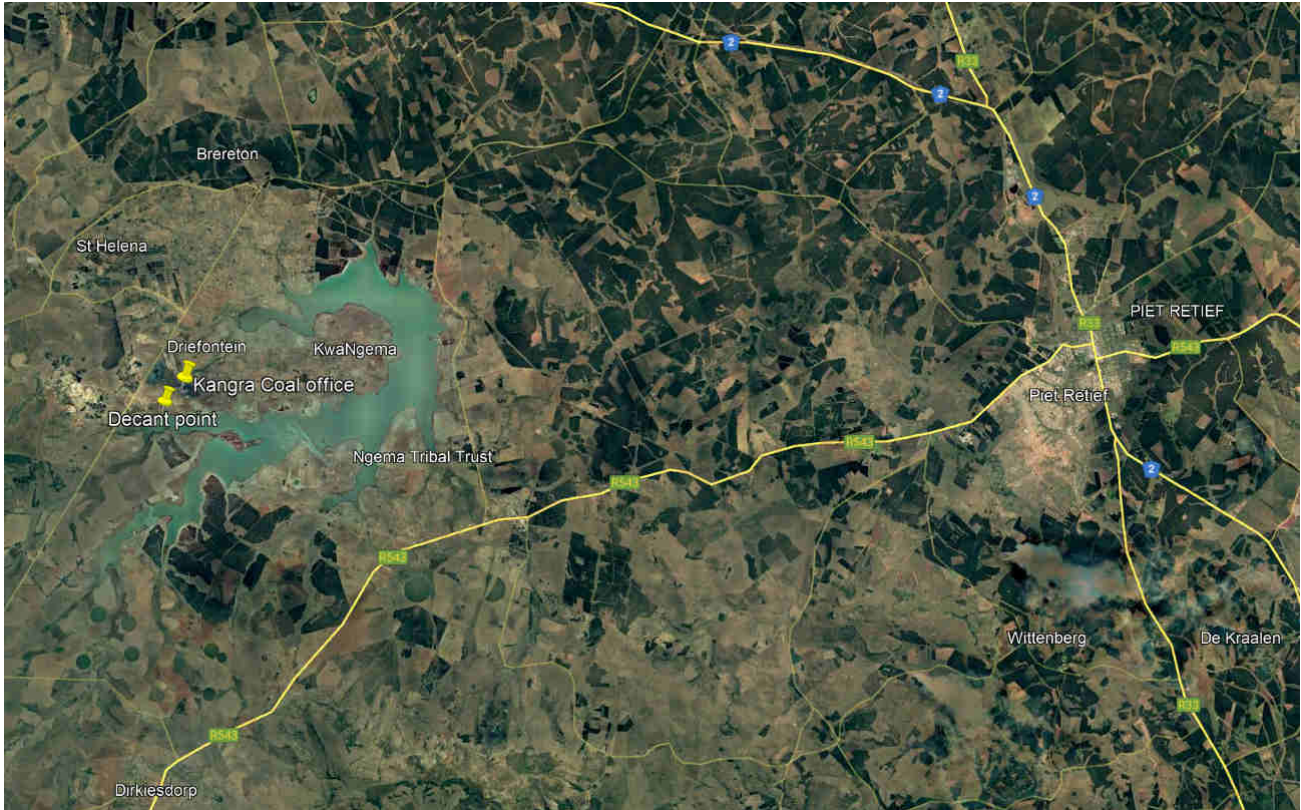


MAQUASA DECANT DAM WALL DESIGN REPORT

9 MAY 2023



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MAQUASA DECANT DAM WALL DESIGN REPORT

9 MAY 2023

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MAQUASA DECANT DAM WALL DESIGN REPORT

9 MAY 2023

1. QUALITY MANAGEMENT AND APPROVALS

Status of report: Final

Approved by GFK Consulting Engineers cc:



F. Krugel
.....

15/05/2023
.....

F. Krugel (ECSA reg.no. 910142)

Date

Recommended by the Employer:



.....

.....

N. Dlamini

Date

(Environmental Manager)

Accepted and Approved by the Employer:



.....

.....

Date

(Print name)

MAQUASA DECANT DAM WALL DESIGN REPORT

9 MAY 2023

2. EXECUTIVE SUMMARY

GFK Consulting Engineers cc was appointed by Kangra Coal (Pty) Ltd to design and implement a strategy to manage and treat the current decanting water which is flowing into the Heyshope dam.

This report focuses on the specific decant point from which water is currently pumped to the PCD's and Pit D.

The existing infrastructure such as the electrical power source, pumps and pipes can and will be continued to be operated in order to pump the decanting water to the new proposed water treatment plant.

New additions to the decant point are required to cut off ground seepage water, by implementing a borehole well curtain (cut off) as well as creating extra buffer capacity of the current decant sump by increasing the dam wall.

The following details are applicable to the raised dam wall and upgraded pond/dam:

- Full Supply Level (FSL): 1306m
- Crest Level: 1307m
- Dam capacity at FSL: 1530m³ (refer to Table 5 below) which is able to contain the 1:50-year return flood.

The spillway will be 7m wide and will include 5x1050ND pipe culvers to allow for vehicle access onto the crest. Access is required to service the boreholes.

Eight (8) boreholes will be drilled into the dam wall at 10m centre to centre spacing up to a 1293m level. These boreholes will be connected with a 75ND HDPE pipe discharging into the decant dam.

Each borehole will be fitted with a stainless-steel borehole pump which is connected to the 75ND pipe.

Seepage water intercepted from the boreholes will thus be pumped to surface, where the current water decants into the dam, from where it will be pumped together with the surface decanting water to the future treatment plant with the existing pipe and pump in place.

The existing gravel road leading to the decant point will be continued to be used in future. A short 110m long portion of the road will be diverted where a new 8m wide gravel road will be constructed. The diverted road crossed an existing trench where a 600ND pipe culvert will be installed.

3. INTRODUCTION

Kangra Coal operates the Maquasa East, Maquasa West and Maquasa West Extension properties, as well as the most recent Block C and Twyfelhoek extensions. These are located about 60km Northwest of Piet Retief (Mkhondo) in Mpumalanga.

GFK Consulting Engineers cc was appointed by Kangra Coal (Pty) Ltd to design and implement a strategy to manage and treat the current decanting water which is flowing into the Heyshope dam.

During investigations of the decant point it has become evident that existing infrastructure is already in place to manage the decanting water to an extent.

The existing infrastructure such as the electrical power source, pumps and pipes can and will be continued to be operated in order to pump the decanting water to the new proposed water treatment plant.

The new additions to the decant point required to cut off ground seepage water, as well as creating extra buffer capacity of the current decant sump will be described in this report.

During the decant point investigations, it further became evident that surplus water exists on the Maquasa mine operations which must also be managed.

It is thus recommended by GFK to manage the decant water, including all other surplus water on the mine by pumping it to the current Maquasa East Pollution Control Dams. These PCD's will be used as a centralised point to collect all water from the mine from where it will be pumped to a new proposed water treatment plant located directly adjacent to the PCD's.

Figure 1 below indicates all the operations which are either already connected or will be connected via a pipe system, which eventually all leads to Maquasa East where the PCD's and proposed new water treatment plant are.

This report focuses and deals with the decant point specifically. Reference to the Proposed Discharge Water Qualities and Design Flows for The Maquasa East Water Treatment Plant, 13 April 2022 report by GFK should be made regarding the mine wide water balance (includes water from this decant point), treatment qualities and water management of the proposed treatment plant.

The objective of this report is to address the design of the decant dam wall and associated stormwater management thereof.

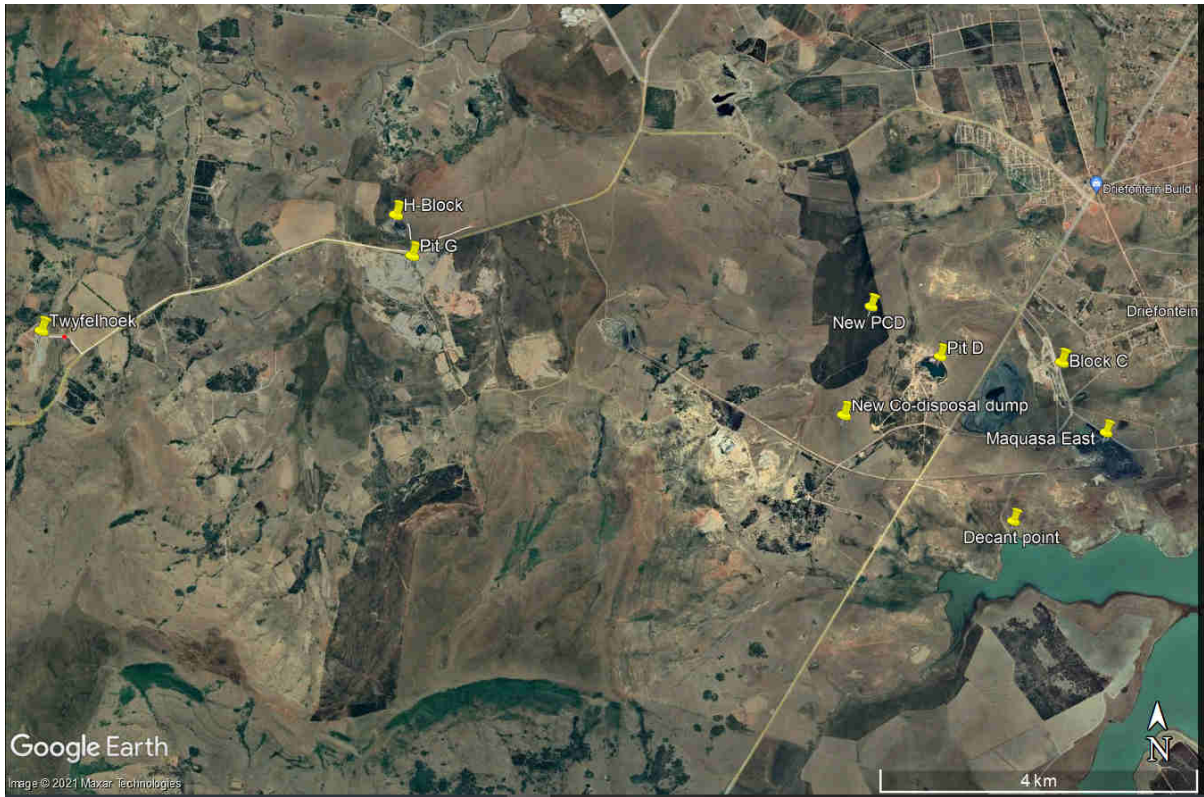


Figure 1: Kangra operations considered for the treatment plant design

4. HYDROLOGY GENERAL

The Maquasa East mine and decant point is located in the Usutu- Mhlathuze catchment management area and lies within quaternary catchment W51B.

