ESKOM HOLDINGS LIMITED

PANEL B CONSULTANTS JOINT VENTURE

KUSILE POWER STATION

STATION DIRTY DAMS

DETAILED DESIGN REPORT 5452/80/008 REV 2

Task Order Number: PBC JV – TO #31

MAY 2010

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1 INTRODUCTION

The Panel B Consultants Joint Venture (CJV) has been appointed by Eskom Enterprises to carry out the civil design of the water license structures for the Kusile Power Station.

This report details the design of the Station Dirty Dams (SDD).

1.1 Background

Eskom is the principal supplier of electricity in South Africa. In order to meet the growing need for electricity, and in support of the growth and development strategy of the national government, Eskom has embarked on an expansion program to build new power stations. Part of this expansion program includes the construction of two large coal-fired power stations.

Located near Witbank and Kendal Power Station in the Mpumalanga province, Kusile Power Station will be a 4,800 MW coal-fired power plant. Kusile Power Station is currently under construction with a target commissioning date of June 2014 for the first of its six units.

1.2 Scope

Panel B CJV is responsible for the engineering design and construction drawings for the Pollution Control Dams (PCDs) at Kusile Power Station. This is the detailed design report for the SDD. It addresses all client requirements, as well as all relevant South African regulatory requirements. These include:

- The National Water Act, No. 36 of 1998.
- Section 117(c)(i) of the National Water Act, 1998, relating to dams with a safety risk.
- Government Notice No. 704, Regulations on use of water for mining and related activities aimed at the protection of water resources, in terms of the National Water Act (Act 36 of 1998)
- SANS 1200: Standardised Specifications for Civil Engineering Construction

1.3 Client User Requirement Specification

The design criteria for the SDD satisfy the requirements of the Eskom User Requirement Specification (URS) as detailed in *Section 5.2.2: Water Management*.

1.4 Drawings

All SDD detailed design drawings that are relevant to the water use licensing are marked with an asterisk, provided in *Appendix A*. The complete set of relevant drawings for the SDD is the following:

- *K5452-80-020: Pollution Control Dams: Locality Plan;
- *K5452-80-021: SDD: General Arrangement;
- *K5452-80-022: SDD: Typical Sections;
- *K5452-80-023: SDD: Typical Details;
- *K5452-80-024: SDD: Compartment No. 1 Inlet – GA and Details;
- *K5452-80-025: SDD: Compartment No. 1 Outlet – GA and Details;
- *K5452-80-026: SDD: Spillway No. 1 – GA and Typical Details;
- *K5452-80-027: SDD: Spillway No. 2 – GA and Typical Details;
- *K5452-80-028: SDD: Compartment No. 2 Inlet – GA and Details;
- *K5452-80-029: SDD: Compartment No. 2 Outlet – GA and Details;
- *K5452-80-030: SDD: Compartment No. 1 Energy Dissipator – GA and Details;
- *K5452-80-031: SDD: Compartment No. 2 Energy Dissipator – GA and Details;
- *K5452-80-032: SDD: Leakage Detection Sump GA and Details;
- K5452-80-053: SDD: Floor Slab Reinforcing Sheet 1;
- K5452-80-054: SDD: Floor Slab Reinforcing Sheet 2;
- K5452-80-055: SDD: Floor Slab Reinforcing Sheet 3;
- K5452-80-056: SDD: Compartment No. 1 & 2 Energy Dissipator Reinforcing;
- K5452-80-057: SDD: Spillway No. 1 & 2 Concrete Reinforcing Details;
- K5452-80-079: SDD Road Layout: General Arrangement;
- K5452-80-080: SDD Road Layout: Road 2 Layout and Long Sections;
- K5452-80-093: SDD Road Layout: Road 2A Layout and Long Sections;
- K5452-80-094: SDD Road Layout: Road 2A Layout and Long Sections;
- K5452-80-095: SDD Road Layout: Road 2B Layout and Long Sections;
- K5452-80-101: SDD: Leakage Detection Sump Reinforcement Details.

2 STATION DIRTY DAMS DESIGN

2.1 SDD Overview

All potentially contaminated water on the Kusile Power Station is managed in a closed system. The Station Dirty Dams (SDD) are two equal capacity, lined, temporary holding dams that act as a collection point for all polluted storm-water and wash-down water on the Kusile site, before it is pumped to the Holding/Recycle Dams (HRD). The position of the SDD is shown on drawing K5452-80-021.

The SDD will receive inflows from two distinct sources:

1) Coal Stockyard Settling Tanks (CSY ST): The CSY ST will receive inflows from the Coal Stockyard (CSY), emergency ash dump, limestone processing area, and a number of grit sumps. Clarified water leaving the CSY ST will travel via gravity pipeline to the SDD.

2) Station Dirty Dams Settling Tanks (SDD ST): The SDD ST will receive inflows from the station terrace area. Clarified water leaving the SDD ST will travel via gravity pipeline to the SDD.

2.2 Design Parameters

The SDD general arrangement and typical section drawings are presented as Drawing. Nos. K5452-80-021 and 022. The SDD was designed to meet the following requirements:

2.2.1 Location

The SDD will receive gravity discharges of dirty water from the rest of the Kusile Power Station. It will be the furthest downstream dirty water structure on the site and therefore is required to be down-gradient from the power station. The natural contours of the site slope downwards to the north-west, towards the non-perennial tributary of the Klipfonteinspruit.

The SDD will be optimally located approximately 1 km north-west of the power station's north-west fence corner. The selected position avoids surrounding wetlands and the 1:100 year flood line of the natural stream. The SDD elevation will range from 1,441 meters above sea level (masl) at the sump of Compartment No. 2 to 1,454 masl at the crest of Compartment No. 1.

2.2.2 Storage Capacity

Government Notice Regulation 704 specifies that a dirty water system may not spill into a clean water system more than once in 50 years, and that 800 mm freeboard be supplied. The SDD is designed to contain all of the dirty water runoff from the Kusile Power Station for the 1:50 year, 24 hour duration storm event. The hydrology

calculation was performed by BV using the Rational Method, and yielded a total SDD capacity requirement of 165,000 m^3.

The design volume will be split equally between two compartments, to allow for occasional maintenance and inspection access without interrupting the functionality of the SDD. The SDD is designed with an 800 mm freeboard at full capacity.

The BV hydrology calculations are provided as *Appendix B* of this report.

2.2.3 Operation

The two compartments of the SDD will have a combined capacity that accommodates the runoff generated during the calculated 1:50 year, 24 hour storm event. The SDD will not be a storage dam; it will be a collection point for all polluted water from the site before it is pumped to the HRD. The SDD will be operated empty so that it has the capacity to accommodate the design storm event at any time.

2.3 SDD Modelling

The two-compartment SDD was modelled using 3D CAD software. The structure will be excavated into natural ground with some above ground earthfill for the perimeter walls. Maximum excavation depth will be 6.5 m in Compartment No. 1 and 6.0 m in Compartment No. 2. Maximum wall heights above natural ground level will be 4.5 m in Compartment No. 1, and 4.0 m in Compartment No. 2. The internal and external embankment walls will be sloped at 1V:3H. The basin area of each compartment will be sloped at 1V:200H towards the sumps at the southern end.

The 3D model was used to calculate the Elevation-Capacity curve for both Compartment No. 1 and Compartment No. 2. The resultant Elevation-Capacity curves are presented in *Figure 2-1* and *Figure 2-2*. The final combined storage capacity of the SDD, with sloping floors and access ramps included, is 181,960 m^3. This is conservatively larger than the required volume calculated by BV (165,000 m^3).

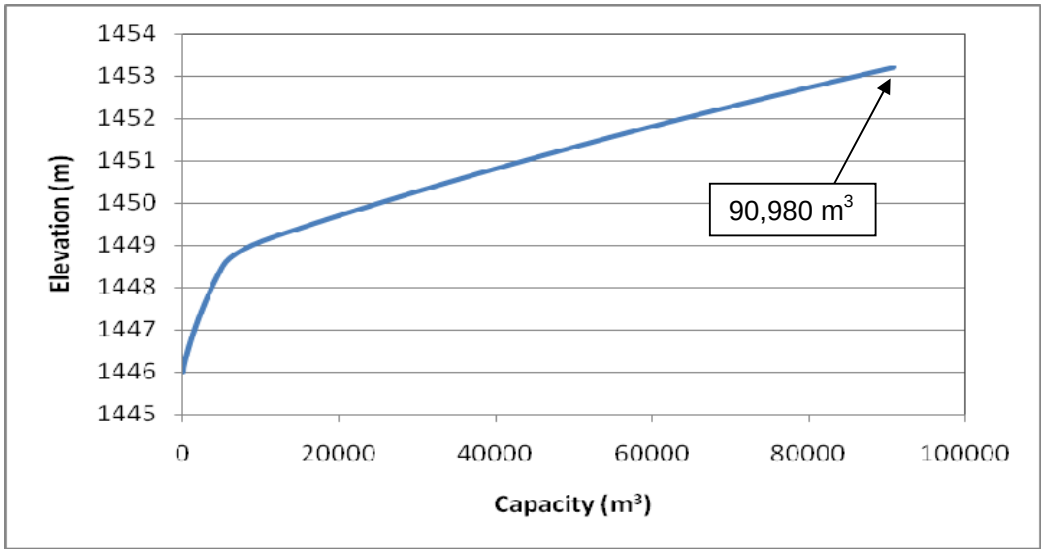

Figure 2-1: Elevation - Capacity Curve – Compartment No. 1

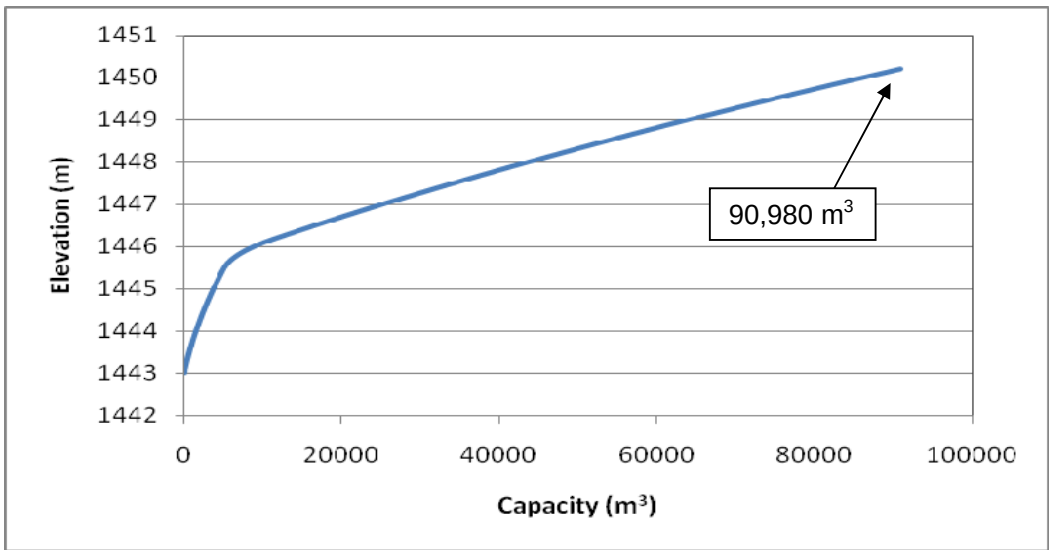

Figure 2-2: Elevation - Capacity Curve – Compartment No. 2

2.4 Liner Details

To prevent contamination to the underlying soil, the SDD is required to be a fully contained structure. The SDD will be fully lined with a double liner, and a leakage detection system.

The sub-grade earthworks will entail preparation of a smooth surface, free from loose angular particles and vegetative matter, compacted to 96% STD Proctor. Bidim A4 Geo-textile (or similar non-woven needled punched geo-fabric) will be placed on the finished grade as a further protective measure for the liner system. With the geo-fabric installed, a continuous 1.5 mm mono-textured HDPE geo-membrane liner will be placed as the secondary liner (textured side down). A cuspated drainage layer (HI-drain 50 or similar approved) will be laid onto this geomembrane, and will facilitate leakage drainage to the leakage detection sumps, should the primary liner fail. A 110 mm OD slotted corrugated HDPE collector pipe will be installed along the inside toe on the south end (low end) of the dam to collect any flow from the drainage layer, and convey it to the leakage detection sumps. Finally, a 1.5 mm smooth HDPE geomembrane liner will be installed as the primary liner. *Figure 2-3* provides a schematic illustration of the liner system.

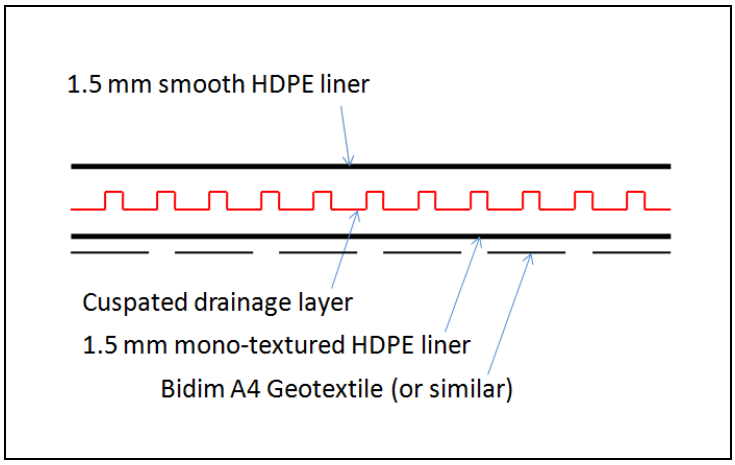

Figure 2-3: SDD Liner System

At the south end of the SDD, the synthetic liner will continue beneath the concrete slab (refer to Section 2.11). This will prevent any possible contamination if the slab were to crack. At the interface of the liner and the outlet sump, the seal will be made as follows: Anchor bolts will be installed to the sides of the sump walls. A galvanized angle iron will be fixed to the anchor bolts. The HDPE geo-membrane liner will be clamped to the angle iron, between two 6 mm thick rubber gaskets and a galvanised mild steel gusset on top. Refer to Drawing Nos. K5452-80-025 and 029 for details.

The geo-membrane liner and geo-fabric will be secured on the embankment crests in anchor trenches. All design details relevant to the liner system can be found on Drg. No. K5452-80-023.

The leakage detection outlet pipes will be installed in the same alignment as the SDD outlet pipes. The leakage detection sumps are located immediately to the north of the pump building, as indicated on Drawing Nos. K5452-80-025 and 029.

2.5 Under Liner Drainage System

The geotechnical investigation undertaken at the site of the SDD (refer to Section 3) indicates the presence of a high water table. The groundwater below the geo-membrane liner will cause an uplift force on the liner, particularly when the SDD is empty. It is necessary to provide a drainage system beneath the liner to relieve the pressure and ensure good condition of the liner.

The design will include a number of finger drains excavated beneath finished grade of the SDD. The location of finger drains is indicated in plan on Drawing No. K5452-80-021.

The drains will be formed by excavating a 500 mm deep, trapezoidal trench. A 160 mm diameter HDPE flexible slotted drainage pipe (Drainex or similar approved) will be installed, the trench filled with 19 mm washed stone and the pipe and stone wrapped in a non-woven needled punched geofabric (Bidim A4 or similar approved) with a minimum overlap of 300 mm. (Refer to Drawing No. K5452-80-023 for details). The drains will conform to the bottom slope of the SDD compartments until they pass beneath the western embankment of Compartment No.2. At this point, the drain will

transition to an un-perforated 160 mm OD PVC-U class 12 outlet pipe that daylights to natural ground surface at a 1 percent grade. Refer to Drawing No. K5452-80-023 for the finger drain section as well as the drain outlet details.

2.6 Inlet Details

Inflow to the SDD will be through a 2,250 mm ND Class 100D concrete pipe (Rocla). In both compartments, where the pipe passes through the south wall of the SDD, The pipe will be encased in reinforced concrete. Refer to Section 2.4 for liner to concrete connection details. Drawing Nos. K5452-80-024 and K5452-80-028 show the arrangement and details for the inlets of Compartment No. 1 and Compartment No.2.

At the inlet the water will impact an energy dissipator that will still the incoming water and prevent damage to the liner. The energy dissipater has been sized to handle the maximum combined instantaneous flow from the CSY ST and SDD ST of 23.9 m^3/s. The energy dissipators are detailed on Drawing Nos. K5452-80-030 and K5452-80-031. The calculations records are provided as *Appendix D*.

2.7 Outlet Details

The outlet sumps are located on the depressed south end of each compartment. They comprise a rectangular reinforced concrete sump with inside dimensions of 2 m length, 1.2 m width, and 1.2 m depth, with 300 mm thick walls. The 630 mm (ND) HDPE DR 11 outlet pipes will be installed in the centre of the shorter wall and they will convey water to the pump station sump situated outside the toe of the SDD on the south side.

The outlet pipes will be encased in reinforced concrete where they are situated below the embankment footprint. The HDPE outlet pipes will be pressure tested before they are concrete encased.

The top of the sump will be covered with a Vitagrid 5 type VE, medium duty grate to allow water flow but restrict the ingress of foreign objects. The grate will be removable to allow for cleaning and the insertion of a submersible pump in the sump, should this be required for dam emptying purposes. Refer to Drawing Nos. K5452-80-025 and K5452-80-029 for details.

2.8 Spillway Details

A spillway will be provided between the two compartments (Spillway No. 1) to allow the upstream Compartment No. 1 to spill into the lower Compartment No. 2. Compartment No. 2 will be provided with an emergency spillway (Spillway No. 2), that discharges northwards towards the natural stream. Both spillways will comprise a trapezoidal, concrete lined channel with freeboard depth of 800 mm and base width 6.0 m. An energy dissipator is provided at the base of Spillway No. 2 to reduce erosion damage downstream of the spillway outlet.

All of the dirty water structures at Kusile Power Station were designed to handle the 1:50 year, 24 hour storm event. The capacity limitations of the upstream structures will prevent increased inflow to the SDD even in events exceeding the 1:50 year recurrence interval. The inflow to the SDD is limited to the maximum capacity of the upstream structures plus the rain attenuation on the SDD surface itself.

The rainfall data from Rainfall Station 0593419W at the Wilge River is considered to be the most relevant to the Kusile Power Station, since the rainfall station is in close proximity of the site and it has 94 years of records available. Summarized rainfall data for this station is presented below in *Table 2-1*.

Table 2-1: Design Rainfall for Station 0593419W

Duration	Return Period (years)						
	2	5	10	20	50	100	200
24 Hour	50	70	84	100	122	141	162

The SDD catchment area is limited to the surface area of the two compartments and their surrounding embankments only. The area of the SDD and its contributing perimeter embankments is roughly 65,300 m^2, or 32,650 m^2 per compartment. This means that 3,983 m^3 per compartment is generated in the 24 hour, 50 year return period storm event.

With 800 mm freeboard in the spillway, it is clear that the rain attenuation of 122 mm will not pose a problem in terms of spillway capacity. The spillway capacity (with no dry freeboard) is estimated at 9.34 m^3/s.

All spillway details are provided on Drawing Nos. K5452-80-026 and K5452-80-027.

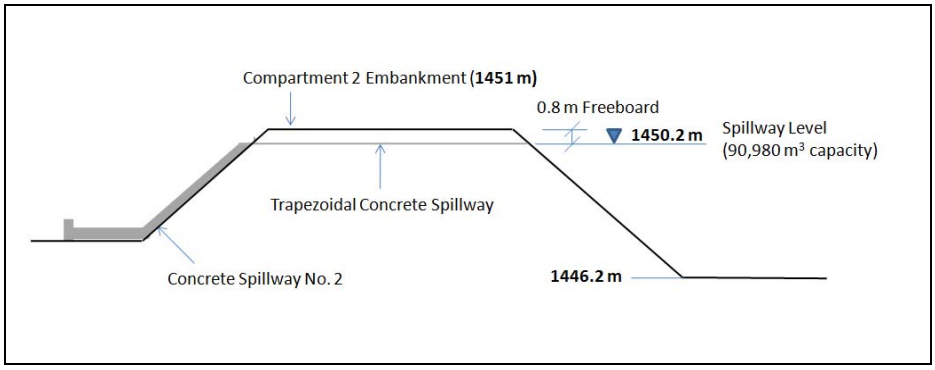

Figure 2-4: Compartment No. 2 Spillway Schematic

2.9 Surface Water Management

A grassed stormwater channel will be excavated upstream of the SDD, parallel to the SDD access road. This channel will intercept clean surface run-off and divert the flow around the dams. The channel will have a nominal depth of 1 m and base width of 1 m, with side slopes of 1V:3H. The channel will be constructed with a minimum slope of 1/2 percent to ensure the effective transport of the surface water away from the SDD. Refer to Drawing No. K5452-80-020 and K5452-80-079 for details.

2.10 Groundwater Cut-off Drain

A groundwater cut-off drain will be constructed upstream of the clean stormwater channel mentioned above. The drain will be constructed to 4 m depth, and will effectively transport shallow groundwater around the SDD. The drain will comprise 19 mm clean stone wrapped in Bidim A4 Geo-textile (or similar approved), with three 160 ND Perforated Drainex collector pipes at the bottom. Downstream of the SDD the drain will daylight to the natural ground surface. Refer to Drawing No. K5452-80-020 and K5452-80-079 for details.

2.11 Maintenance Access Ramp

Maintenance access for service vehicles and equipment is provided to the depressed south end of each compartment by inclusion of a concrete access ramp sloping from the embankment crest to the floor at 1V:6H. The whole of the low end of each compartment, including the access ramp, will be concrete lined to accommodate heavy equipment loads and to protect the liner from damage during cleaning and maintenance activities. The concrete lining will extend out of the southern sump area, and at its northern extent will have a concrete up-stand at the interface of the concrete and HDPE liner. The depressed south end of the SDD will concentrate the sedimentation, thereby easing the efforts to clean the dam.

Refer to Drawing Nos. K5452-80-021, K5452-80-024, and K5452-028 for details on the maintenance access ramp.

2.12 Perimeter Access Road and Fencing

Access to the SDD will be from the south. The access road will run parallel to the inlet pipes and stormwater channel. At the SDD, the access road will do a loop around the perimeter of the structure. This will provide access to both maintenance access ramps, as well as Spillway No. 2.

The road width will be 7 m. The road layer works will comprise a base, sub-base and wearing course layers. The layer specifications are shown on Drawing No. K5452-80-079 and summarised in *Table 2-2*.

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Table 2-2: Access Road Layer Specifications

Layer name	Thickness (mm)	Type
Base	150	G3
Upper Sub-Base	150	G4
Lower Sub-Base	150	G7
Upper Selected	150	G9
Lower Selected/Sub-Grade	150	G10

At the access ramps to the SDD, where the road is elevated from the natural ground level, Armco barriers will be provided for safety.

A single fence will be installed around the perimeter of the SDD. The fence will have locked access gates at the access road entrance, as well as at the access ramps to the SDD embankment crests. The fencing to be used will be per the BV drawings S3915 and S3916 Series. Refer to K5452-80-021 and K5452-80-079 for the fence position.

3 SITE CONDITIONS

3.1 Geotechnical Investigation

3.1.1 Introduction

The geotechnical investigation involved the digging and geotechnical logging of test pits on the original site of the proposed SDD. The purpose of the geotechnical logging and testing was to determine the geotechnical parameters and substrate conditions on site for use in the design of the SDD. From the findings at the original site the SDD was moved further northwest to be positioned entirely on the shales of the Ecca group. The original report is relevant and reproduced in part below.

The geotechnical information supplied by Partridge Maud and Associates, report reference number 1-6/07 entitled *Project Bravo - Report on Geotechnical Investigations Undertaken at the Power Station Site by Partridge Maud and Associates, March 2008*[(Ref. 3)] has relevance and gives the overall geotechnical conditions of the plant site.

3.1.2 Regional Geology

Partridge Maud & Associates indicated three main rock types in their power station terrace report:

- Rocks of the Dwyka Group (Karoo Supergroup) including indurated shale, tillite, and subordinate sandstone. The Dwyka group shales, defined by Partridge Maud and the Ecca group shales indicated on the loggings by the Knight Piésold engineering geologist, had previously been grouped under the name Dwyka. They have subsequently been divided into the two named groups in recent years and in terms of material characteristics the residual soils are very similar. It is this group that the report will concentrate on.

- Diabase intrusions related to the nearby Bushveld Igneous Complex

- Rocks of the Rayton Formation which includes shales and quartzites

No displacements were found within the Karoo rocks in the area concerned, although small displacements were visible in rocks of the Rayton formation.

3.1.3 Local Geology

The original SDD location was immediately to the north west of the station complex on the side slope adjacent to the non-perennial tributary of the Klipfonteinspruit. The

site has grassland vegetation with sparse trees and bushes. The central northern part of the site has a minor wet area where an ill-defined drainage course discharges surface run-off. The test pit investigation reveals the eastern portion of the site to be underlain by pre-Karoo dolerite (diabase) with outcrop of boulders of diabase observed along the eastern boundary. The flatter western portion is underlain by shale of the Silverton Formation of the Pretoria Group.

3.1.4 Station Dirty Dam (SDD)

11 Test pits were excavated to a maximum of about 5.2 m depth in the general region of the SDD just north west of the plant site Test pits SDD 3, 4 and 5 are relevant to the new site.

Table 3-1 summarises the general horizons intercepted.

Table 3-1: Summary of the horizons

Test Pit	Topsoil (m)	Transported	Hillwash (m)	Gravel (m)	Residual Soil (m)	ES/VS/S/ MH/H Rock (m)	Seepage level (m)
SDD1	0 – 0.45			0.45 – 0.95	0.95 – 3.15Fe	3.15 - 5.2ES	2.9
SDD2		0 – 0.8			0.8 – 2.4	2.4 - 5.15ES	5.1
SDD3	0 – 0.25PM				0.25 – 0.55	0.55 – 1.15MH	-
SDD4	0 – 0.3		0.3 – 0.65	0.65 – 1.25RS		1.25 – 1.85MH	1.65
SDD5	0 – 0.35PM			0.35 – 0.7RS		0.7 – 2.75 S/MH	-
SDD6		0 – 0.6			0.6 – 1.1	1.1 – 3.7ES	-
SDD7	0 – 0.7PM				0.35 – 2.7	2.7 – 3.5MH	At surface
SDD8	0 – 0.4				0.4 – 2.3	2.3 – 2.9MH	2.7
SDD9	0 – 0.55					0.55 – 0.65 ref HFe	At surface
SDD10	0 – 0.25		0.25 – 0.65			0.65 – 0.75HFe	0.65
SDD11	0 – 0.75PM				0.75 – 3.4	3.4 – 4.6MH	1.05

Fe - Ferruginised
ES/VS/S/MH/H – Extremely soft/very soft/soft/medium hard/hard
PM - Pebble Marker
RS – Residual shale
HFe – Hardpan ferricrete

3.1.5 Laboratory Testing

Bulk and undisturbed samples were obtained from the SDD area. The laboratory tests included:

- Atterberg limits
- Grading
- Natural moisture content
- Maximum dry density
- California Bearing Ratio

- Shear box

A summary of the tests results are shown in *Table 3-2* and *Table 3-3* and the original laboratory test sheets are shown in Report 5406/10/06 “Geotechnical investigation on the pollution control dams, river diversion and contractor’s camp”.

Table 3-2: Summary of indicator tests

Test Position	Depth (mm)	Material Description	Atterberg Limits			Grading (Jennings)				GM	NMC %	Classification		Heave classification	Group
			LL%	PI	LS%	Clay%	Silt%	Sand%	Gravel%			PRA	USC		
SDD1	4400	Residual diabase	35	12	8	33.2	18.7	38.7	9.4	0.65	22.2	A-6(7)	CL	Low	B
SDD2	3500-4500	Com weath ext soft rock sugar diabase	47	10	7.5	9.5	23.5	63.4	3.6	0.63	21.7	A-7-6(4)	SM	Low	B
SDD8	900	Residual shale	59	23	11	55.3	15	20.3	9.4	0.5	21.8	A-7-5(17)	OH	Low	C
SDD11	1500	Residual shale	48	15	11	25.6	13.3	34.1	24	1.15	14.8	A-7-6(7)	SC	Medium	B-C

LL – Liquid Limit
PI – Plasticity Index (whole sample)
LS – Linear Shrinkage

GM – Grading Modulus
NMC – Natural Moisture Content
Fe – Ferruginised

C - Canal Diversion
ADD – Ash Dump Dam
SDD – Station Dirty Dam

Red type denotes either heavy clays or heave potential.

Table 3-3: Summary of shear box and compaction tests

Test Position	Depth (mm)	Material Description	Atterberg Limits			GM	NMC % or PRA	Consolidated Drained Shear Box		Maximum Dry Density kg/m^3	Optimum Moisture content %	California Bearing Ratio @					
			LL%	PI	LS%			c kN/m^2	ϕ deg			90 %	93 %	95 %	97 %	98 %	100 %
SDD2	3500-4500	Com weath ext soft rock sugar diabase	47	14	7.5	0.84	A-7-5(4)	-	-	1724	19.8	4.8	5.4	6.1	7.6	8.8	11

Red type denotes either heavy clays or heave potential.

3.1.6 Foundation Conditions

Silverton Shales - SDD3, 4, 5, 7, 8, 10,11
Diabase sill – SDD2, 6, 9

The test pits show medium hard rock in all the above test pits except test pits 9 and 10 where the hardpan ferricrete was intercepted at shallow depth and could not be penetrated by the TLB.

The medium hard rock levels varied from 0.55 m depth in SDD3 in the north west corner to 3.4 m depth in the centre of the dam at SDD11. The rock levels were then reduced to mean sea level and show a definite trend of dipping to the north west at approximately 5 degrees to the horizontal.

Water seepage was intercepted in test pits SDD1, 2, 4, 7, 9 and 11 and varies from 5.1 m below ground at SDD2 to surface water in SDD7 and 9. The average depth from the test pits excluding SDD2 as an anomaly is 0.95 m. The deeper seepage paths were found in the diabase sill where the profile showed a greater gravel content and hence a higher permeability.

In terms of consistency, the topsoil, hillwash, the upper gravel horizons and nodular ferricrete horizons are deemed loose and should be discarded in the clearing and grubbing. The horizons are not suitable for founding purposes and do not extend much deeper than 1 m.

In SDD3, 4, 7, 8 and 11 there is a consistent clayey gravel horizon which ranges from medium dense to dense and is usually found just above the shale bedrock.

The horizons above the gravel tend to range from firm to stiff but do not necessarily increase in stiffness with depth. There is probably a softening due to the high seepage levels across the site.

In terms of the Eskom Group Classification the material is generally group B to C. Test results on the sugar dolerite show very low CBR results of 6 at 95% which translates to safe bearing capacity of about 60 kPa.

The inferred bearing capacity from the engineering geologists logging and the indicator tests (*Table 3-2*) is based on a consistency rating of firm below the topsoil hillwash horizon. Empirical estimates from the consistency show that the horizons (both residual diabase residual shale) have an undrained cohesion of approximately 40 kPa. This seems to correlate with Grouping, classification, indicator test results and CBR results.

The ponds in their present position will require cut to fill in order to create a level platform. It would also be straddling two geological features in the diabase and shale contacts with the deeper weathering in the diabase. There is also the shallow seepage across the middle of the ponds which will require dewatering probably by the construction of sumps and pumping.

Two options from the investigation of the originally proposed SDD site are recommended for repositioning:

The ponds have subsequently been moved 450 m further to the north west - towards SDD3, 4 and 5 where they will be completely on medium hard rock shale. Estimated

empirical safe bearing capacity values for the medium hard rock are conservatively put at 600 to 700 kPa. Excavation will be in medium hard rock and slopes will be cut at 1V:2H. A Slope stability analyses has been performed on the embankment slopes in the new SDD position. Parameters used in the original stability analyses are still relevant and are discussed in section 3.2.

3.2 Slope Stability Analysis

The Rocscience computer software program "Slide, Version 5.029", was used to analyse the slope stability of the SDD. The critical slopes of the new design of the SDD were analyzed for all operating conditions (empty or full compartments), including when there's a truck load (assumed to be 75kN/m^3) on the crests of the different sections. All the SDD embankments are sloped at 1V: 3H. *Figure 3-1 to Figure 3-2* graphically show the typical sections of the SDD walls that were analyzed.

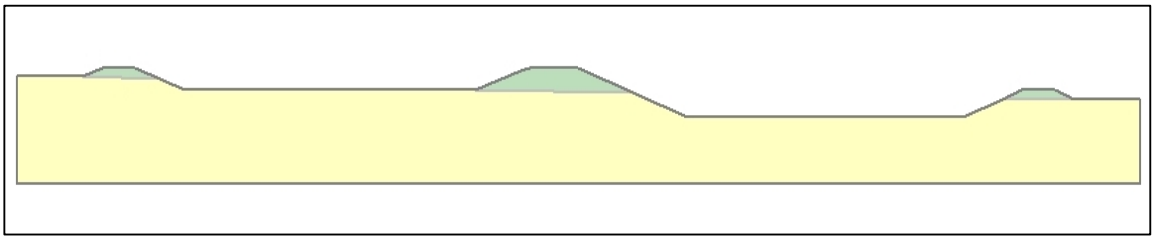


Figure 3-1: East-West Section Through SDD

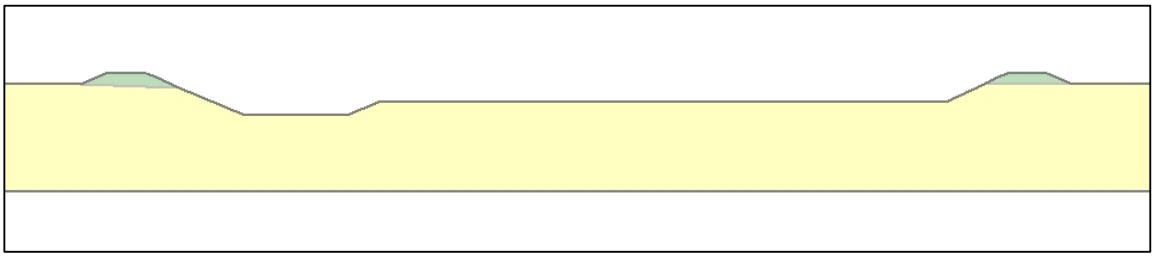


Figure 3-2: South-North Section Through SDD

The input parameters were selected from the laboratory test results from samples taken within the vicinity of the SDD. They are shown in *Table 3-4* below.

Material	γ (kN/m^3)	Φ (^{o})	c (kPa)
In - Situ	16.5	27	10
Fill	18.5	30	0

Table 3-4: Slope Stability Input Parameters

The Factor of Safety (FOS) in all conditions (ie. Full or empty compartments) are greater than the design requirements of 1.5. The complete analysis showing sections and FOS can be viewed in Appendix C.

4 CONSTRUCTION

4.1 Method

The SDD construction is to comply with the terms of SANS 1200 DE, Standard Specifications for Small Dams.

To assist in reducing the amount of water at the SDD construction site, the groundwater cut-off drain and stormwater channel should be constructed first. Construction of the SDD will ideally occur during the dry winter months.

It is recommended that after clearing and grubbing the area, the top 300 mm of material be stripped and carted to stockpile for future rehabilitation purposes. The basin areas can then be excavated, followed by fill placement to the impounding embankments.

The basin area, onto which the liner system is to be installed, should be prepared next by trimming all slopes to those specified, followed by the installation of the groundwater drainage collection system. The sub-grade preparation for liner installation is to be finalised and the various layers of liner installed.

The inlet and outlet pipes for the drainage collection and leakage detection systems should be installed before fill placement, as these will be trenched into natural ground.

Particular care is necessary for placement of the compacted fill around the buried inlet and outlet pipes. Concrete encasement to the pipes is provided in case of seepage from leakage water past the liner system.

The perimeter access road, barriers and fencing will be constructed last.

4.2 Earthworks Specifications

The top 300 mm of insitu material is to be stripped and carted to stockpile as this material is not suitable for wall building but could be used for rehabilitation purposes later on.

The newly exposed surface is to be ripped to 300 mm deep and re-compacted to minimum 96% Std Proctor density.

Embankment construction will be in maximum 300 mm loose layers compacted to a minimum of 96% Std Proctor density at -1/+2% OMC using a sheep's foot compactor. Trials will be conducted to achieve optimum efficiency. The embankments should preferably be constructed from Group A type material, however a mixture of Group A and B will also be suitable.

