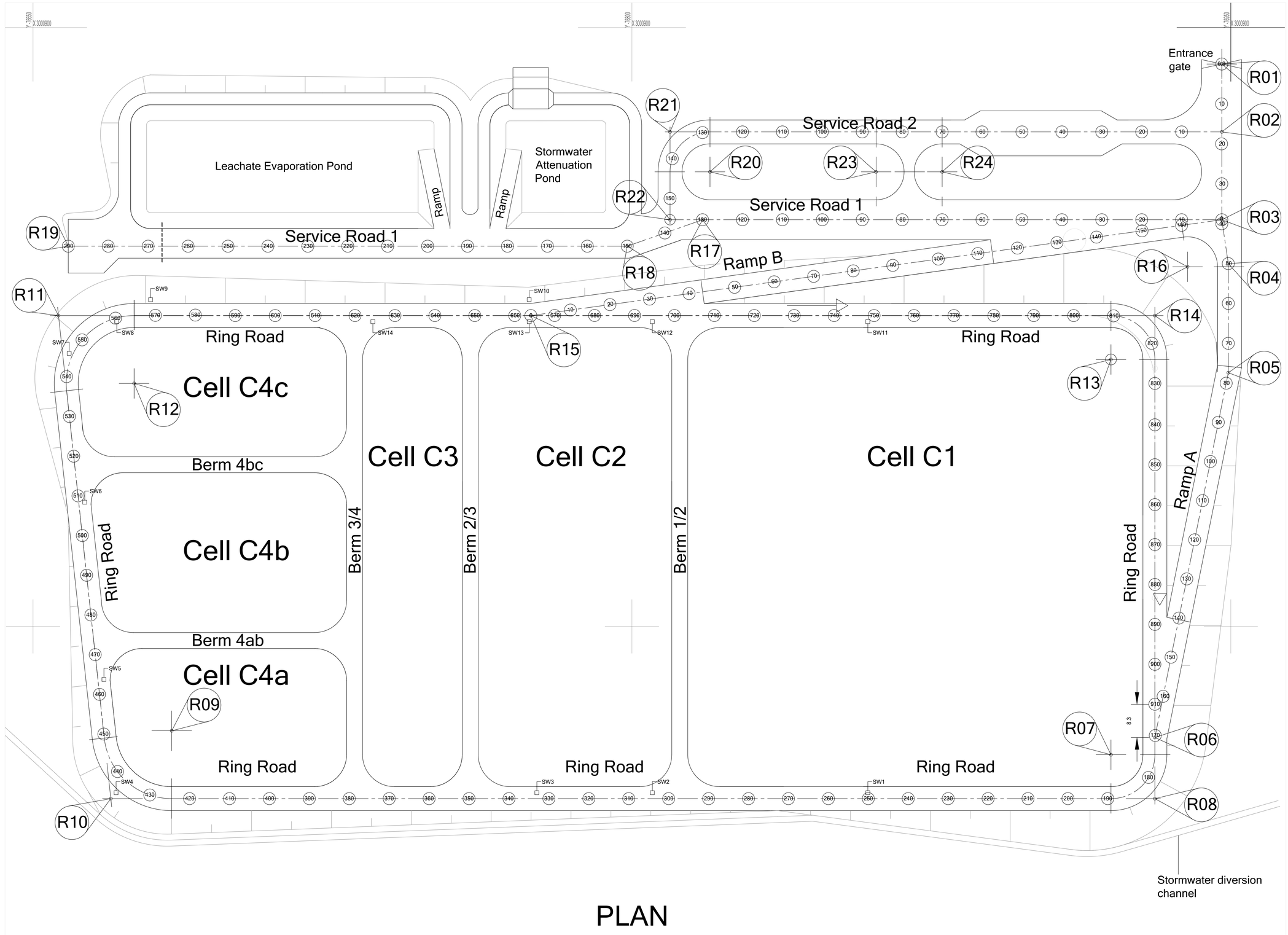

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R05	-76949.380	3000986.472
R06	-76930.985	3001077.834
R07	-76919.985	3001082.144
R08	-76930.985	3001093.144
R09	-76684.744	3001076.144
R10	-76669.486	3001093.144
R11	-76656.377	3000972.154
R12	-76675.319	3000989.154
R13	-76919.985	3000983.154
R14	-76930.985	3000972.154
R15	-76774.690	3000972.154
R16	-76939.174	3000959.936
R17	-76817.695	3000948.154
R18	-76798.830	3000954.778
R19	-76658.830	3000954.778
R20	-76819.555	3000936.154
R21	-76809.555	3000926.154
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R23	-76861.137	3000936.154
R24	-76877.712	3000936.154