The catchment information obtained from WR2012 [1] is indicated in Table 1 below.

Table 1: Quaternary Catchment Information

Quaternary Catchment	BASIC INFORMATION							1920 - 2009
	Catchment area		S-pan evaporation			Rainfall		MAR (WR2012)
	Gross (km ²)	Net (km ²)	evap zone	MAE WR2005 (mm)	MAE WR90 (mm)	Rainfall zone	MAP (mm)	Net (mcm)
W52A	289	289	13A	1400	1400	W5C	836	31.72
W51B	496	496	13A	1400	1400	W5A	864	51.37

Monthly rainfall and evaporation are obtained from South African Weather Station W5E009. The station is located approximately 12km east of the site.

A MAP of 852mm is observed, while the Mean Annual S-Pan Evaporation from this station is 1632mm.

Table 2: Monthly Evaporation and Rainfall

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
S-Pan Evaporation (mm)	158	166	183	165	139	144	120	106	91	96	121	145	1632
Rain (mm)	110	121	163	138	101	102	46	16	8	8	14	26	852

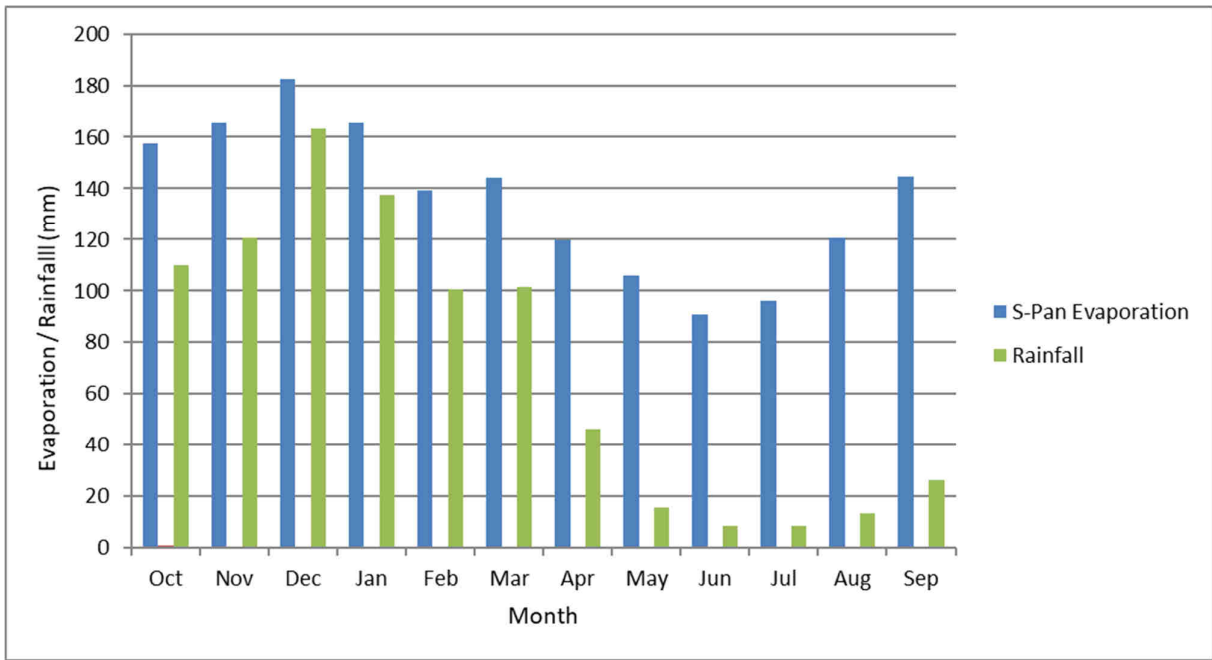


Figure 2: Monthly rainfall and evaporation, from SAWS Station W5E009.

5. LOCATION AND BACKGROUND OF THE DECANT POINT

The decant point is located on the edge of the Heyshope dam at the following co-ordinates.

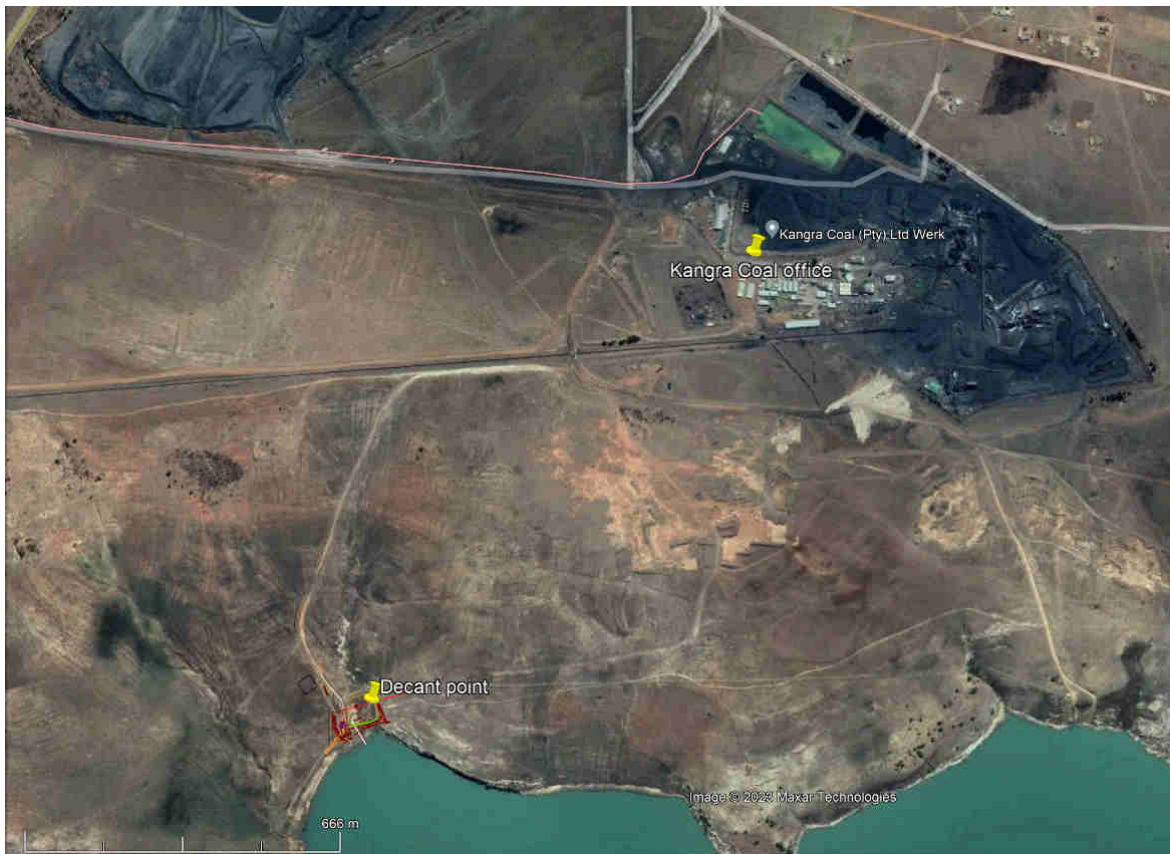


Figure 3: Location of decant point in proximity to the mine

Currently decanting water to the surface is managed in the form of a contamination pond/sump system. Water is allowed to pond up and is then regulated by pumping it out of this sump to the existing Manquasa East PCD and also Pit D.

The decanting water is continuously pumped by Kangra to ensure it does not spill over to the Heyshope dam.

As reported in the GCS Geohydrological Study Update for Maquasa East, Maquasa West and Nooitgesien Operations, 2018 [2], there is seepage water that may be entering the Heyshope Dam underground in addition to the decanting water appearing and currently being managed on surface. Various options in the GCS study have been proposed to manage the decanting water, including the seepage groundwater. The GCS report should be consulted for the detailed description of each proposed method.

In summary these include:

1. Installation of the cut off trench/sump downstream of the decant point
2. Installation of the borehole well point system
3. Installation of a syphon drain system.

All the above would result in pumping the 'cut off' contaminated seepage water to a treatment facility.

In addition to the above-mentioned proposals, it was recommended by GCS that the decanting water qualities could be reduced by reducing the recharge to the various mining operations contributing to the decant. It was estimated in the GCS study that rehabilitating Pit D could reduce the decant quantity by 19%. As Pit D is currently used as a buffer storage facility by the mine to manage the surplus water, it would be recommended to start rehabilitation of the Pit D only after the installation and commissioning of the water treatment facility.

The various decant point management options were analysed by GFK to determine the best suited method for implementation and construction.

Due to extremely limited space between the decant point and Heyshope dam Full Supply Level (FSL), as well as the average operating level of the dam, a cut off sump would be impractical for construction. Should such a method be implemented the sump walls would need to be extended (most likely with concrete) to ensure the clean water of the Heyshope dam would not spill over to this sump during flooding.

The syphon system would require a series of experimental boreholes to be drilled according to the GCS report to determine if the hydraulic head would be sufficient to create such a syphon system.

The most feasible solution is the borehole well system proposed to manage the decanting water together with the water decanting to surface.

This report will focus on the implementation of such a well system that will function as a 'cut-off' system intercepting groundwater, pumping it to surface and ultimately to the proposed water treatment facility.

6. HEYSHOPE DAM INFORMATION

The following information was confirmed and provided by the Dam Safety office which was considered in the decant dam wall design:

- Non-Overspill Crest (NOC) Level : RL 1306.5 m
- Freeboard between NOC and FSL : 3.5 m
- Full Supply Level : RL 1303 m

7. STORMWATER MANAGEMENT

The decant point is currently enclosed by an earth berm and fence. The earth berm allows a majority of the clean water to be diverted around the dam. A portion of the berm and fence (northern side) will be kept as is, with a new dam wall and two diversion channels to be constructed.

All clean stormwater and dirty decant water will be separated. With the stormwater diversion channels and berms in place only direct rainfall and runoff within the decant dam, as well as the actual decanting water will be stored in the decant dam.

The clean stormwater diversion channels will be grass lined. Heavy siltation of the clean water channels in general is not expected as the clean stormwater runoff area is mostly from grasslands. Fairly clean stormwater will thus discharge into the Heyshope dam via dispersion and erosion control structures downstream of the channels.

Shallow sandstone is observed near the water edge of the Heyshope dam. Erosion at the stormwater outlets is thus expected to be minimal.

The peak discharges for the channels and decant area runoff were calculated using the SCS [5] method. The channels were sized using predicated 1:50 year flood intensities as are indicated in Table 4 .

Kikuyu or grass of similar properties is to be established in the channel to avoid erosion. Such Kikuyu grass can handle a velocity up to 2.3m/s. The channel design velocities are 2m/s to minimise erosion. The channel is to be constructed at a slope of 1:150 or flatter to ensure subcritical flow conditions are maintained.