The sub-grade to be prepared for liner installation will be smooth and free from organic material or any loose angular particles which can damage the liner.

The perimeter access road will comprise layers as shown in.*Table 4-1.*

4.3 Dam Safety Classification

In terms of Section 117(c)(i) of the National Water Act, 1998, a dam with a storage capacity of more than 50,000 m^3 and a vertical wall height exceeding 5.0 m is considered to be a dam with a safety risk. The SDD does not fall within the definition of a dam subject to DWA dam safety regulations, as its wall height is less than 5 m. The following statistics apply to the SDD:

Table 4-1: Compartment Characteristics

Component	Maximum Wall Height (m)	Storage Volume (m^3)
Compartment 1	4.5	90,980
Compartment 2	4.0	90,980

5 REFERENCES

1. National Water Act, 1998.

2. Government Notice No.704, Regulations on use of water for mining and related activities aimed at the protection of water resources, in terms of the National Water Act (Act 36 of 1998)

3. Project Bravo – Report on Geotechnical Investigations undertaken at the Power Station site, No. 1-6/07, Partridge Maude and Associates, March 2008.

4. Kusile power station, Geotechnical investigation on the pollution control dams, river diversion and contractor's camp, Report 5406/10/06, September 2008, Panel B CJV.

5. SANS 1200: Standardised Specifications for Civil Engineering Construction

6. Eskom User Requirement Specification

6 DOCUMENT CONTROL SHEET

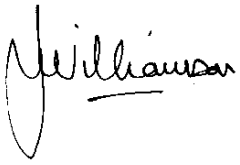
CLIENT : ESKOM HOLDINGS LIMITED

PROJECT : KUSILE POWER STATION **PROJECT No : 5452/80**

TITLE : STATION DIRTY DAMS – DESIGN REPORT

	Prepared by	Reviewed by	Approved by
REV 0	NAME **AJ STRAUSS**	NAME **JRG WILLIAMSON**	NAME **CJ ABRAHAMSON**
DATE 5 Dec 2008	SIGNATURE	SIGNATURE	SIGNATURE

REV 1	NAME **S REES**	NAME **AJ STRAUSS**	NAME **CJ ABRAHAMSON**
DATE 8 June 2009	SIGNATURE 	SIGNATURE	SIGNATURE

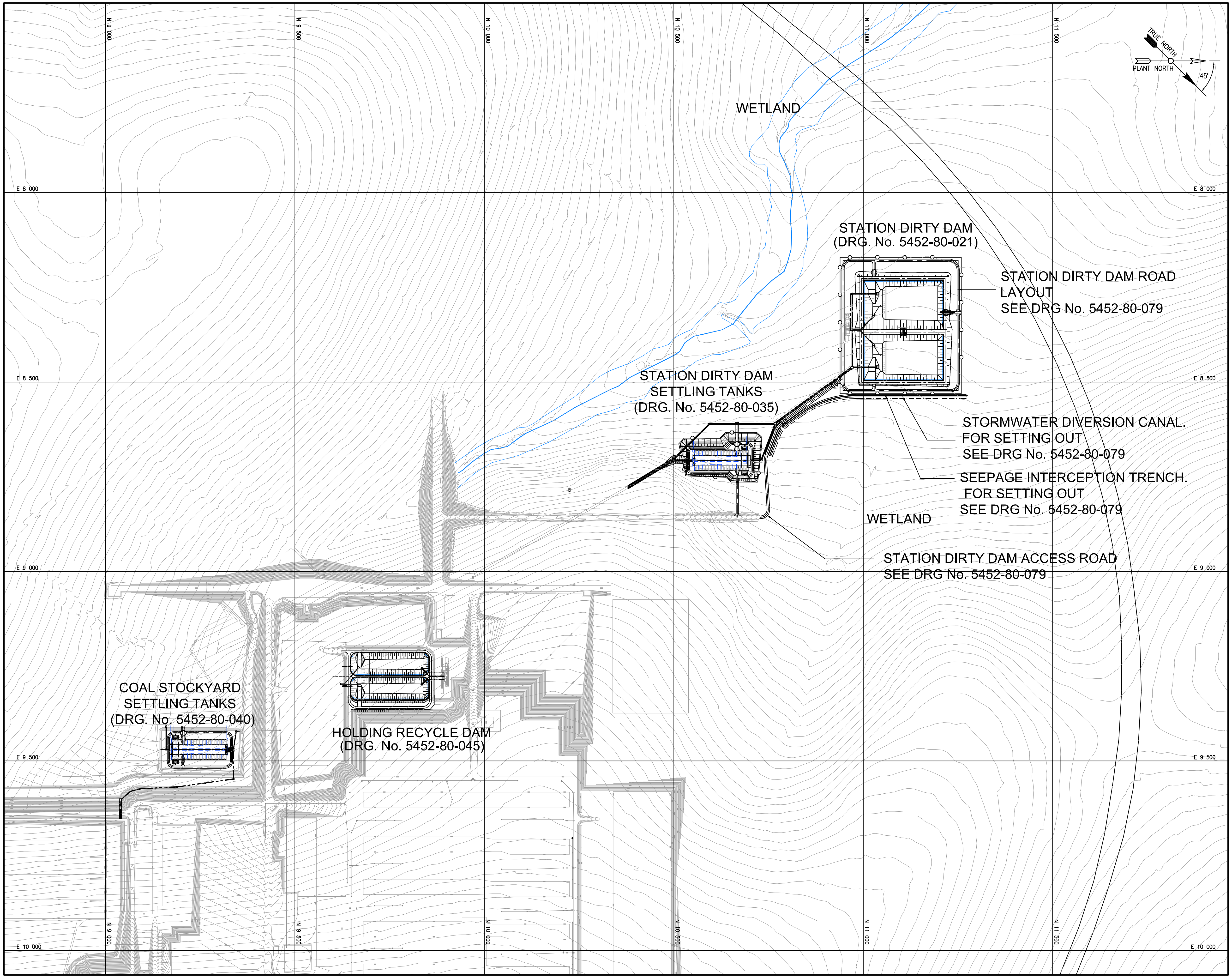
REV 2	NAME **S REES**	NAME **JRG WILLIAMSON**	NAME **AJ STRAUSS**
DATE 4 May 2010	SIGNATURE 	SIG 	

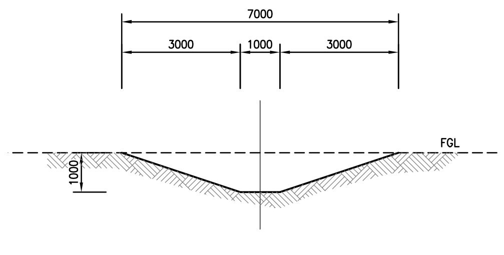
	NAME	NAME	NAME
DATE	SIGNATURE	SIGNATURE	SIGNATURE

APPENDIX A

DRAWINGS

- K5452-80-020: SDD: Locality Plan
- K5452-80-021: SDD: General Arrangement
- K5452-80-022: SDD: Typical Sections
- K5452-80-023: SDD: Typical Details
- K5452-80-024: SDD: Compartment No. 1 Inlet – GA and Details
- K5452-80-025: SDD: Compartment No. 1 Outlet – GA and Details
- K5452-80-026: SDD: Spillway No. 1 – GA and Typical Details
- K5452-80-027: SDD: Spillway No. 2 – GA and Typical Details
- K5452-80-028: SDD: Compartment No. 2 Inlet – GA and Details
- K5452-80-029: SDD: Compartment No. 2 Outlet – GA and Details
- K5452-80-030: SDD: Compartment No. 1 Energy Dissipator – GA and Details\
- K5452-80-031: SDD: Compartment No. 2 Energy Dissipator – GA and Details
- K5452-80-032: SDD: Leakage Detection Sump GA and Details





TYPICAL SECTION THROUGH STORMWATER DIVERSION CANAL

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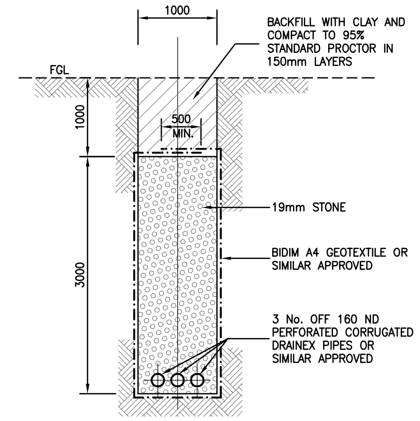

TYPICAL SECTION THROUGH SEEPAGE INTERCEPTION TRENCH

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								5452-80-040	C.S.Y. SETTLING TANKS - G.A.
	2	21/04/10	APPROVED FOR CONSTRUCTION	Z.L	SR	JRW		5452-80-035	S.D.D. SETTLING TANKS - G.A.
	1	25/08/09	FINALISED FOR CONSTRUCTION	D.E.M.	JRW	JRW		5452-80-021	STATION DIRTY DAM - G.A.
	0	01/07/09	FINALISED FOR CONSTRUCTION	D.E.M.	JRW	JRW		5452-80-079	S.D.D. ROAD LAYOUT - G.A.

DRG REGISTR		
DESIGN APPROVED	01/07/09	JRW
KKS APP		
DO AUTH	21/04/10	DO
CHKD BY	01/07/09	JRW
DRAWN BY	01/07/09	D.E.M.
SCALE	1:5000	

AUTHORISED FOR ESKOM BY:	DATE
MOW	21/04/10

PANEL B CONSULTANTS JOINT VENTURE

Knight Piésold CONSULTING

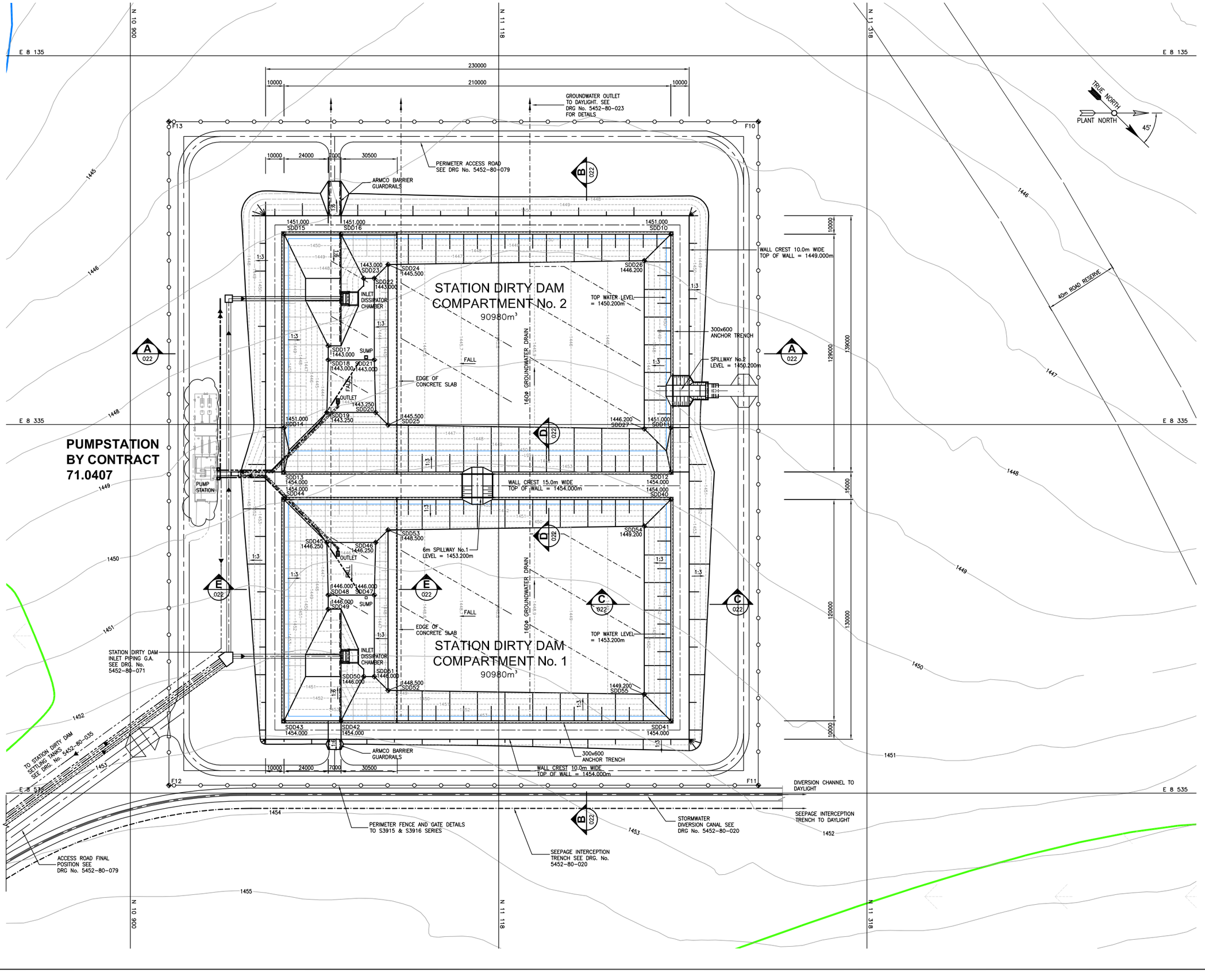
Eskom

KUSILE POWER STATION

STATION DIRTY DAM
POLLUTION CONTROL DAMS
LOCALITY PLAN

DRG. No. K 5452-80-020 — REV 2

0.90/2391 — SHEET A1 — REV 2



COORDINATE LIST
PLANT GRID

POINT	N-COORD	E-COORD
CONST:		
FENCE		
F10	11258.619	8170.967
F11	11258.619	8530.967
F12	10938.619	8530.967
F13	10938.619	8170.967
STATION DIRTY DAM		
SDD10	11211.119	8231.967
SDD11	11211.119	8336.967
SDD12	11211.119	8360.967
SDD13	11001.119	8360.967
SDD14	11001.119	8336.967
SDD15	11001.119	8231.967
SDD16	11032.119	8231.967
SDD17	11025.119	8292.567
SDD18	11025.119	8300.167
SDD19	11024.369	8328.717
SDD20	11050.869	8328.717
SDD21	11050.119	8300.167
SDD22	11050.119	8255.967
SDD23	11044.419	8255.967
SDD24	11057.619	8248.467
SDD25	11057.619	8335.467
SDD26	11196.719	8246.367
SDD27	11196.719	8337.567
SDD40	11211.119	8375.967
SDD41	11211.119	8495.967
SDD42	11032.119	8495.967
SDD43	11001.119	8495.967
SDD44	11001.119	8375.967
SDD45	11024.369	8399.217
SDD46	11050.869	8399.217
SDD47	11050.119	8427.767
SDD48	11025.119	8427.767
SDD49	11025.119	8435.367
SDD50	11044.419	8471.967
SDD51	11050.119	8471.967
SDD52	11057.619	8479.467
SDD53	11057.619	8392.467
SDD54	11196.719	8390.367
SDD55	11196.719	8481.567

NOTES:

1. Station Dirty Dams Contract No. 71.0402
2. All works to be carried out in accordance with SANS 1200 D
3. Contour values are given for descriptive purposes only.
4. All setting out shall be from tabulated points and levels or from dimensions given.
5. All levels indicated are to finished surface.
6. Co-ordinate system is PLANT

CONCRETE NOTES:

1. CONCRETE TO BE GRADE 35/19. MIX DESIGNS FOR CONCRETE TO BE SUBMITTED TO THE ENGINEER FOR APPROVAL PRIOR TO COMMENCEMENT OF CONCRETE WORK
2. FINISHING:
   2.1 SMOOTH FINISH TO ALL SHUTTERED SIDES.
   2.2 WOODFLOAT TO TOPS OF WALLS AND SLABS.
   2.3 25x25mm CORNER FILLETS TO ALL EXPOSED EDGES.
3. TOLERANCES TO BE IN ACCORDANCE WITH SABS 1200G CLASS 1.
4. COVER TO REINFORCEMENT: AS INDICATED.
5. CURING OF ALL CONCRETE SURFACES TO BE DONE USING SAMSON'S WAX BASED WHITE PIGMENTED CURING COMPOUND.
6. ALL WORK TO BE CARRIED OUT IN CONFORMANCE WITH THE RELEVANT SABS 1200 SPECIFICATIONS.
7. ALL CONCRETE IS TO BE PROPERLY VIBRATED. HEAPING OF CONCRETE TO BE AVOIDED. CASTING OF CONCRETE MUST BE CONTINUOUS.
8. ALL WORK TO BE CHECKED BY SUPERVISING ENGINEER PRIOR TO POURING OF CONCRETE (MINIMUM 24 HOURS NOTICE.
9. AN ALLOWABLE FOUNDATION BEARING PRESSURE OF 300KPa ON COMPETENT SOIL IS REQUIRED. REMOVE AND REPLACE IN SITU MATERIAL AS REQUIRED.
10. ALL DIMENSIONS TO BE CONFIRMED ON SITE.
11. ALL STRUCTURES SHALL BE CONSTRUCTED ON A SUB-FOUNDATION CARPET OF 15MPa/19mm BLINDING CONCRETE, NOT LESS THAN 75mm THICK.

D.O. REV	DATE						
8	21/04/10	APPROVED FOR CONSTRUCTION	DL	SR	JBB		
7	25/09/09	FINALISED FOR CONSTRUCTION	D.E.M.	JBB	JBB		
6	01/07/09	FINALISED FOR CONSTRUCTION	D.E.M.	JBB	JBB		
5	19/05/09	GROUNDWATER DETAIL ADDED. COMPARTMENT 1 TRL REVISED.	D.E.M.	JBB	JBB		
4	16/05/09	POSITION OF OUTLETS, PUMP STATION & SPILLWAY REVISED. RAMP ELEVATIONS REVISED.	D.E.M.	JBB	JBB	5452-80-020	LOCALITY PLAN
3	06/05/09	PUMP STATION ON HOLD	D.E.M.	JBB	JBB	5452-80-070	ROADS - G.A.
2	27/04/09	COLLECTION DRAINS ADDED	D.E.M.	JBB	JBB	5452-80-071	S.D.D. INLET PIPING - G.A.
1	17/04/09	ISSUED FOR CONSTRUCTION	D.E.M.	JBB	JBB	5452-80-035	S.D.D. - SETTLING TANKS - G.A.
0	30/03/09	ISSUED FOR EARTHWORKS ONLY	D.E.M.	JBB	JBB	5452-80-025	STATION DIRTY DAM - TYPICAL SECTIONS
D.O. REV	DATE	** REVISION **	REV BY	CHKD BY	AUTH BY	KKS APP	REFERENCE DRAWINGS
		INDEX REFERENCE :					

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KKS APP			
DO AUTH	21/04/10	DO	
CHKD BY	30/03/09	JBB	
DRAWN BY	30/03/09	D.E.M.	
SCALE	1:1000		

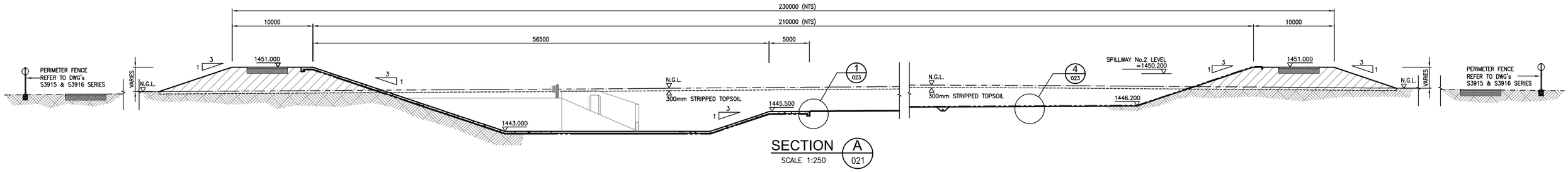
PANEL & CONSULTANTS JOINT VENTURE
Knight Piésold CONSULTING

Eskom

KUSILE POWER STATION
STATION DIRTY DAM
GENERAL ARRANGEMENT

DRG. No. K 5452-80-021 — REV 8

0.90/2392 — SHEET A1 — REV 8



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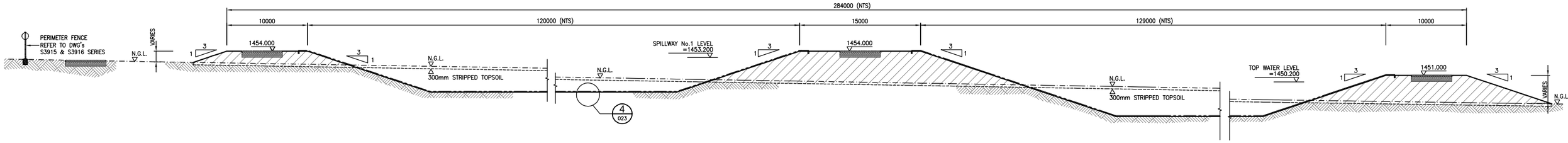

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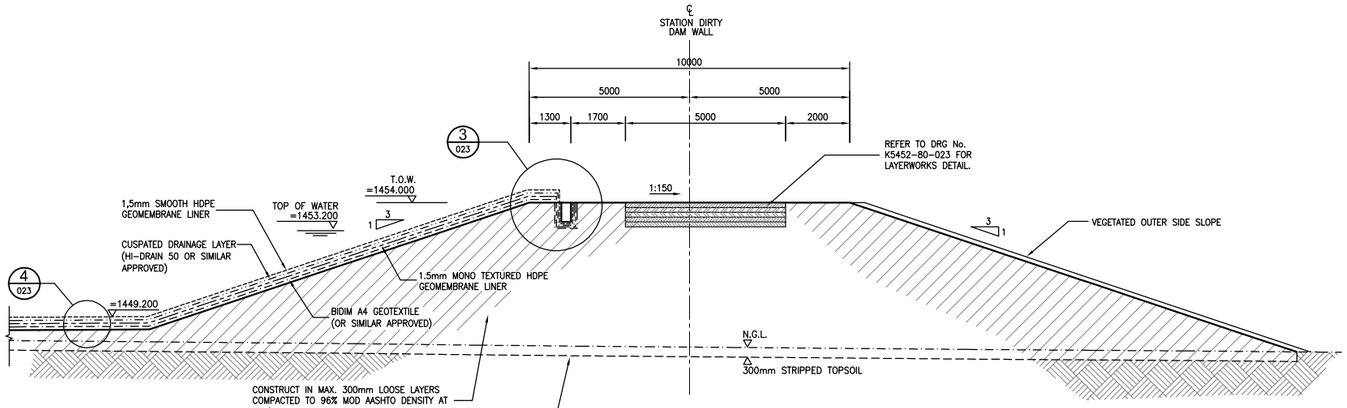

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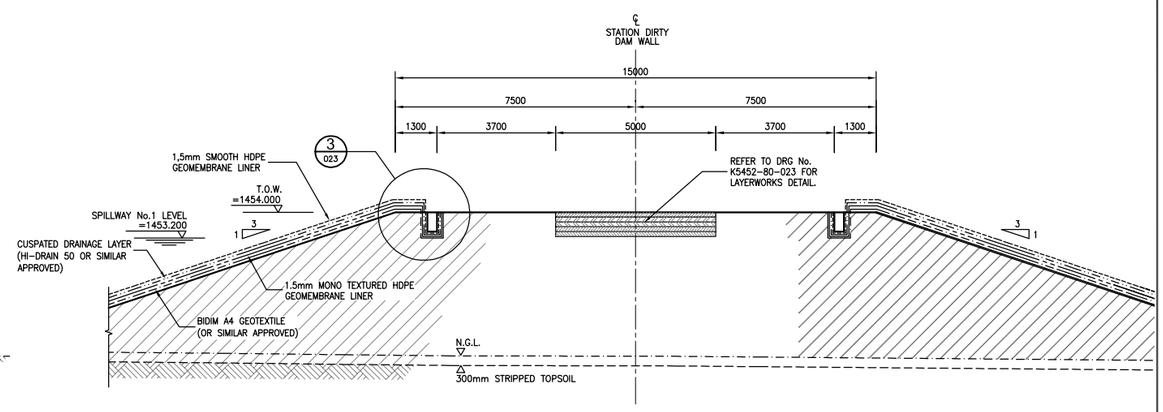
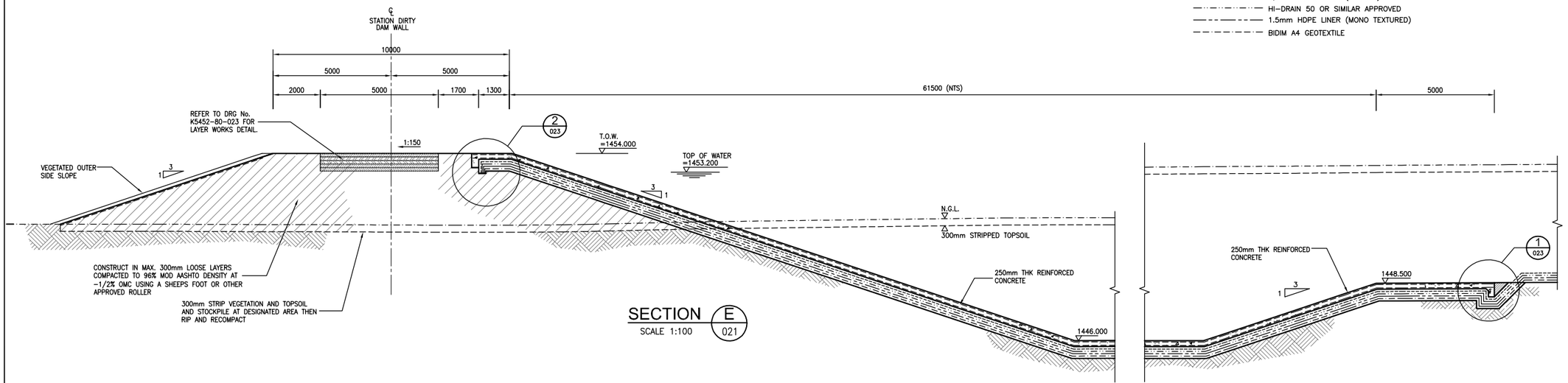


SECTION D (021)
SCALE 1:100

KEY:

- 1,5mm HDPE LINER (SMOOTH)
- HI-DRAIN 50 OR SIMILAR APPROVED
- 1.5mm HDPE LINER (MONO TEXTURED)
- BIDIM A4 GEOTEXTILE



SECTION E (021)
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D.O. REV	DATE	** REVISION ** / INDEX REFERENCE :	REV BY	CHKD BY	AUTH BY	KKS APP	REFERENCE DRAWINGS
5	21/04/10	APPROVED FOR CONSTRUCTION	ZL	SR	JRM		
4	25/08/09	FINALISED FOR CONSTRUCTION	D.E.M.	SR	JRM	-	
3	01/07/09	FINALISED FOR CONSTRUCTION	D.E.M.	SR	JRM	-	
2	09/05/09	ROAD WIDTH REVISED AND LAYERWORKS REVISED	D.E.M.	SR	JRM	-	
1	17/04/09	ISSUED FOR CONSTRUCTION	D.E.M.	SR	JRM	-	5452-80-023 STATION DIRTY DAM - TYPICAL DETAILS
0	30/03/09	ISSUED FOR EARTHWORKS ONLY	D.E.M.	SR	JRM	-	5452-80-021 STATION DIRTY DAM - G.A.

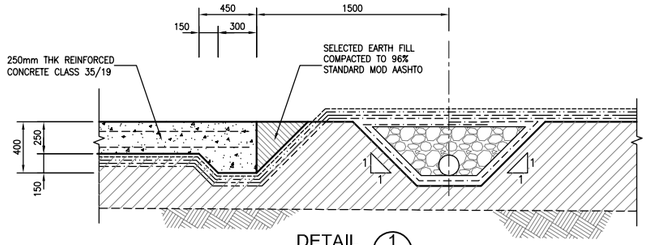
DRG PREPARED		ORIGINATING PSP DESIGN BY:	DATE
DESIGN APPROVED	30/03/09	JRM	MDR 21/04/10
KKS APP			
QC AUTH	21/04/10	DD	
CHKD BY	30/03/09	JRM	
DRAWN BY	30/03/09	D.E.M.	
SCALE	1:100		

PANEL B CONSULTANTS JOINT VENTURE
Knight Piésold Consulting Pty(Ltd)
Eskom

KUSILE POWER STATION
STATION DIRTY DAM
TYPICAL SECTIONS

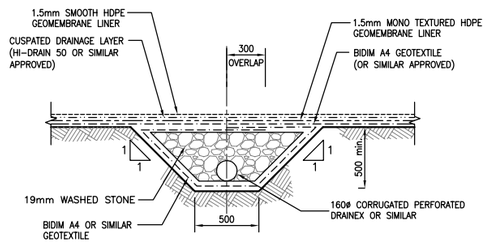
DRG. No. K 5452-80-022 — REV 5

0.90/2393 — SHEET A1 — REV 5



DETAIL 1 / 022 — SCALE 1:25

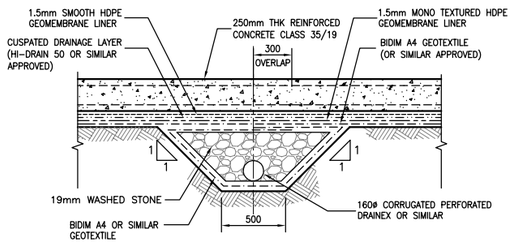
TYPICAL CONCRETE DOWNSTAND AT HDPE INTERFACE



DETAIL 5 / 024 — SCALE 1:25

TYPICAL DRAIN DETAIL - UNDER LINER

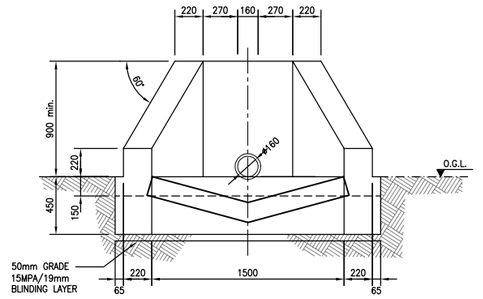
(FOR GROUNDWATER INTERCEPTION)



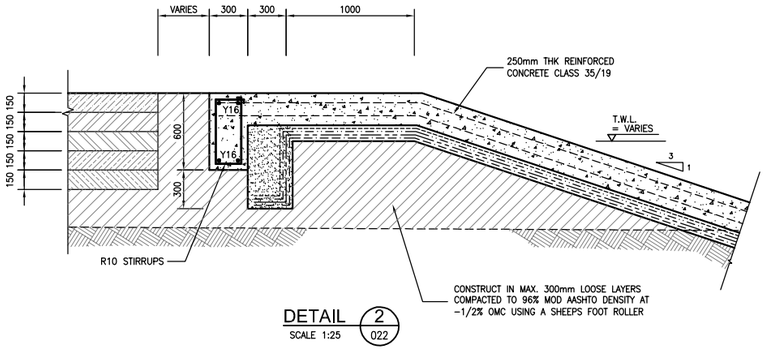
DETAIL 6 / 024 — SCALE 1:25

TYPICAL FINGER DRAIN DETAIL - UNDER SLAB

(FOR GROUNDWATER INTERCEPTION)

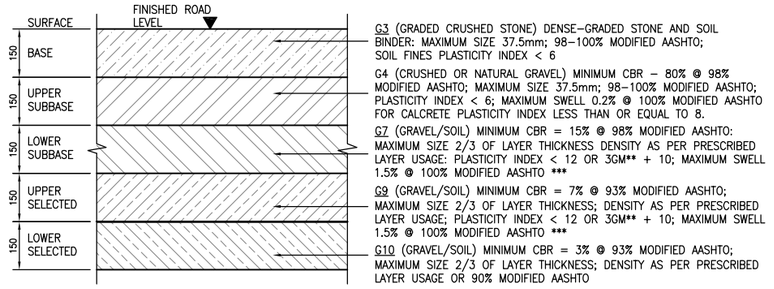


ELEVATION



DETAIL 2 / 022 — SCALE 1:25

TYPICAL CONCRETE DOWNSTAND AT CREST EDGE



LAYERWORKS DETAIL

TYPICAL AGGREGATE SURFACED ROAD (5m)

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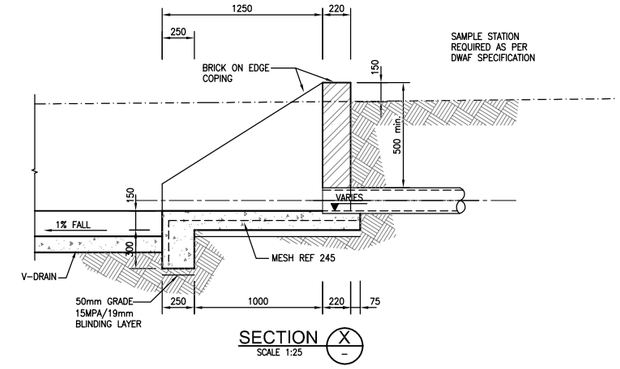
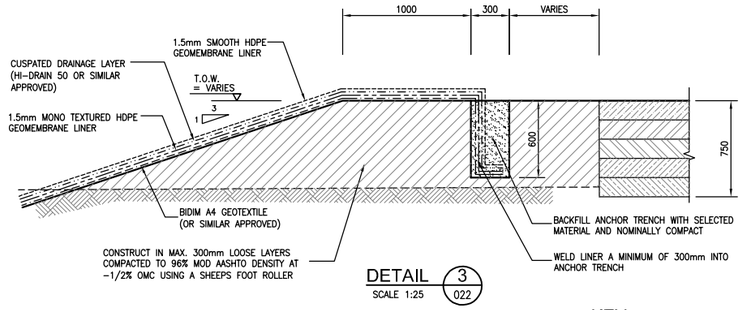


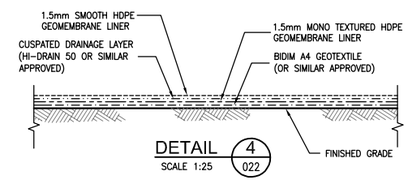
SECTION X

SCALE 1:25



DETAIL 3 / 022 — SCALE 1:25

TYPICAL LINER ANCHOR DETAIL

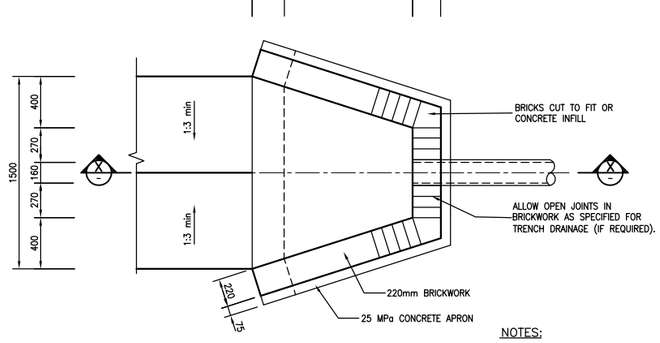


DETAIL 4 / 022 — SCALE 1:25

TYPICAL HDPE LINER DETAIL

KEY:

- 1,5mm HDPE LINER (SMOOTH)
- HI-DRAIN 50 OR SIMILAR APPROVED
- 1,5mm HDPE LINER (MONO TEXTURED)
- BIDIM A4 GEOTEXTILE



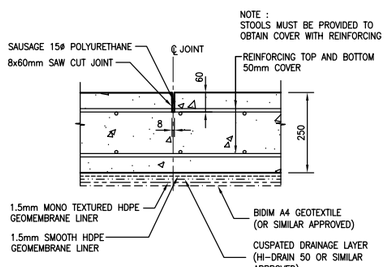
NOTES:

1. ALL BRICKWORK TO BE ENGINEERING UNITS TO SANS 227.
2. ALLOW EXPOSED CONCRETE TO BE STEEL TROWEL FINISH.

DETAIL 9 / 021 — SCALE - 1:25

TYPICAL PLAN ON GROUNDWATER DRAIN OUTLET

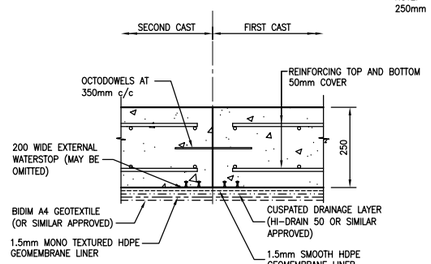
NOTE :
THE NUMBER OF CONSTRUCTION JOINTS TO BE MINIMISED AND CONTRACTION JOINTS MAXIMISED. THE CONTRACTOR SHOULD ENDEVOUR TO CAST PANELS AS LARGE AS POSSIBLE- SAW CUT CONTRACTION JOINTS AT 4x4m INTERVALS ARE PREFERRED OVER CONSTUCTION JOINTS WITH OCTODOWELS



DETAIL 7 / 024 — SCALE 1:10

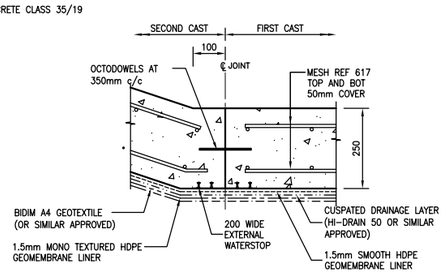
TYPICAL CONTRACTION (SAW-CUT) JOINT IN FLOOR SLABS (S.C.J.)