PRELIMINARY FOR ESKOM CONSIDERATION

Consulting Company

WSM GEOTECHNICAL ENGINEERING A DIVISION OF WSM GROUP

The Employer

Eskom

Project

NEW GENERAL WASTE DISPOSAL FACILITY AT MAJUBA POWER STATION

Drawing Title

ROAD LAYOUT

Drawing Number	Revision
wsm-maj-06	D
Date: 16 March 2022	

PLAN

FIRST ISSUE
** REVISION **
INDEX REFERENCE
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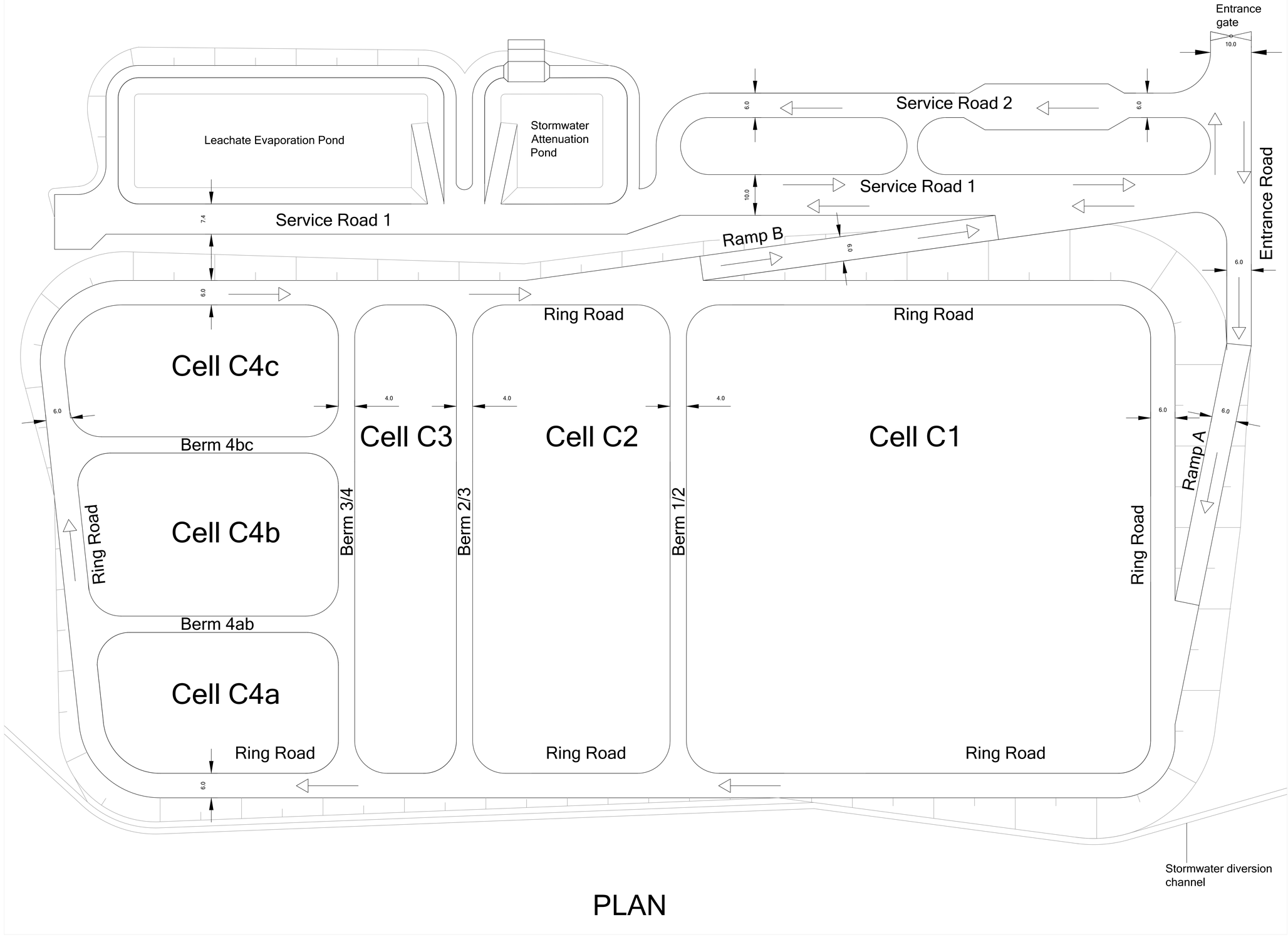