Table 3: Return flows and flood volumes

CATCHMENT NO	CATCHMENT AREA (ha)	STREAM LENGTH (km)	SLOPE STREAM (%)	OVERLAND FLOW LENGTH (km)	OVERLAND SLOPE (%)	OVERLAND ROUGHNESS n	TC	AVE CN	PEAK DISCHARGE (m ³ /s)		VOLUME (m ³)	
									1:50	1:100	1:50	1:100
Decant area	0.4	0.02	3.3%	0.01	3%	0.30	0.10	68	0.6	0.8	999	1143
Channel 1	19.4	0.77	8.7%	0.42	5%	0.30	0.59	68	4.7	5.6	14723	17524
Channel 2	20.7	0.74	9.5%	0.45	5%	0.30	0.62	68	4.8	5.7	15642	18619
Spillway	19.8	0.77	8.7%	0.42	5%	0.30	0.59	68	4.8	5.7	14988	17839

Table 4: Channel size summary

Channel number	Flow (m ³ /s)	Flow depth (m)	Side slope 1 1: Z	Side slope 2 1: Z	N value	Slope 1: S(m)	Free board (m)	Bottom width (m)	Velocity (m/s)	Top width (m)	Flow Status	Lining Type
C1	4.698	0.8	2	2	0.025	150	0.2	1.34	2.0	5.3	Subcritical	GRASS
C2	4.793	0.7	2	2	0.025	150	0.2	2.08	2.0	5.7	Subcritical	GRASS

8. DAM DETAILS

As part of the implementation plan to improve the decanting water management the existing southern berm downstream of the decant point will be upgraded to from a dam wall. The boreholes which will serve as the cut off drain to intercept any groundwater seepage will be drilled into this dam wall.

Raising the dam wall has the added benefit of increasing the storage capacity of the decant water. This will add a buffer capacity to allow for additional storage during pump downtime or maintenance periods.

Additionally, the dam wall will serve a protection to prevent cross-contamination of clean and dirty water during flooding periods and peak rainfall seasons. The Full Supply Level of the decant dam (1360m) is 3m higher than the FSL of the Heyshope dam (1303m) (Refer to Section 6 for the Heyshope dam details).

The following details are applicable to the raised dam wall and upgraded pond:

- Full Supply Level (FSL): 1306m
- Crest Level: 1307m
- Dam capacity at FSL: 1530m³ (refer to Table 5 below)

Table 5: Decant dam capacity

AREA AT : (m ²)	FSL mMSL	AREA (m ²)	VOLUME (m ³)	FSL DEPTH (m)
LOWEST CONTOUR	1304.0	145	73	1.5
CONTOUR ABOVE	1304.2	349	120	1.7
CONTOUR ABOVE	1304.4	415	197	1.9
CONTOUR ABOVE	1304.6	477	286	2.1
CONTOUR ABOVE	1304.8	548	388	2.3
CONTOUR ABOVE	1305.0	614	504	2.5
CONTOUR ABOVE	1305.2	703	636	2.7
CONTOUR ABOVE	1305.6	1024	979	3.1
CONTOUR ABOVE	1305.8	1362	1217	3.3
FULL SUPPLY LEVEL	1306.0	1774	1530	3.5

The added storage capacity will allow the dam to contain the 1:50 year instantaneous runoff flood. A flood higher than the 1:50-year return period could be expected to spill over, considering the channels are also designed to contain the 1:50-year return flows.

An emergency spillway has been designed to allow for the 1:100-year return floods (5.7m³/s) from the decant dam, as well as Channel 1 catchment area, as the channel discharges to the spillway.

A total of 5 x 1050 ND precast pipes will be installed in the spillway to allow for vehicle access to the dam crest to service the boreholes and associated switchgear.

A 200mm thick concrete slab will serve as the cover above the pipes.

Table 6: Culverts in spillway capacity

Culvert no	Runoff m ³ /sec	Culvert entrance loss Coefficient	Pipe friction f	No of pipes	Pipe Internal Diameter (m)	Cover on pipe at inlet (m)	Length (m)	Pipe grade (m/m)	Down stream flow depth (m)	Velocity in pipe m/s	Capacity m ³ /s
Spillway	5.700	1.7	0.02	5	0.986	0.20	4.88	0.05	0.700	1.51	5.77

The dam wall will be zoned with the following sequence:

- Impervious clay core compacted in 150mm layers at 98% Proctor at optimum moisture content (OMC). The clay core will be constructed up the sandstone level with is situated approximately 1m below NGL.
- Sandy material transition zone, 800mm this on the outer sided of the clay core. Bidim or similar approved A7 geotextile is to be placed on the outer side of the sandy material separating the transition material from the outer shells.

- Outer shells consisting of 50-200mm diameter sized rockfill, with an upstream slope of 1:2 and downstream slope of 1:1.5. This rockfill material will be selected hards material from the mine dumps.

Also refer to drawing G2021/03/02/100-06/02 Rev 1 in the Annexure.

Rockfill outer shells are selected to simultaneously act as the protecting rip rap of the dam to prevent erosion of the dam walls. This is particularly important due to rising water levels that can be expected at the Heyshope dam to ensure the decant dam wall toe does not get eroded.

A steeper downstream slope is implemented due to the limited space between the decant point and Heyshope dam.

9. BOREHOLES

Boreholes will be installed in the dam wall drilled into the underground sandstone based on the conceptualisation plan by GCS indicated in Figure 4 below.

Refer to drawing G2021/03/02/100-06/02 Rev 1 attached for the implantation by GFK. Eight boreholes will be installed in Phase 1 of the operation spaced at 10m centres.

Only one row of boreholes will be installed during this implementation phase. Due to the close proximity to the Heyshope dam, the risk exists that clean water can also be dewatered.

The GCS report proposes that a concrete wall approximately 15m deep be constructed between the boreholes and the Heyshope dam to prevent the dewatering of the clean water in the Heyshope dam.

Due to the construction impracticality with the close proximity to the dam and the sandstone it was decided to thus rather install only one row of boreholes as far as practically possible from the Heyshope dam.

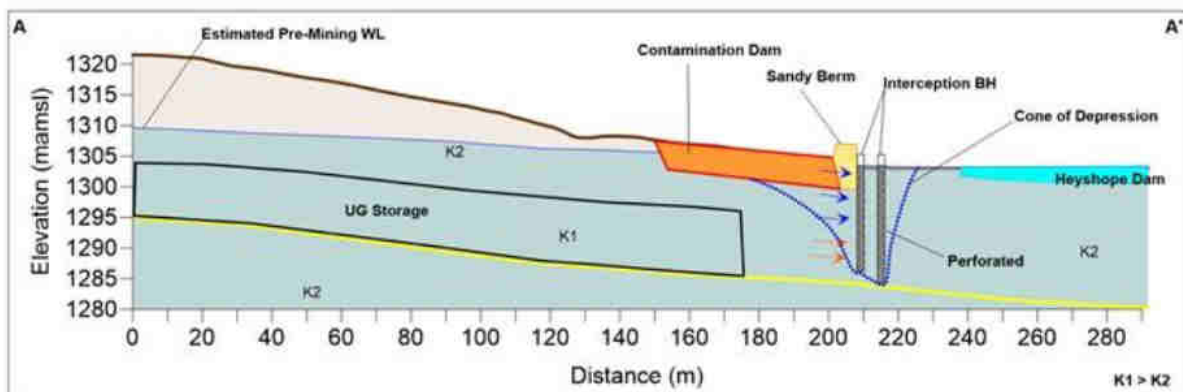


Figure 4: Conceptualisation of well point system by GCS [2]

A cross-section of the proposed borehole installation in the dam wall is indicated in Figure 5 below.

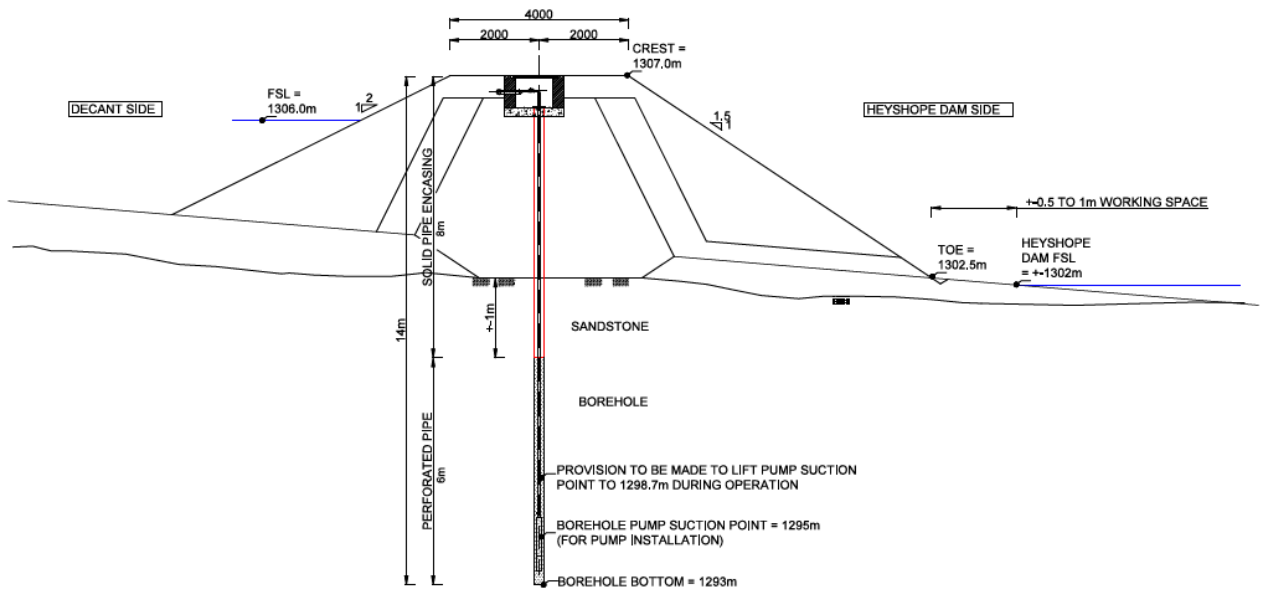


Figure 5: Borehole implementation installation

All the boreholes are connected by a 75ND HDPE pipe running along the top of the dam wall. Each borehole will be fitted with a stainless-steel submersible pump and level probes set to start pumping when the water in the borehole reaches the following conditions.

- Starting condition: liquid level in the water well is at 1299.7m, which is above Lower probe; the Product will run pump
- Stop condition: liquid level in the water well is at 1295.5m; which is below Lower probe; the Product will stop pump running.

Installing the level probes will ensure the pumps will only pump if the water reaches a certain level minimising the risk of continuously pumping and dewatering clean water from the Heyshope dam.

A pump flow rate of 5l/s has been used in the design.