NOTE:
250mm THK CONCRETE CLASS 35/19



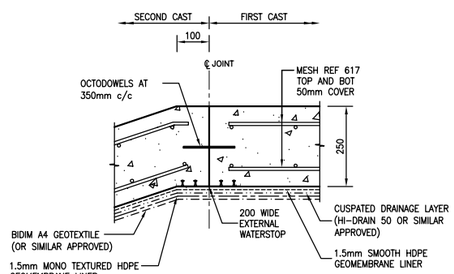
DETAIL 8 / 024 — SCALE 1:10

TYPICAL CONSTRUCTION JOINT IN FLOOR SLABS (C.J.)



DETAIL 12 / 024 — SCALE 1:10

TYPICAL CONSTRUCTION JOINT IN FLOOR SLABS ON INCLINED SLOPE (C.J.)



DETAIL 13 / 024 — SCALE 1:10

TYPICAL CONSTRUCTION JOINT IN FLOOR SLABS ON INCLINED SLOPE (C.J.)

REV	DATE	REVISION	BY	CHKD BY	AUTH BY	KKS APP	REFERENCE DRAWINGS
							5452-80-020 SDD COMPART 2 - OUTLET GA & DET
							5452-80-030 SDD COMPART 2 - INLET GA & DET
3	21/04/10	APPROVED FOR CONSTRUCTION	ZL	SR	JRW		5452-80-025 SDD COMPART 1 - OUTLET GA & DET
2	16/04/09	APPROVED FOR CONSTRUCTION	D.E.M.	JRW	JRW		5452-80-024 SDD COMPART 1 - INLET GA & DET
1	01/07/08	FINALISED FOR CONSTRUCTION	D.E.M.	JRW	JRW		5452-80-022 STATION DIRTY DAM - TYPICAL SECTIONS
0	22/05/08	ISSUED FOR CONSTRUCTION	D.E.M.	JRW	JRW		5452-80-021 STATION DIRTY DAM - G.A.

** REVISION **
INDEX REFERENCE
FOR ERROR RE: DATE: MDW 21/04/10

DRG REGISTR		
DESIGN APPROVED	22/05/08	JRW
KKS APP		
QC WITH	21/04/10	DD
CHKD BY	22/05/08	JRW
DRAWN BY	22/05/08	D.E.M.
SCALE	1:25	

PANEL & CONSULTANTS JOINT VENTURE
Knight Piésold CONSULTING
Eskom

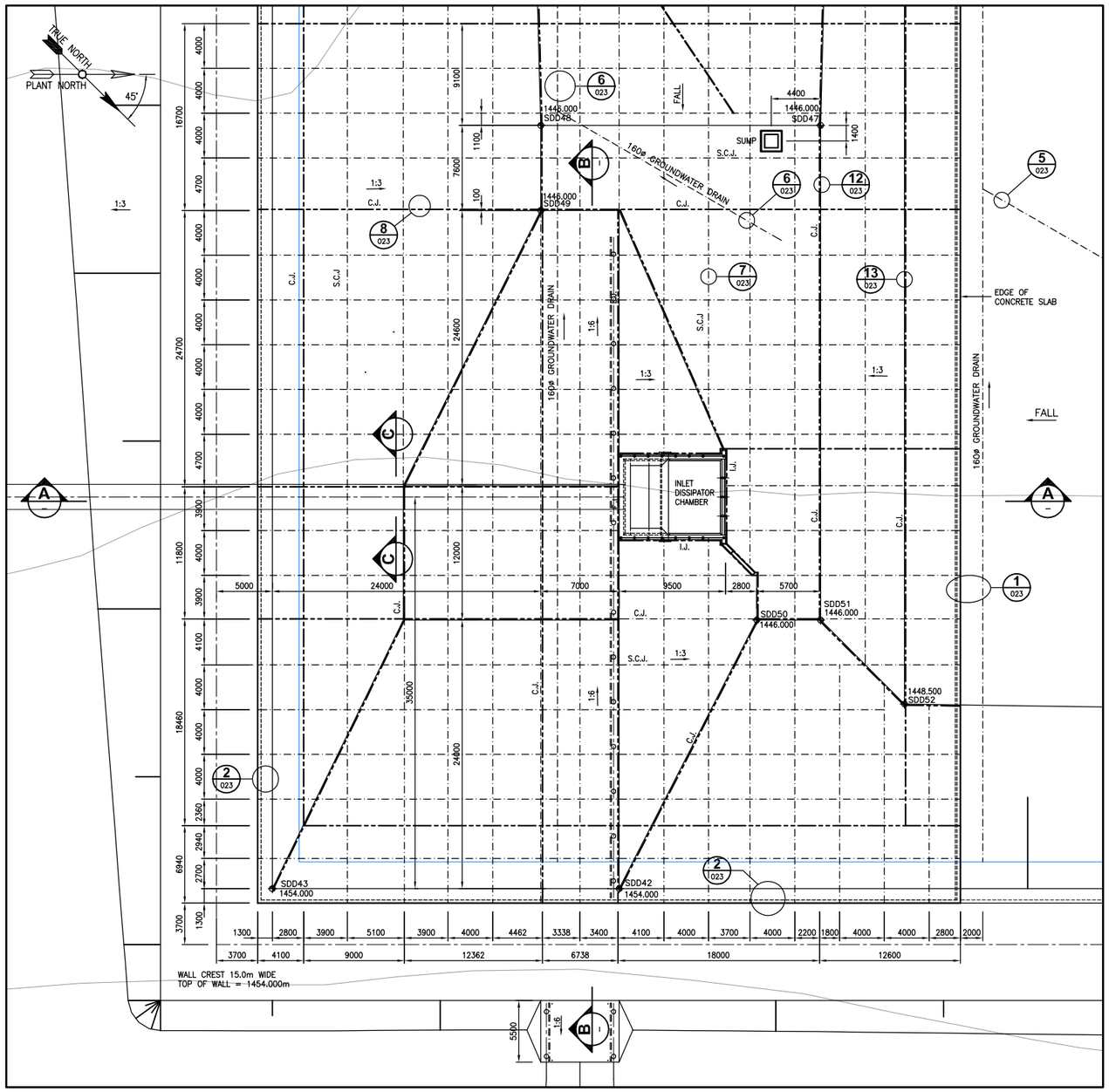
KUSILE POWER STATION

STATION DIRTY DAM

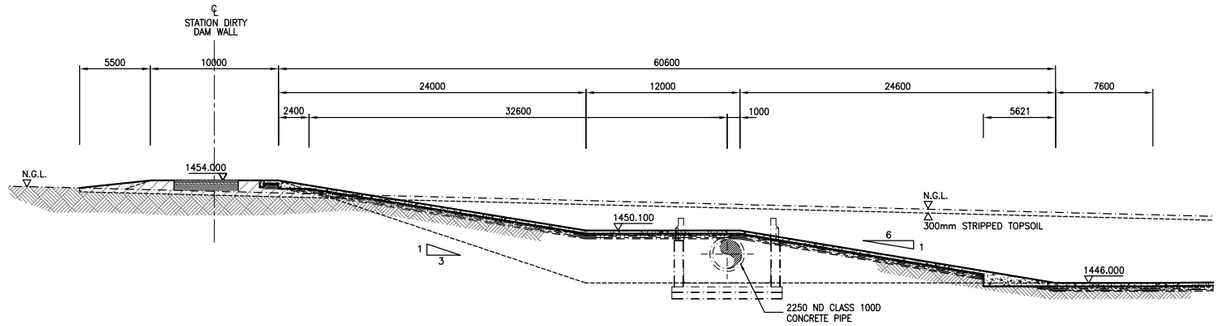
TYPICAL DETAILS

DRG. No. K 5452-80-023 — REV 3

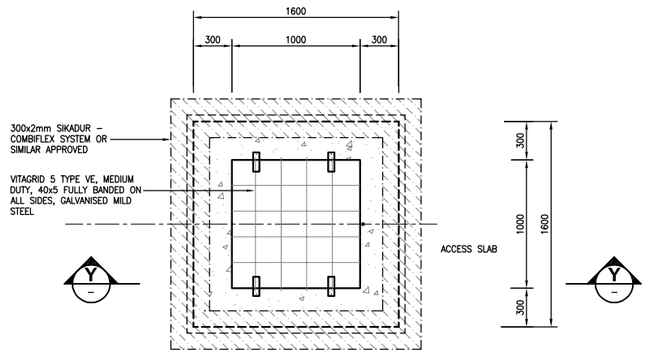
0.90/2394 — SHEET A1 — REV 3



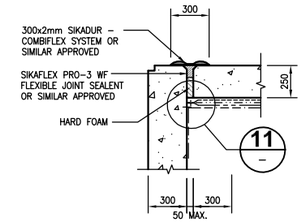
GENERAL ARRANGEMENT OF COMPARTMENT No. 1
INLET SYSTEM
SCALE 1:250



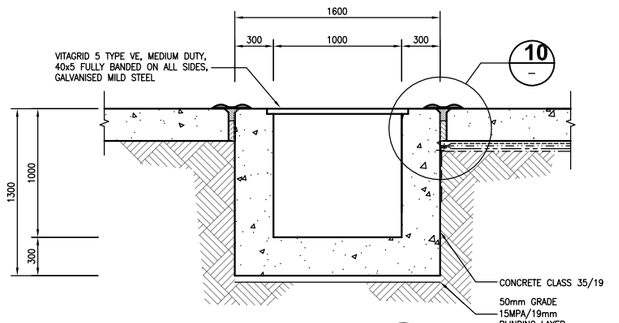
SECTION B
SCALE 1:250



PLAN ON SUMP
SCALE 1:25

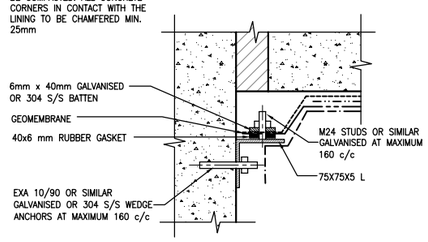


DETAIL 10
SCALE 1:25

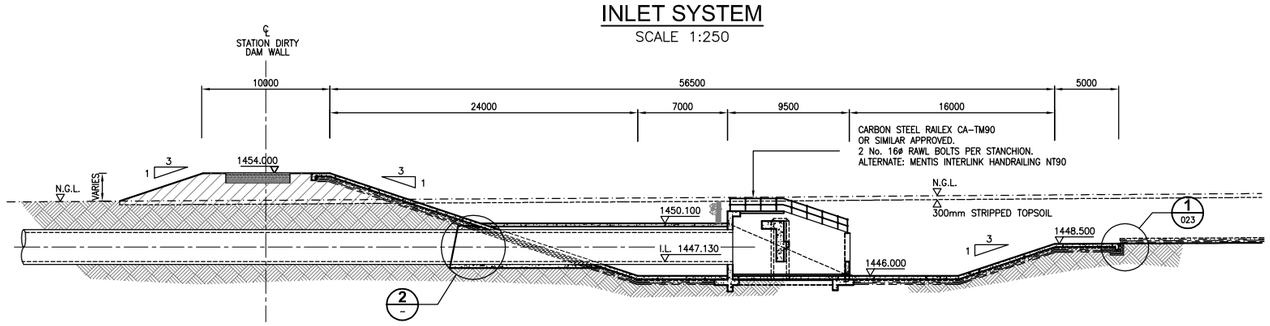


SECTION Y
SCALE 1:25

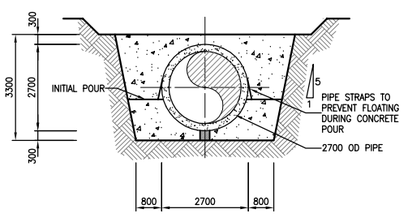
NOTE :
EARTH ADJACENT TO CONCRETE TO BE COMPACTED. ALL CONCRETE CORNERS IN CONTACT WITH THE LINING TO BE CHAMFERED MIN. 25mm



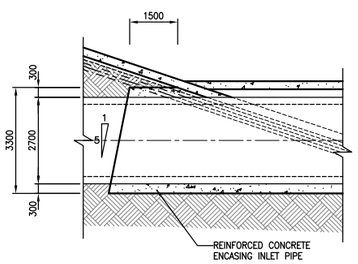
DETAIL 11
SCALE 1:5



SECTION A
SCALE 1:250



SECTION C
SCALE 1:100



DETAIL 2
SCALE 1:100

D.O. REV	DATE	REVISION / INDEX REFERENCE	REV BY	CHKD BY	AUTH BY	KKS APP	REFERENCE DRAWINGS
3	21/04/10	APPROVED FOR CONSTRUCTION	ZL	SR	JRB		5452–80–056 SDD FLOOR SLAB–REINF'DETAILS SHT 3
2	28/08/09	FINALISED FOR CONSTRUCTION	D.E.N.	JRB	JRB		5452–80–055 SDD FLOOR SLAB–REINF'DETAILS SHT 2
1	01/07/09	FINALISED FOR CONSTRUCTION	D.E.N.	JRB	JRB		5452–80–053 SDD FLOOR SLAB–REINF'DETAILS SHT 1
0	22/05/09	ISSUED FOR CONSTRUCTION	D.E.N.	JRB	JRB		5452–80–021 STATION DIRTY DAM – TYPICAL DETAILS
							5452–80–020 STATION DIRTY DAM – G.A.

DRG REGISTR: —
DESIGN APPROVED: 22/05/09 JRB
KKS APP: —
DO AUTH: 21/04/10 DO
CHKD BY: 22/05/09 JRB
DRAWN BY: 22/05/09 D.E.N.
SCALE: AS SHOWN

APPROVED FOR ISSUE (Rl): MDR DATE: 21/04/10

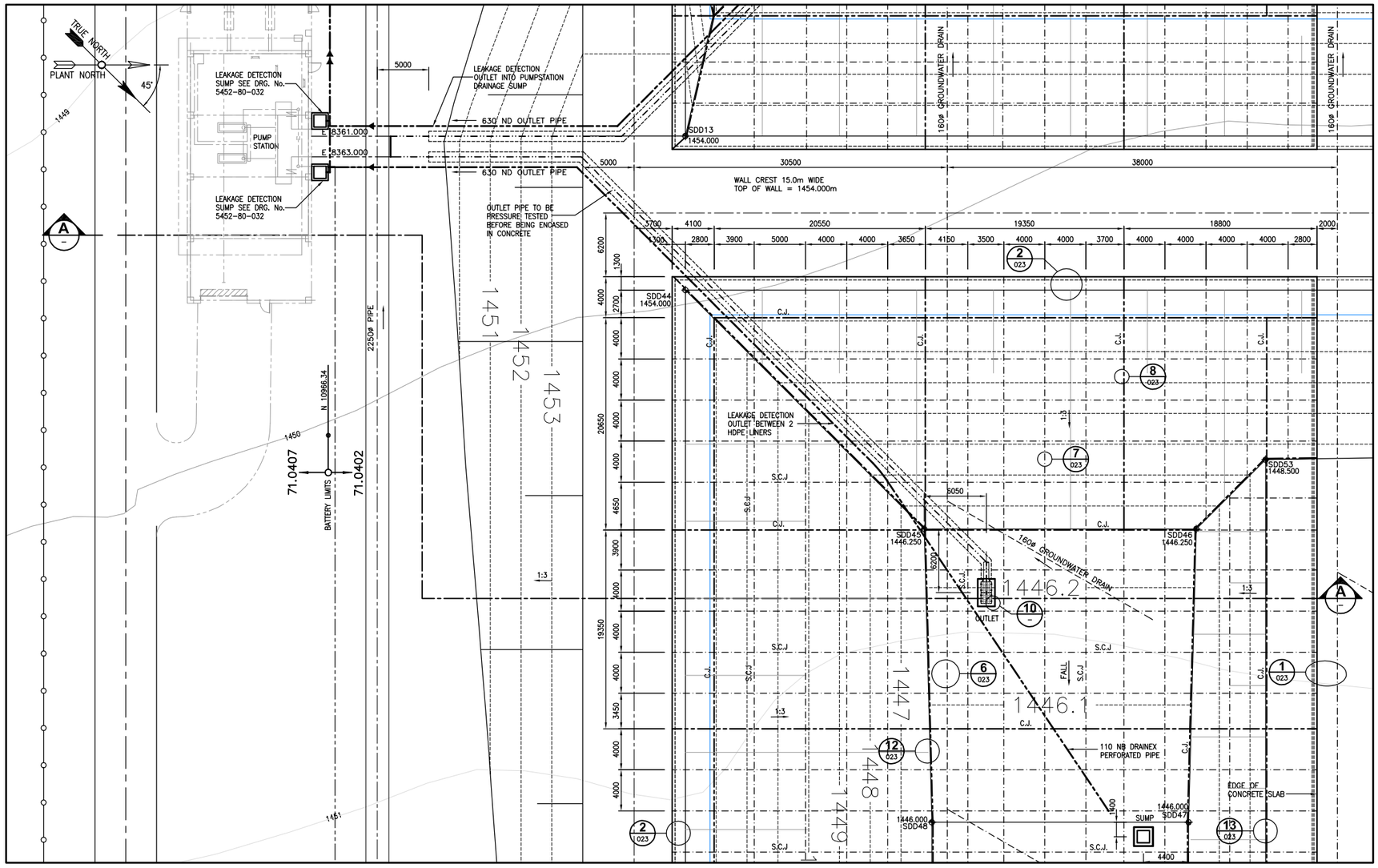
PANEL & CONSULTANTS JOINT VENTURE
Knight Piésold CONSULTING

Eskom

KUSILE POWER STATION
STATION DIRTY DAM
COMPARTMENT No. 1 INLET
GENERAL ARRANGEMENT & DETAILS

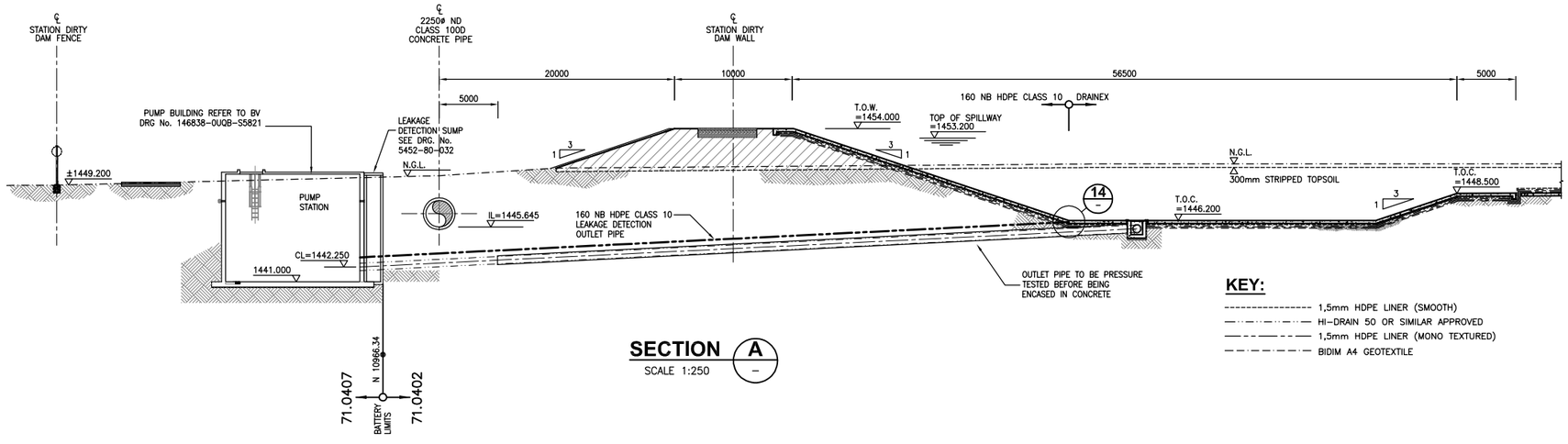
DRG. No. K 5452–80–024 REV 3

0.90/2395 SHEET A1 REV 3



GENERAL ARRANGEMENT OF COMPARTMENT No. 1 OUTLET SYSTEM

SCALE 1:250

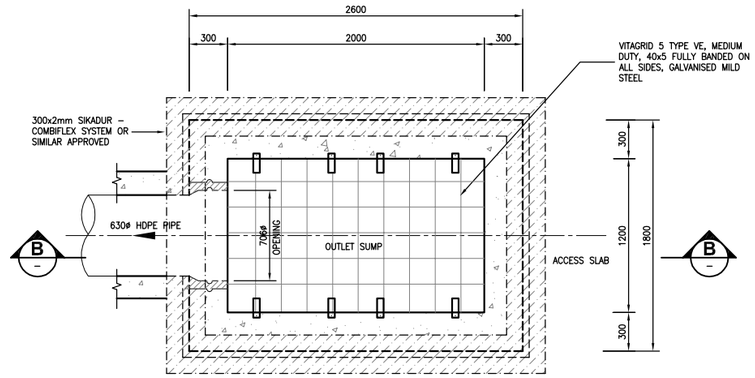


SECTION A

SCALE 1:250

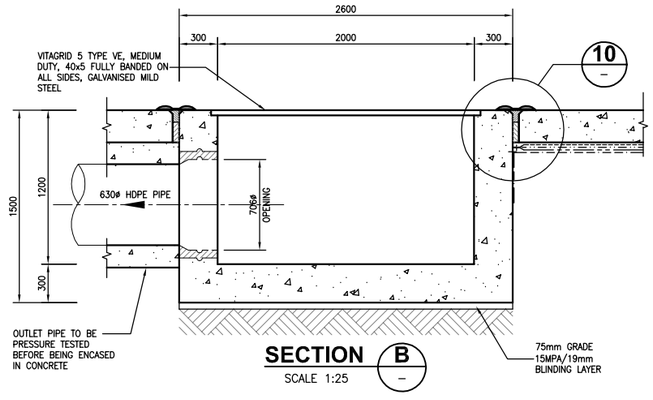
KEY:

- 1,5mm HDPE LINER (SMOOTH)
- HI-DRAIN 50 OR SIMILAR APPROVED
- 1,5mm HDPE LINER (MONO TEXTURED)
- BIDIM A4 GEOTEXTILE



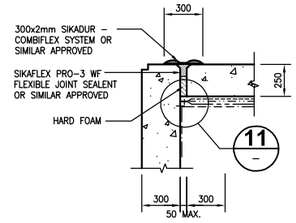
PLAN ON SUMP TO ACCESS SLAB JOINT

SCALE 1:25



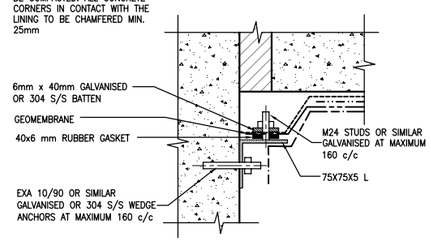
SECTION B

SCALE 1:25



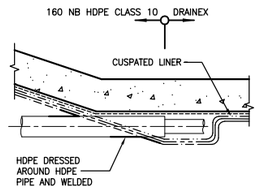
DETAIL 10

SCALE 1:25



DETAIL 11

SCALE 1:5



DETAIL 14

SCALE 1:25

REV	DATE	INDEX REFERENCE : ** REVISION **	CHKD BY	AUTH BY	KKS APP	REFERENCE DRAWINGS
						5452-80-026 SDO FLOOR SLAB-REINF'DETAILS SHT 3
3	21/04/10	APPROVED FOR CONSTRUCTION	ZL	SR	JRW	5452-80-054 SDO FLOOR SLAB-REINF'DETAILS SHT 2
2	16/09/09	FINALISED FOR CONSTRUCTION	D.E.M.	SR	JRW	5452-80-053 SDO FLOOR SLAB-REINF'DETAILS SHT 1
1	01/07/09	FINALISED FOR CONSTRUCTION	D.E.M.	SR	JRW	5452-80-023 STATION DIRTY DAM - TYPICAL DETAILS
0	22/05/09	ISSUED FOR CONSTRUCTION	D.E.M.	SR	JRW	5452-80-021 STATION DIRTY DAM - G.A.

DRG REGISTR		ATTORNEY: FILE ENGR. INT.	DATE
DESIGN APPROVED	22/05/09	JRW	MDM
KKS APP			21/04/10
DO AUTH	21/04/10	DO	
CHKD BY	22/05/09	JRW	
DRAWN BY	22/05/09	D.E.M.	
SCALE	AS SHOWN		

PANEL B CONSULTANTS JOINT VENTURE
Knight Piésold CONSULTING

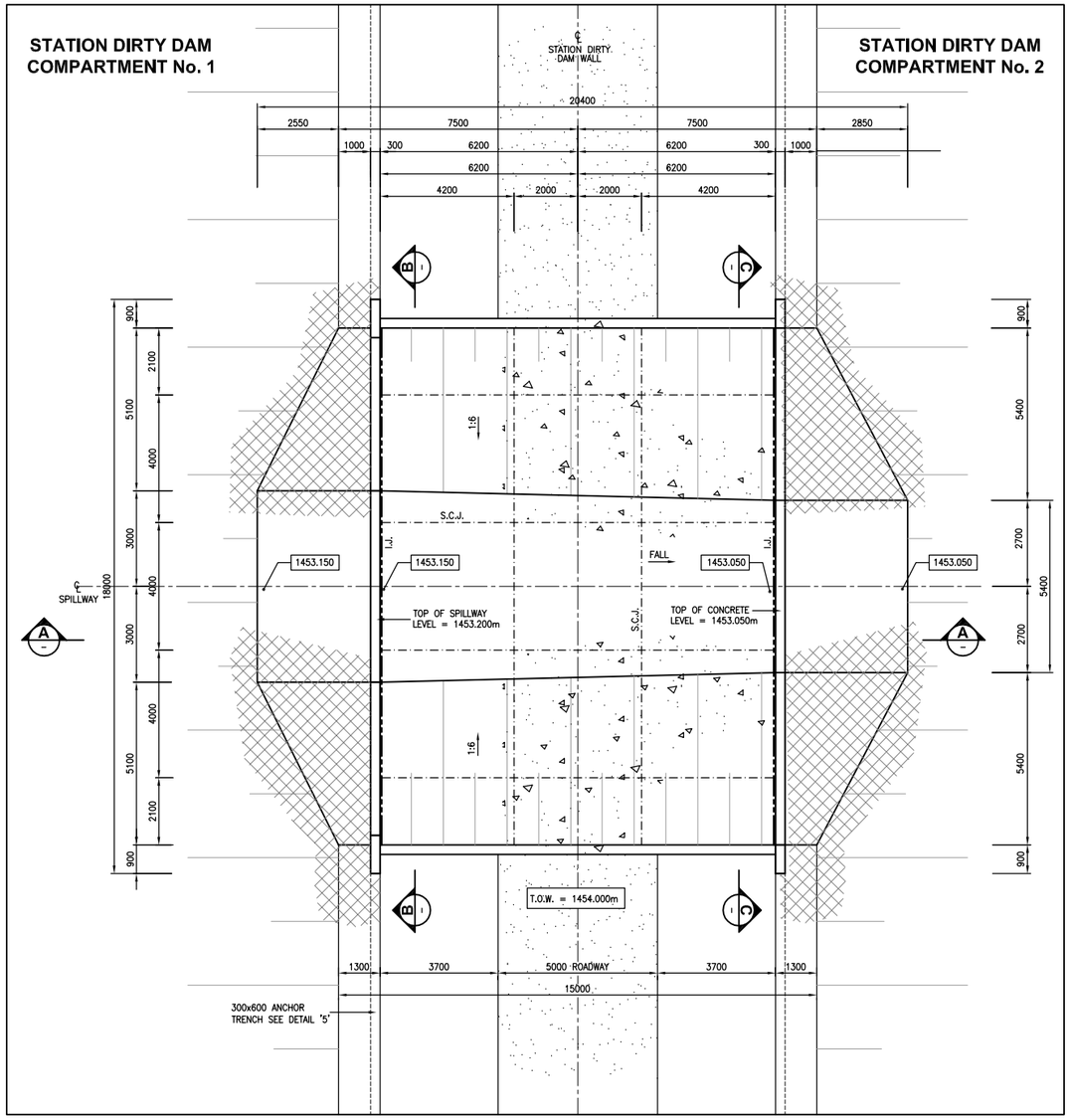
Eskom

KUSILE POWER STATION

STATION DIRTY DAM
COMPARTMENT No. 1 OUTLET
GENERAL ARRANGEMENT & DETAILS

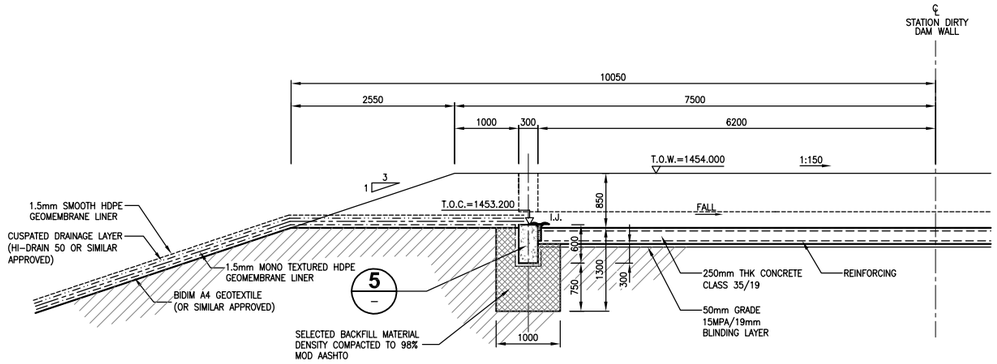
DRG. No. K 5452-80-025 — REV 3

0.90/2396 — SHEET A1 — REV 3



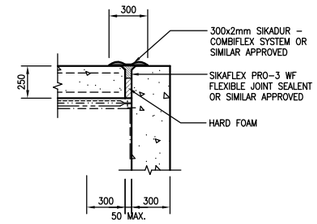
GENERAL ARRANGEMENT OF SPILLWAY No. 1

SCALE 1:100



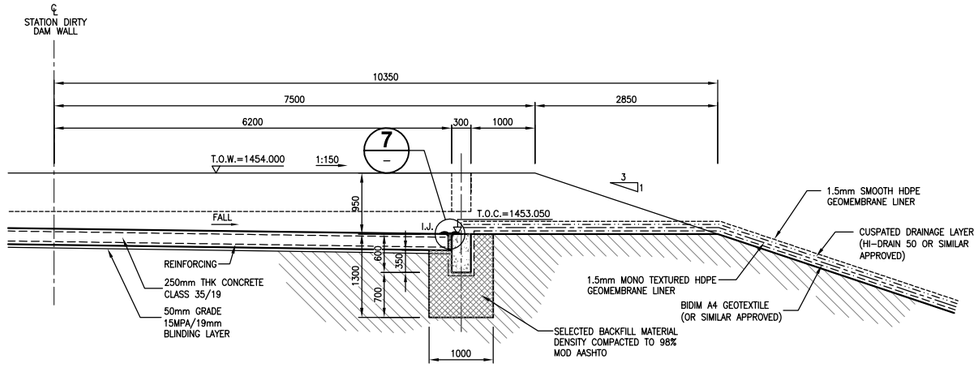
DETAIL 1

SCALE 1:50



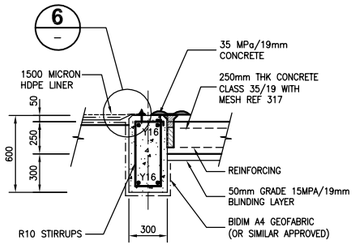
DETAIL 7

SCALE 1:25



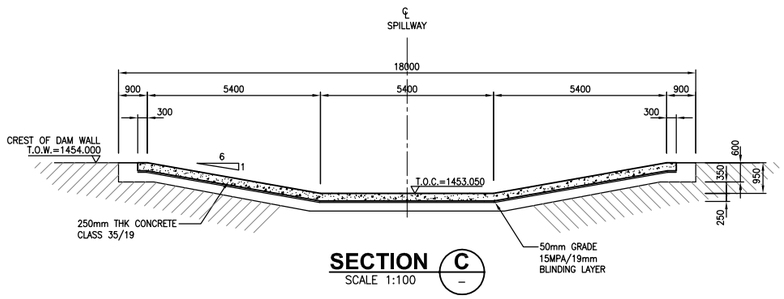
DETAIL 2

SCALE 1:50



DETAIL 5

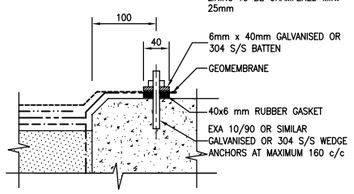
SCALE 1:25



SECTION C

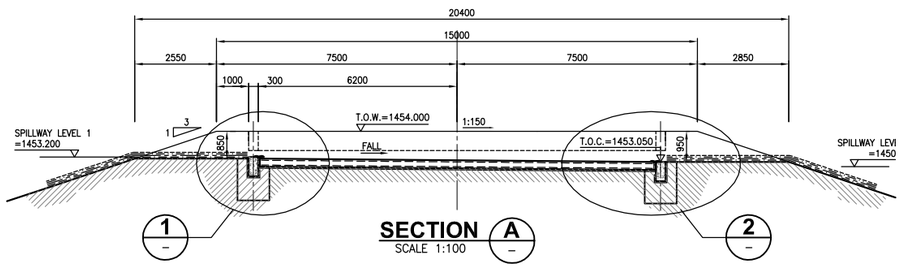
SCALE 1:100

NOTE :
EARTH ADJACENT TO CONCRETE TO BE COMPACTED. ALL CONCRETE CORNERS IN CONTACT WITH THE LINING TO BE CHAMFERED MIN. 25mm



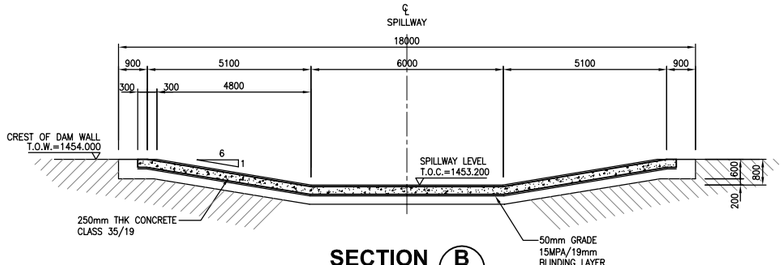
DETAIL 6

SCALE 1:5



SECTION A

SCALE 1:100



SECTION B

SCALE 1:100

3	21/04/10	APPROVED FOR CONSTRUCTION		ZL	SR	JRW		
2	25/05/09	FINALISED FOR CONSTRUCTION		D.E.M.	JRW	JRW		
1	01/07/08	FINALISED FOR CONSTRUCTION		D.E.M.	JRW	JRW	5452–80–027	SDD SPILLWAY–REINFORCING DETAILS
0	22/05/08	ISSUED FOR CONSTRUCTION		D.E.M.	JRW	JRW	5452–80–025	STATION DIRTY DAM – G.A.
D.O. REV	DATE	** REVISION ** INDEX REFERENCE :		REV BY	CHKD BY	AUTH BY	KKS APP	REFERENCE DRAWINGS

DRG REGISTR		APPROVED FOR ERECTION	DATE
DESIGN APPROVED	22/05/08	JRW	MDB 21/04/10
KKS APP			
DO AUTH	21/04/10	DO	
CHKD BY	22/05/08	JRW	
DRAWN BY	22/05/08	D.E.M.	
SCALE	1:100		