PLAN

PRELIMINARY FOR ESKOM CONSIDERATION

Consulting Company

WSM GEOTECHNICAL ENGINEERING A DIVISION OF WSM GROUP

The Employer

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Project

NEW GENERAL WASTE DISPOSAL FACILITY AT MAJUBA POWER STATION

Drawing Title

ROAD WIDTHS

Drawing Number	Revision
wsm-maj-07	D
Date: 16 March 2022	

D.C.	REV.	DATE	INDEX REFERENCE
			FIRST ISSUE
			** REVISION: **

REFERENCE DRAWINGS: 0.__

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REG. No.
2002/015527/06

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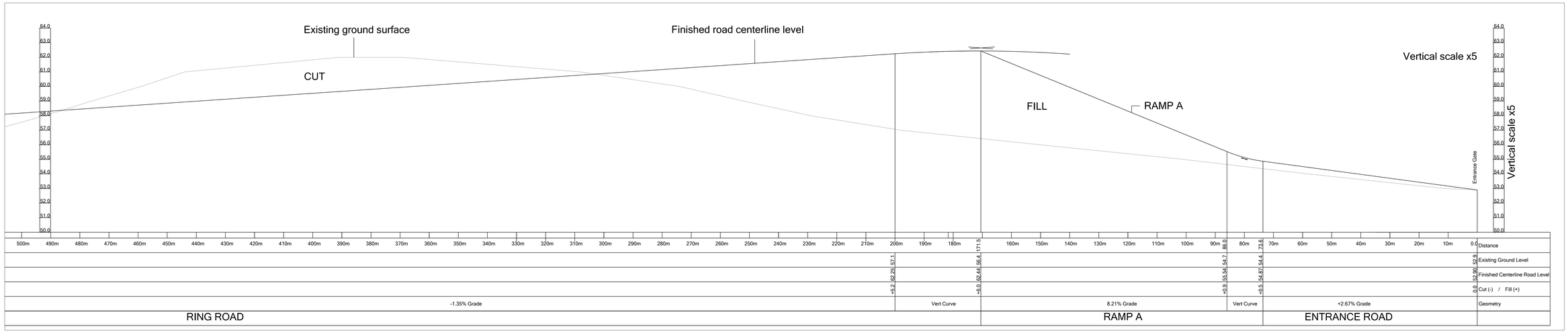
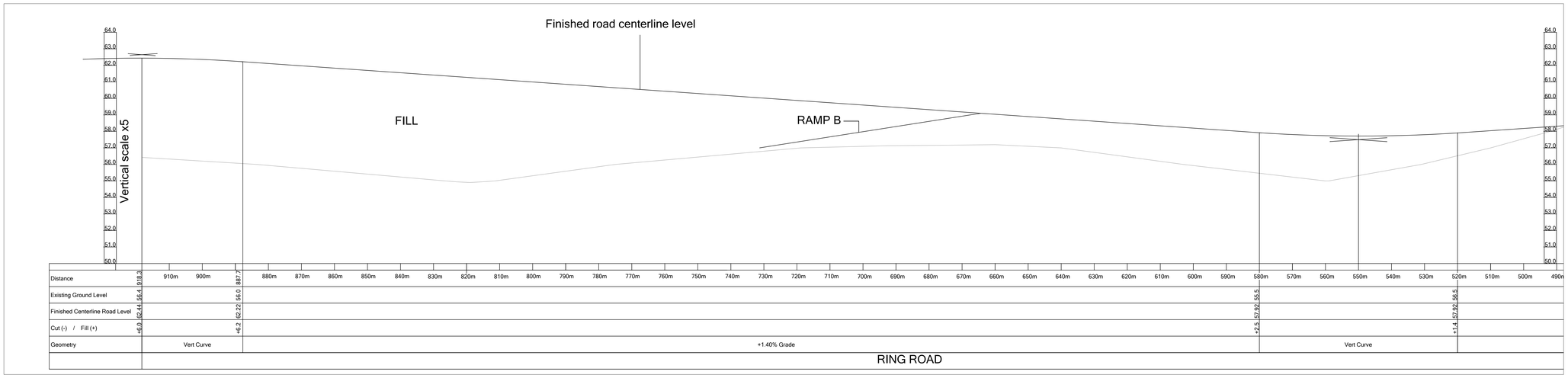
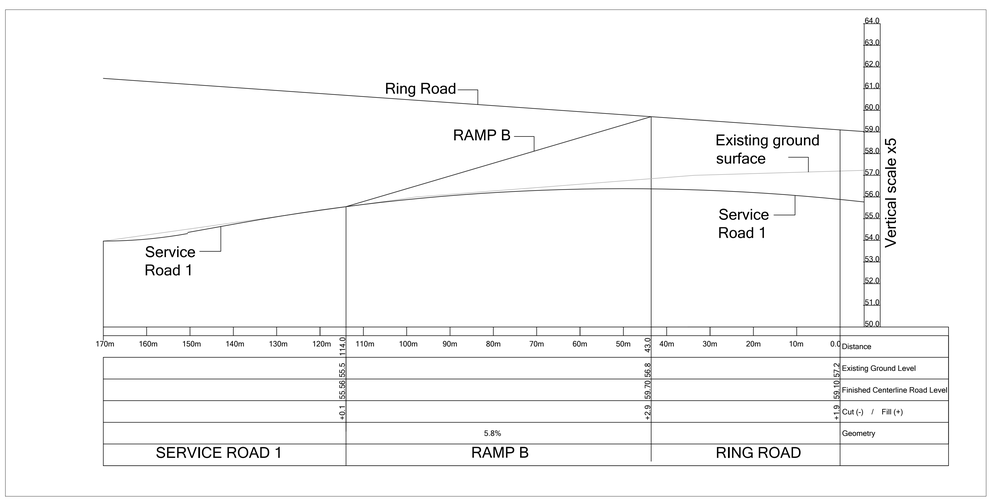
SIZE A