A water meter will be installed to measure quantities pumped from the borehole. This meter functions separately from the water meter already installed at the decant point which measure how much surface decant water is pumped out on a monthly basis.

10. ROAD

The existing gravel road will continue to be used for access to the decant point. A small portion approximately 110m long will be diverted from the existing road where a new road will be constructed.

The new diverted road will be 8m wide with standard v-drains (500mm deep) on either side. This diverted road will cross an existing trench, where a 600ND pipe culvert will be installed.

11. OTHER INFRASTRUCTURE

Existing infrastructure such as the incoming powerline and transformer will continue to be used.

The existing pipeline from the decant point to the Maquasa East PCD's will also be used.

The fence will be extended around the entire dam facility to ensure no unauthorised access to the decant dam.

12. REFERENCES

- [1] WR2012 : Water Resources of South Africa : Water Reseach Commision and Royal Haskoning.
- [2] G. Consultants, “Geohydrological Study Update for Maquasa East Maquasa West and Nooitgesien Operations,” 25 June 2018.
- [3] SA Atlas of Climatology en Agrohydrology : University of Kwazulu Natal.

13. ANNEXURE

13.1. DRAWINGS

General Notes and Specifications

1. FINAL POSITION AND LENGTH TO BE CONFIRMED BY ENGINEER ON SITE.

References

Drawing No.	Title
-------------	-------

Amendments

Date	Checked	Done by	Description
------	---------	---------	-------------



CONSULTING ENGINEERS CC

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B MUHL	B MUHL	F KRUGEL

Approvals:
F Krugel 16/03/2022
Engineer (G F KRUGEL, Pr Eng, ECSA Reg N° 910142): Date

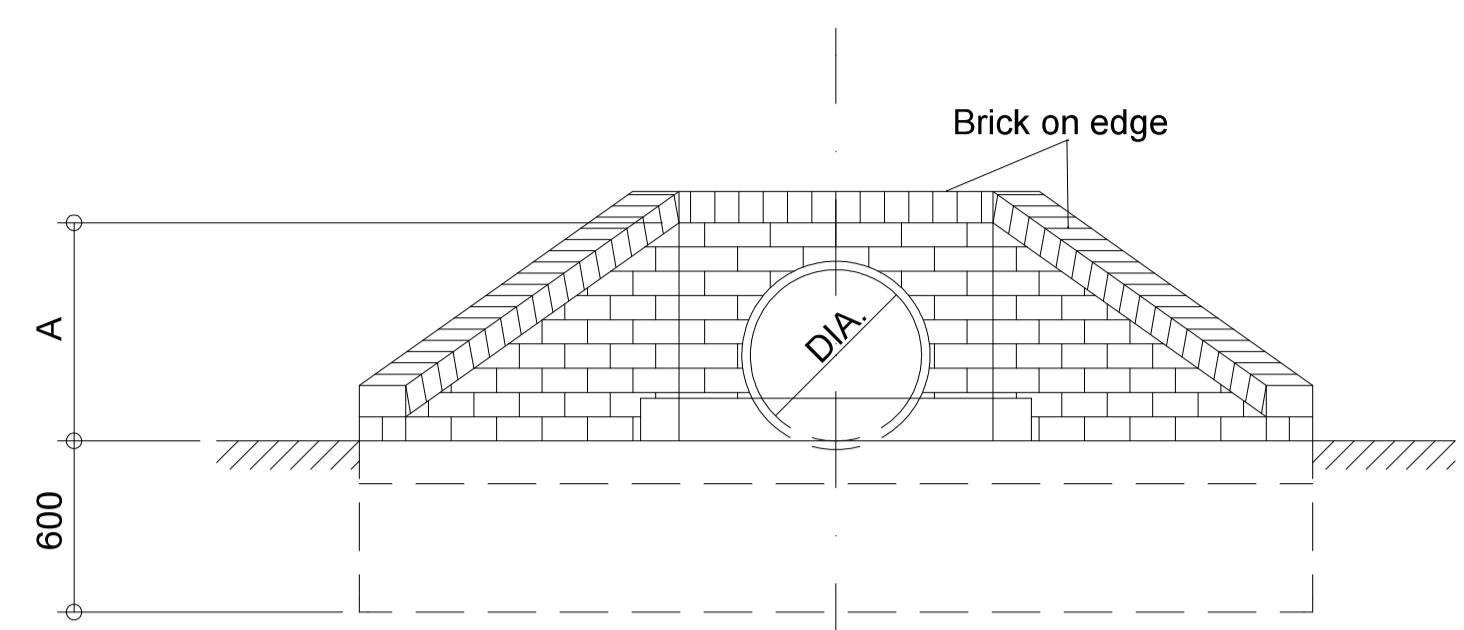
Client:
KANGRA COAL
KANGRA COAL PTY LTD
7th Floor, 13 Fredman Drive, Fredman Towers, Sandton, 2196, Johannesburg, South Africa

Approvals:
Client: _____ Date _____

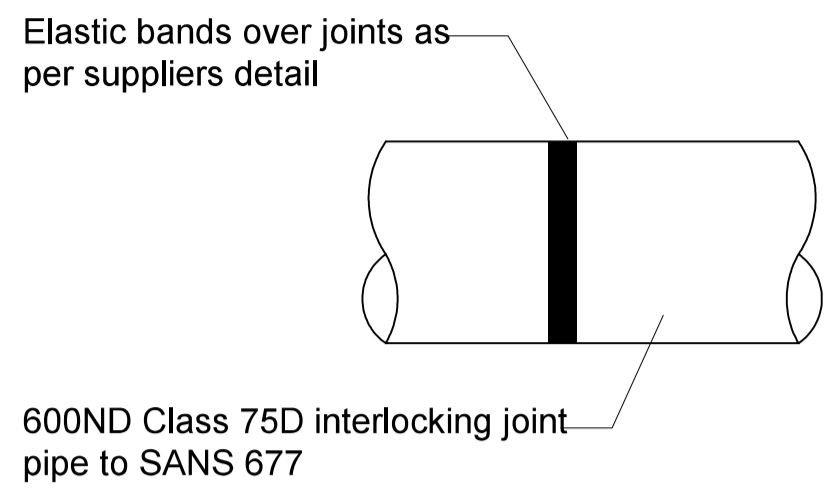
Project Name:
MAQUASA DECANT

Drawing Description:
STANDARD PIPE CULVERT DETAIL

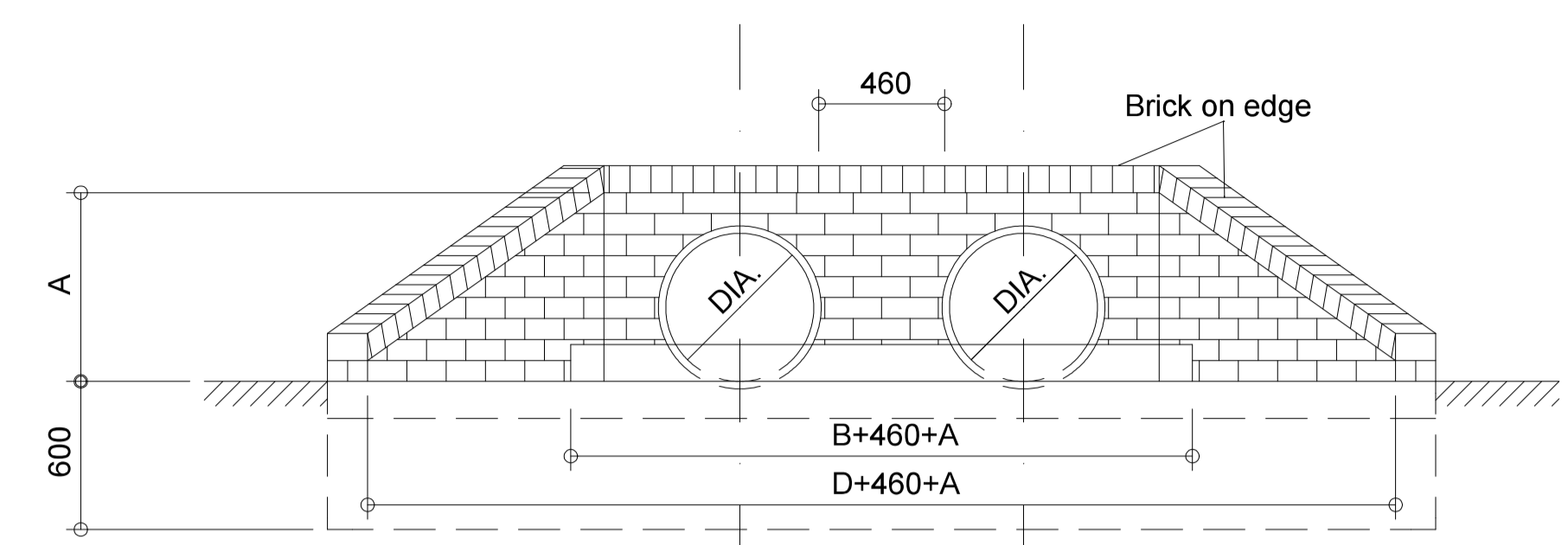
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Drawing Sequence N°: G2021/03/02/100/04