PANEL & CONSULTANTS JOINT VENTURE
Knight Piésold CONSULTING

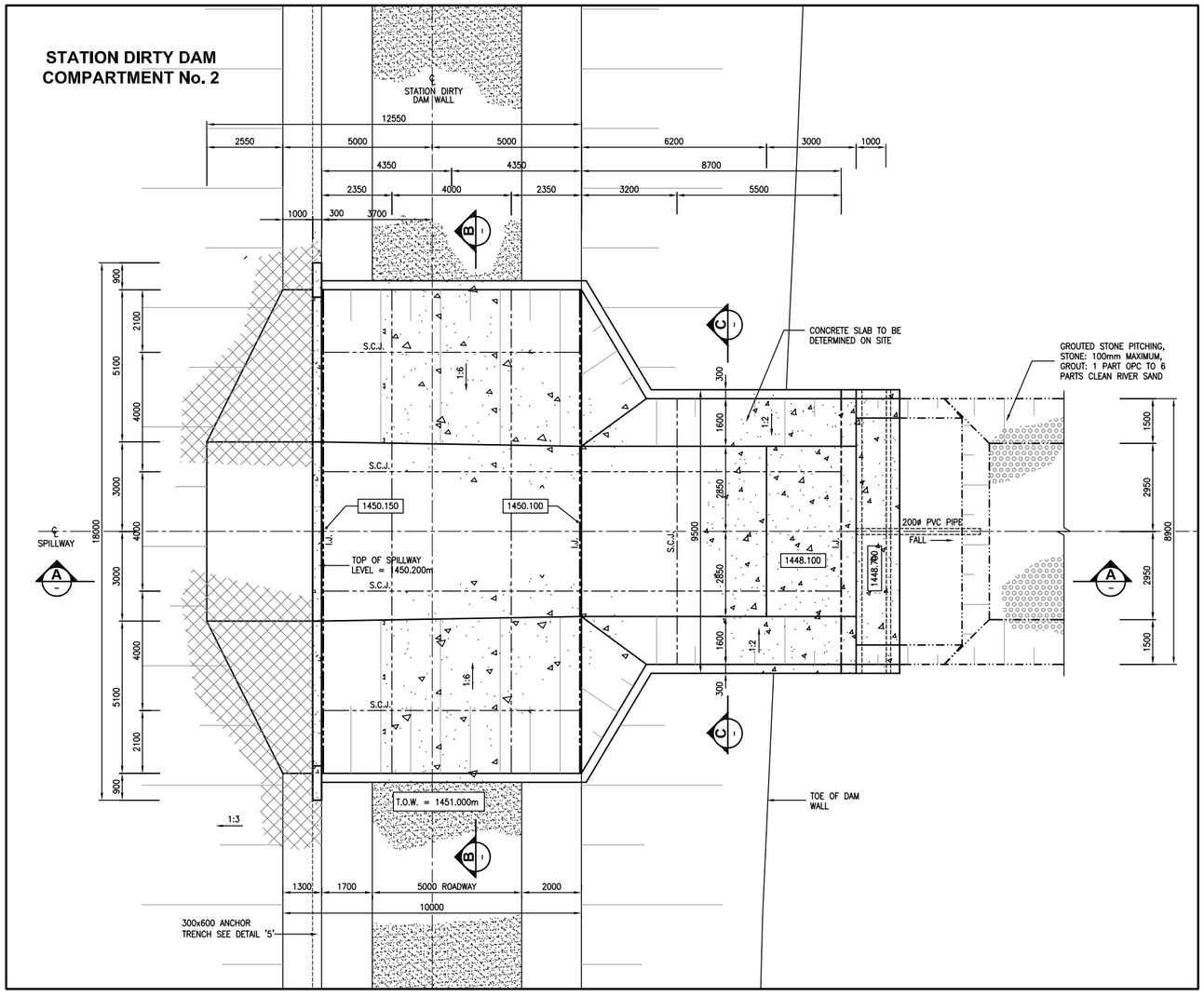
Eskom

KUSILE POWER STATION

STATION DIRTY DAM
SPILLWAY No.1
G.A. & TYPICAL DETAILS

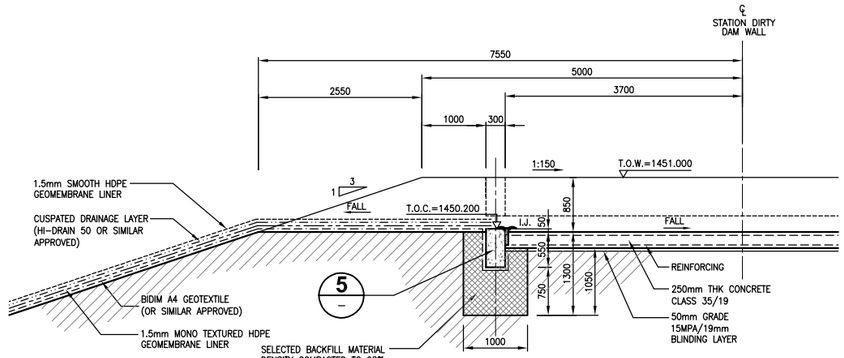
DRG. No. K 5452–80–026 REV 3

0.90/2397 SHEET A1 REV 3

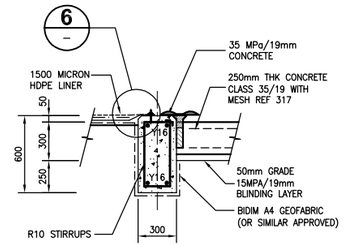


GENERAL ARRANGEMENT OF SPILLWAY No. 2 & ENERGY DISSIPATOR

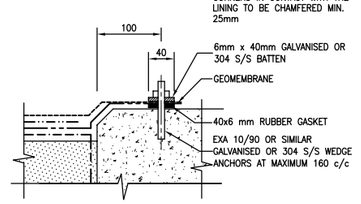
SCALE 1:100



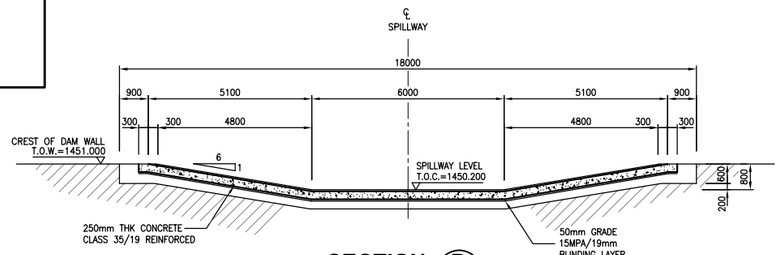
DETAIL 1
SCALE 1:50



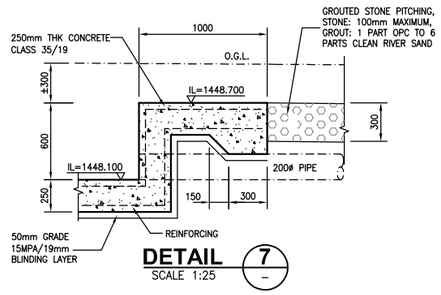
DETAIL 5
SCALE 1:25



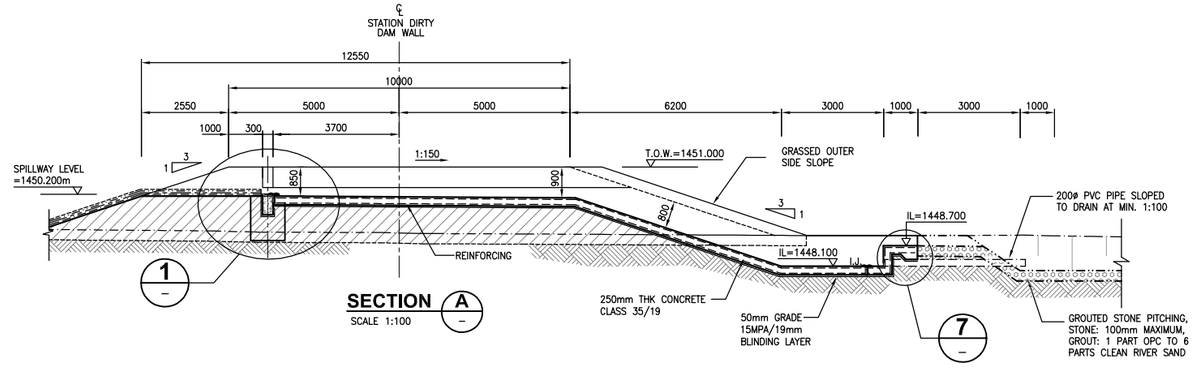
DETAIL 6
SCALE 1:5



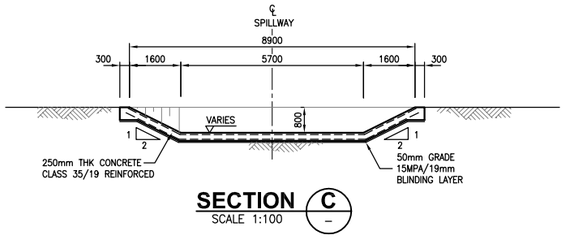
SECTION B
SCALE 1:100



DETAIL 7
SCALE 1:25



SECTION A
SCALE 1:100



SECTION C
SCALE 1:100

REV	DATE	DESCRIPTION	CHKD BY	AUTH BY	KKS APP	REFERENCE DRAWINGS
3	21/04/10	APPROVED FOR CONSTRUCTION	SS	JBM		
2	25/09/09	FINALISED FOR CONSTRUCTION	D.E.M.	JBM	JBM	
1	01/07/09	FINALISED FOR CONSTRUCTION	D.E.M.	JBM	JBM	5452-80-027 SDD SPILLWAY-REINFORCING DETAILS
0	22/05/09	ISSUED FOR CONSTRUCTION	D.E.M.	JBM	JBM	5452-80-025 STATION DIRTY DAM - G.A.

D.O. REV: 0 | INDEX REFERENCE : | ** REVISION ** | REV BY: | CHKD BY: | AUTH BY: | KKS APP:

DRG PREPARED		STRUCTURE FOR ENGINEERING	DATE
DESIGN APPROVED	22/05/09	JBM	BOM 21/05/10
KKS APP			
DO AUTH	21/04/10	DO	
CHKD BY	22/05/09	JBM	
DRAWN BY	22/05/09	D.E.M.	
SCALE	1:100		

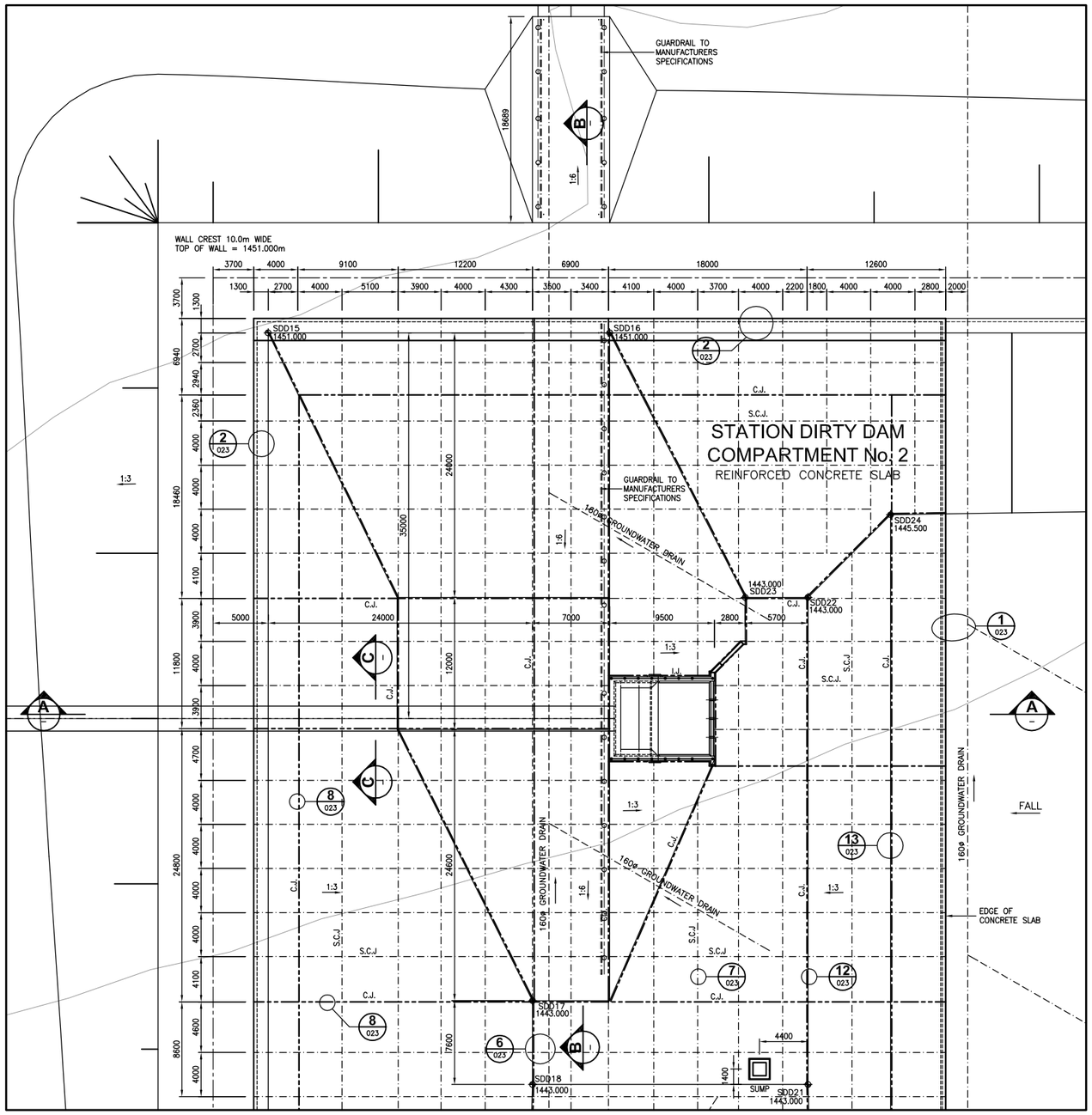
PANEL & CONSULTANTS JOINT VENTURE
Knight Piésold CONSULTING

Eskom

KUSILE POWER STATION
STATION DIRTY DAM
SPILLWAY No.2
G.A. & TYPICAL DETAILS

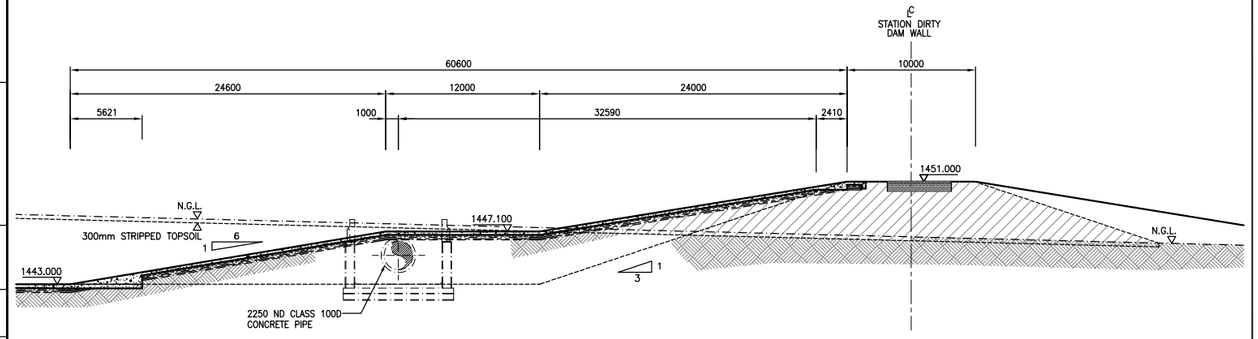
DRG. No. K 5452-80-027 | REV 3

0.90/2398 | SHEET A1 | REV 3



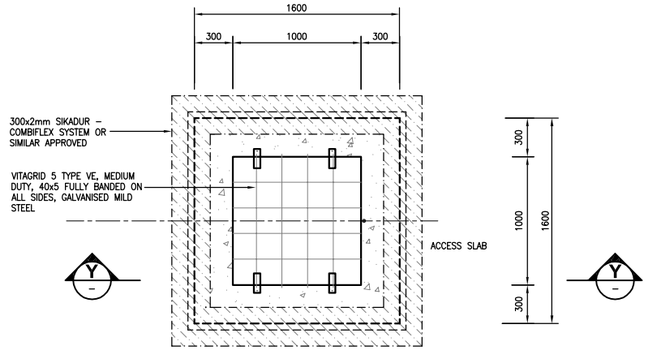
GENERAL ARRANGEMENT OF COMPARTMENT No. 2 INLET SYSTEM

SCALE 1:250



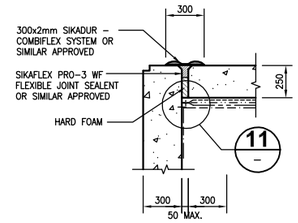
SECTION B

SCALE 1:250



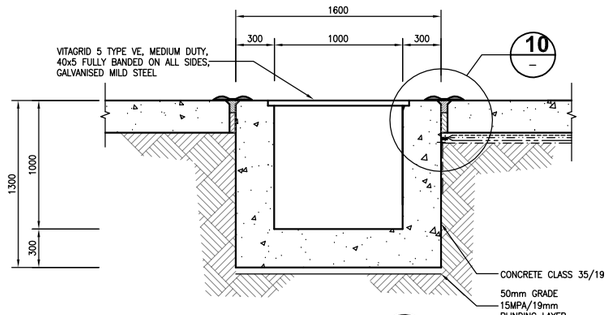
PLAN ON SUMP

SCALE 1:25



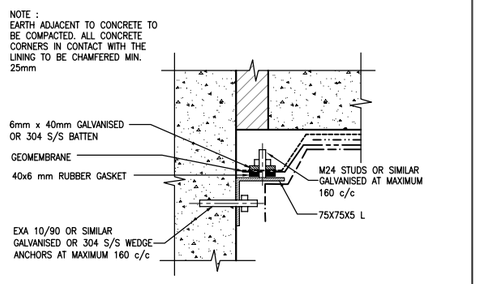
DETAIL 10

SCALE 1:25



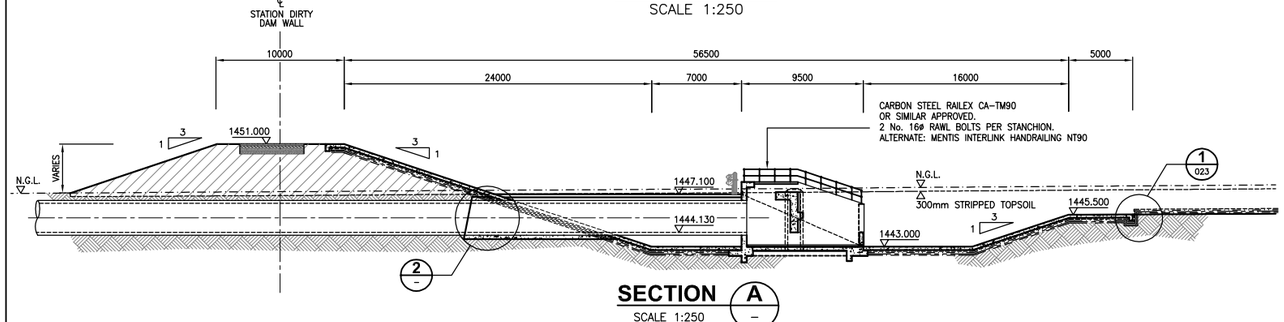
SECTION Y

SCALE 1:25



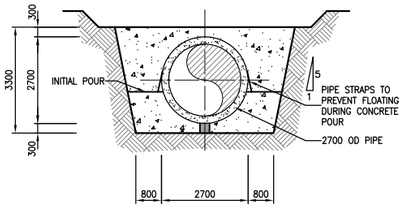
DETAIL 11

SCALE 1:5



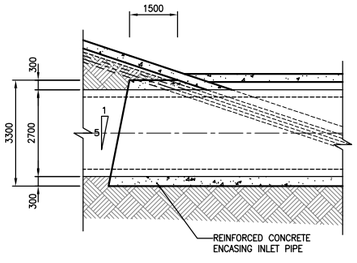
SECTION A

SCALE 1:250



SECTION C

SCALE 1:100



DETAIL 2

SCALE 1:100

REV	DATE	REVISION / INDEX REFERENCE	BY	CHKD BY	AUTH BY	KKS APP	REFERENCE DRAWINGS
							5452–80–005 SDD FLOOR SLAB–REINFDETAILS SHT 3
3	21/04/10	APPROVED FOR CONSTRUCTION	ZL	SR	JRM		5452–80–004 SDD FLOOR SLAB–REINFDETAILS SHT 2
2	25/08/09	FINALISED FOR CONSTRUCTION	D.E.M.	JRM	JRM		5452–80–003 SDD FLOOR SLAB–REINFDETAILS SHT 1
1	01/07/09	FINALISED FOR CONSTRUCTION	D.E.M.	JRM	JRM		5452–80–022 STATION DIRTY DAM – TYPICAL DETAILS
0	22/05/09	ISSUED FOR CONSTRUCTION	D.E.M.	JRM	JRM		5452–80–021 STATION DIRTY DAM – G.A.

D.O. REV	DATE
DRG REGISTR	
DESIGN APPROVED	22/05/09 JRM
KKS APP	
QC AUTH	21/04/10 SO
CHKD BY	22/05/09 JRM
DRAWN BY	22/05/09 D.E.M.
SCALE	1:250

ATTENDED FOR ENGR. BY	DATE
MDM	21/04/10

PANEL & CONSULTANTS JOINT VENTURE
Knight Piésold CONSULTING

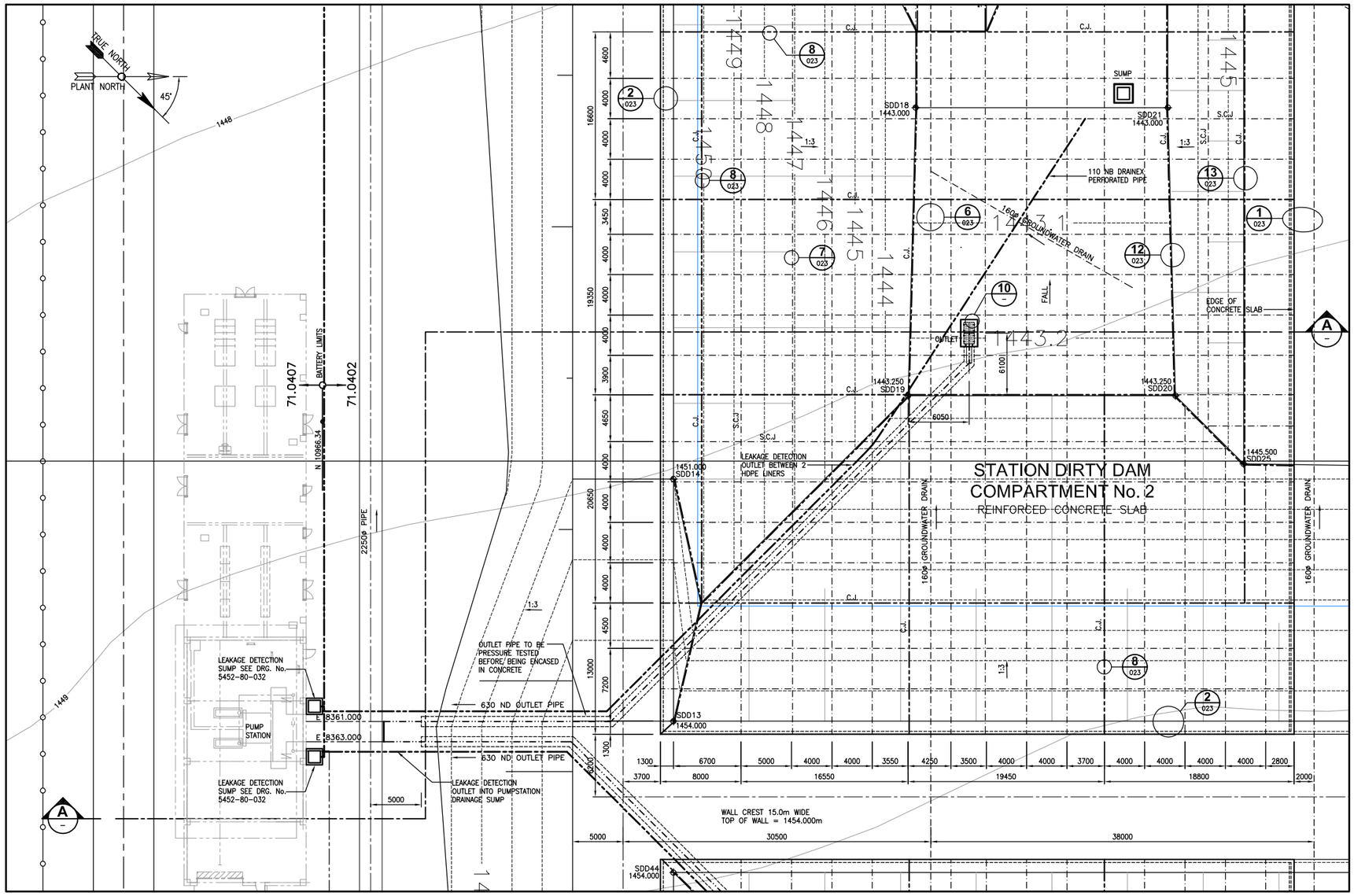
Eskom

KUSILE POWER STATION

STATION DIRTY DAM
COMPARTMENT No. 2 INLET
GENERAL ARRANGEMENT & DETAILS

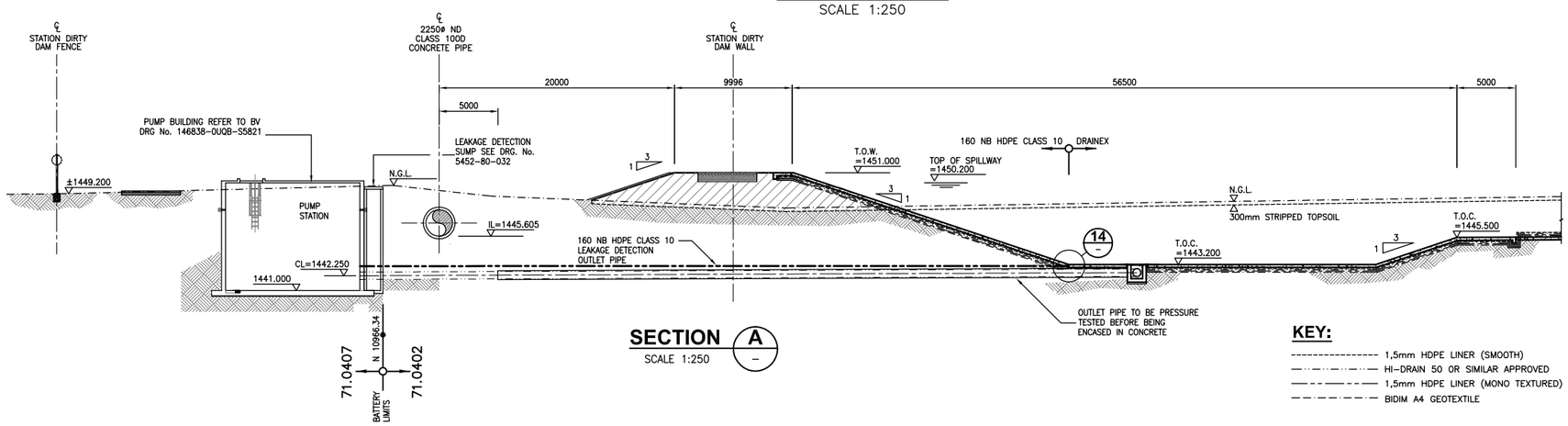
DRG. No. K 5452–80–028 — REV 3

0.90/2399 — SHEET A1 — REV 3



GENERAL ARRANGEMENT OF COMPARTMENT No.2 OUTLET SYSTEM

SCALE 1:250

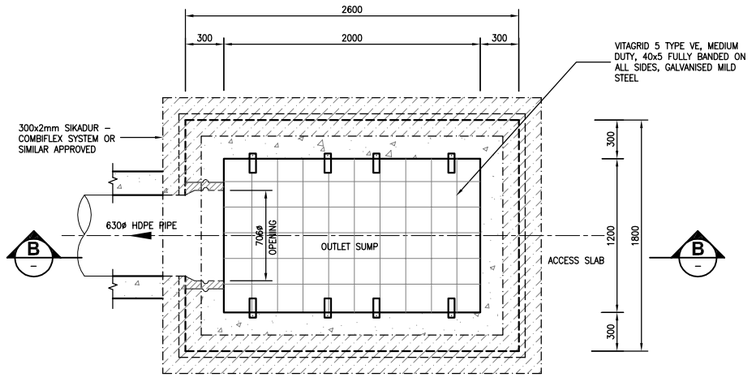


SECTION A

SCALE 1:250

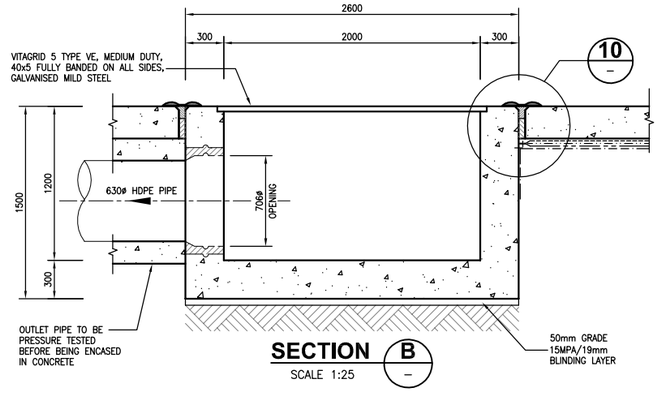
KEY:

- 1,5mm HDPE LINER (SMOOTH)
- HI-DRAIN 50 OR SIMILAR APPROVED
- 1,5mm HDPE LINER (MONO TEXTURED)
- BIDIM A4 GEOTEXTILE



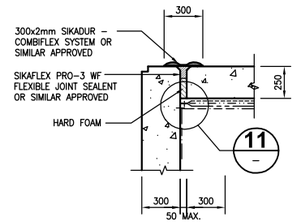
PLAN ON SUMP TO ACCESS SLAB JOINT

SCALE 1:25



SECTION B

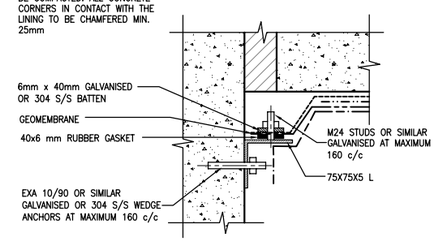
SCALE 1:25



DETAIL 10

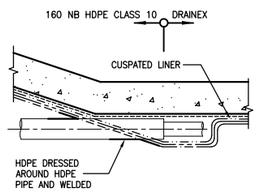
SCALE 1:25

NOTE :
EARTH ADJACENT TO CONCRETE TO BE COMPACTED. ALL CONCRETE CORNERS IN CONTACT WITH THE LINING TO BE CHAMFERED MIN. 25mm



DETAIL 11

SCALE 1:5



DETAIL 14

SCALE 1:25

D.G. REV	DATE	** REVISION **	REV BY	CHKD BY	AUTH BY	KKS APP	REFERENCE DRAWINGS
		INDEX REFERENCE :					5452-80-026 SDD FLOOR SLAB-REINFSTEALS SHT 3
3	21/04/10	APPROVED FOR CONSTRUCTION	DL	SR	JRM		5452-80-004 SDD FLOOR SLAB-REINFSTEALS SHT 2
2	25/08/09	FINALISED FOR CONSTRUCTION	D.G.L	JRM	JRM		5452-80-003 SDD FLOOR SLAB-REINFSTEALS SHT 1
1	01/07/09	FINALISED FOR CONSTRUCTION	D.G.L	JRM	JRM		5452-80-002 STATION DIRTY DAM – TYPICAL DETAILS
0	22/05/09	ISSUED FOR CONSTRUCTION	D.G.L	JRM	JRM		5452-80-001 STATION DIRTY DAM – G.A.