PRELIMINARY FOR ESKOM CONSIDERATION

Consulting Company

USM GEOTECHNICAL ENGINEERING A DIVISION OF WSM GROUP

The Employer

Eskom

Project

NEW GENERAL WASTE DISPOSAL FACILITY AT MAJUBA POWER STATION

Drawing Title

LONGSECTIONS 1 RING ROAD

Drawing Number: wsm-maj-08

Revision: D

Date: 16 March 2022

REV	DATE	** REVISION **	REV BY	CHKD BY	AUTH BY	KKS APP
00	0	FIRST ISSUE				

INDEX REFERENCE — REFERENCE DRAWINGS

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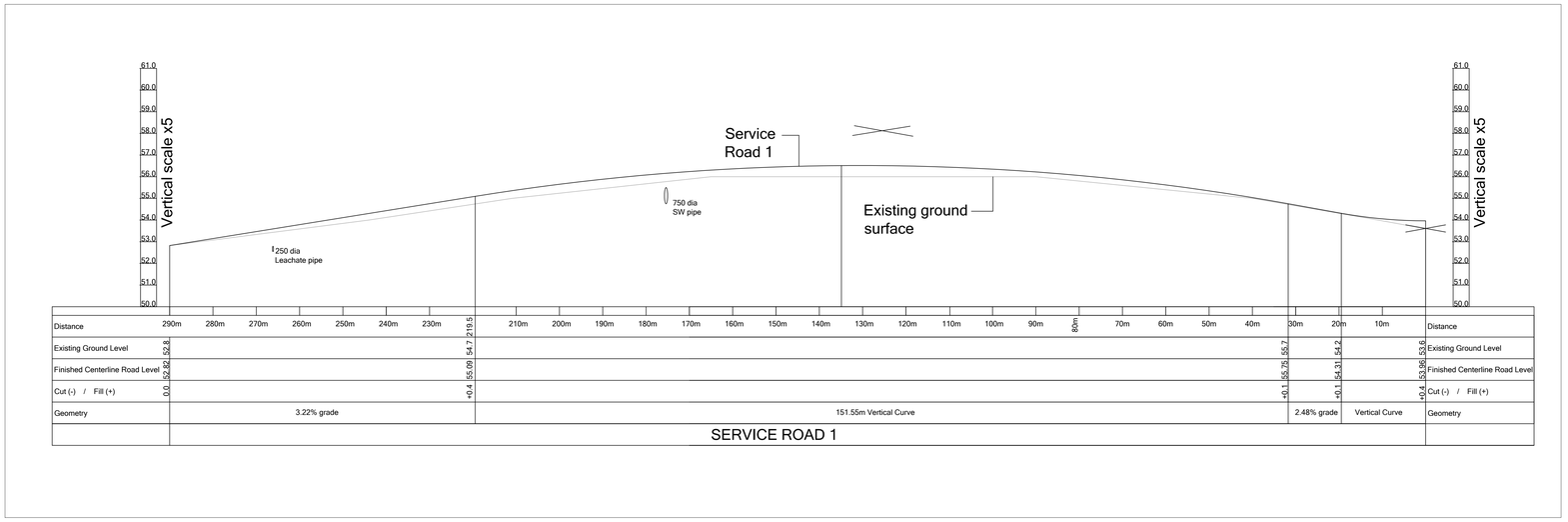
SIZE A4



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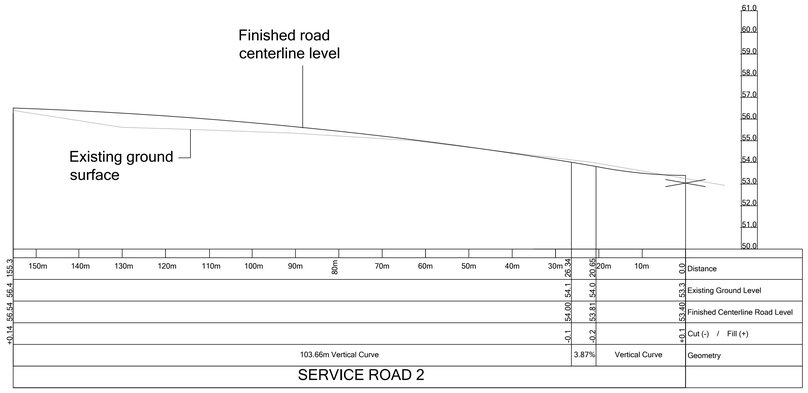
Existing Ground Level	52.8							54.7																			55.7	54.2		53.6	Existing Ground Level
Finished Centerline Road Level	52.82							55.09																			55.75	54.31		53.96	Finished Centerline Road Level
Cut (-) / Fill (+)	0.0							+0.4																			+0.1	+0.1		+0.2	Cut (-) / Fill (+)
Geometry	3.22% grade							151.55m Vertical Curve																			2.48% grade	Vertical Curve			Geometry

SERVICE ROAD 1



Distance	150m	140m	130m	120m	110m	100m	90m	80m	70m	60m	50m	40m	30m	26.34	20.65	20m	10m	0.0	Distance
Existing Ground Level	55.3												54.1	54.0				53.3	Existing Ground Level
Finished Centerline Road Level	56.4												54.00	53.81				53.40	Finished Centerline Road Level
Cut (-) / Fill (+)	+0.14	56.54											-0.1	-0.2				+0.1	Cut (-) / Fill (+)
Geometry	103.66m Vertical Curve												3.87%	Vertical Curve					Geometry