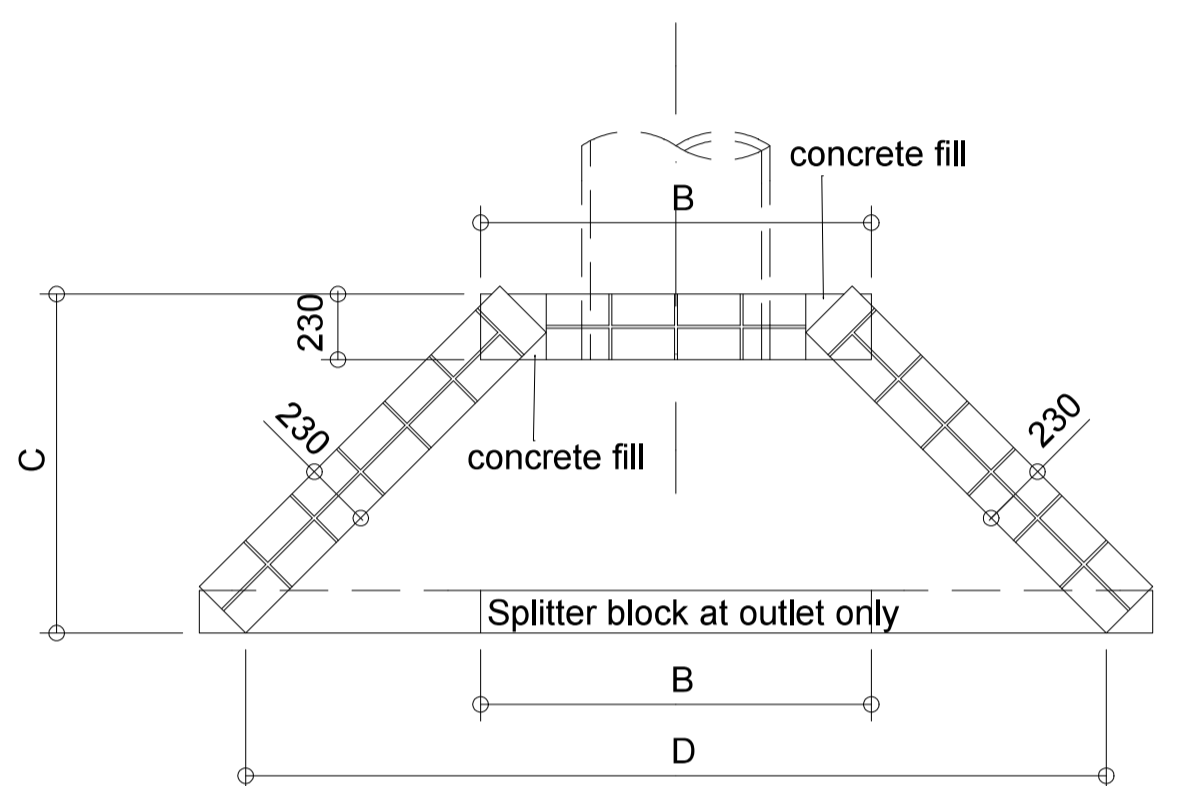
FRONT ELEVATION - SINGLE PIPE



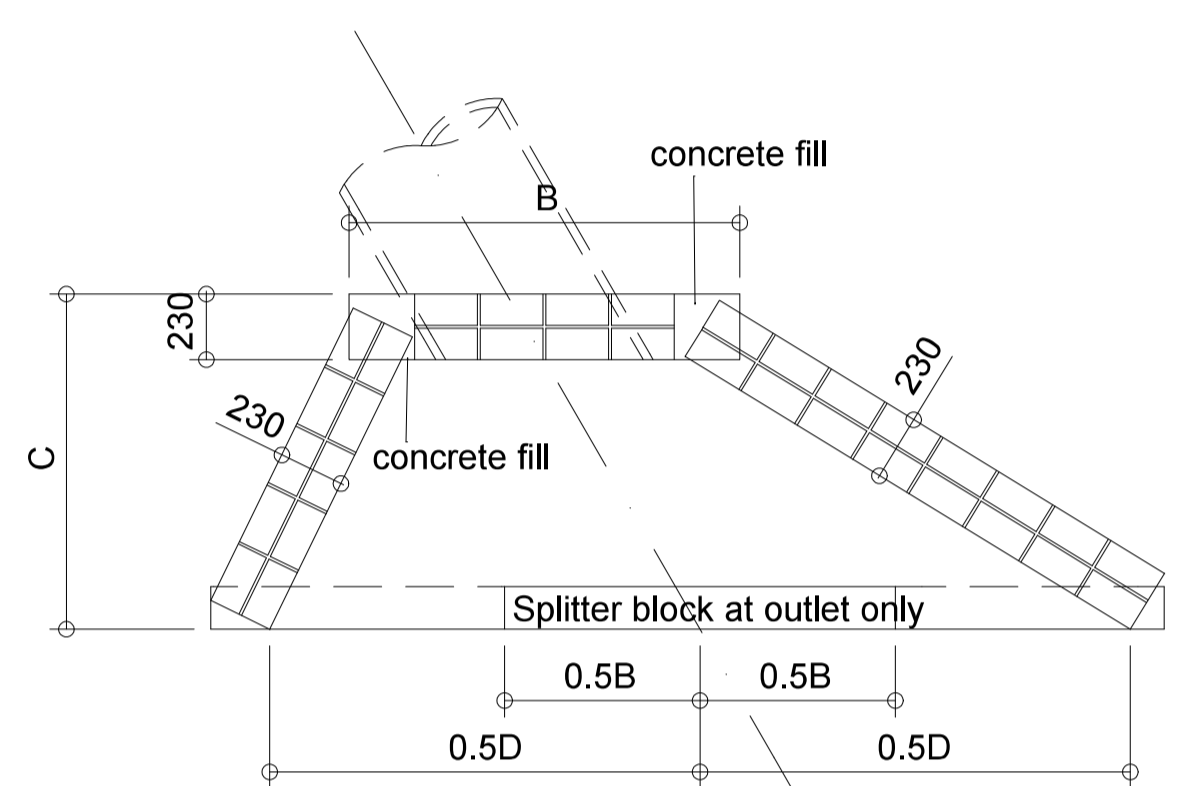
TYPICAL PIPE JOINT DETAIL



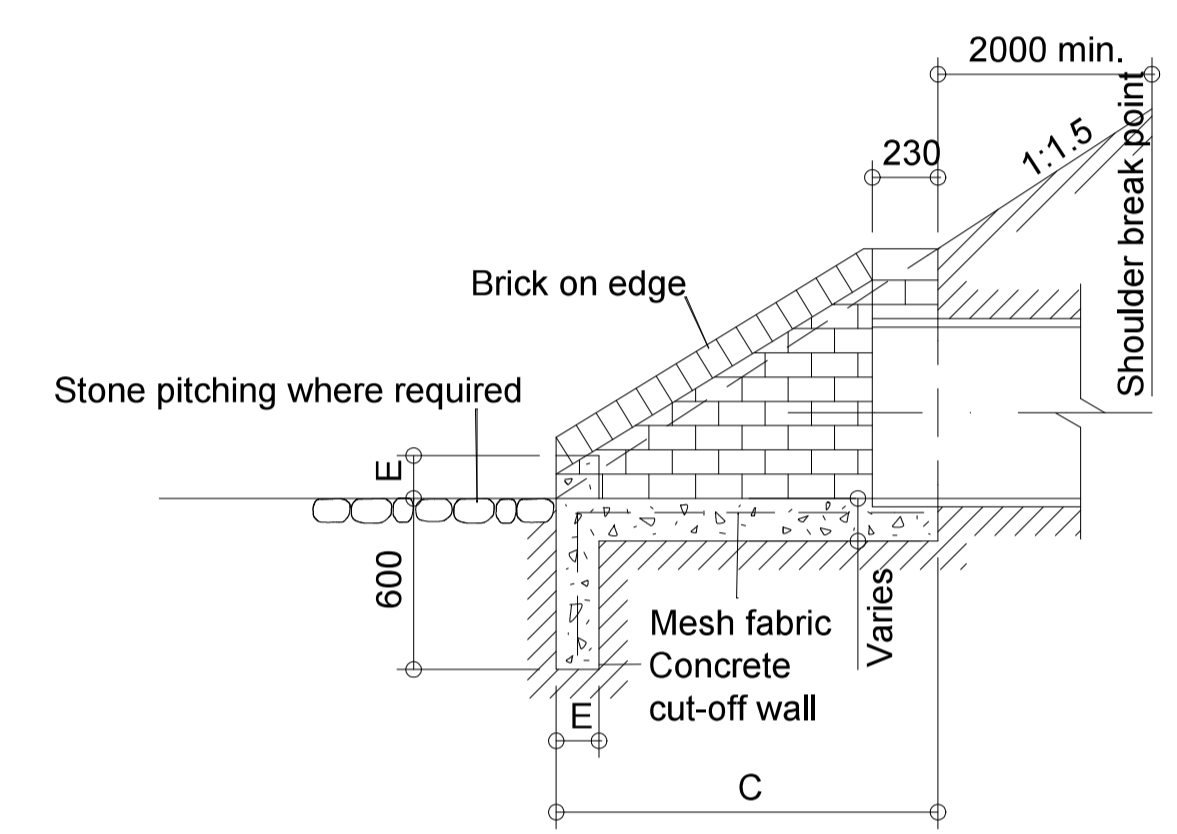
FRONT ELEVATION - DOUBLE PIPE



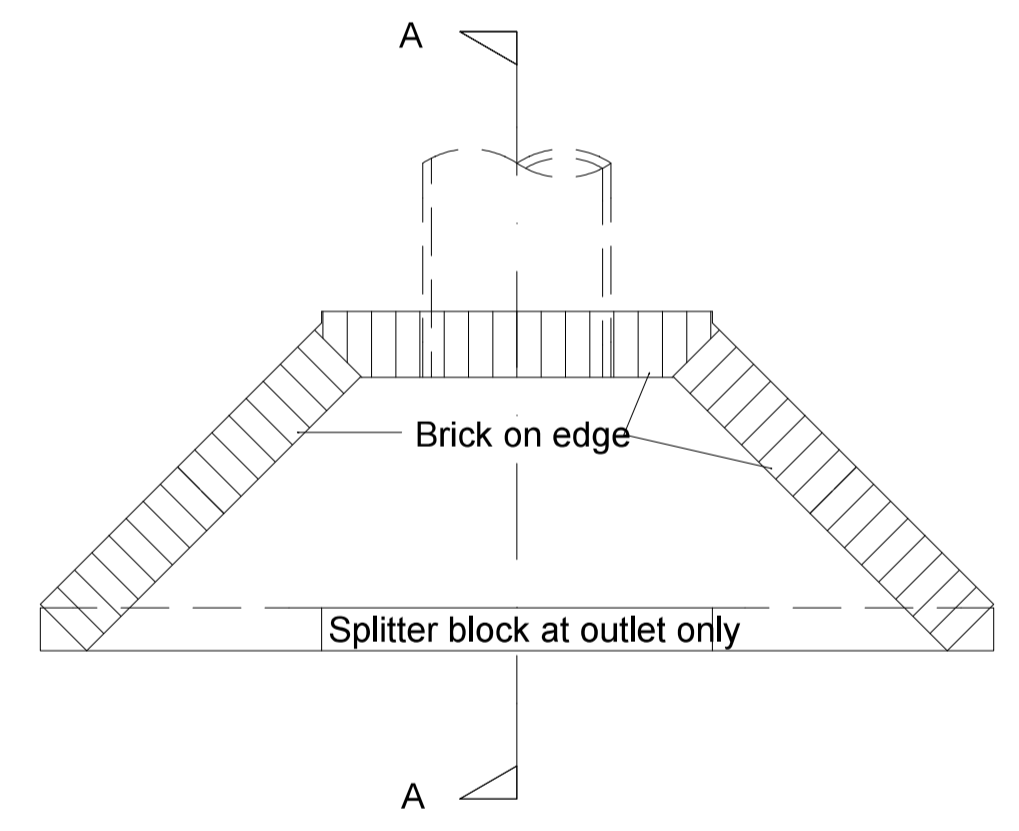
LAYOUT OF BRICKWORK



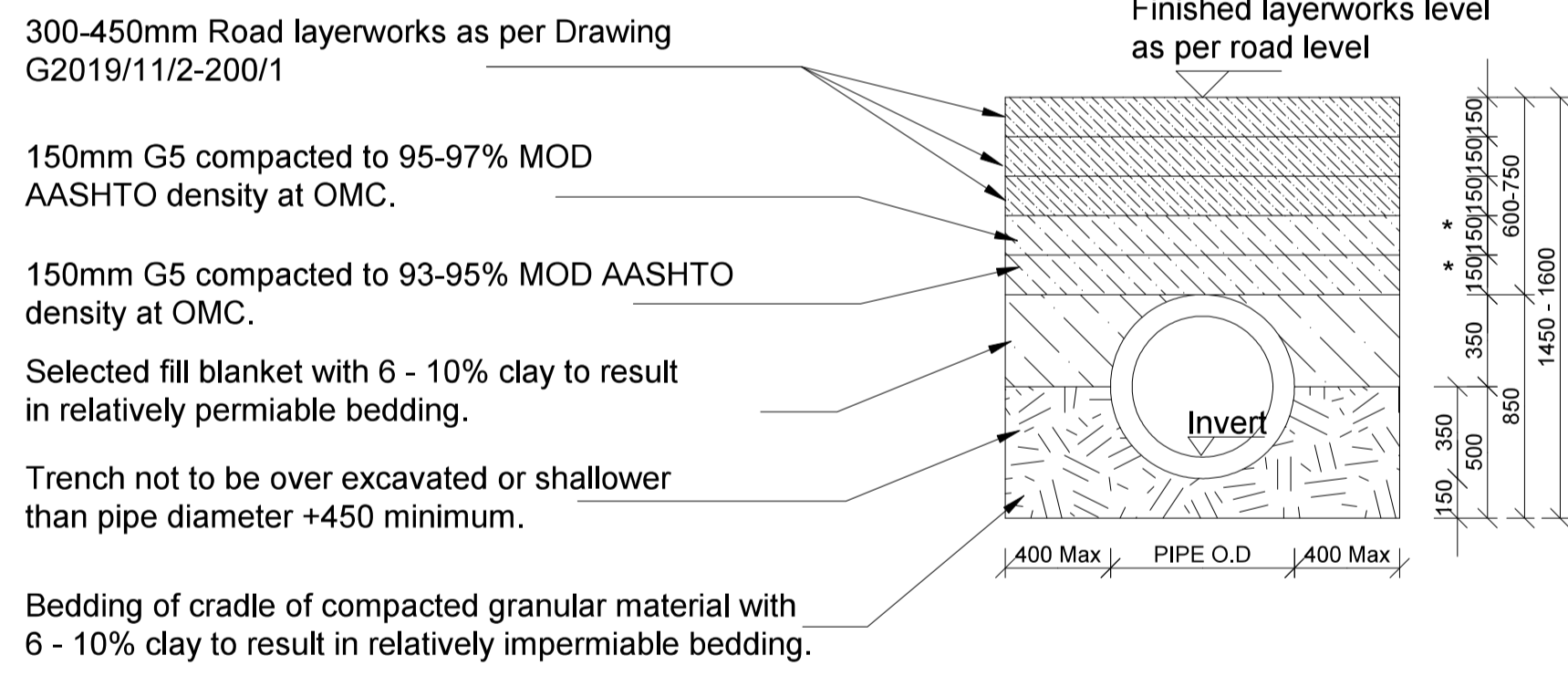
LAYOUT OF BRICKWORK



SECTION A-A



PLAN



LAYERWORKS DETAIL

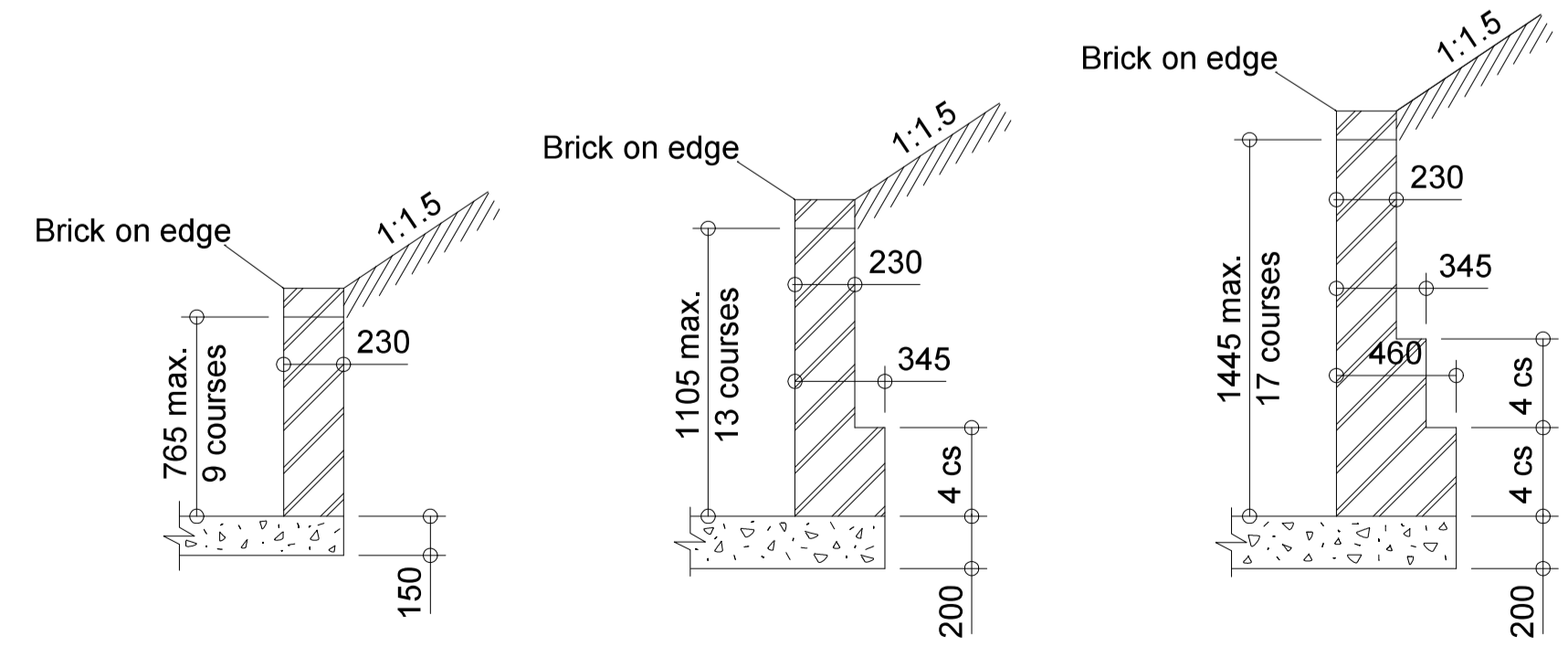
300-450mm Road layerworks as per Drawing G2019/11/2-200/1
150mm G5 compacted to 95-97% MOD AASHTO density at OMC.
150mm G5 compacted to 93-95% MOD AASHTO density at OMC.
Selected fill blanket with 6 - 10% clay to result in relatively permeable bedding.
Trench not to be over excavated or shallower than pipe diameter +450 minimum.
Bedding of cradle of compacted granular material with 6 - 10% clay to result in relatively impermeable bedding.

NOTES :

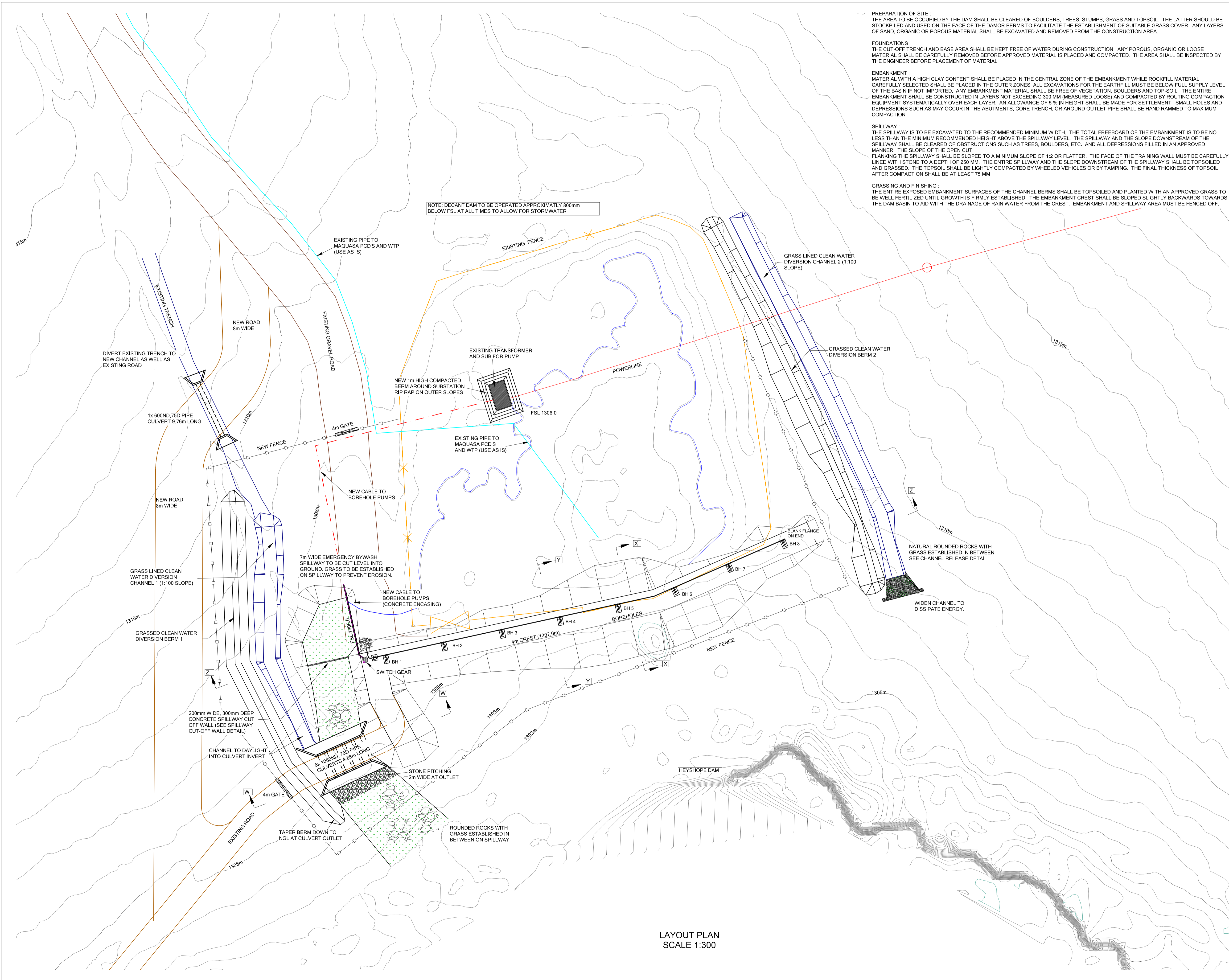
1. Splitter block and pitching to be provided at all outlets where erosion is likely to occur.
2. Splitter block may be omitted if discharge velocity is less than 0.9 m/s.
3. Cut-off walls may be omitted if structure is founded on rock.
4. For multiple pipe culverts increase dimensions 'E' and 'F' by (n-1)(A+460)mm : Where n = number of pipes and A = nominal diameter of pipes
5. Pipes to be cut flush with headwall.
6. For skew pipe culverts the headwall shall be parallel to the centre line of the road.
7. If corrugated metal pipes are used 4x20mmx150mm long galvanised anchor bolts in the hollows of the corrugation are to be used.
8. All concrete is to be 20MPa.
9. Square mesh fabric (Reference S.M.F.193) is to be placed 50mm from top in all apron slabs and centrally in cut-off walls.
10. Brickwork is to consist of good quality burnt clay common bricks in accordance with SABS 227 Specification, or cement bricks in accordance with SABS 987 Specification, uniform in size and shape layed in stretcher bond style with the skins tied together with galvanised crimped wire wall ties.
11. Brickforce is to be placed every 4th course.
12. Jointing on all visible faces to be pointed
13. No in-fill shall be larger than a half standard brick size unless 15MPa concrete is used.