DRG REGISTER		ATTENDED FOR DESIGN BY: MDM	DATE: 31/04/10
DESIGN APPROVED	22/05/09	JRM	
KKS APP			
DO AUTH	21/04/10	DO	
CHKD BY	22/05/09	JRM	
DRAWN BY	22/05/09	D.G.L	
SCALE	1:250		

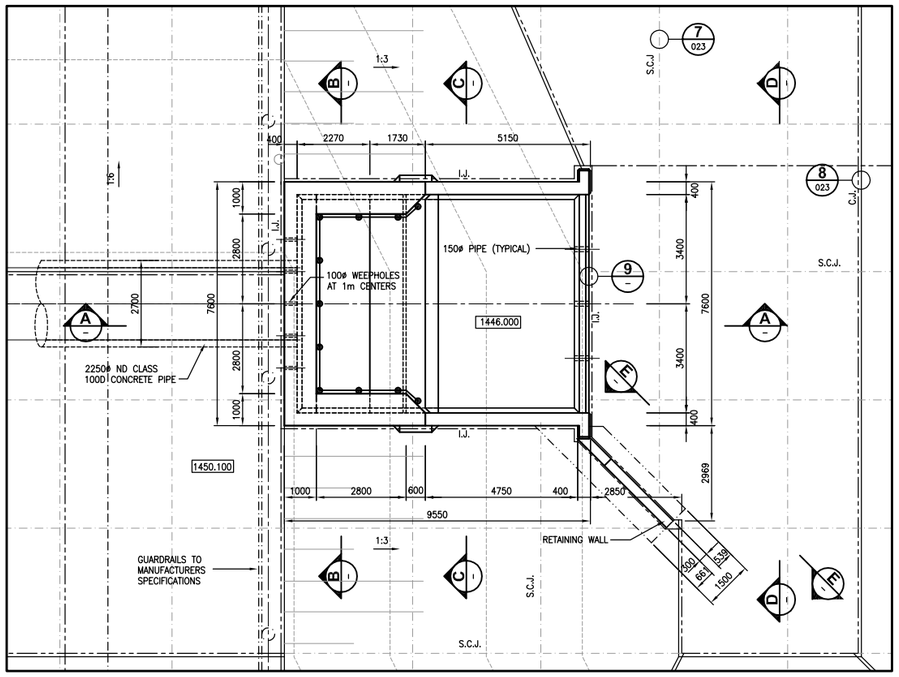
PANEL & CONSULTANTS JOINT VENTURE
Knight Piésold CONSULTING
Eskom

KUSILE POWER STATION

STATION DIRTY DAM
COMPARTMENT No. 2 OUTLET
GENERAL ARRANGEMENT & DETAILS

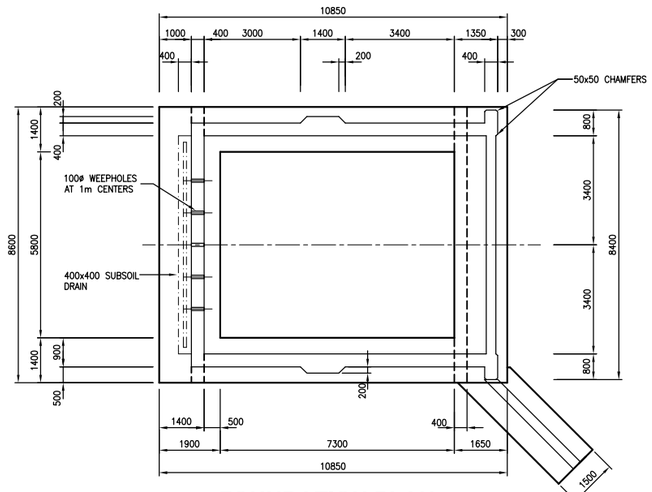
DRG. No. K 5452-80-029 — REV 3

0.90/2400 — SHEET A1 — REV 3



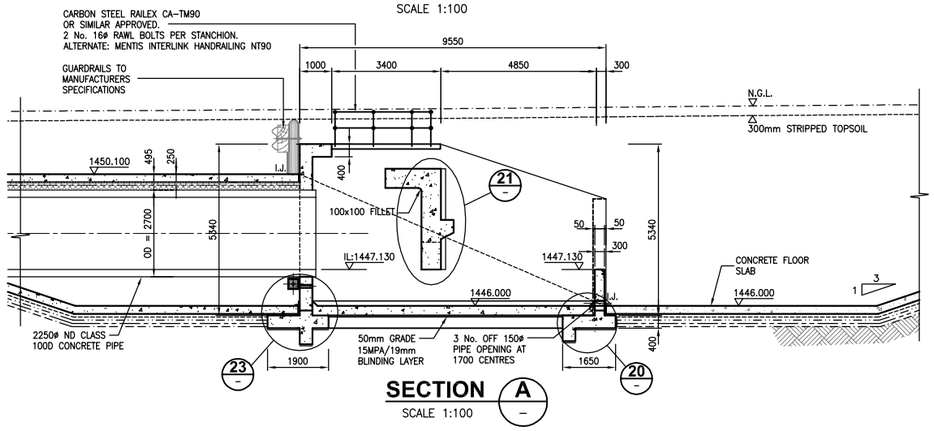
PLAN ON COMPARTMENT No.1 ENERGY DISSIPATOR

SCALE 1:100



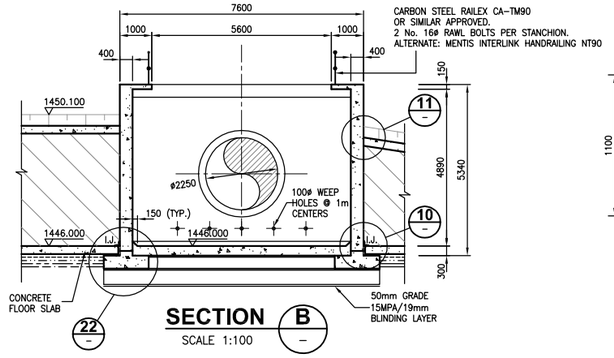
FOUNDATION PLAN

SCALE 1:100



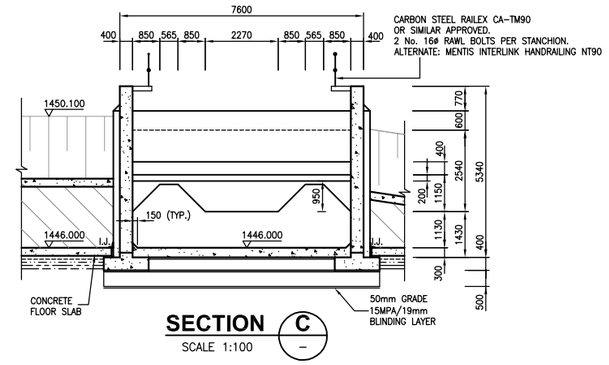
SECTION A

SCALE 1:100



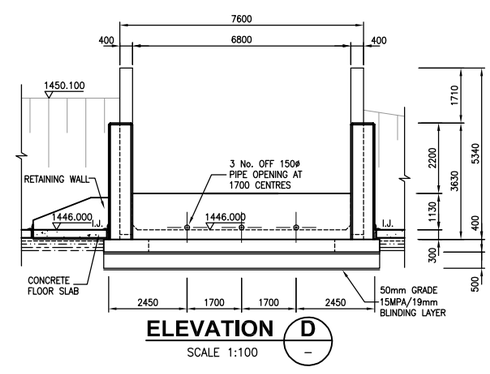
SECTION B

SCALE 1:100



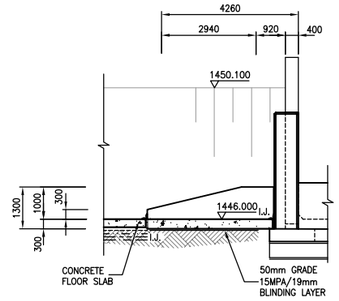
SECTION C

SCALE 1:100



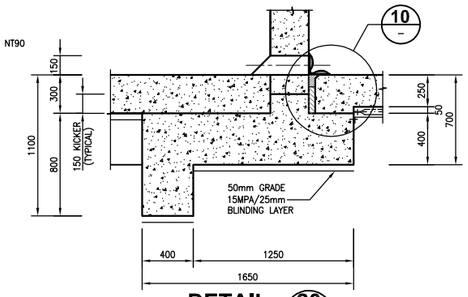
ELEVATION D

SCALE 1:100



ELEVATION E

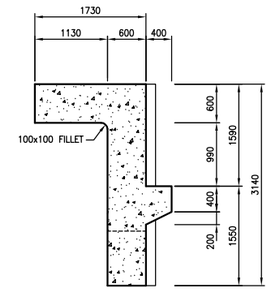
SCALE 1:100



DETAIL 20

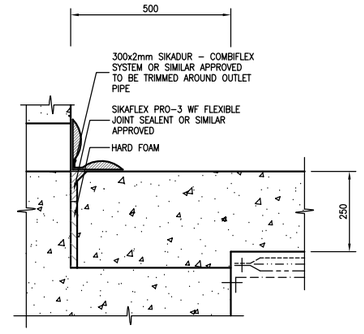
SCALE 1:25

TYPICAL ISOLATION JOINT IN FLOOR SLABS (I.J.)



DETAIL 21

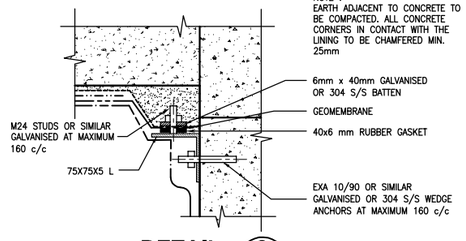
SCALE 1:50



DETAIL 10

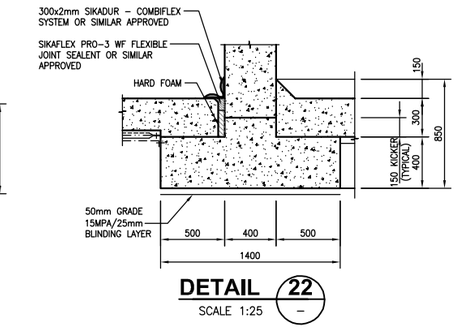
SCALE 1:10

TYPICAL ISOLATION JOINT IN FLOOR SLABS (I.J.)



DETAIL 9

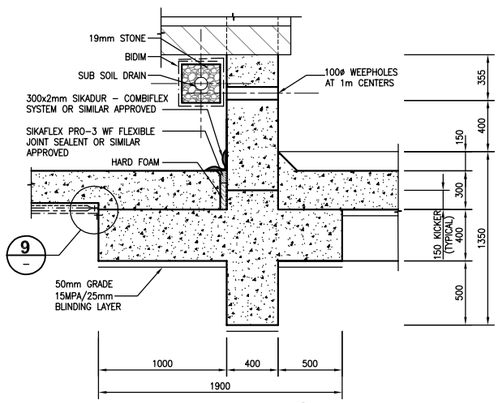
SCALE 1:5



DETAIL 22

SCALE 1:25

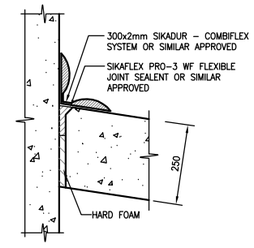
TYPICAL ISOLATION JOINT IN FLOOR SLABS (I.J.)



DETAIL 23

SCALE 1:25

TYPICAL ISOLATION JOINT IN FLOOR SLABS (I.J.)



DETAIL 11

SCALE 1:10

TYPICAL ISOLATION JOINT IN FLOOR SLABS (I.J.)

D.O. REV.	DATE	** REVISION **	REV BY	CHKD BY	AUTH BY	KKS APP	REFERENCE DRAWINGS
		INDEX REFERENCE :					
3	21/04/10	APPROVED FOR CONSTRUCTION	DL	SR	JRM		
2	25/08/09	FINALISED FOR CONSTRUCTION	G.E.N.	JRM	JRM		
1	01/07/09	FINALISED FOR CONSTRUCTION	G.E.N.	JRM	JRM		5452-80-006 SDD ENERGY DISSIPATOR REINF. DETAILS
0	22/05/09	ISSUED FOR CONSTRUCTION	G.E.N.	JRM	JRM		5452-80-021 STATION DIRTY DAM – G.A.

DRG REGISTER		HOD	21/04/10
DESIGN APPROVED	22/05/09	JRM	
KKS APP.			
DO AUTH.	21/04/10	DO	
CHKD BY	22/05/09	JRM	
DRAWN BY	22/05/09	G.E.N.	
SCALE	1:100		

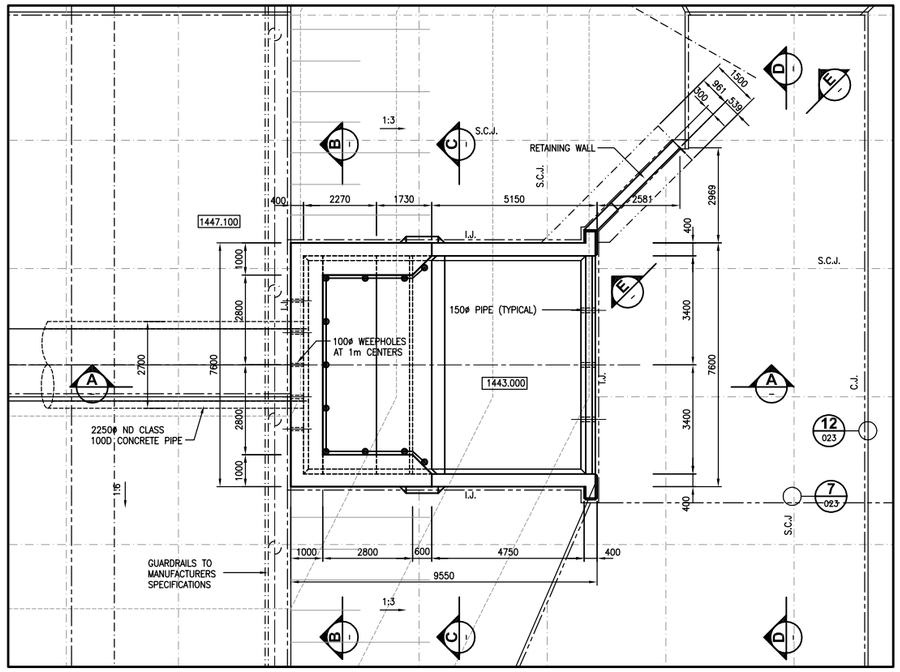
PANEL & CONSULTANTS (PTY) LTD REVISION
Knight Piésold CONSULTING
Eskom

KUSILE POWER STATION

STATION DIRTY DAM
COMPARTMENT No.1 ENERGY DISSIPATOR
GENERAL ARRANGEMENT & DETAILS

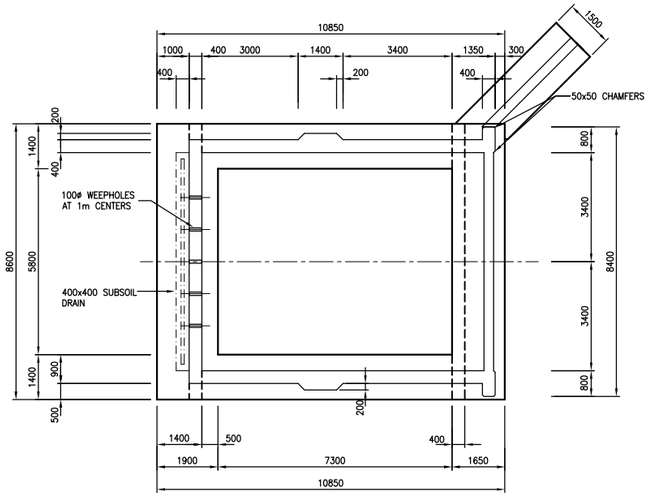
DRG. No. K 5452-80-030 REV 3

0.90/2401 SHEET A1 REV 3



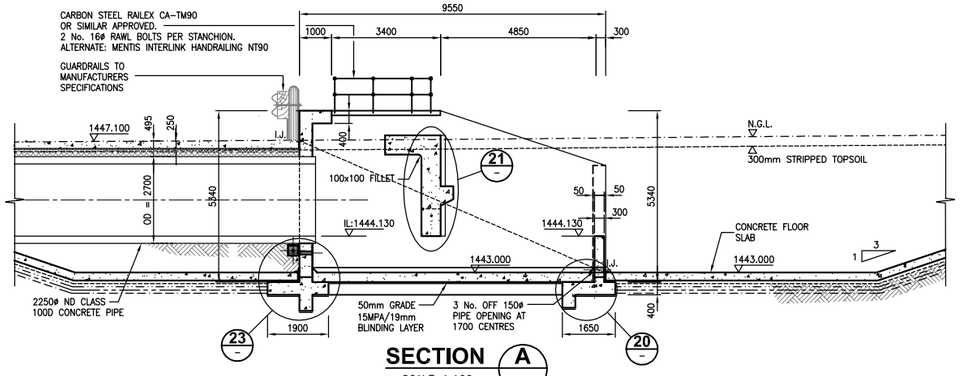
PLAN ON COMPARTMENT No.2 ENERGY DISSIPATOR

SCALE 1:100



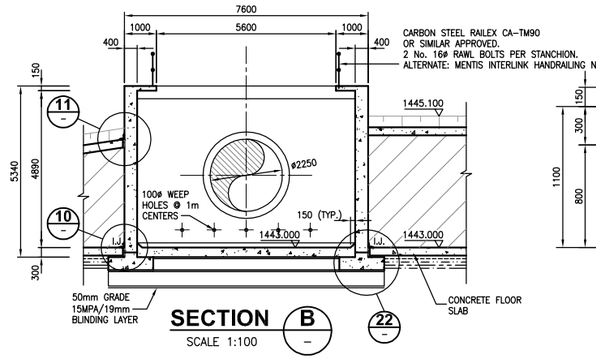
FOUNDATION PLAN

SCALE 1:100



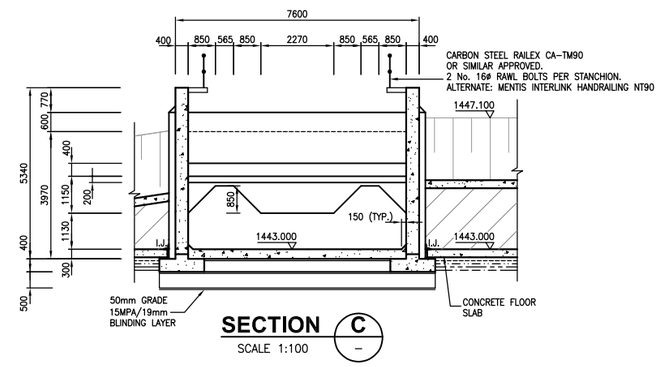
SECTION A

SCALE 1:100



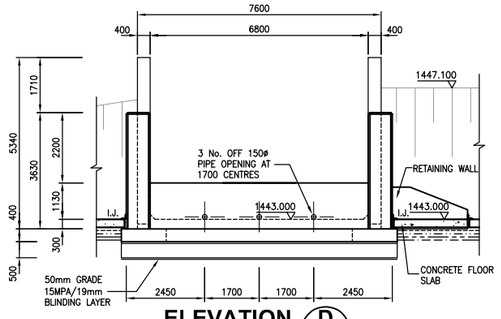
SECTION B

SCALE 1:100



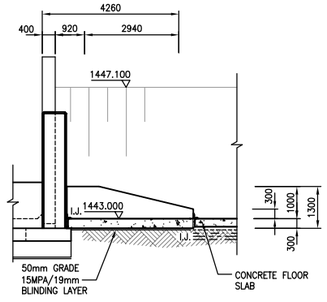
SECTION C

SCALE 1:100



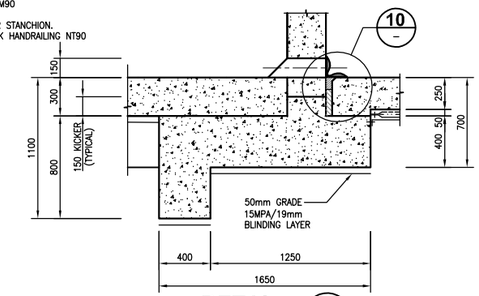
ELEVATION D

SCALE 1:100



ELEVATION E

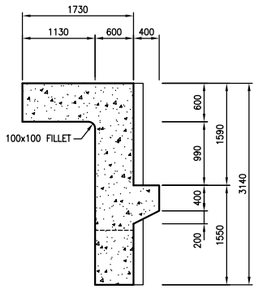
SCALE 1:100



DETAIL 20

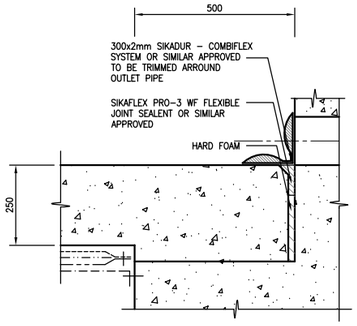
SCALE 1:25

TYPICAL ISOLATION JOINT IN FLOOR SLABS (I.J.)



DETAIL 21

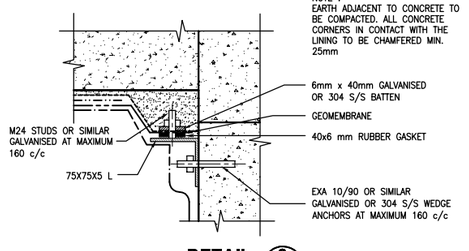
SCALE 1:50



DETAIL 10

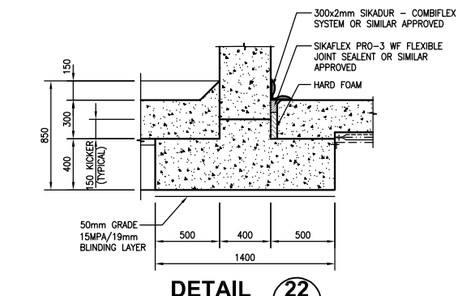
SCALE 1:10

TYPICAL ISOLATION JOINT IN FLOOR SLABS (I.J.)



DETAIL 9

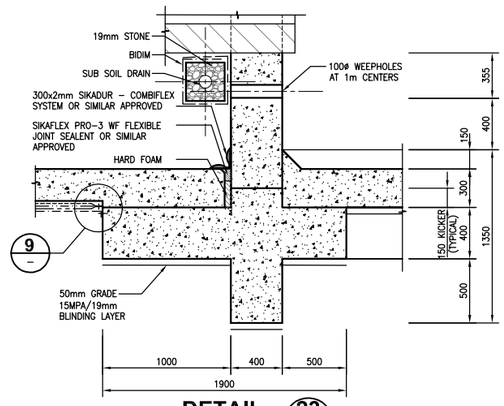
SCALE 1:5



DETAIL 22

SCALE 1:25

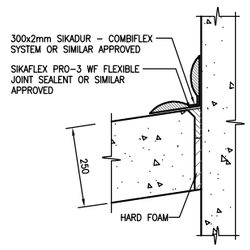
TYPICAL ISOLATION JOINT IN FLOOR SLABS (I.J.)



DETAIL 23

SCALE 1:25

TYPICAL ISOLATION JOINT IN FLOOR SLABS (I.J.)



DETAIL 11

SCALE 1:10

TYPICAL ISOLATION JOINT IN FLOOR SLABS (I.J.)

REV	DATE	REVISION	ZL	SR	JRM	
3	21/04/10	APPROVED FOR CONSTRUCTION	ZL	SR	JRM	
2	25/08/08	FINALISED FOR CONSTRUCTION	D.E.M.	JRM	JRM	
1	01/07/08	FINALISED FOR CONSTRUCTION	D.E.M.	JRM	JRM	5452-80-006 SDD ENERGY DISSIPATOR REINF DETAILS
0	22/05/08	ISSUED FOR CONSTRUCTION	D.E.M.	JRM	JRM	5452-80-021 STATION DIRTY DAM - G.A.

D.O. REV	DATE	INDEX REFERENCE	REV BY	CHKD BY	AUTH BY	KKS APP	REFERENCE DRAWINGS

DRG REGISTR					
DESIGN APPROVED	22/05/08	JRM			
KKS APP					
DO AUTH	21/04/10	DO			
CHKD BY	22/05/08	JRM			
DRAWN BY	22/05/08	D.E.M.			
SCALE	1:100				

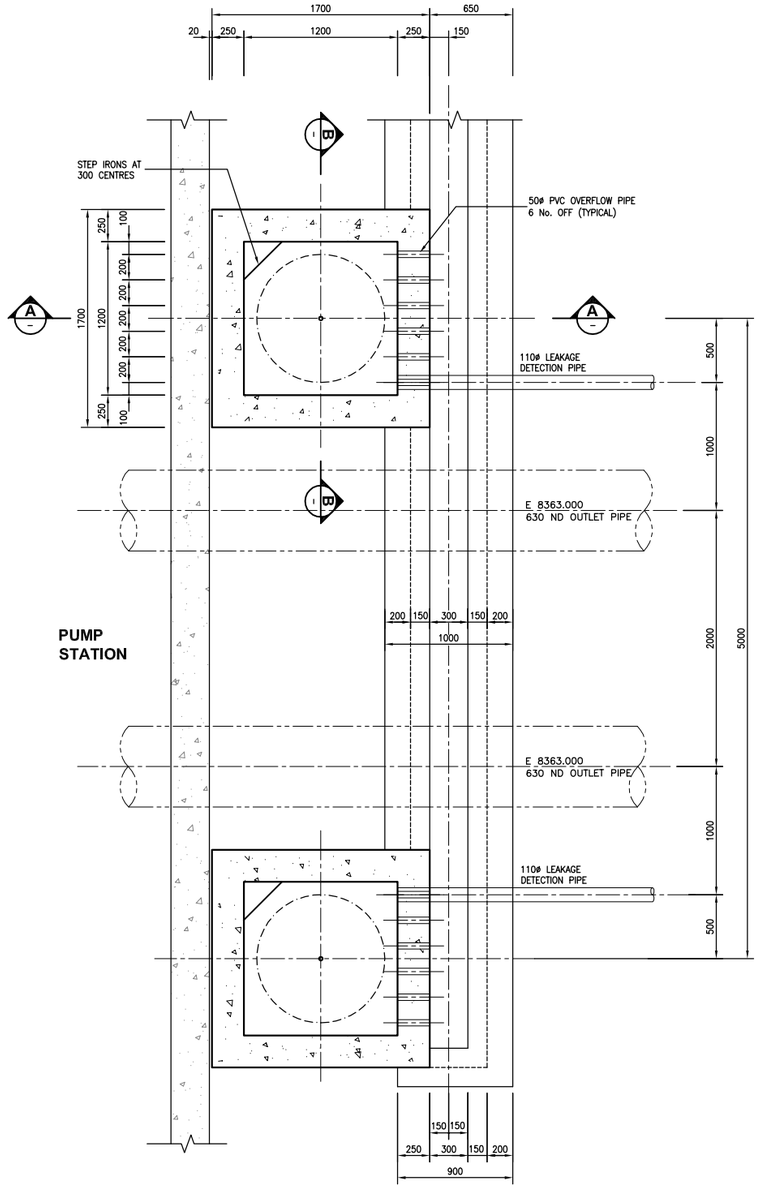
PANEL & CONSULTANTS JOINT VENTURE
Knight Piésold CONSULTING

Eskom

KUSILE POWER STATION
STATION DIRTY DAM
COMPARTMENT No.2 ENERGY DISSIPATOR
GENERAL ARRANGEMENT & DETAILS

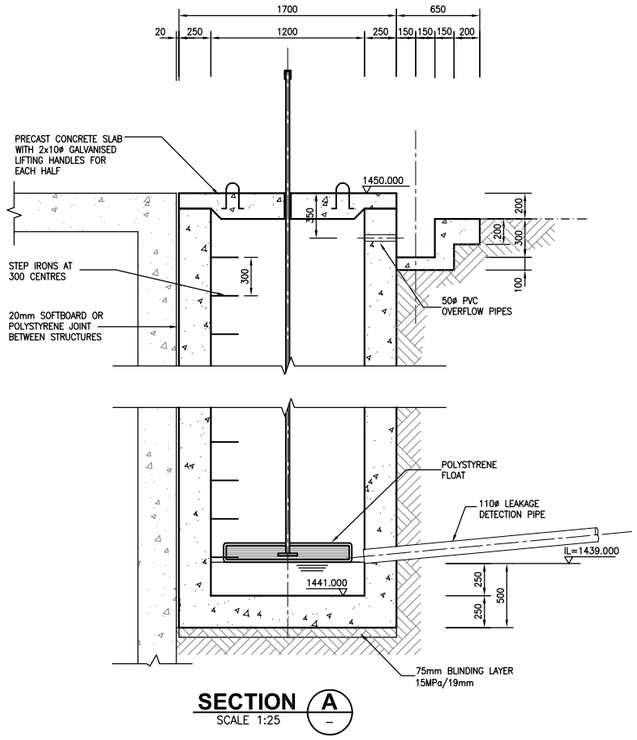
DRG. No. K 5452-80-031 — REV 3

0.90/2402 — SHEET A1 — REV 3



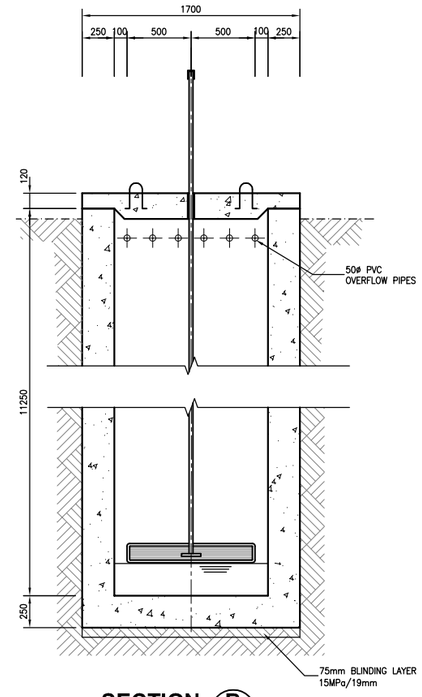
PLAN OF LEAKAGE DETECTION SUMPS

SCALE 1:25



SECTION A

SCALE 1:25

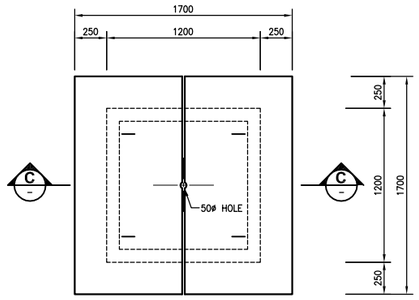


SECTION B

SCALE 1:25

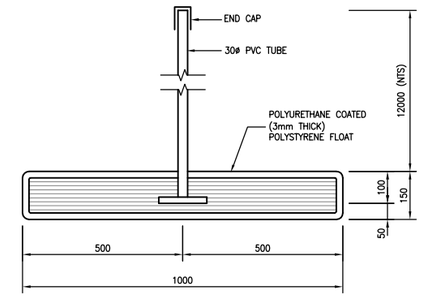
CONCRETE NOTES:

1. CONCRETE TO BE GRADE 35/19. MIX DESIGNS FOR CONCRETE TO BE SUBMITTED TO THE ENGINEER FOR APPROVAL PRIOR TO COMMENCEMENT OF CONCRETE WORK
2. FINISHING:
   2.1 SMOOTH FINISH TO ALL SHUTTERED SIDES.
   2.2 WOODFLOAT TO TOPS OF WALLS AND SLABS.
   2.3 25x25mm CORNER FILLETS TO ALL EXPOSED EDGES.
3. TOLERANCES TO BE IN ACCORDANCE WITH SABS 1200G CLASS 1.
4. COVER TO REINFORCEMENT: AS INDICATED.
5. CURING OF ALL CONCRETE SURFACES TO BE DONE USING SAMSON'S WAX BASED WHITE PIGMENTED CURING COMPOUND.
6. ALL WORK TO BE CARRIED OUT IN CONFORMANCE WITH THE RELEVANT SABS 1200 SPECIFICATIONS.
7. ALL CONCRETE IS TO BE PROPERLY VIBRATED. HEAPING OF CONCRETE TO BE AVOIDED. CASTING OF CONCRETE MUST BE CONTINUOUS.
8. ALL WORK TO BE CHECKED BY SUPERVISING ENGINEER PRIOR TO POURING OF CONCRETE (MINIMUM 24 HOURS NOTICE.
9. AN ALLOWABLE FOUNDATION BEARING PRESSURE OF 300KPa ON COMPETENT SOIL IS REQUIRED. REMOVE AND REPLACE IN SITU MATERIAL AS REQUIRED.
10. ALL DIMENSIONS TO BE CONFIRMED ON SITE.
11. ALL STRUCTURES SHALL BE CONSTRUCTED ON A SUB-FOUNDATION CARPET OF 15MPa/19mm BLINDING CONCRETE, NOT LESS THAN 75mm THICK.



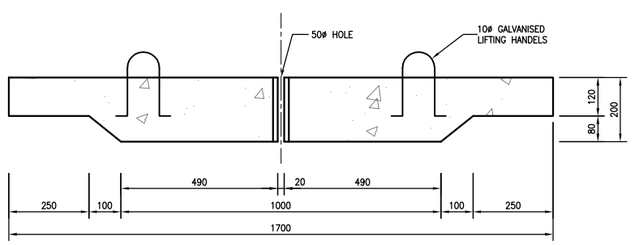
PLAN OF SLAB
2 No. OFF

SCALE 1:25



CROSS SECTION ON FLOAT
2 No. OFF

SCALE 1:10



SECTION C

SCALE 1:10

							5452-80-101 S.D.D. LEVAGE-REINFORCEMENT DETAILS
1	21/04/10	APPROVED FOR CONSTRUCTION	JL	SR	JRM		5452-80-035 S.D.D. - G.A. & TYPICAL DETAILS
0	25/09/09	ISSUED FOR COMMENT AND APPROVAL	D.E.M.	JRM	JRM		5452-80-031 STATION DIRTY DAM - G.A.
D.O. REV	DATE	** REVISION **	REV BY	CHKD BY	AUTH BY	KKS APP	REFERENCE DRAWINGS

INDEX REFERENCE :

DRG REGISTR		AUTHORISED FOR ENGR. RLS.	DATE
		MDH	21/04/10
DESIGN APPROVED	25/09/09	JRM	
KKS APP			
DO AUTH	21/04/10	DO	
CHKD BY	25/09/09	JRM	
DRAWN BY	25/09/09	D.E.M.	
SCALE	1:25		

PANEL B CONSULTANTS JOINT VENTURE
Knight Piésold CONSULTING
Eskom

KUSILE POWER STATION
STATION DIRTY DAM
LEAKAGE DETECTION SUMP
GENERAL ARRANGEMENT & DETAILS

DRG. No. K 5452-80-032 REV 1

0.90/2403 SHEET A1 REV 1

APPENDIX B

HYDROLOGY

BLACK & VEATCH
Building a world of difference.

CALCULATION RECORD

Client Name: Eskom

Page 1 of 3 (8 TOTAL)

Project Name: Kusile Power Station

Project No.: 146838

Calculation Title: Station Dirty Dam Volume

Calculation No./File No.: 52.5427.1101.01

Verification Method: ☒ Check and Review ☐ Alternate Calculations

Objective Calculate the station dirty dam volume for the Kusile Power Station.

Unverified Assumptions Requiring Subsequent Verification			
No.	Assumption	Verified By	Date

Refer to Page _____ of this calculation for additional assumptions.

This Section Used for Software-Generated Calculations

Program Name/Number: _____ Version: _____

Standard B&V Application Used? ☐ Yes ☐ No
If no, list approved deviation permit number below and attach approved deviation permit.

Review and Approval						
Rev	Prepared By	Date	Verified By	Date	Approved By	Date
0	Stephen M. Reitz	March 13, 2009	Dennis N. Short	March 13, 2009	J.W. Fitzwater	03/13/2009
	Stephen M. Reitz		Dennis N. Short	3/13/2009	J.W. Fitzwater	

Accepted: 16/03/09

BLACK & VEATCH						
	Owner	ESKOM			Computed By	S. M. Reitz
	Plant	Kusile Power Station	Unit No.	0 (Common)	Date	3/13/2009
	Project No	146838	File No.	52.5427.1101.01	Verified By	DNS
	Title	Station Dirty Dam Volume			Date	3/13/2009
					Page:	2 of 3

1.0 PURPOSE:

Calculate the station dirty dam volume for the Kusile Power Station.

2.0 REFERENCES:

1. The Bravo Power Station is located approximately 100 kilometers east of Johannesburg, South Africa.
2. Project Bravo 6x800 (Gross) Units - Project Design Manual, Black & Veatch, July 2008
3.
4.
5.
6.
7.
8.
9. B&V Drawing No _____ Rev. _____
10. B&V Drawing No _____ Rev. _____
11. B&V Calculation No. _____ Rev. _____
12. B&V Calculation No. _____ Rev. _____
13. B&V Calculation No. _____ Rev. _____
14. B&V Calculation No _____ Rev. _____

3.0 CONCLUSIONS:

The volume for the station dirty dam will be 164,595 m^3 to handle the 24 hour, 50 year rainfall event

4.0 PROCEDURE/METHODOLOGY OF DESIGN:

4.1 Determine coverage areas and total area (A) of each catchment from the AutoCAD drawings of Appendix B.
4.2 Determine 24 Hour, 50 Year storm event from Project Design Manual (Reference 2).
4.3 Calculate the station dirty dam volume.

5.0 ASSUMPTIONS:

5.1 Assumptions requiring verification will be listed on the cover sheet.
5.2 All other relevant assumptions are located within the "Analysis/Solution" section of this calculation.

6.0 DEFINITION OF UNITS AND CONSTANTS:

mm	millimeter	m^2	square meter
m	meter	m^3	cubic meter

Accepted
16/03/09

7.0 ANALYSIS/SOLUTION:

7.1 Station Dirty Dam Volume

Catchment Areas

Power Block (South) =	199,691	m^2	(Appendix B)
Power Block (North) =	150,812	m^2	(Appendix B)
Limestone Handling/Emergency Ash Dump =	209,930	m^2	(Appendix B)
Coal Transfer Tower =	4,923	m^2	(Appendix B)
Coal Stock Yard =	670,886	m^2	(Appendix B)
Coal Stock Yard (East Slope) =	70,066	m^2	(Appendix B)
Total Catchment Area =	1,306,308	m^2	

Design Rainfall

The design rainfall event shall be a 50 year, 24 hour storm. (Ref. 2, pg 4-17)

24 Hour, 50 Year Event Rainfall = 126 mm (Ref. 2, pg 1-13)

Station Dirty Dam Volume

$$\text{Volume (m)} = \frac{\text{Total Catchment Area } (m^2) \times \text{Design Rainfall (mm)}}{1000 \text{ mm/m}}$$

Volume = 164,595 m^3

8.0 APPENDICES TO CALCULATIONS:

8.1 Appendix A - Project Design Manual - Rainfall Data
8.2 Appendix B - Catchment Area Map

Accepted:
16/03/09

APPENDIX A
PROJECT DESIGN MANUAL
(DESIGN RAINFALL)

Accepted
16/3/09

Table 1-7
Meteorological Data

Design Parameter	Minimum Design	Maximum Design	Units
Rainfall - 24 Hour, 50 Year Event	--	126	mm
-24 Hour, 100 Year Event (Design rainfall parameter may vary depending on local codes or agencies.)		145	mm
Wind Velocity (Maximum sustained wind speed or 3 second gust)	--	40	m/sec
Annual Barometric Pressure Data, adjusted to site elevation		637	mmHg
Ambient Temperature (extremes)	-7.6 DB	42.3 DB	°C
Freeze Protection Design Conditions	-2 DB with 10 kph coincident wind	--	°C
Space Conditioning Ambient Design Temperature (Kendal Station Weather Data, 2.0% summer/99.0% winter)	-1.8 DB	34.5 DB/20 WB	°C

Accepted
16/03/09

Table 4-12
Road Design Component Criteria

Design Component	Criteria
Grading Slope, minimum	1 percent in main plant complex, or as appropriate for surface type, conveying storm runoff away from permanent facilities.
Grading Slope, maximum	8 percent unless Owner agrees to steeper slope.
Drainage Storm Event, unless local code or regulations control	25 year, 24 hour runoff event.
Finish Floor Relative Elevation	150 to 300 mm above 1 percent probability (100 year) storm event.
Channels, ditches	Trapezoidal cross section, designed to reduce erosion.
Culverts	Reinforced concrete, corrugated metal, or corrugated high density polyethylene (HDPE) pipes; reinforced concrete box where necessary.
Detention, Retention, and Evaporation Pond Storm Event, unless local code or regulations control	50 year, 24 hour runoff event.
Roads, main plant access	Two 3,000 mm asphalt paved lanes, optional 900 mm aggregate surfaced shoulders.
Roads, other than main plant access	Two 3,000 mm aggregate surfaced lanes, no shoulders.