SERVICE ROAD 2

PRELIMINARY FOR ESKOM CONSIDERATION

Consulting Company

WSM GEOTECHNICAL ENGINEERING A DIVISION OF WSM GROUP

The Employer

Eskom

Project

NEW GENERAL WASTE DISPOSAL FACILITY AT MAJUBA POWER STATION

Drawing Title

LONGSECTION 2 SERVICE ROADS

Drawing Number	Revision
wsm-maj-09	D
Date: 16 March 2022	

D.O.	REV.	DATE	INDEX REFERENCE
D.O.	0		FIRST ISSUE
			** REVISION **

REV BY | CHKD BY | AUTH BY | KKS APP | REFERENCE DRAWINGS

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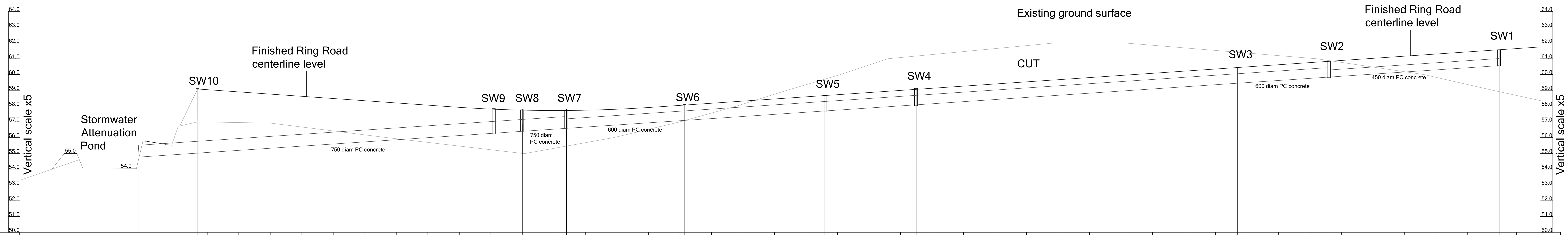
ESKOM HOLDINGS LTD. REG. No. 2002/015527/06

Eskom

0-__/ _____ REV __

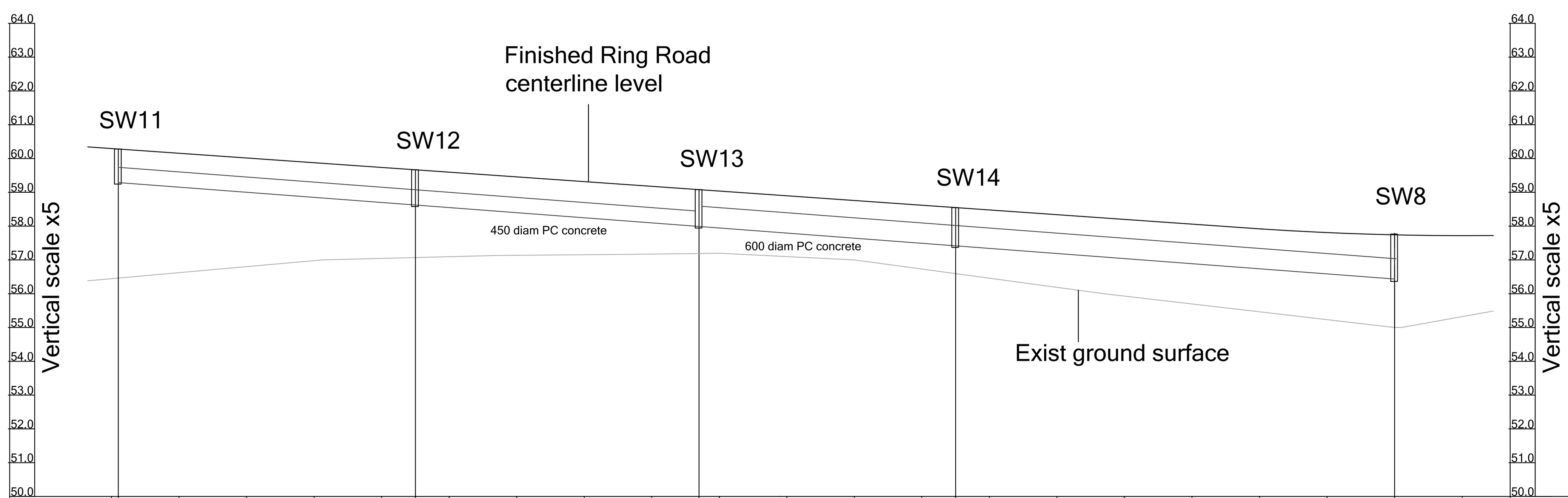
SIZE A1



Distance: 660m 650m 640m 630m 620m 610m 600m 590m 580m 570m 560m 550m 540m 530m 520m 510m 500m 490m 480m 470m 460m 450m 440m 430m 420m 410m 400m 390m 380m 370m 360m 350m 340m 330m 320m 310m 300m 290m 280m 270m 260m 250m