ISSUED FOR CONSTRUCTION

Dimensions (mm)					
Nominal Dia.	A	B	C	D	E
450	595	1 150	1 050	2 700	150
600	765	1 380	1 200	3 000	150
750	935	1 610	1 350	3 300	150
900	1 105	1 840	1 500	3 600	230
1 050	1 275	2 070	1 750	3 900	230
1 200	1 445	2 300	1 900	4 200	230



TYPICAL RETAINING WALL DETAILS



PREPARATION OF SITE :
 THE AREA TO BE OCCUPIED BY THE DAM SHALL BE CLEARED OF BOULDERS, TREES, STUMPS, GRASS AND TOPSOIL. THE LATTER SHOULD BE STOCKPILED AND USED ON THE FACE OF THE DAM OR BERMS TO FACILITATE THE ESTABLISHMENT OF SUITABLE GRASS COVER. ANY LAYERS OF SAND, ORGANIC OR POROUS MATERIAL SHALL BE EXCAVATED AND REMOVED FROM THE CONSTRUCTION AREA.

FOUNDATIONS :
 THE CUT-OFF TRENCH AND BASE AREA SHALL BE KEPT FREE OF WATER DURING CONSTRUCTION. ANY POROUS, ORGANIC OR LOOSE MATERIAL SHALL BE CAREFULLY REMOVED BEFORE APPROVED MATERIAL IS PLACED AND COMPACTED. THE AREA SHALL BE INSPECTED BY THE ENGINEER BEFORE PLACEMENT OF MATERIAL.

EMBANKMENT :
 MATERIAL WITH A HIGH CLAY CONTENT SHALL BE PLACED IN THE CENTRAL ZONE OF THE EMBANKMENT WHILE ROCKFILL MATERIAL CAREFULLY SELECTED SHALL BE PLACED IN THE OUTER ZONES. ALL EXCAVATIONS FOR THE EARTHFILL MUST BE BELOW FULL SUPPLY LEVEL OF THE BASIN IF NOT IMPORTED. ANY EMBANKMENT MATERIAL SHALL BE FREE OF VEGETATION, BOULDERS AND TOP-SOIL. THE ENTIRE EMBANKMENT SHALL BE CONSTRUCTED IN LAYERS NOT EXCEEDING 300 MM (MEASURED LOOSE) AND COMPACTED BY ROUTING COMPACTION EQUIPMENT SYSTEMATICALLY OVER EACH LAYER. AN ALLOWANCE OF 5 % IN HEIGHT SHALL BE MADE FOR SETTLEMENT. SMALL HOLES AND DEPRESSIONS SUCH AS MAY OCCUR IN THE ABUTMENTS, CORE TRENCH, OR AROUND OUTLET PIPE SHALL BE HAND RAMMED TO MAXIMUM COMPACTION.

SPILLWAY :
 THE SPILLWAY IS TO BE EXCAVATED TO THE RECOMMENDED MINIMUM WIDTH. THE TOTAL FREEBOARD OF THE EMBANKMENT IS TO BE NO LESS THAN THE MINIMUM RECOMMENDED HEIGHT ABOVE THE SPILLWAY LEVEL. THE SPILLWAY AND THE SLOPE DOWNSTREAM OF THE SPILLWAY SHALL BE CLEARED OF OBSTRUCTIONS SUCH AS TREES, BOULDERS, ETC., AND ALL DEPRESSIONS FILLED IN AN APPROVED MANNER. THE SLOPE OF THE OPEN CUT FLANKING THE SPILLWAY SHALL BE SLOPED TO A MINIMUM SLOPE OF 1:2 OR FLATTER. THE FACE OF THE TRAINING WALL MUST BE CAREFULLY LINED WITH STONE TO A DEPTH OF 250 MM. THE ENTIRE SPILLWAY AND THE SLOPE DOWNSTREAM OF THE SPILLWAY SHALL BE TOPSOILED AND GRASSED. THE TOPSOIL SHALL BE LIGHTLY COMPACTED BY WHEELED VEHICLES OR BY TAMPING. THE FINAL THICKNESS OF TOPSOIL AFTER COMPACTION SHALL BE AT LEAST 75 MM.

GRASSING AND FINISHING :
 THE ENTIRE EXPOSED EMBANKMENT SURFACES OF THE CHANNEL BERMS SHALL BE TOPSOILED AND PLANTED WITH AN APPROVED GRASS TO BE WELL FERTILIZED UNTIL GROWTH IS FIRMLY ESTABLISHED. THE EMBANKMENT CREST SHALL BE SLOPED SLIGHTLY BACKWARDS TOWARDS THE DAM BASIN TO AID WITH THE DRAINAGE OF RAIN WATER FROM THE CREST. EMBANKMENT AND SPILLWAY AREA MUST BE FENCED OFF.

NOTE: DECANT DAM TO BE OPERATED APPROXIMATELY 800mm BELOW FSL AT ALL TIMES TO ALLOW FOR STORMWATER

LAYOUT PLAN
 SCALE 1:300

General Notes and Specifications

References

G2021/03/02/100-06/02	DECANT POINT DAM DETAILS
G2021/03/02/100-08	BOREHOLE PIPES AND PUMP DETAIL

Amendments

Date	Checked	Done by	Description
13/12/2022	F KRUGEL	B MUHL	BOREHOLE POSITION

CONSULTING ENGINEERS CC

119 Deputasie Street
 P O Box 2266 VRYHEID 3100
 Tel / Fax: 034 982 3425

Designed:	Drawn:	Checked:
B MUHL	B MUHL	F KRUGEL

Approval Engineer:

F Krugel 13/12/2022
 Date

Engineer: G F KRUGEL, Pr.
 Eng. ECSA Reg N° 910142

Client:

KANGRA

KANGRA COAL (PTY) LTD
 7th Floor Fredman Towers,
 13 Fredman drive
 Sandown
 2196
 Tel: 011 783 7996

Approval Client:

Client: _____ Date _____

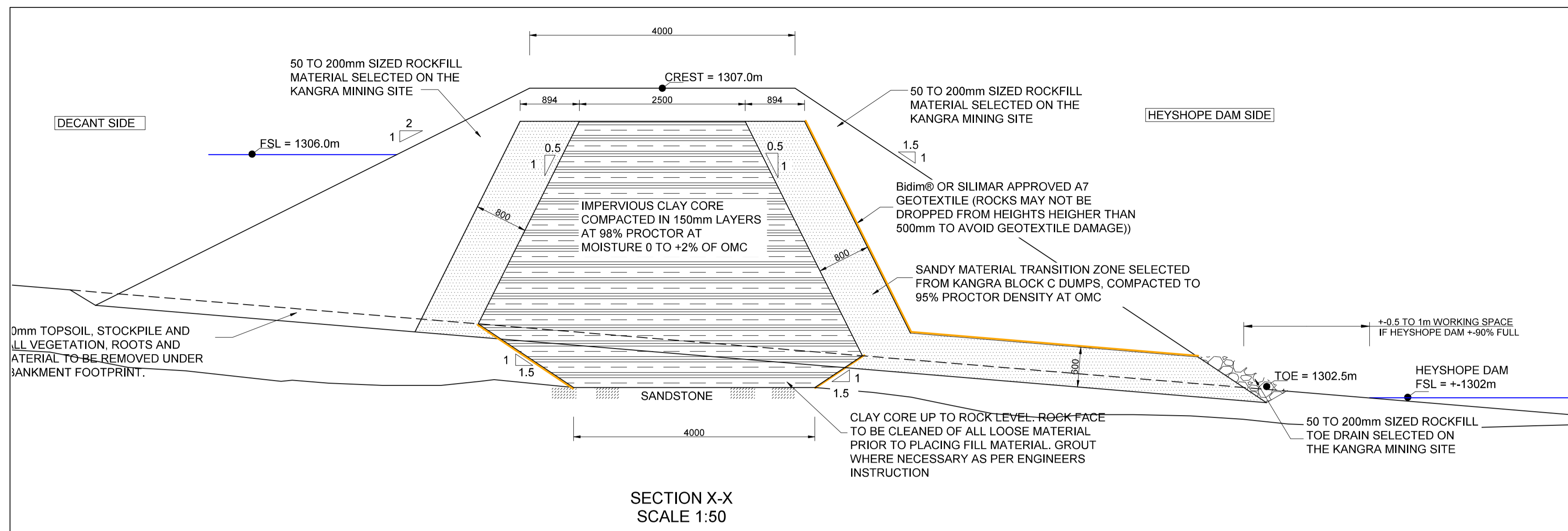
Project Name:

MAQUASA DECANT

Drawing Description:

**DECANT POINT DAM
 DETAILED LAYOUT PLAN**

Scale: AS INDICATED	Plot Date: 13/12/2022
Drawing Sequence N°: G2021/03/02/100-06/01 REV1	



PREPARATION OF SITE :
THE AREA TO BE OCCUPIED BY THE DAM SHALL BE CLEARED OF BOULDERS, TREES, STUMPS, GRASS AND TOPSOIL. THE LATTER SHOULD BE STOCKPILED AND USED ON THE FACE OF THE DAM TO FACILITATE THE ESTABLISHMENT OF SUITABLE GRASS COVER. ANY LAYERS OF SAND, ORGANIC OR POROUS MATERIAL SHALL BE EVACUATED AND REMOVED FROM THE CONSTRUCTION AREA.