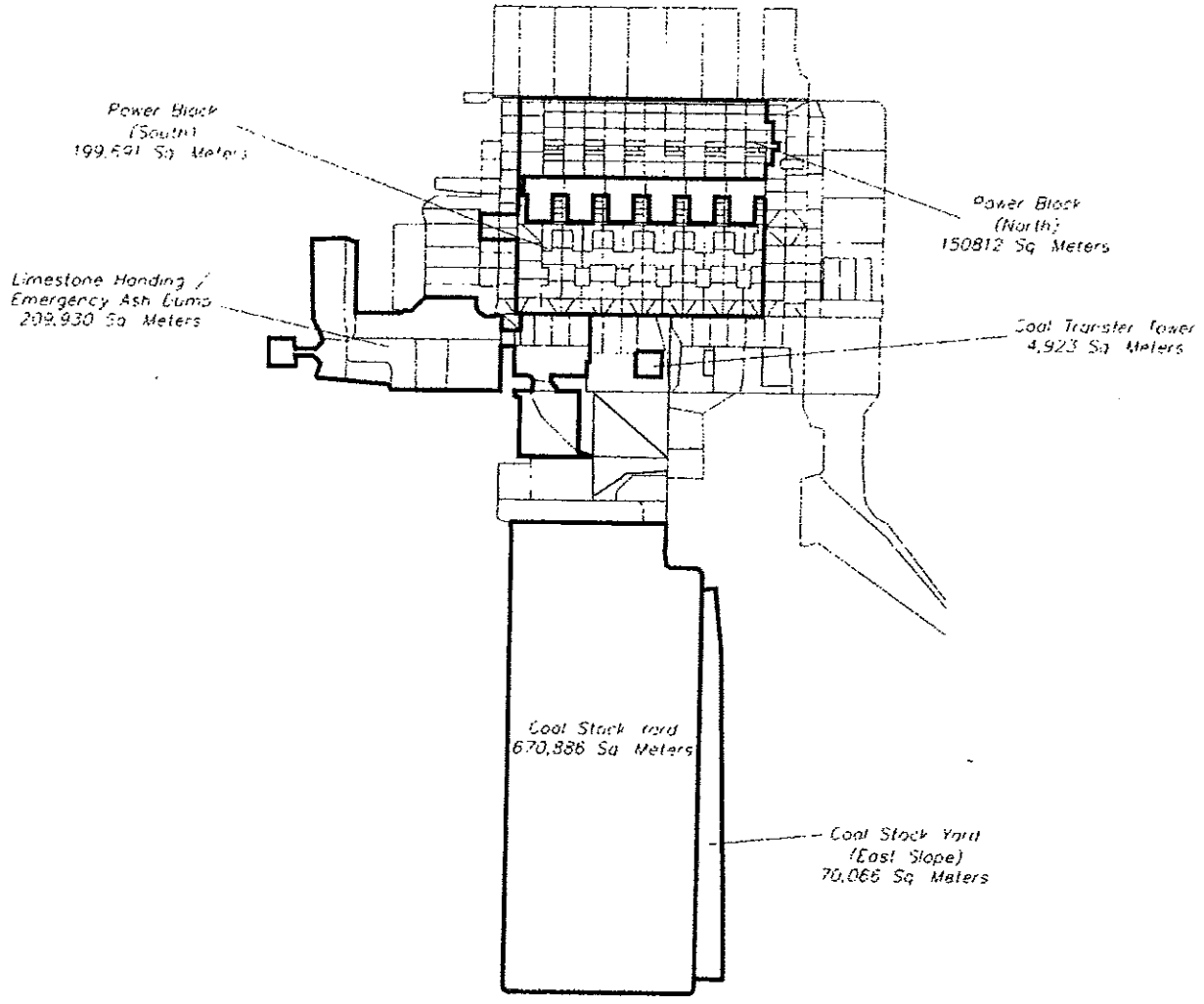
Accepted:
16/03/09

APPENDIX B
CATCHMENT AREA MAP

accepted.
16/03/09

BLACK & VEATCH

Owner:	Eskom			Computed By.	S. M. Reitz
Plant.	Kusile Power Station	Unit No.:		Date:	03/13/2009
Project No.:	146838	File No.:	52.5427.1101.01	Verified By:	DJS
Title:	Station Dirty Dam Volume			Date:	3/13/2009
				Page.	B2 of B2



Accepted:
16/03/09

DRAWING IS BASED ON THE PROJECT NCONMODEL, FMODEL, AND CIVMODEL DATED MARCH 13, 2009

APPENDIX C

SLOPE STABILITY ANALYSIS RESULTS

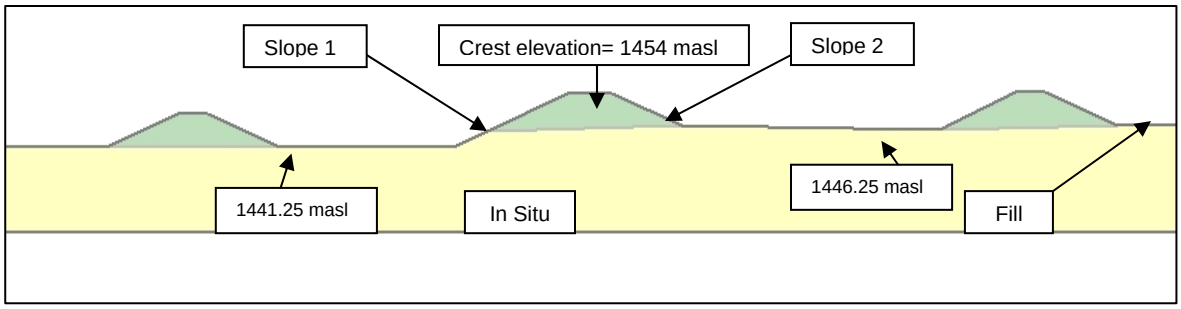


Figure 1.1: Cross section 1

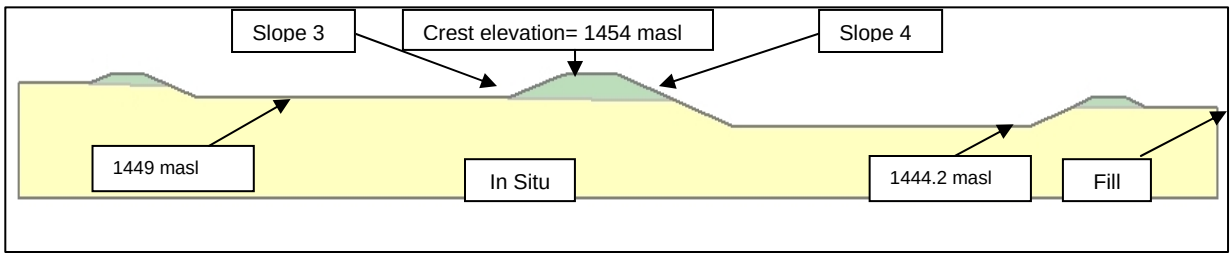


Figure 1.2: Cross section 2

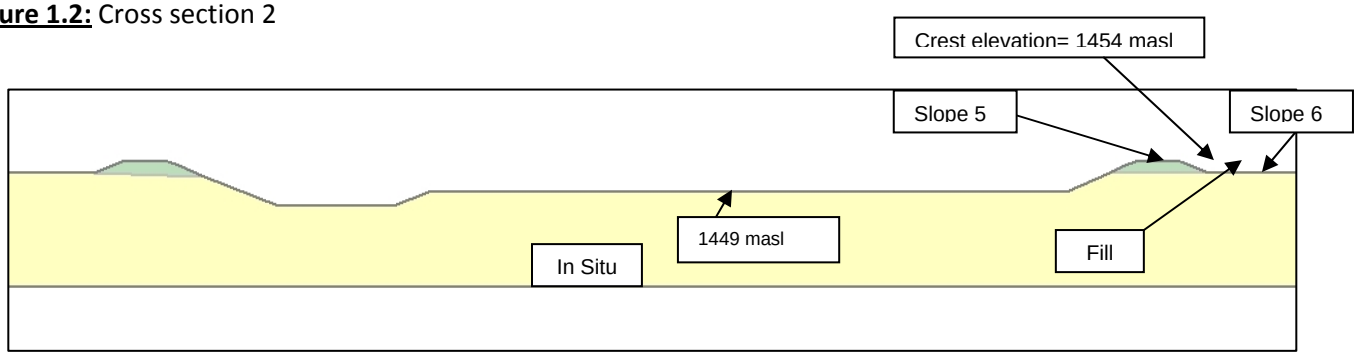


Figure 1.3: Cross section 3

The following materials were used as part of the analysis as they comprised the wall.

Table 1.1: Material Properties used for stability analysis

Material	γ(kN/m$^{3)}$	ϕ(°)	c
In-Situ	16.5	27	10
Fill	18.5	30	0

SECTION 1

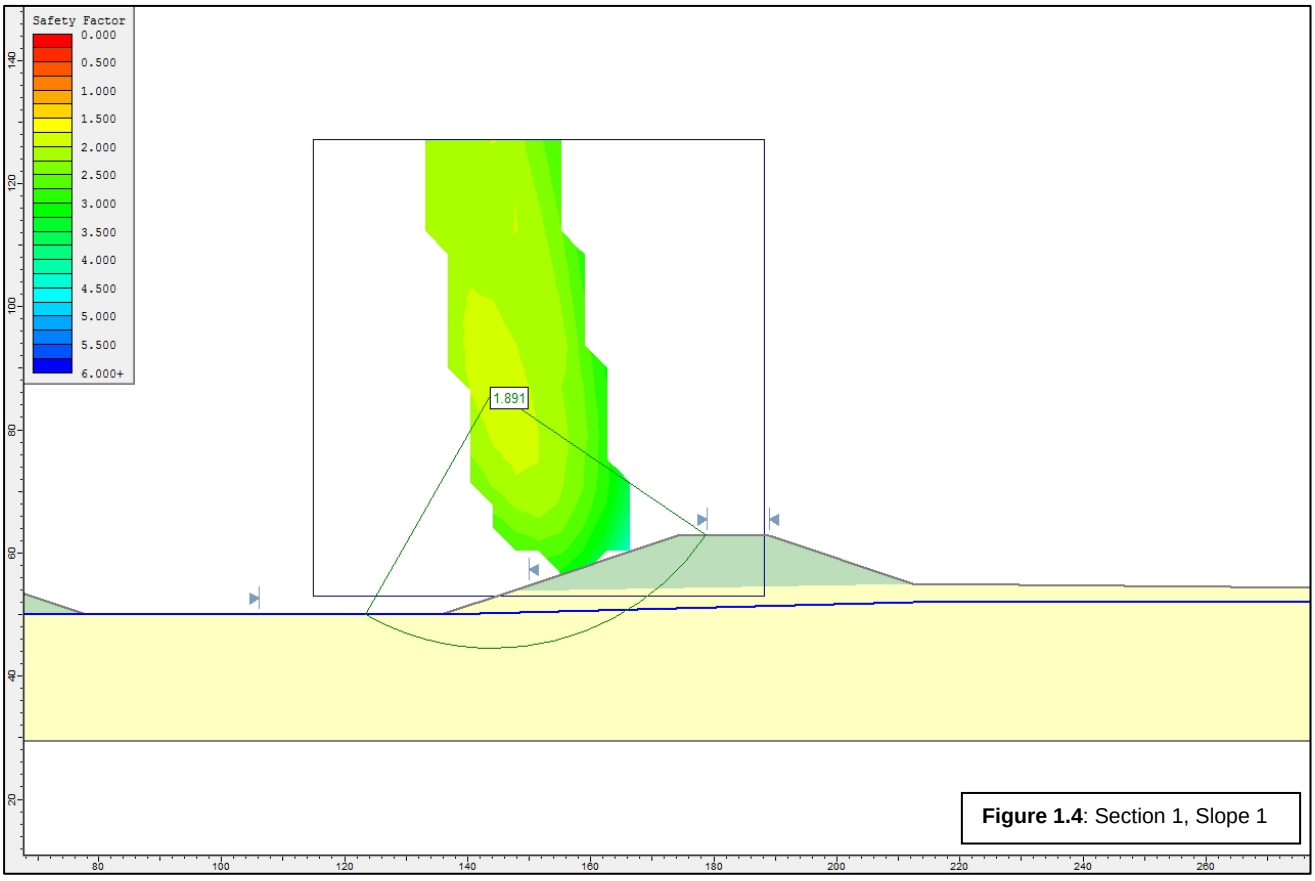


Figure 1.4: Section 1, Slope 1

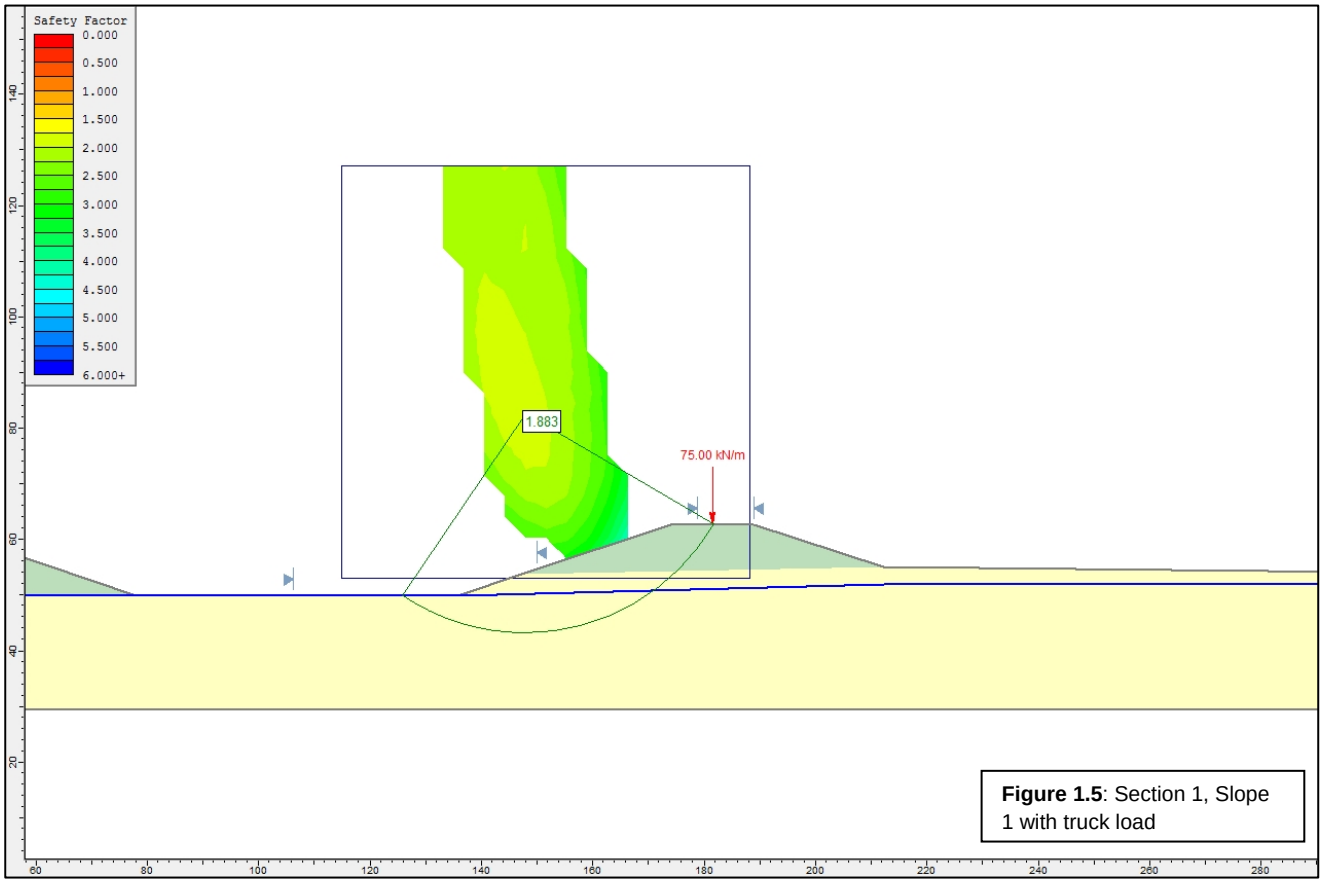


Figure 1.5: Section 1, Slope 1 with truck load

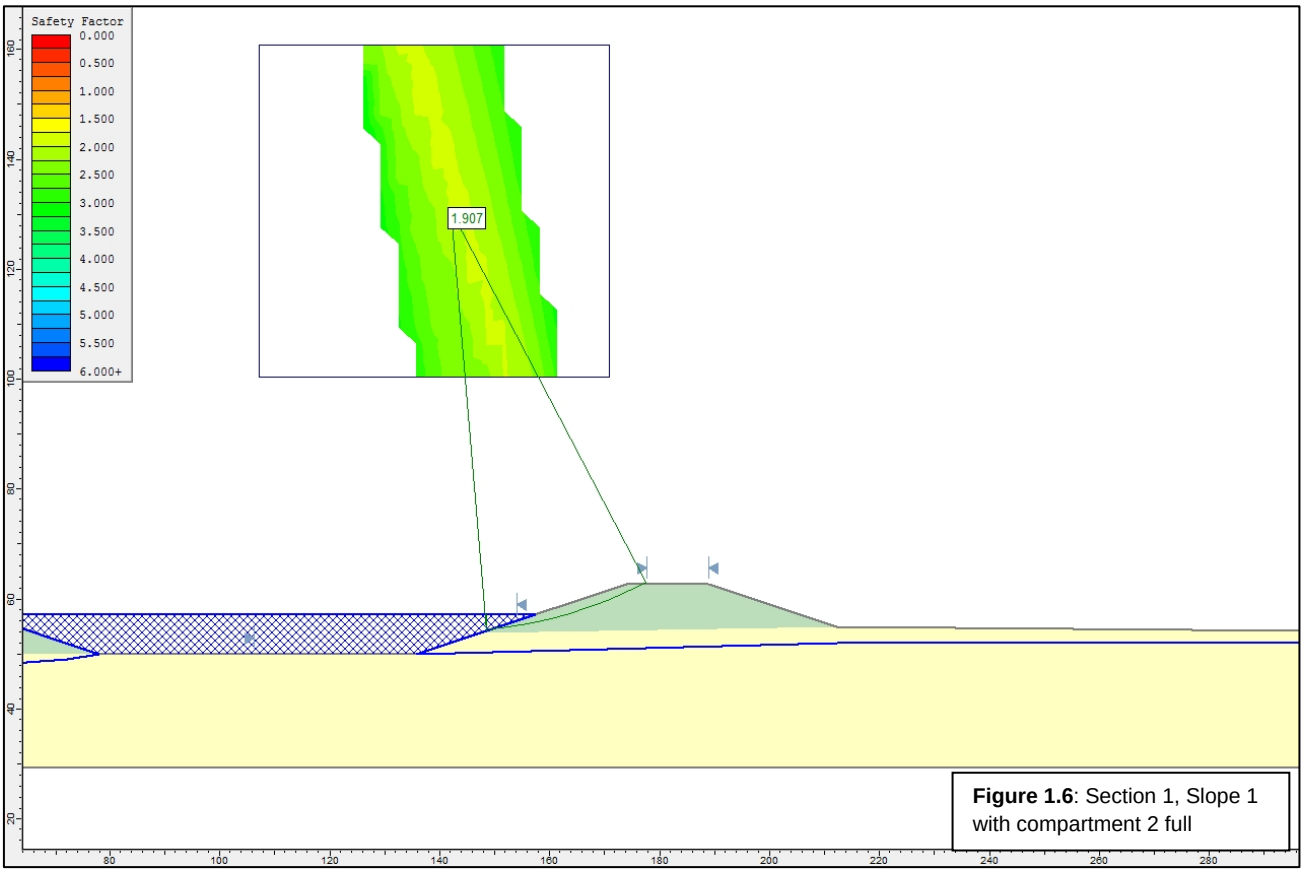


Figure 1.6: Section 1, Slope 1 with compartment 2 full

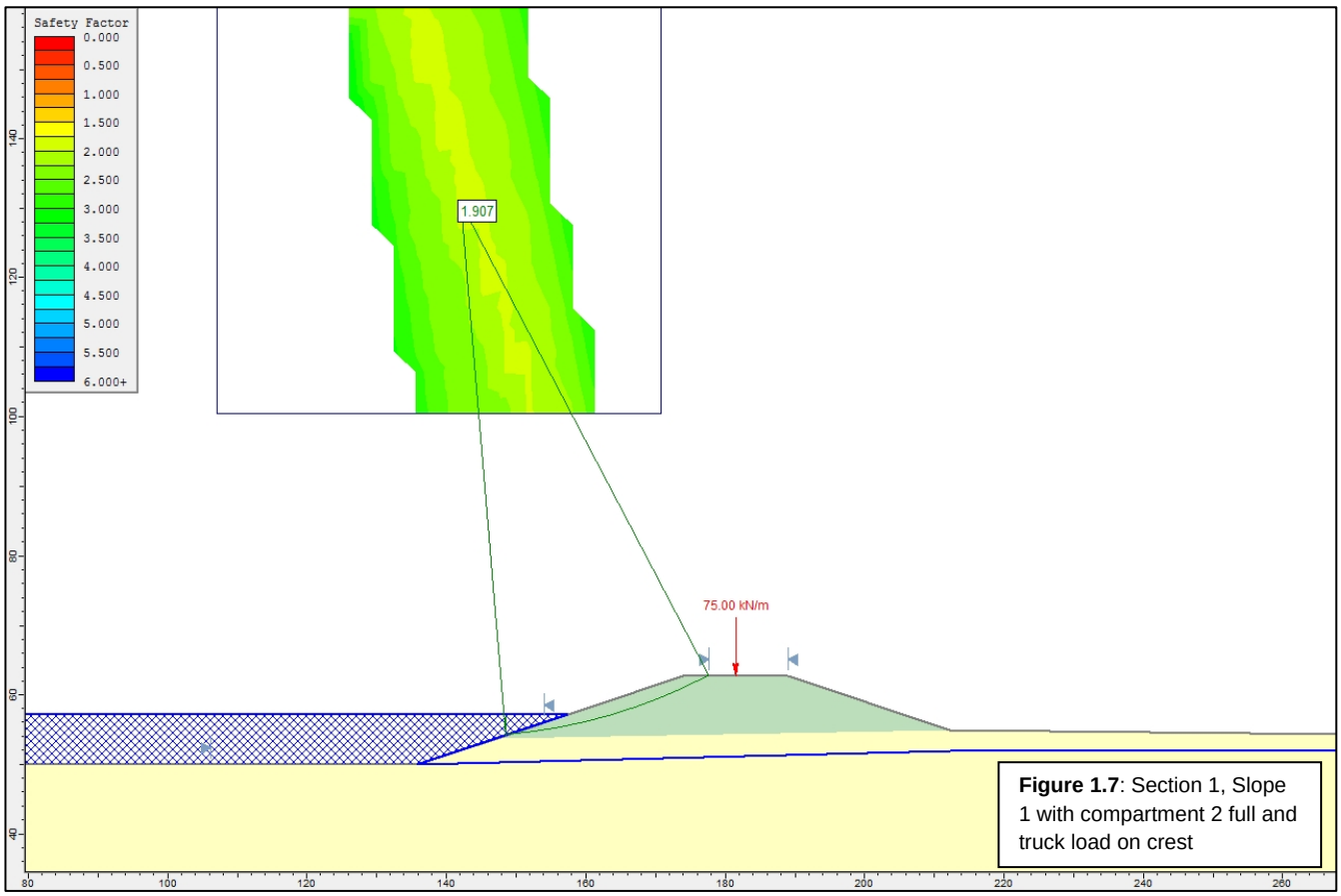


Figure 1.7: Section 1, Slope 1 with compartment 2 full and truck load on crest

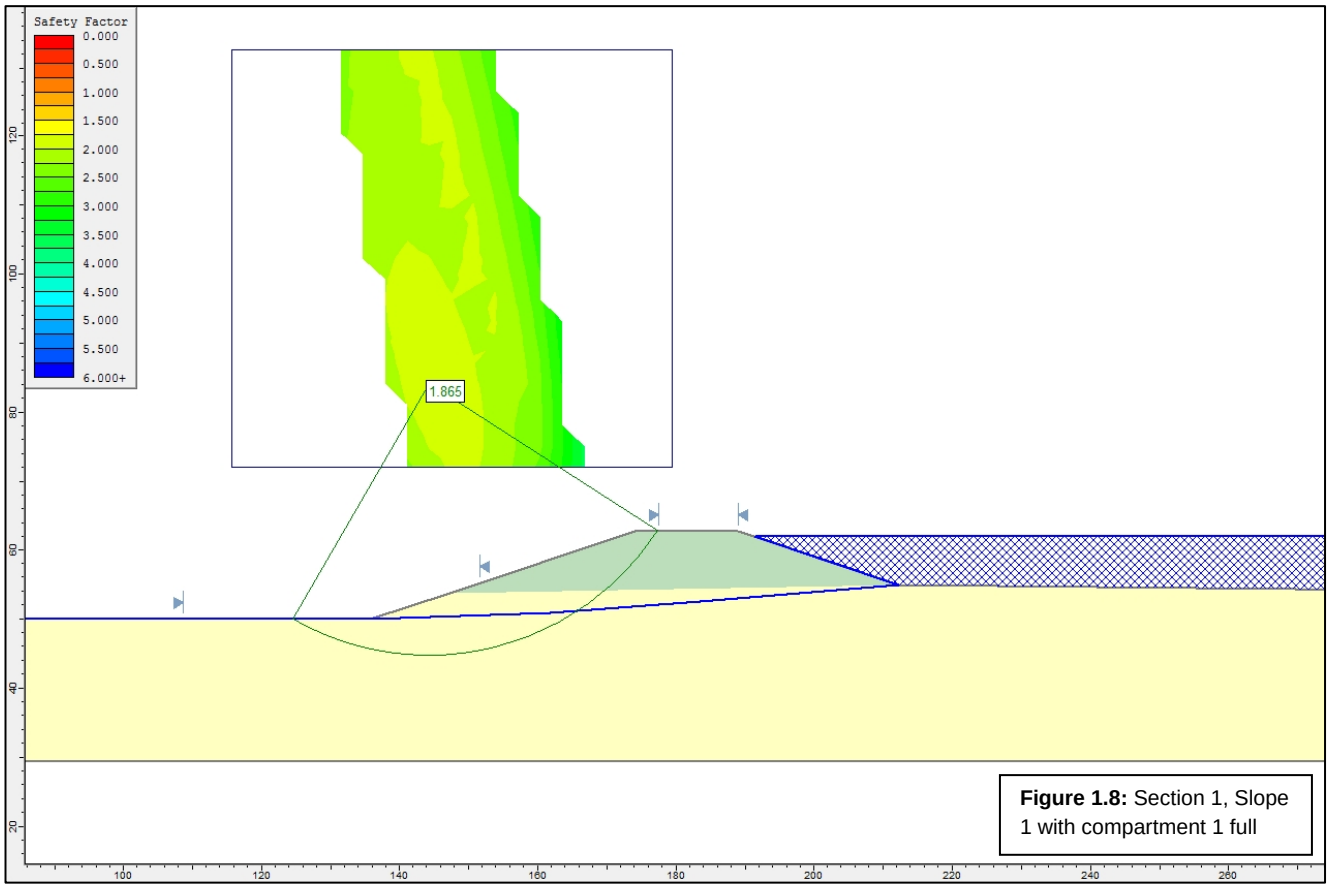


Figure 1.8: Section 1, Slope 1 with compartment 1 full

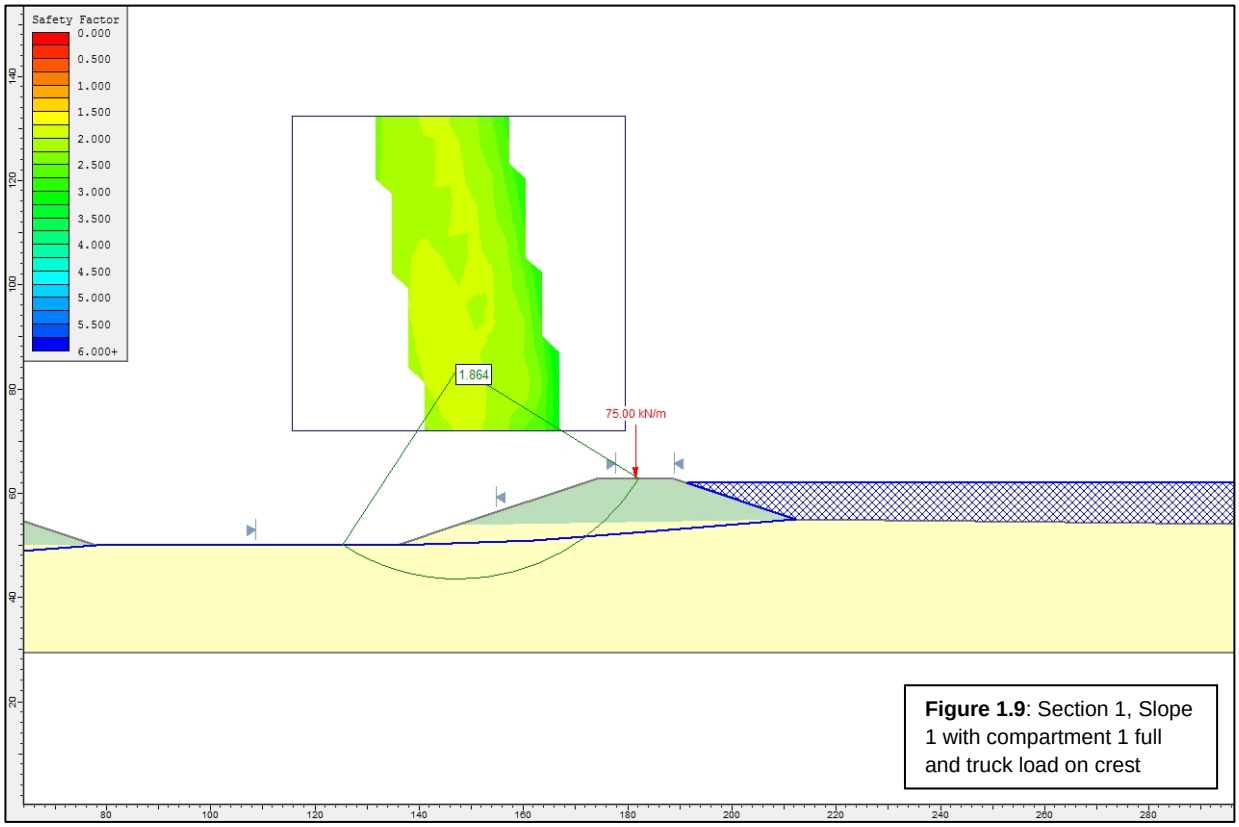


Figure 1.9: Section 1, Slope 1 with compartment 1 full and truck load on crest

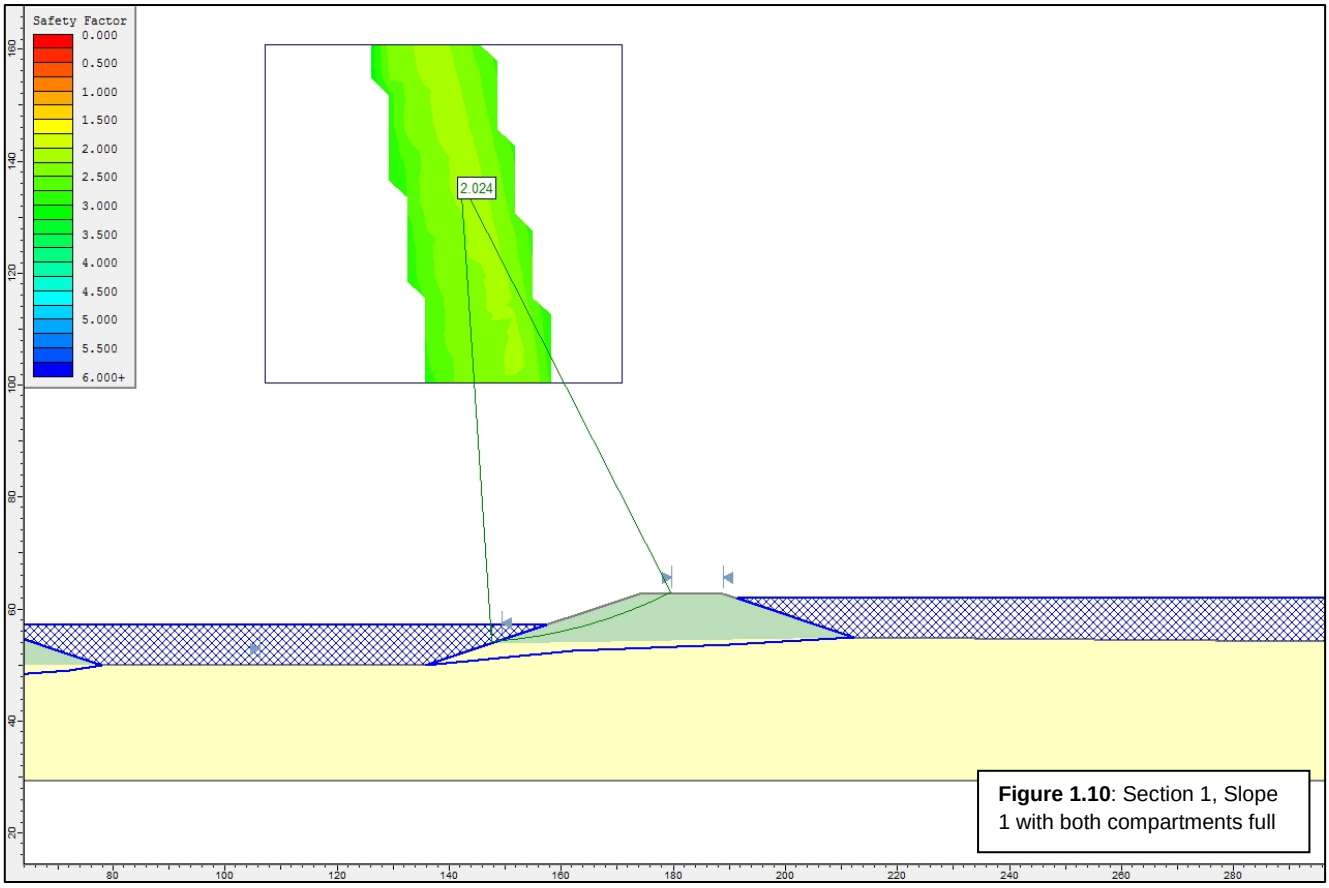


Figure 1.10: Section 1, Slope 1 with both compartments full

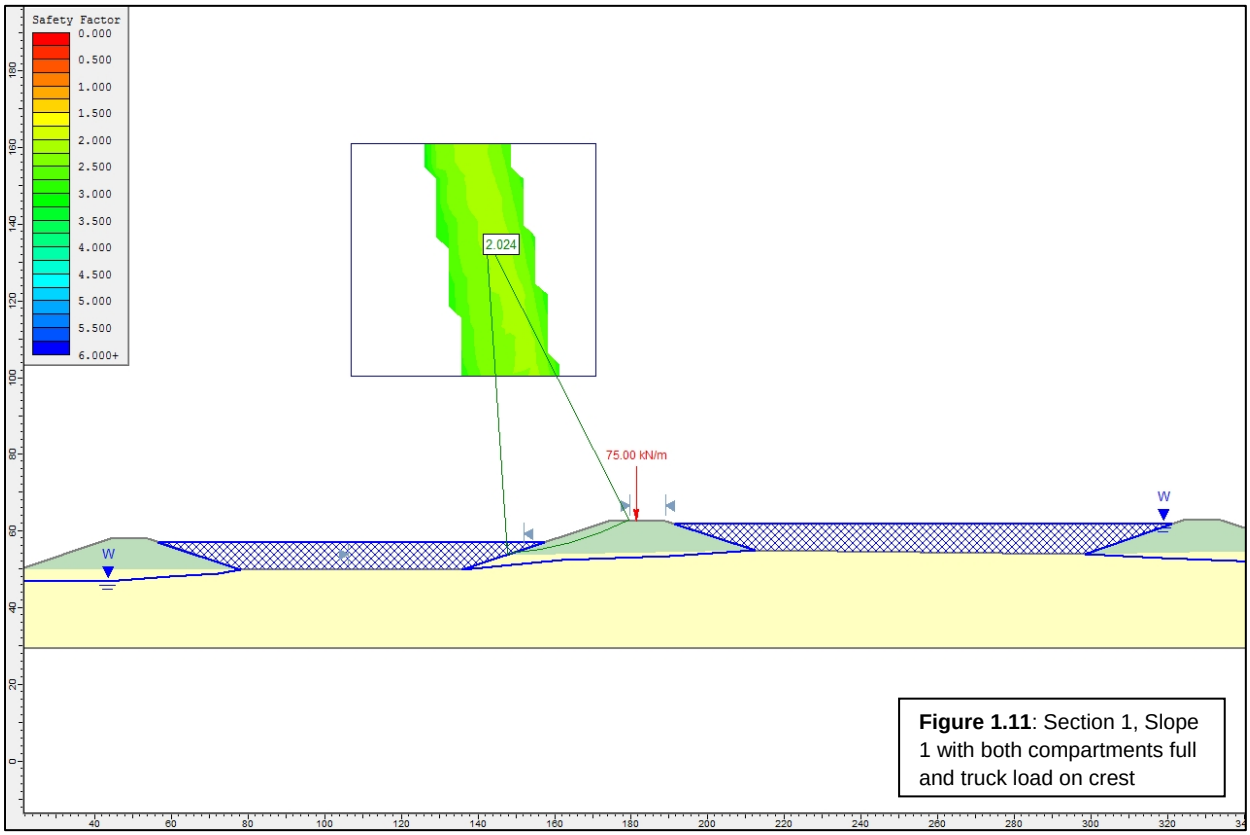


Figure 1.11: Section 1, Slope 1 with both compartments full and truck load on crest