Manhole		SW10	SW9	SW8	SW7	SW6	SW5	SW4	SW3	SW2	SW1
Pipe	750 diam PC concrete	750 diam PC concrete	750 diam PC concrete	750 diam PC concrete	600 diam PC concrete	600 diam PC concrete	600 diam PC concrete	600 diam PC concrete	600 diam PC concrete	450 diam PC concrete	
Road Level		59.08	57.80	57.74	57.72	58.06	58.67	59.12	60.44	60.84	61.57
Depth		4.06	1.52	1.34	1.13	0.97	0.98	1.04	1.04	1.00	1.00
Invert Level	54.75	55.02	56.28	56.40	56.59	57.09	57.69	58.08	59.40	59.84	60.56

PRELIMINARY FOR ESKOM CONSIDERATION



Distance: 750m 740m 730m 720m 710m 700m 690m 680m 670m 660m 650m 640m 630m 620m 610m 600m 590m 580m 570m 560m 550m

Manhole	SW11	SW12	SW13	SW14	SW8
Pipe	450 diam PC concrete	450 diam PC concrete	600 diam PC concrete	600 diam PC concrete	
Road Level	60.28	59.67	59.08	58.55	57.74
Depth	0.99	1.05	1.09	1.13	1.31
Invert Level	59.29	58.62	57.99	57.42	56.43

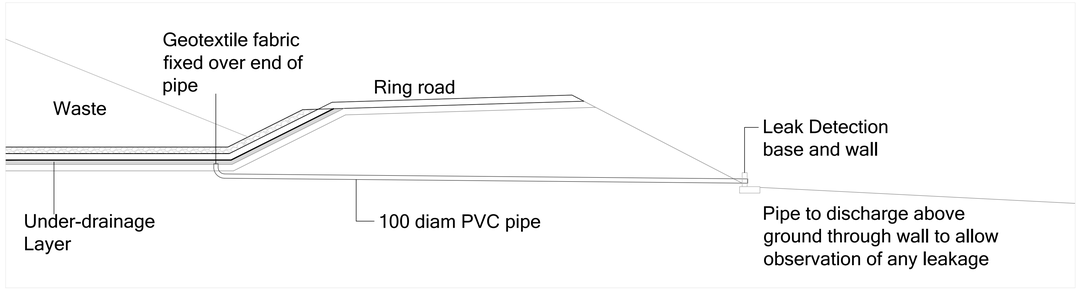
Consulting Company: WSM Geotechnical Engineering, a division of WSM Group