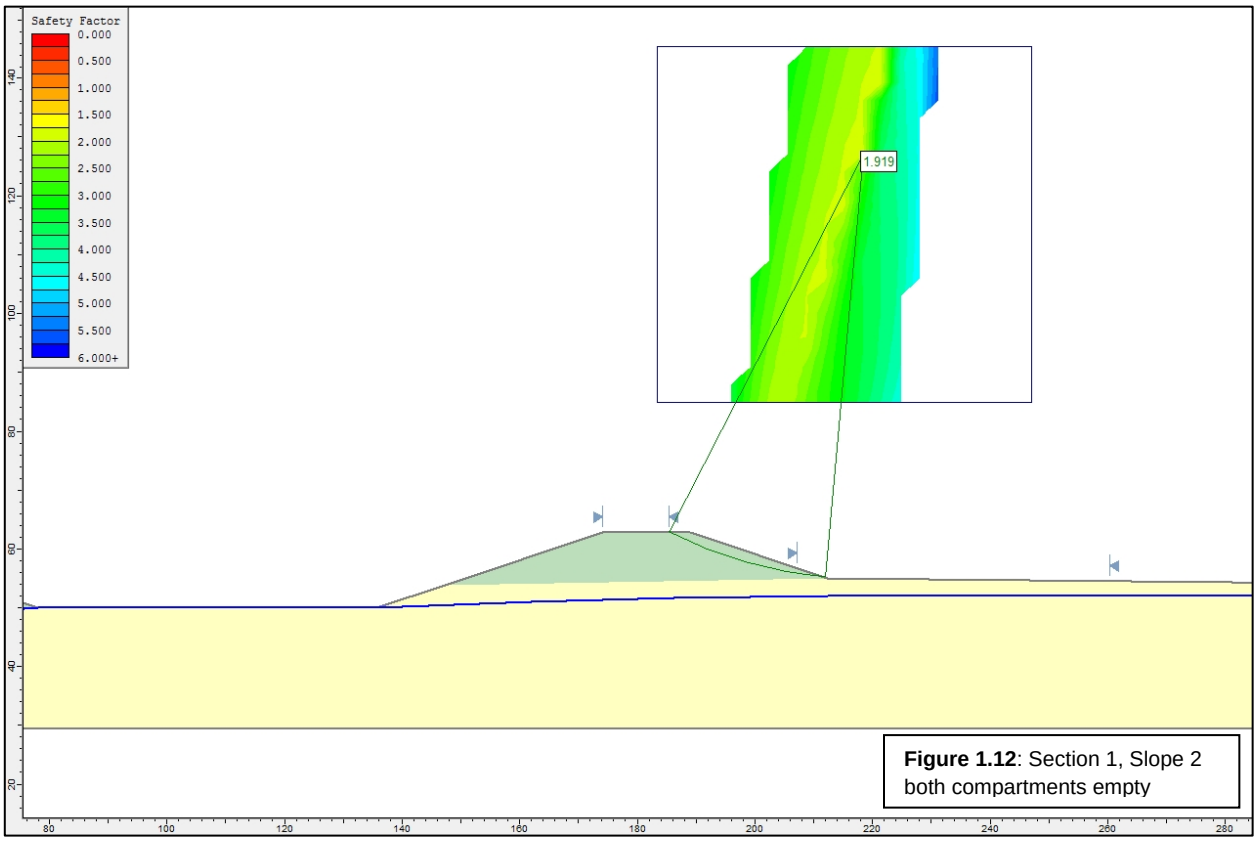


Figure 1.12: Section 1, Slope 2 both compartments empty

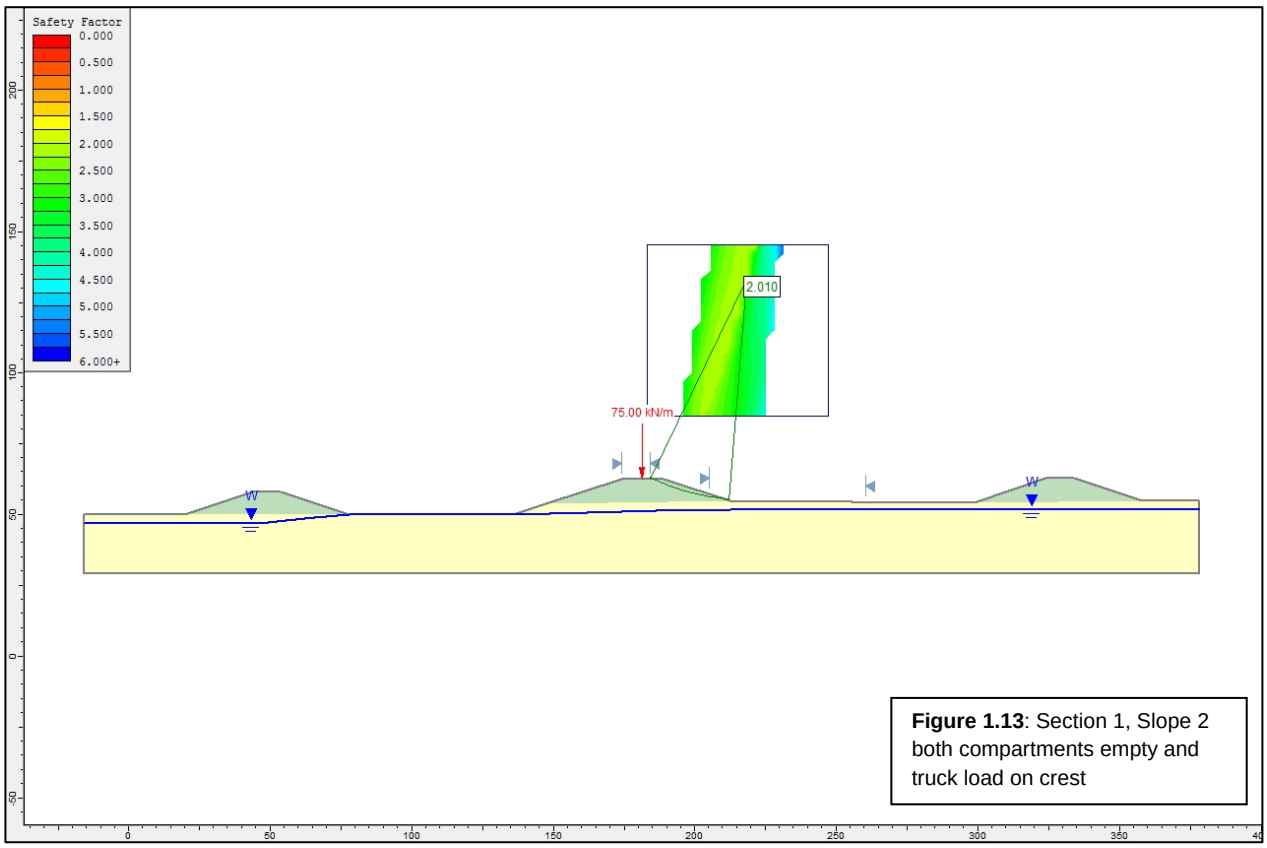


Figure 1.13: Section 1, Slope 2 both compartments empty and truck load on crest

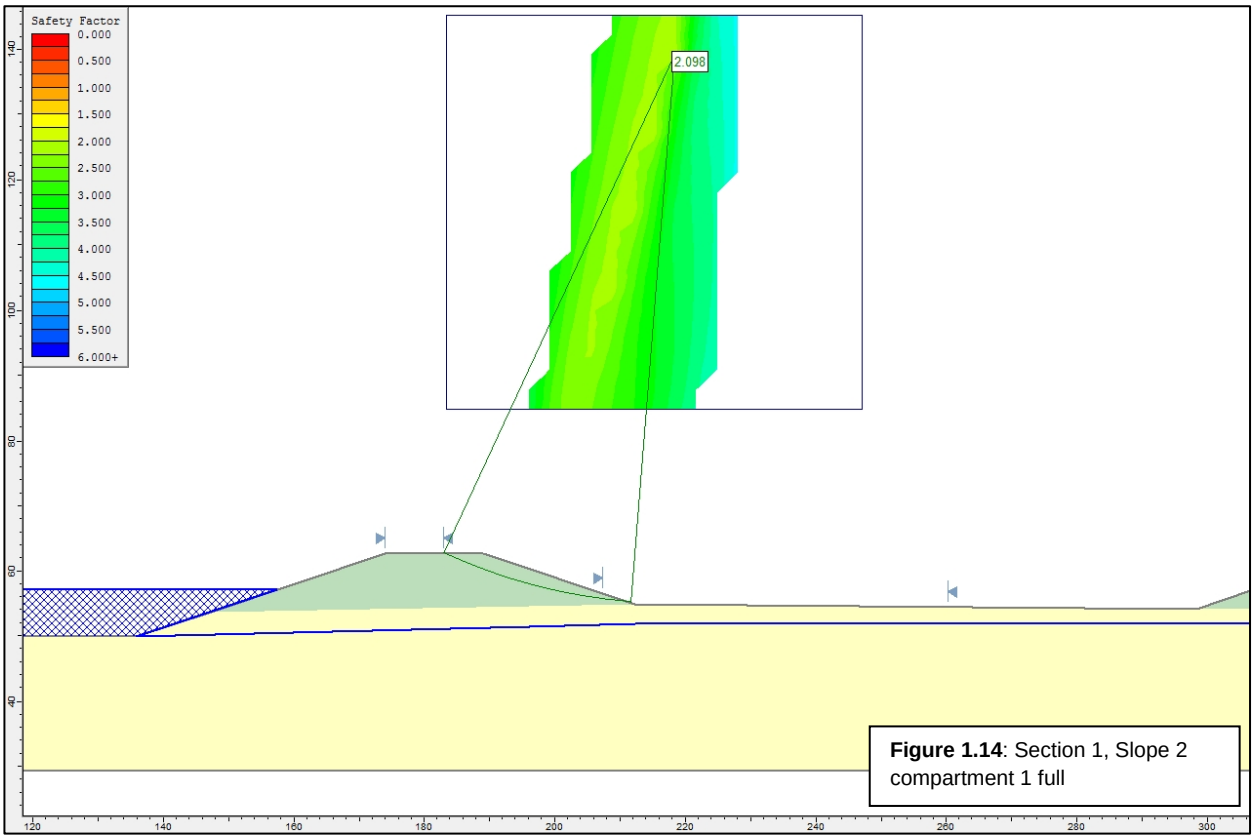


Figure 1.14: Section 1, Slope 2 compartment 1 full

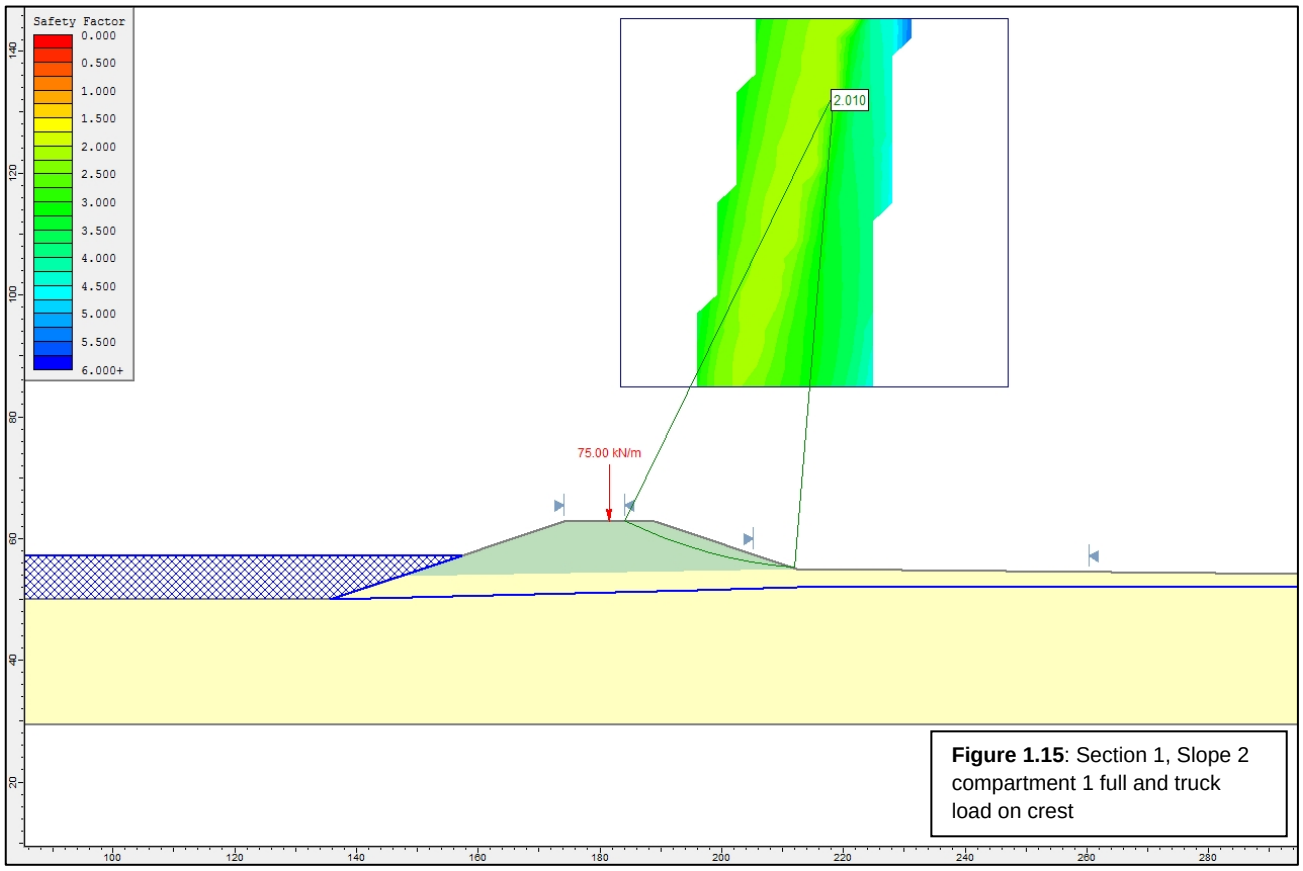


Figure 1.15: Section 1, Slope 2 compartment 1 full and truck load on crest

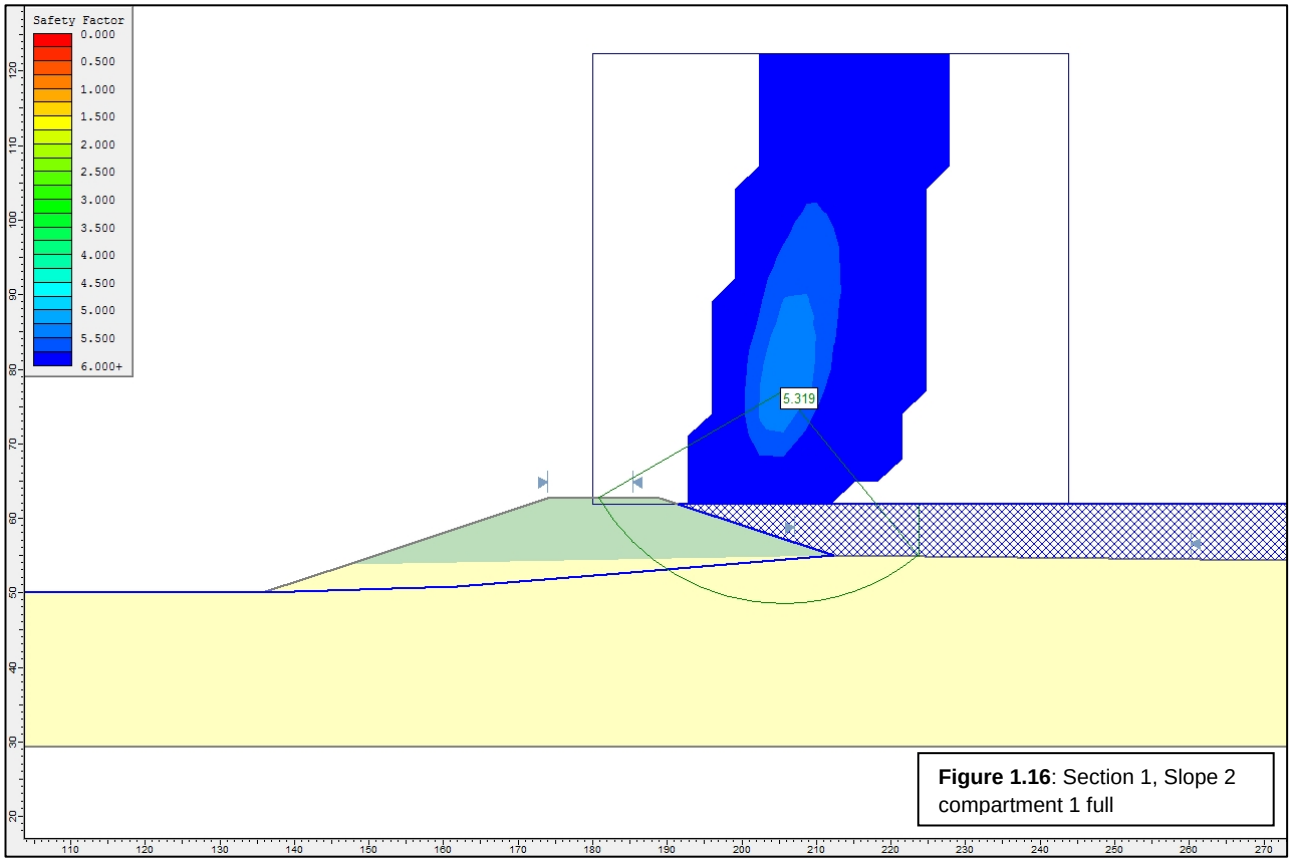


Figure 1.16: Section 1, Slope 2 compartment 1 full

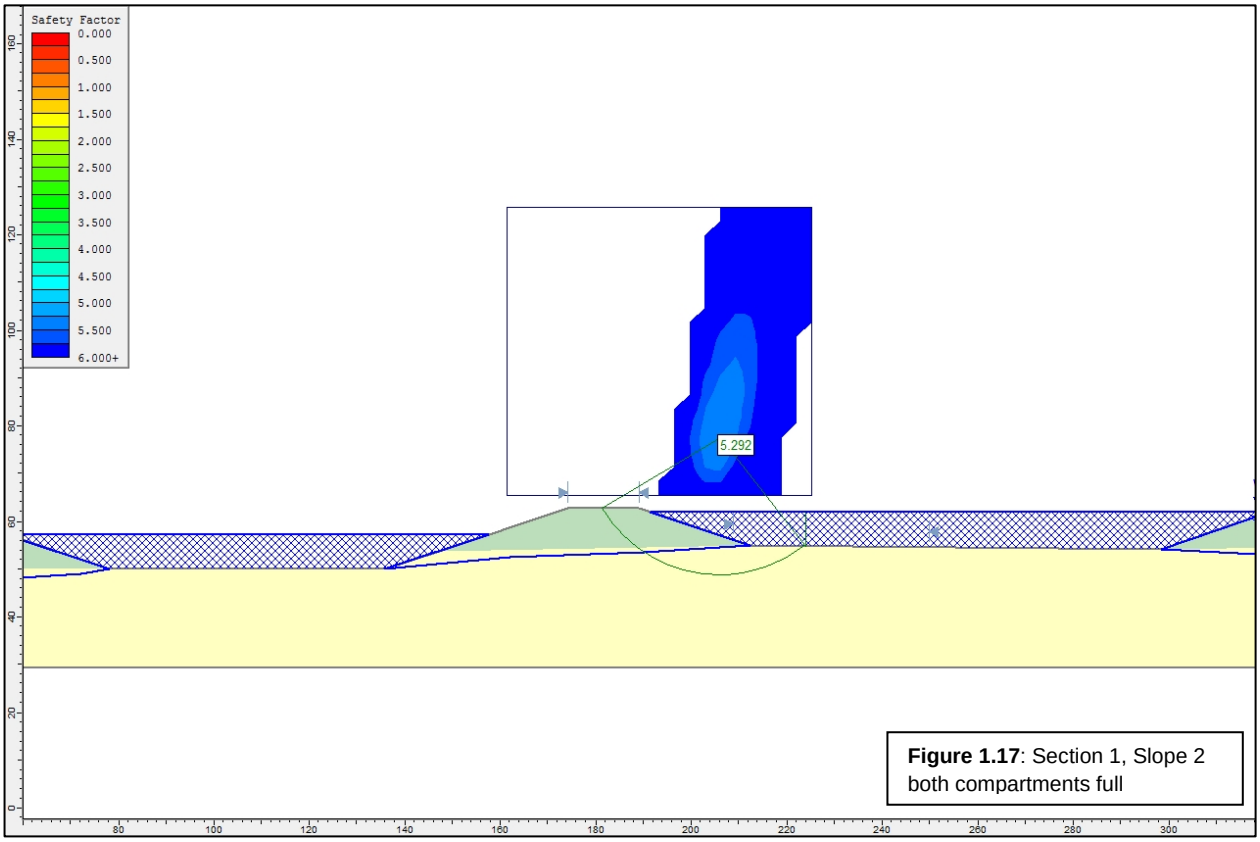


Figure 1.17: Section 1, Slope 2 both compartments full

SECTION 2

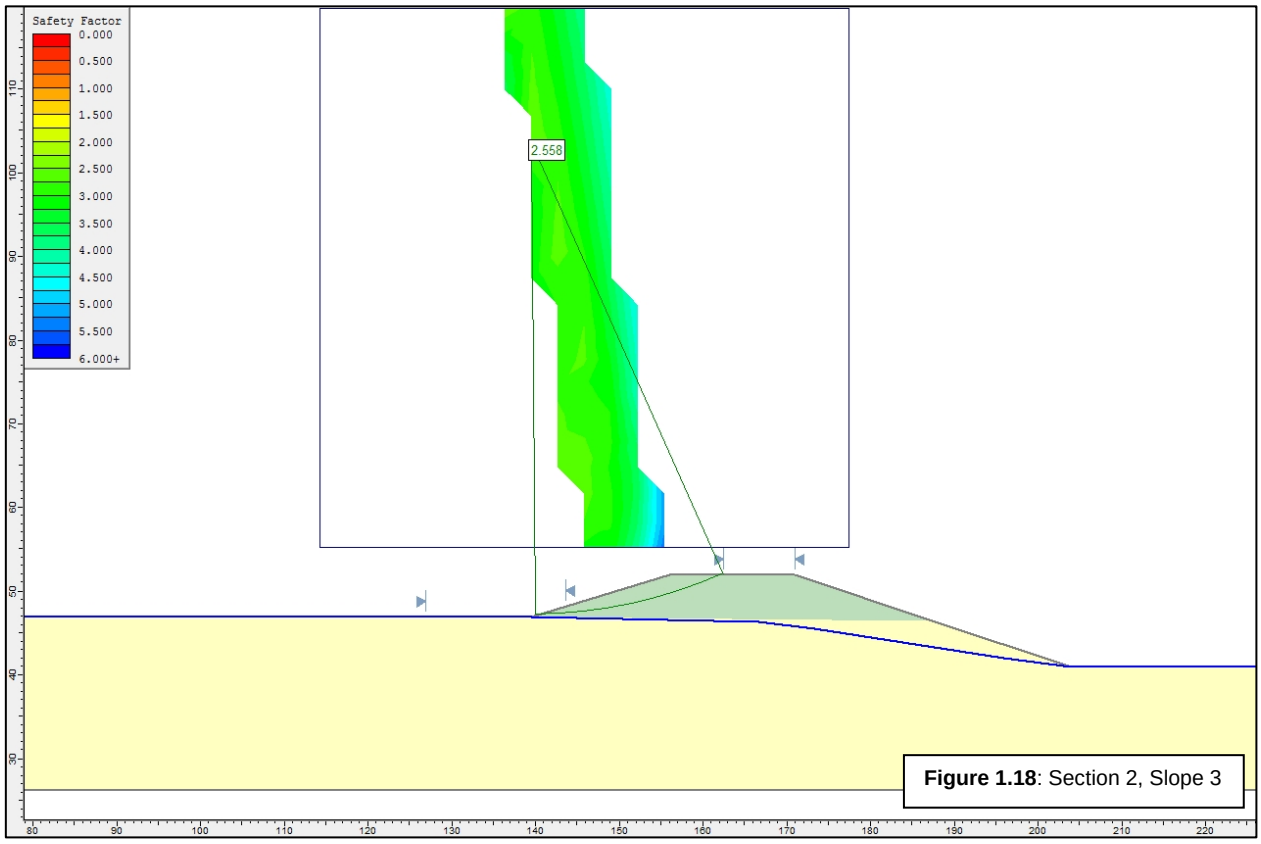


Figure 1.18: Section 2, Slope 3

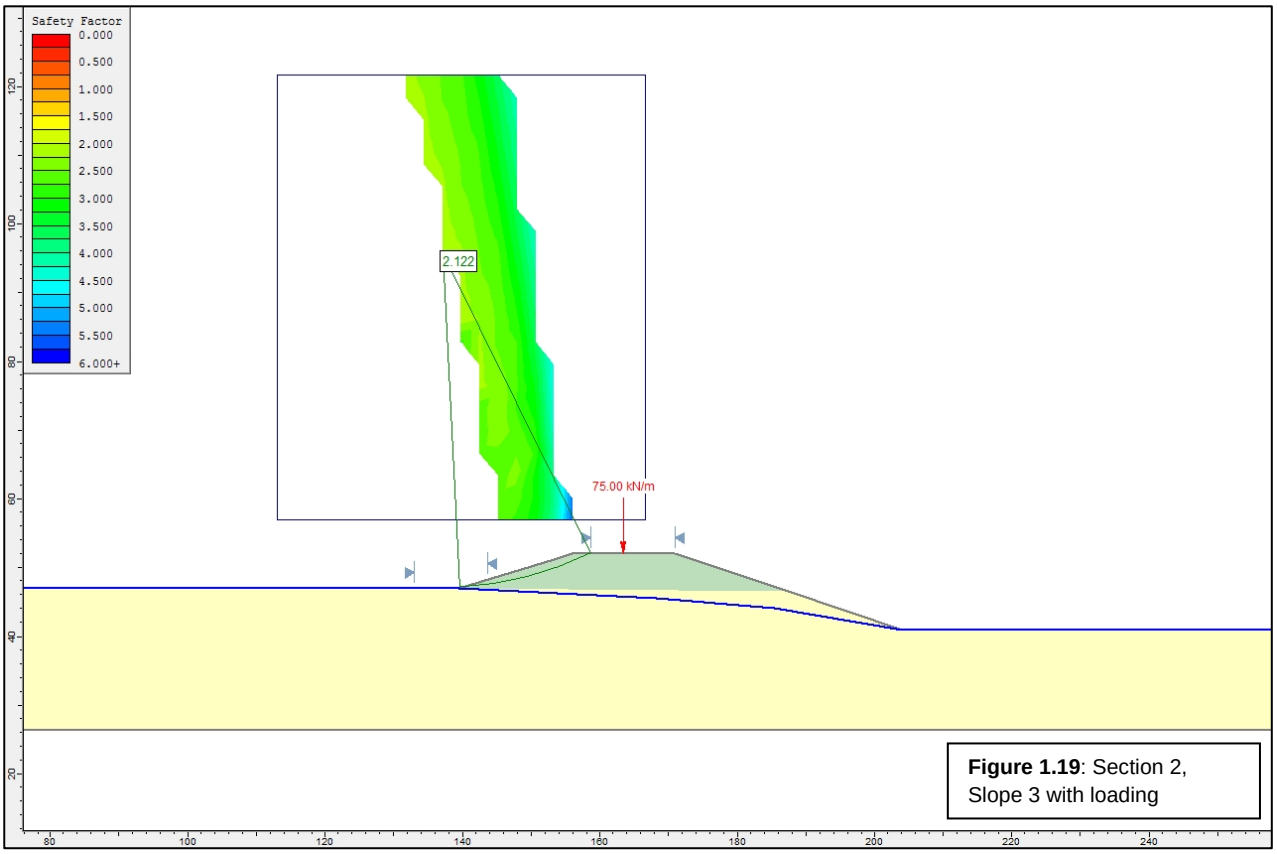


Figure 1.19: Section 2, Slope 3 with loading

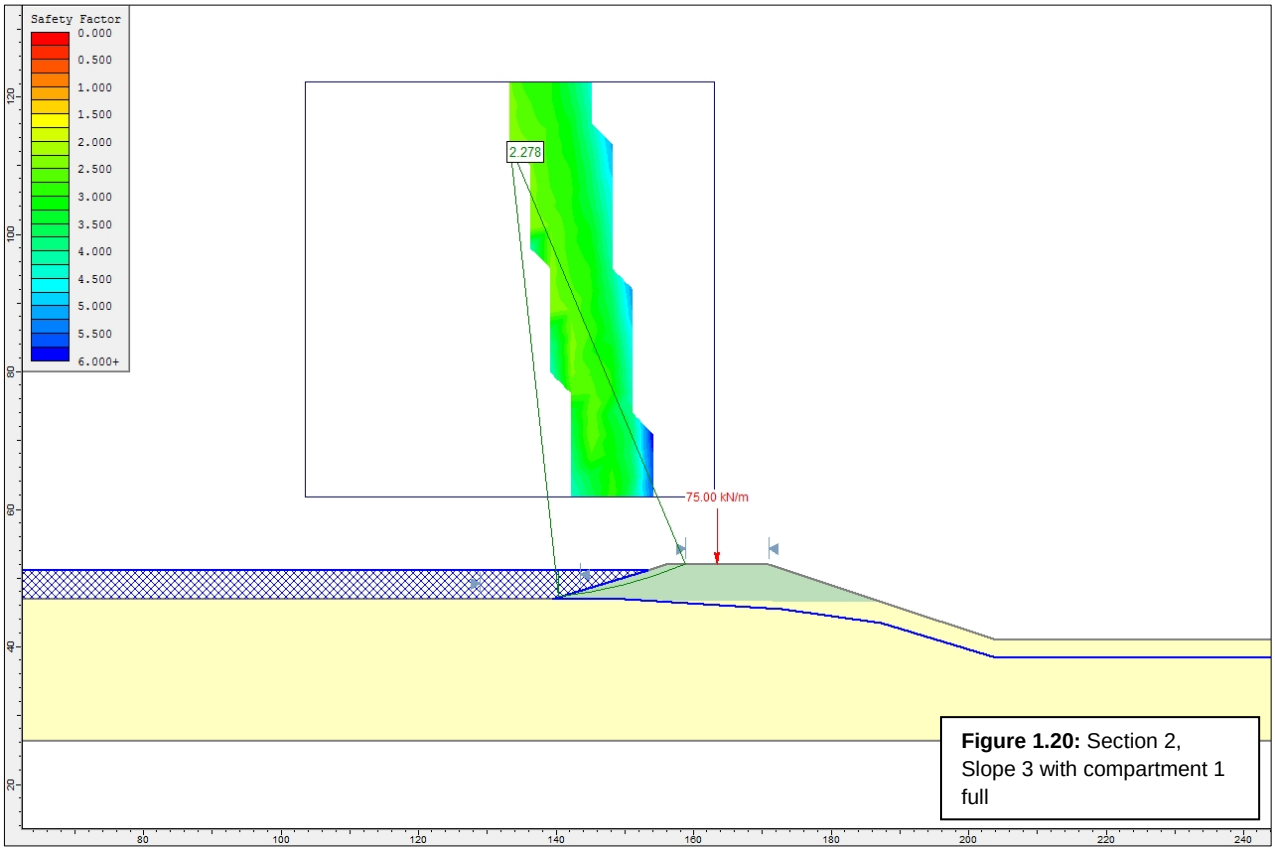


Figure 1.20: Section 2, Slope 3 with compartment 1 full

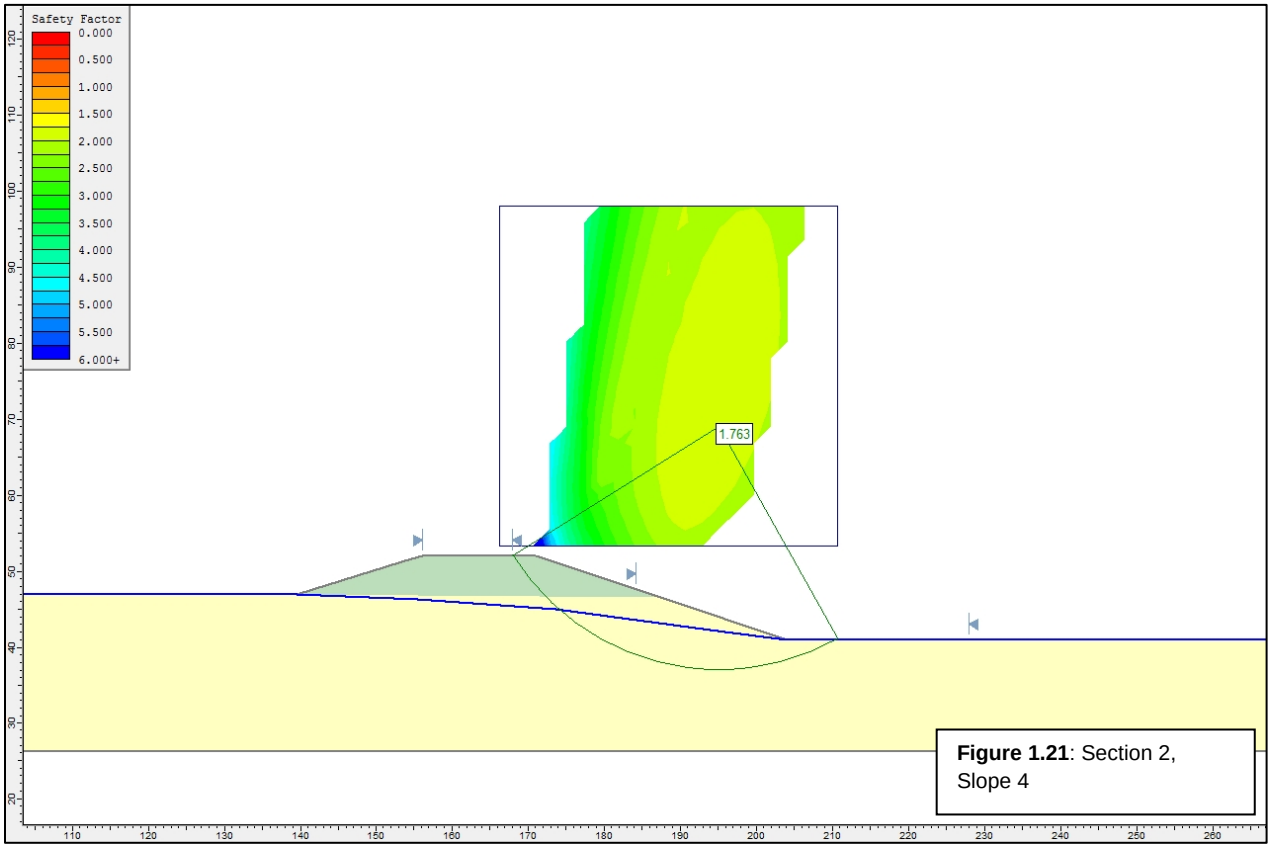


Figure 1.21: Section 2, Slope 4

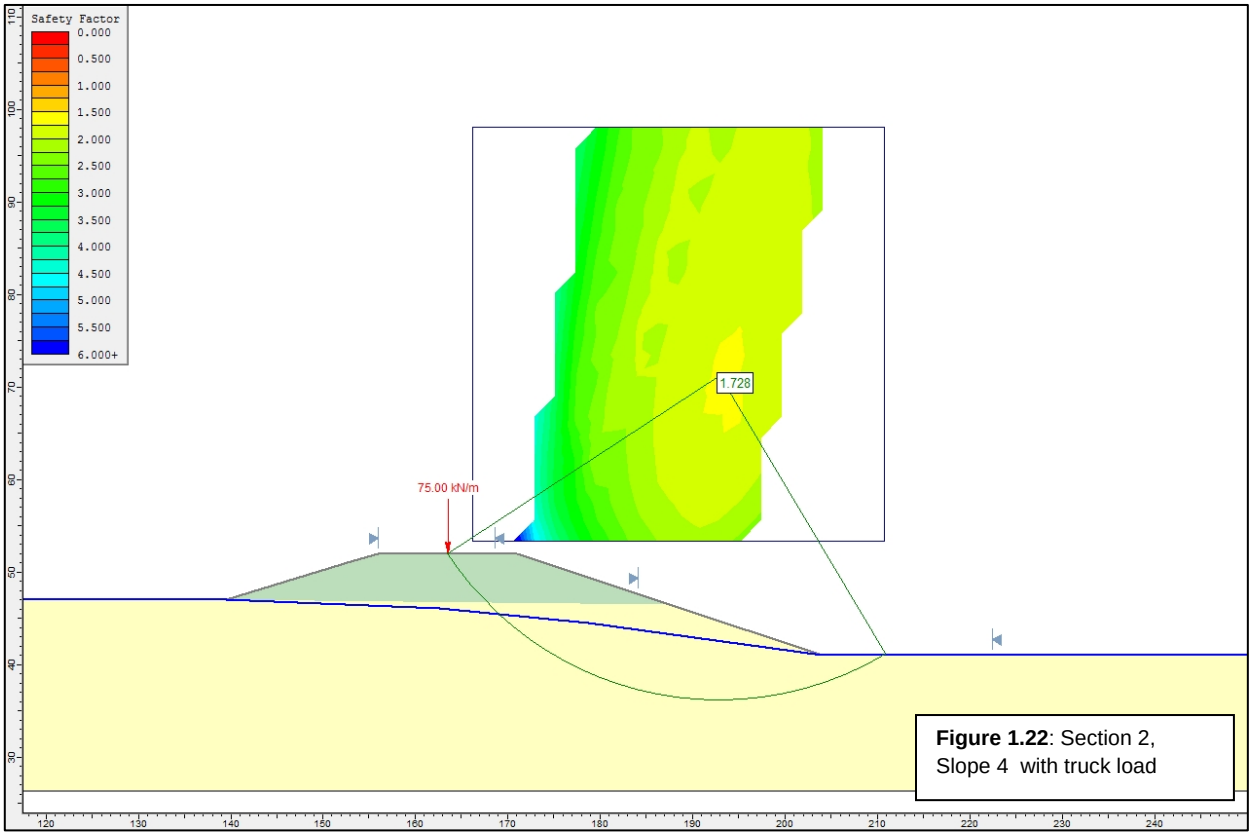


Figure 1.22: Section 2, Slope 4 with truck load

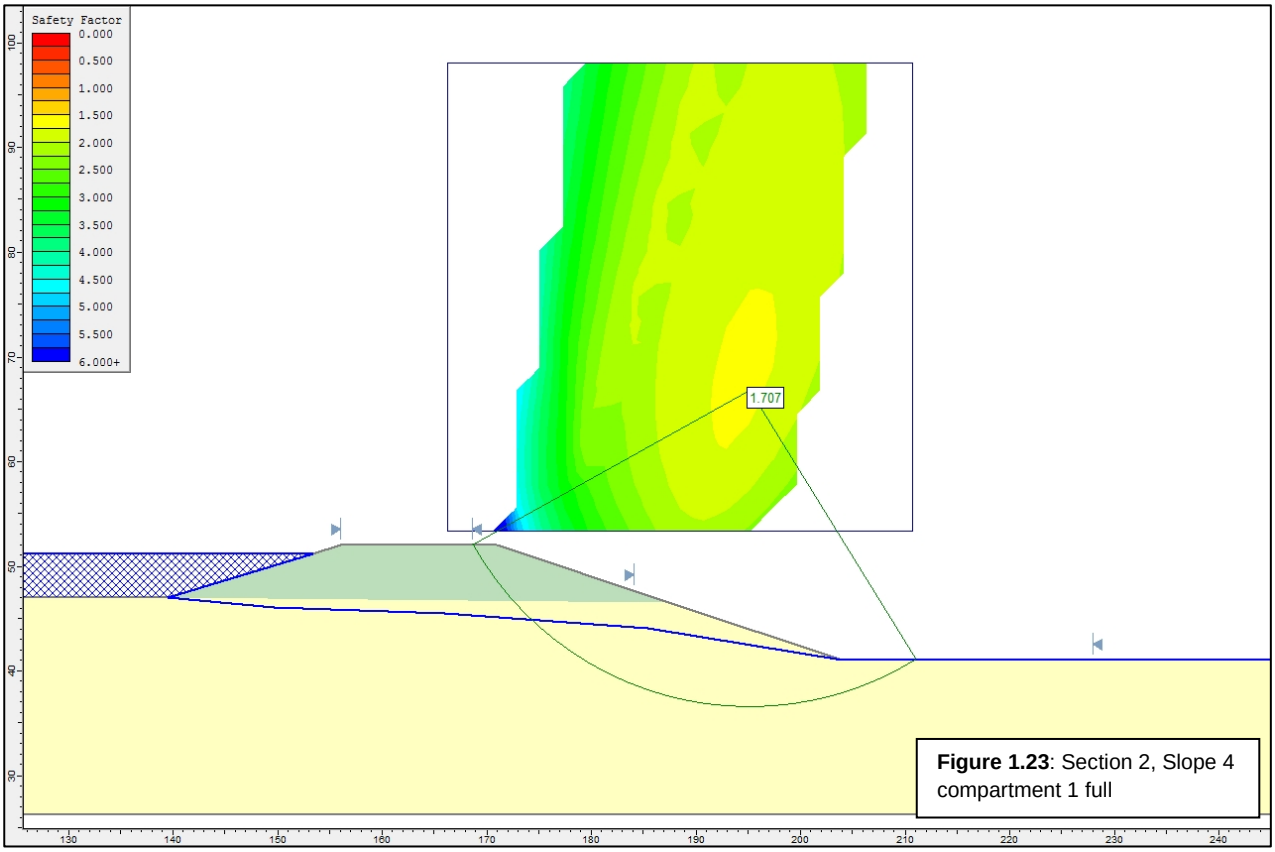


Figure 1.23: Section 2, Slope 4 compartment 1 full

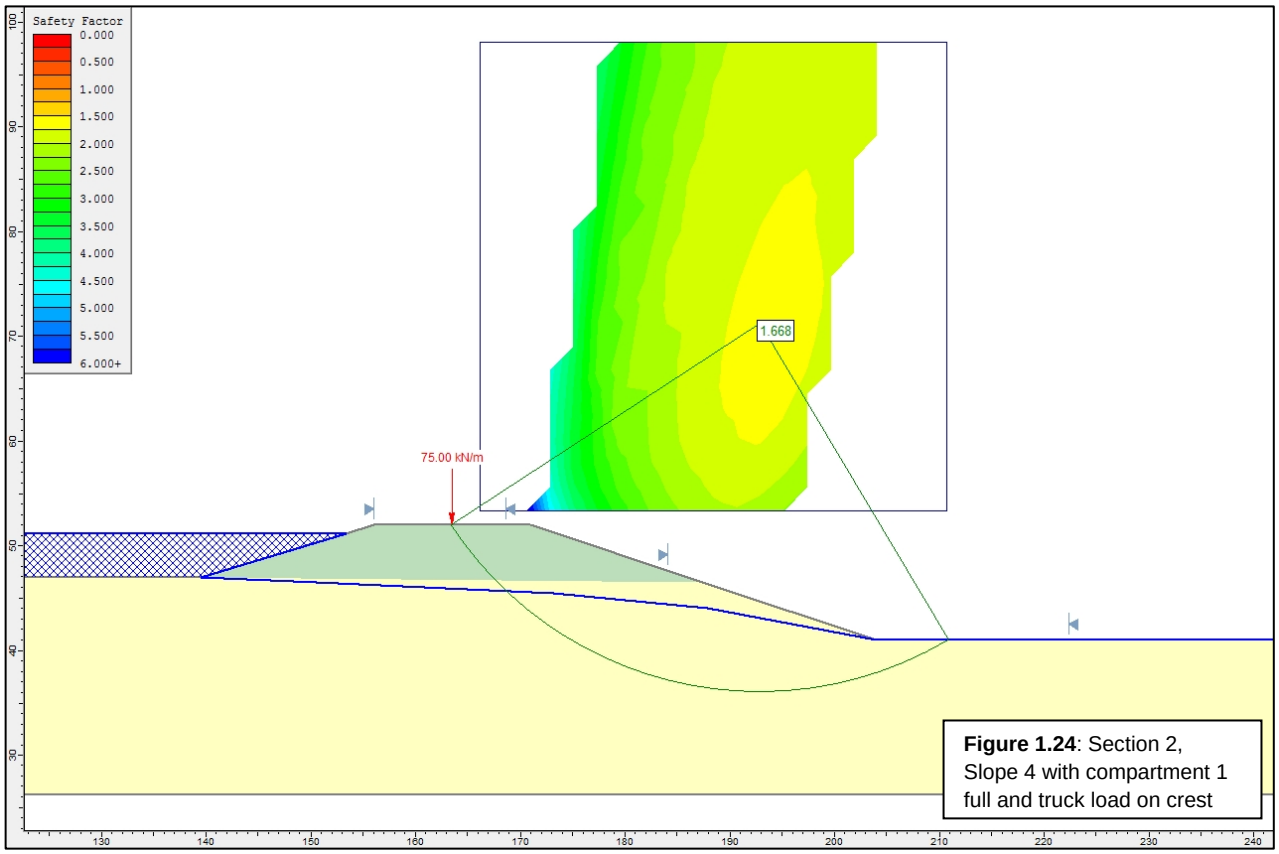


Figure 1.24: Section 2, Slope 4 with compartment 1 full and truck load on crest

SECTION 3

NOTE: Scale different to above graphical sections and thus sections may appear bigger and water table deeper but it's the same depth(3m) as all above sections.

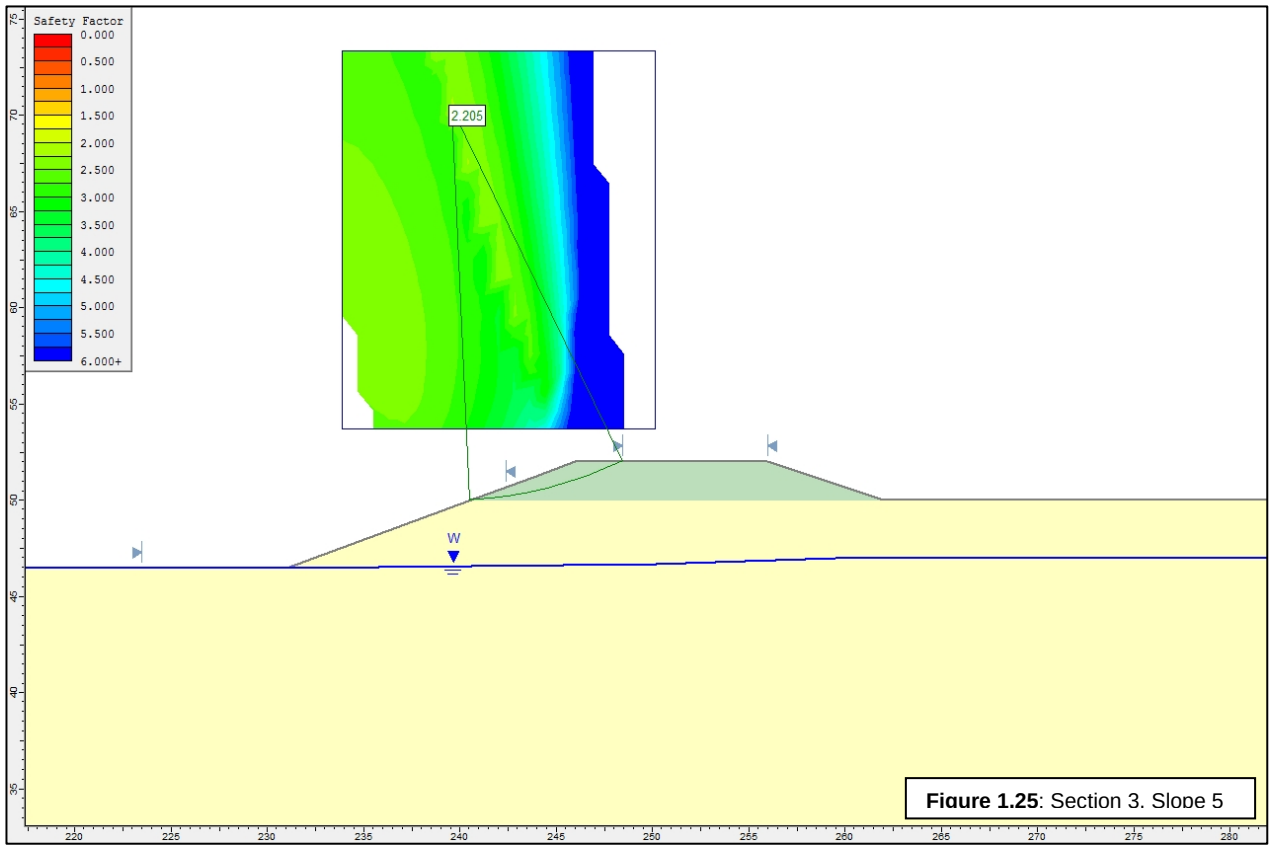


Figure 1.25: Section 3. Slope 5

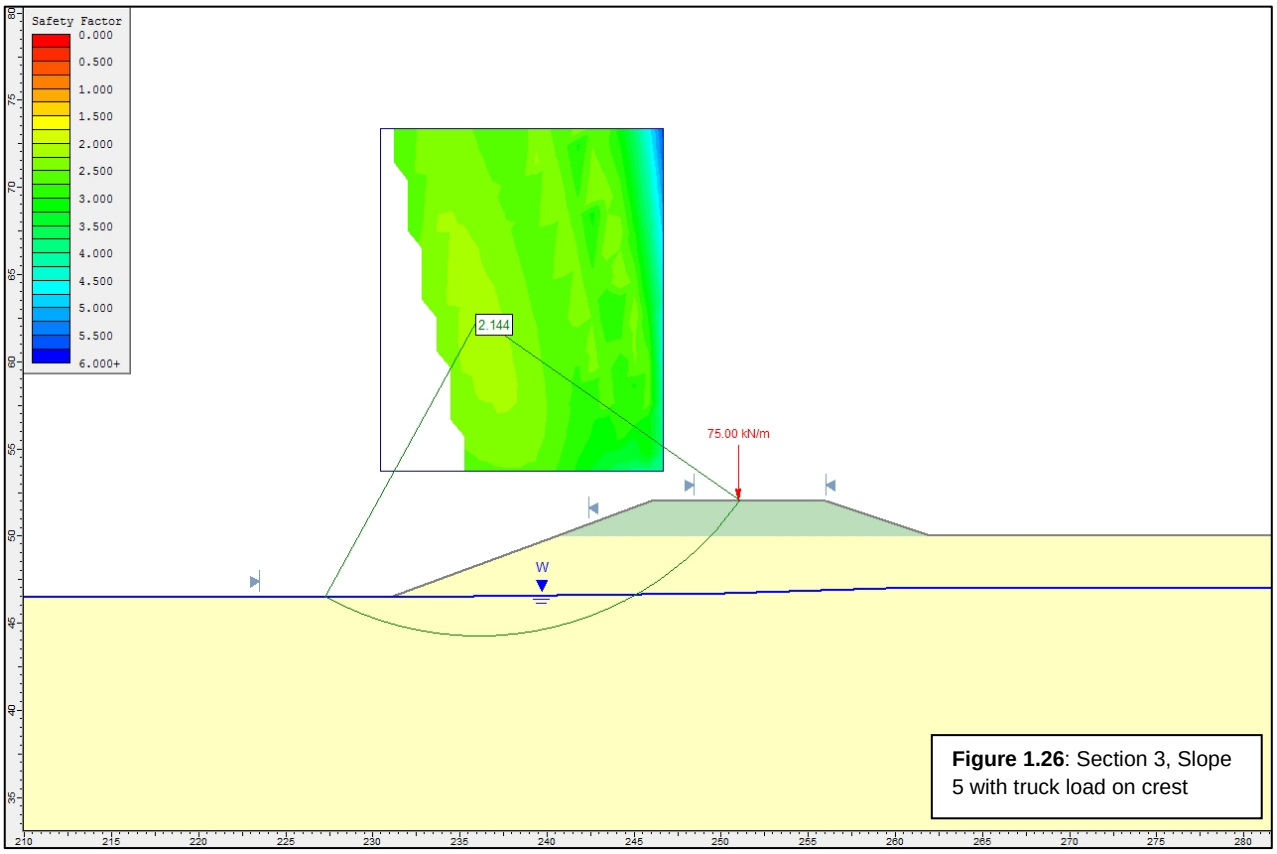


Figure 1.26: Section 3, Slope 5 with truck load on crest

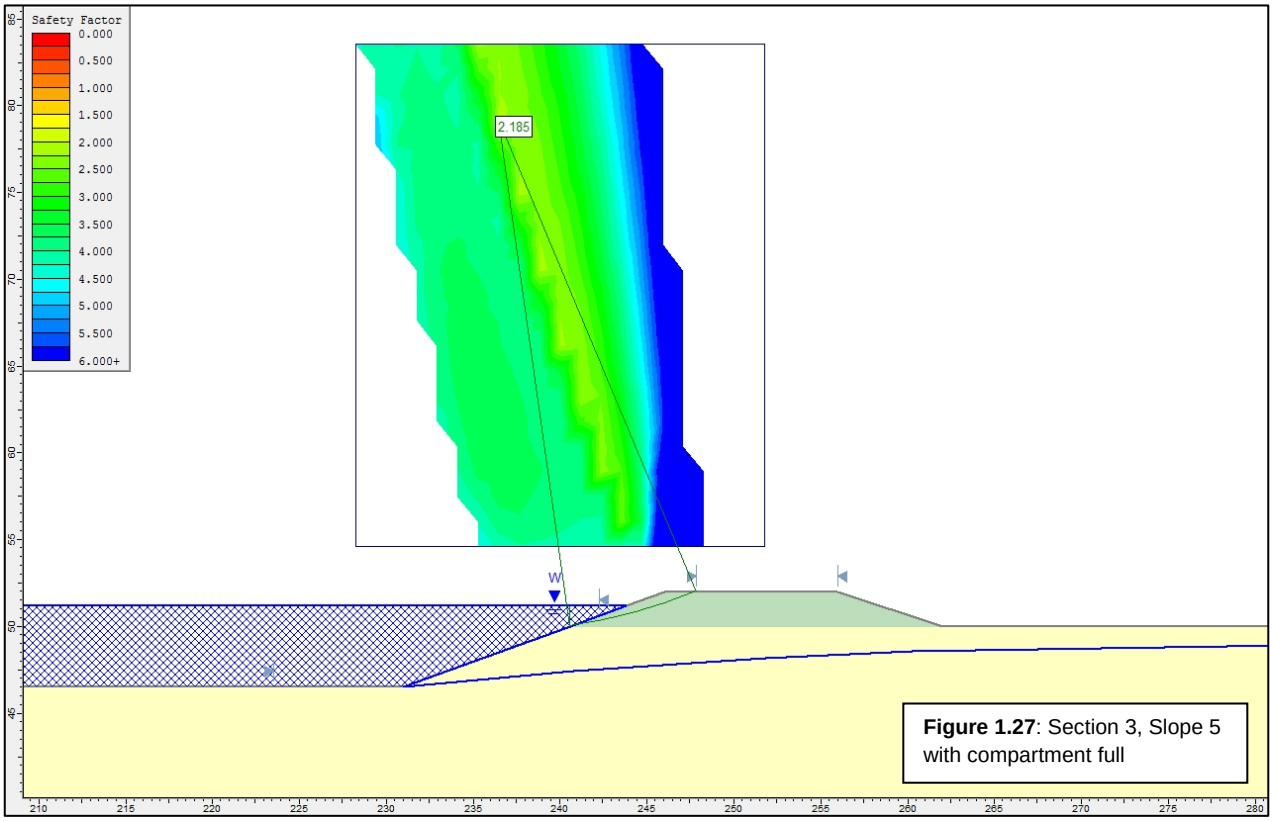


Figure 1.27: Section 3, Slope 5 with compartment full

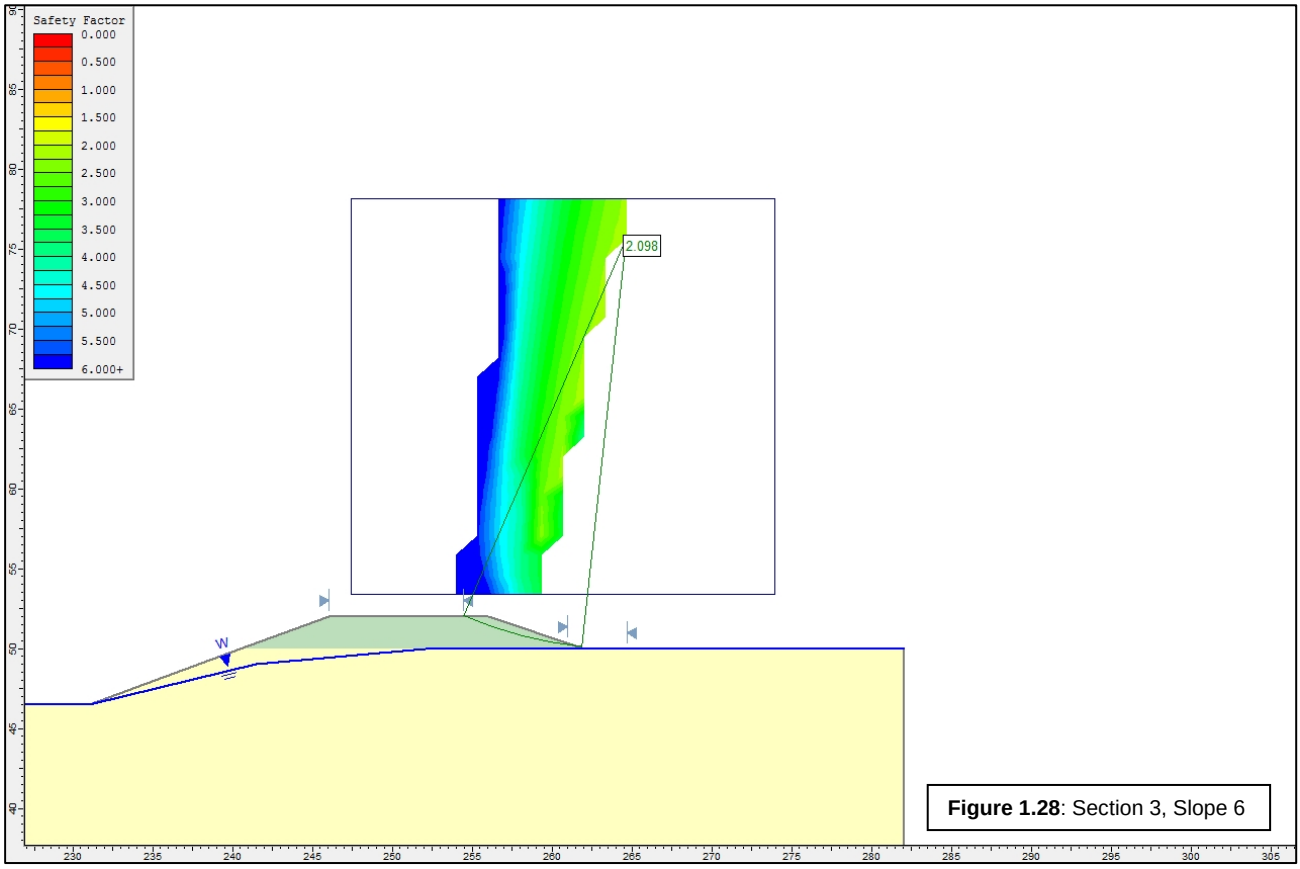


Figure 1.28: Section 3, Slope 6

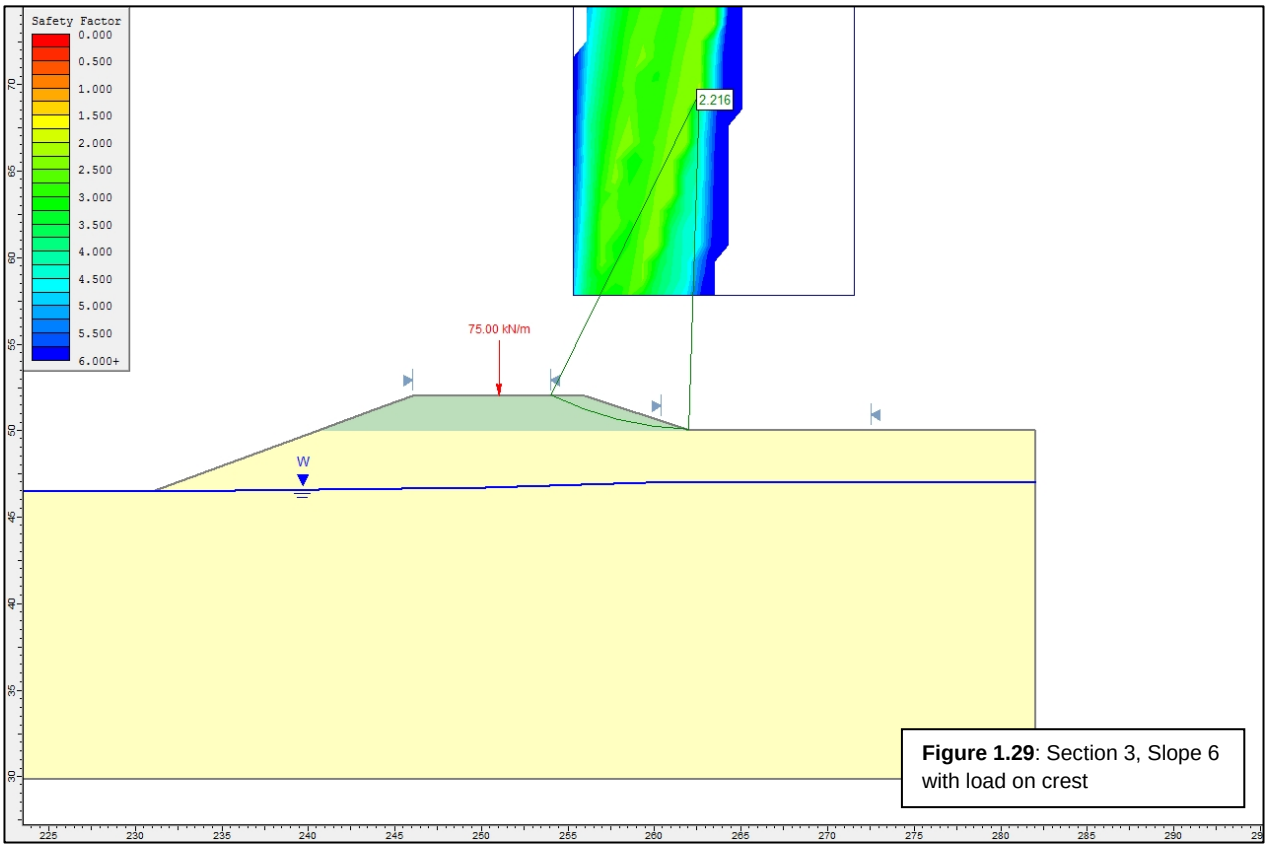


Figure 1.29: Section 3, Slope 6 with load on crest

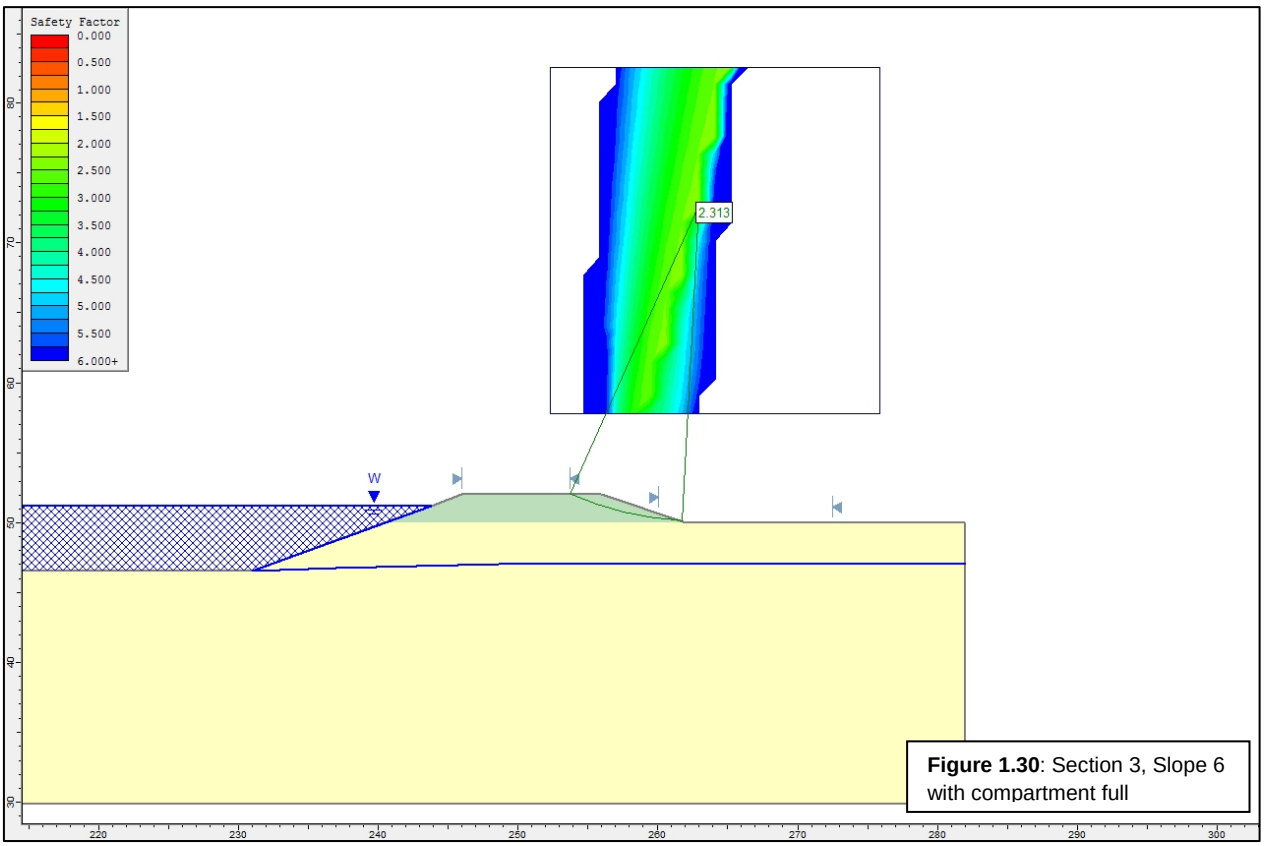


Figure 1.30: Section 3, Slope 6 with compartment full

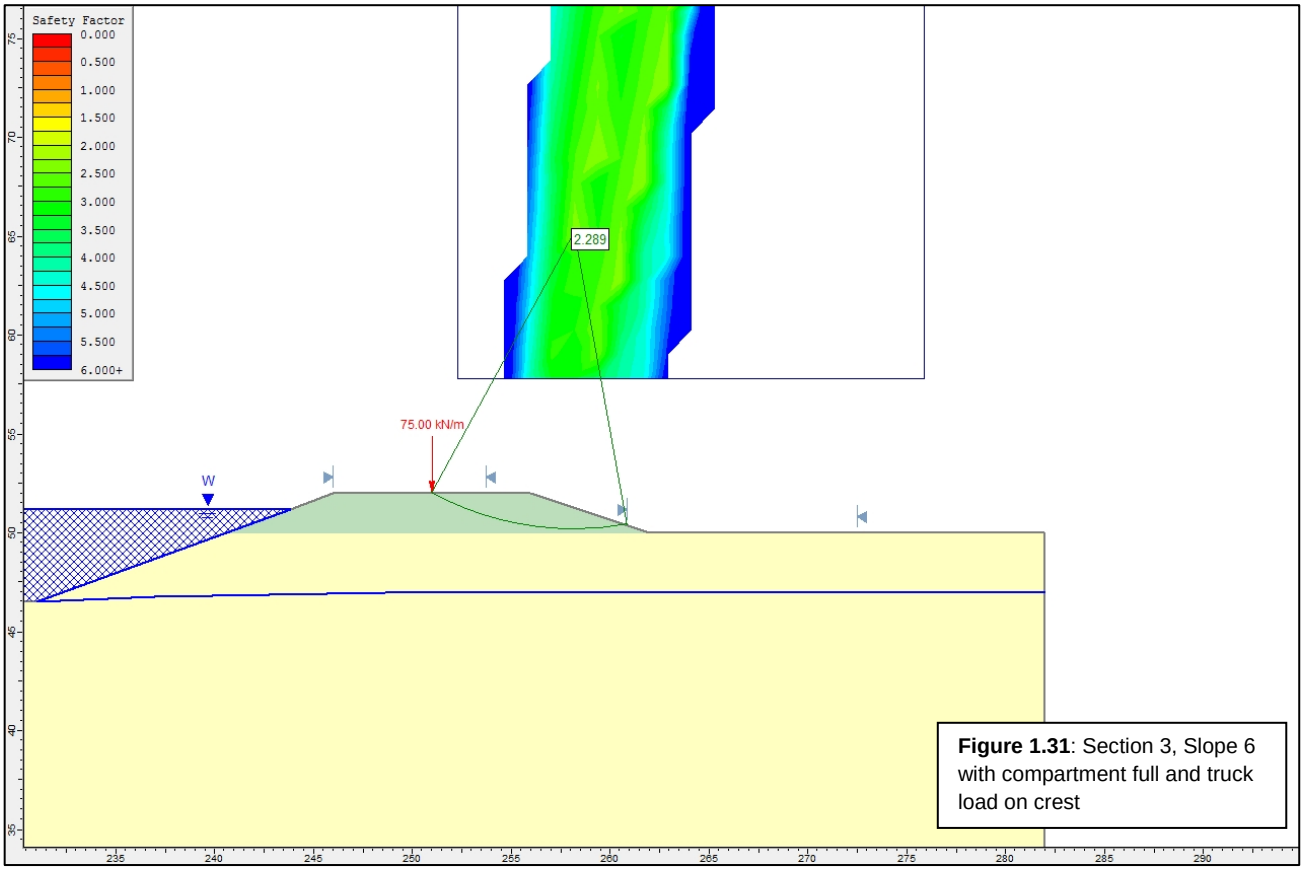


Figure 1.31: Section 3, Slope 6 with compartment full and truck load on crest