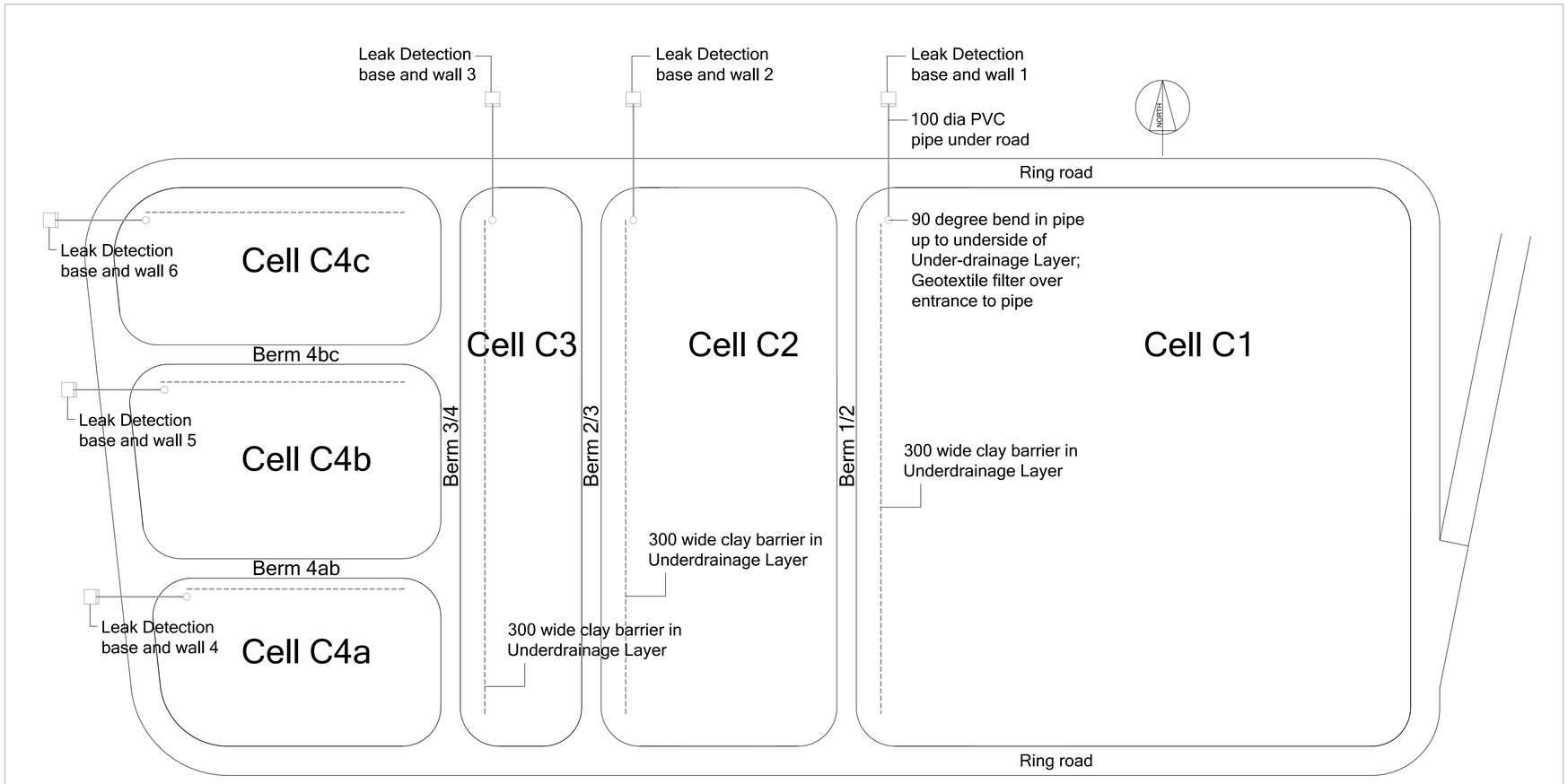
The Employer: Eskom

Project: NEW GENERAL WASTE DISPOSAL FACILITY AT MAJUBA POWER STATION

Drawing Title: LONGSECTIONS 3 STORMWATER DRAINAGE

Drawing Number: wsm-maj-10
Revision: D
Date: 16 March 2022





LEAK DETECTION UNDERDRAINAGE SYSTEM

PRELIMINARY FOR ESKOM CONSIDERATION

Consulting Company

WSM GEOTECHNICAL ENGINEERING A DIVISION OF WSM GROUP

The Employer

Eskom

Project

NEW GENERAL WASTE DISPOSAL FACILITY AT MAJUBA POWER STATION

Drawing Title

LEAK DETECTION & UNDER-DRAINAGE SYSTEM

Drawing Number	Revision
wsm-maj-11	D
Date: 16 March 2022	

D.O.	REV.	DATE	INDEX REFERENCE
			FIRST ISSUE
			** REVISION: **

REV BY | CHKD BY | AUTH BY | KKS APP | 0.__ REFERENCE DRAWINGS

DRG REGISTR | APPROVED BY

KKS APP | AUTHORISED BY

AUTH BY | ESKOM HOLDINGS LTD. REG. No. 2002/015527/06

CHKD BY | DRAWN BY | SCALE

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