FOUNDATIONS :
THE CUT-OFF TRENCH AND BASE AREA SHALL BE KEPT FREE OF WATER DURING CONSTRUCTION. ANY POROUS, ORGANIC OR LOOSE MATERIAL SHALL BE CAREFULLY REMOVED BEFORE APPROVED MATERIAL IS PLACED AND COMPACTED.

EMBANKMENT :
MATERIAL WITH A HIGH CLAY CONTENT SHALL BE PLACED IN THE CENTRAL ZONE OF THE EMBANKMENT WHILE ROCKFILL MATERIAL CAREFULLY SELECTED SHALL BE PLACED IN THE OUTER ZONES. ALL EXCAVATIONS FOR THE EARTHFILL MUST BE BELOW FULL SUPPLY LEVEL OF THE BASIN IF NOT IMPORTED. ANY EMBANKMENT MATERIAL SHALL BE FREE OF VEGETATION, BOULDERS AND TOP-SOIL. THE ENTIRE EMBANKMENT SHALL BE CONSTRUCTED IN LAYERS NOT EXCEEDING 300 MM (MEASURED LOOSE) AND COMPACTED BY ROUTING COMPACTION EQUIPMENT SYSTEMATICALLY OVER EACH LAYER. AN ALLOWANCE OF 5 % IN HEIGHT SHALL BE MADE FOR SETTLEMENT. SMALL HOLES AND DEPRESSIONS SUCH AS MAY OCCUR IN THE ABUTMENTS, CORE TRENCH, OR AROUND OUTLET PIPE SHALL BE HAND RAMMED TO MAXIMUM COMPACTION.

SPILLWAY :
THE SPILLWAY IS TO BE EXCAVATED TO THE RECOMMENDED MINIMUM WIDTH. THE TOTAL FREEBOARD OF THE EMBANKMENT IS TO BE NO LESS THAN THE MINIMUM RECOMMENDED HEIGHT ABOVE THE SPILLWAY LEVEL. THE SPILLWAY AND THE SLOPE DOWNSTREAM OF THE SPILLWAY SHALL BE CLEARED OF OBSTRUCTIONS SUCH AS TREES, BOULDERS, ETC., AND ALL DEPRESSIONS FILLED IN AN APPROVED MANNER. THE SLOPE OF THE OPEN CUT FLANKING THE SPILLWAY SHALL BE SLOPED TO A MINIMUM SLOPE OF 1:2 OR FLATTER. THE FACE OF THE TRAINING WALL MUST BE CAREFULLY LINED WITH STONE TO A DEPTH OF 250 MM. THE ENTIRE SPILLWAY AND THE SLOPE DOWNSTREAM OF THE SPILLWAY SHALL BE TOPSOILED AND GRASSED. THE TOPSOIL SHALL BE LIGHTLY COMPACTED BY WHEELED VEHICLES OR BY TAMPING. THE FINAL THICKNESS OF TOPSOIL AFTER COMPACTION SHALL BE AT LEAST 75 MM.

GRASSING AND FINISHING :
THE ENTIRE EXPOSED EMBANKMENT SURFACES OF THE CHANNEL BERMS SHALL BE TOPSOILED AND PLANTED WITH AN APPROVED GRASS TO BE WELL FERTILIZED UNTIL GROWTH IS FIRMLY ESTABLISHED. THE EMBANKMENT CREST SHALL BE SLOPED SLIGHTLY BACKWARDS TOWARDS THE DAM BASIN TO AID WITH THE DRAINAGE OF RAIN WATER FROM THE CREST. EMBANKMENT AND SPILLWAY AREA MUST BE FENCED OFF.

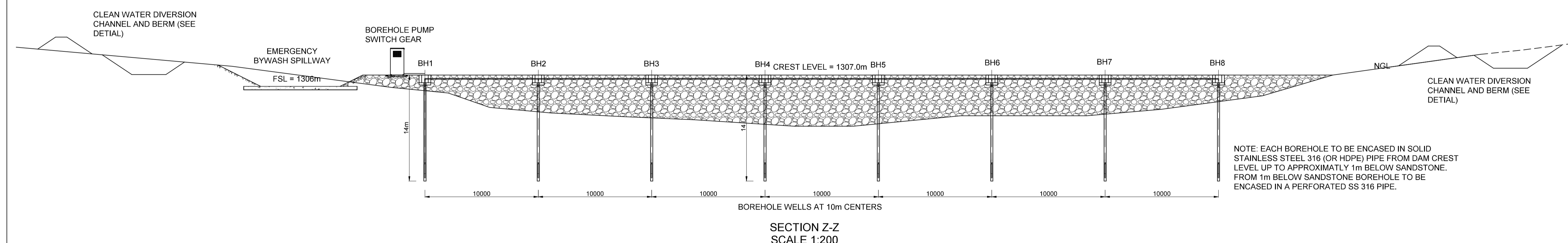
General Notes and Specifications

References

G2021/03/02/100-06/01	DECANT POINT DAM DETAILED LAYOUT PLAN
G2021/03/02/100-08	BOREHOLE PIPES AND PUMP DETAIL

Amendments

Date	Checked	Done by	Description
13/12/2022	F KRUGEL	B MUHL	BOREHOLE POSITION



CESA

CONSULTING ENGINEERS CC

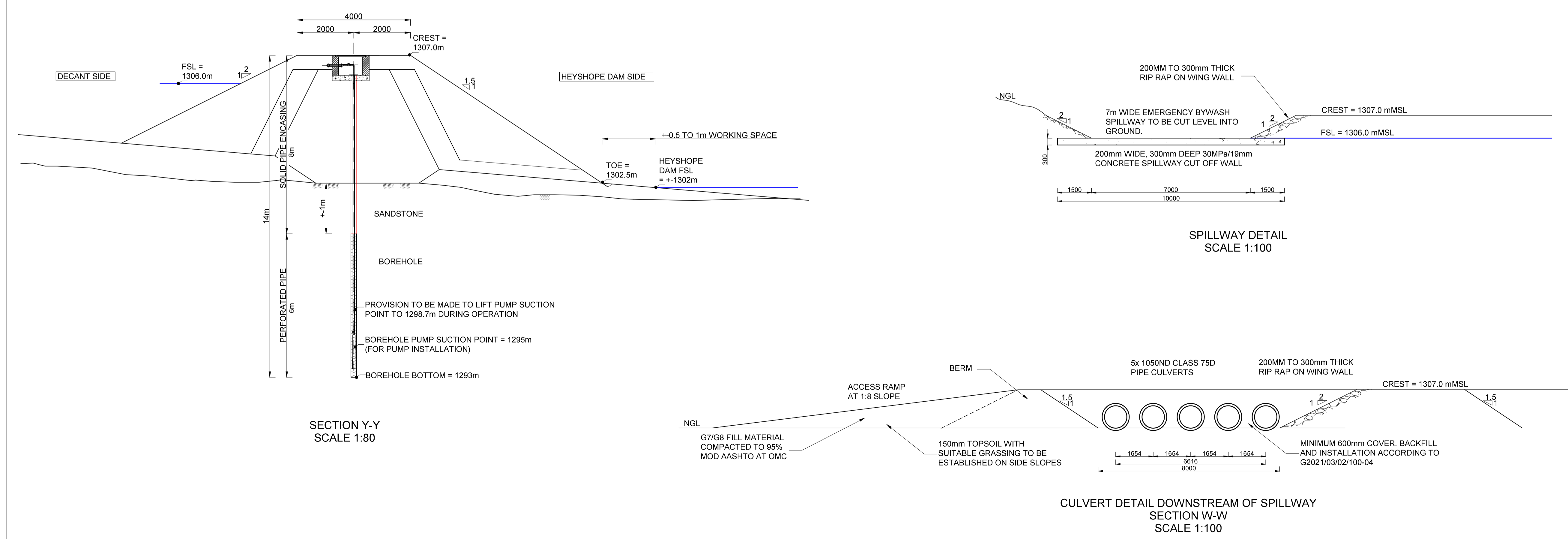
119 Deputasie Street
P O Box 2266 VRYHEID 3100
Tel / Fax: 034 982 3425

Designed:	Drawn:	Checked:
B MUHL	B MUHL	F KRUGEL

Approval Engineer:

F Krugel 13/12/2022

Engineer : G F KRUGEL, Pr. Date
Eng. ECSA Reg N° 910142



Client:

KANGRA

KANGRA COAL (PTY) LTD
7th Floor Fredman Towers,
13 Fredman drive
Sandown
2196
Tel: 011 783 7996

Approval Client:

Client: _____ **Date:** _____

Project Name:

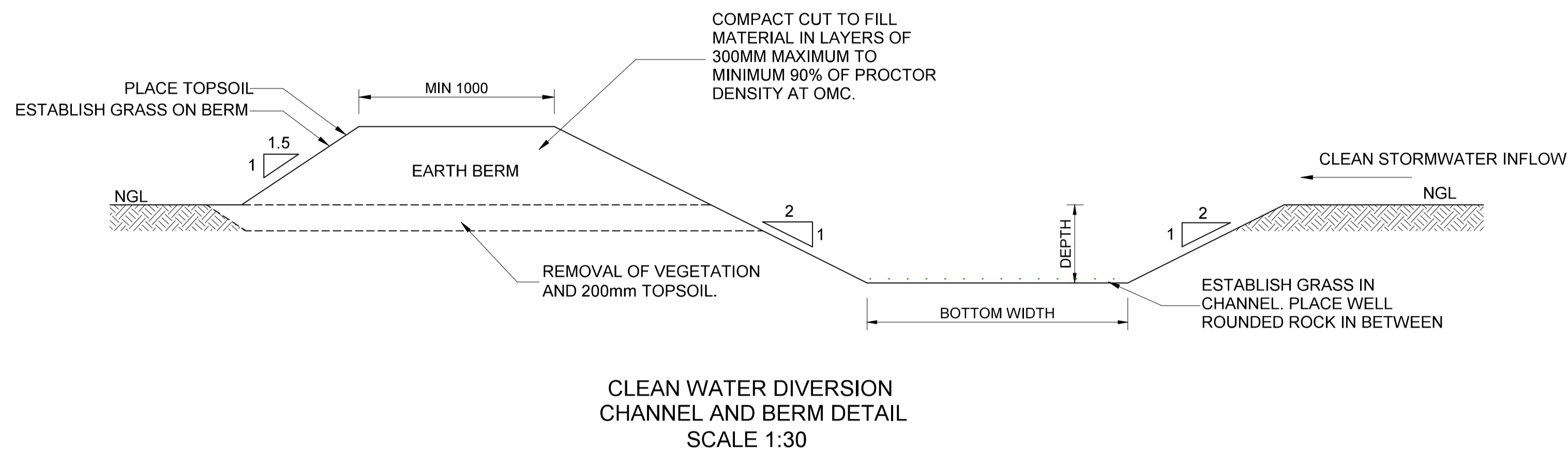
MAQUASA DECANT

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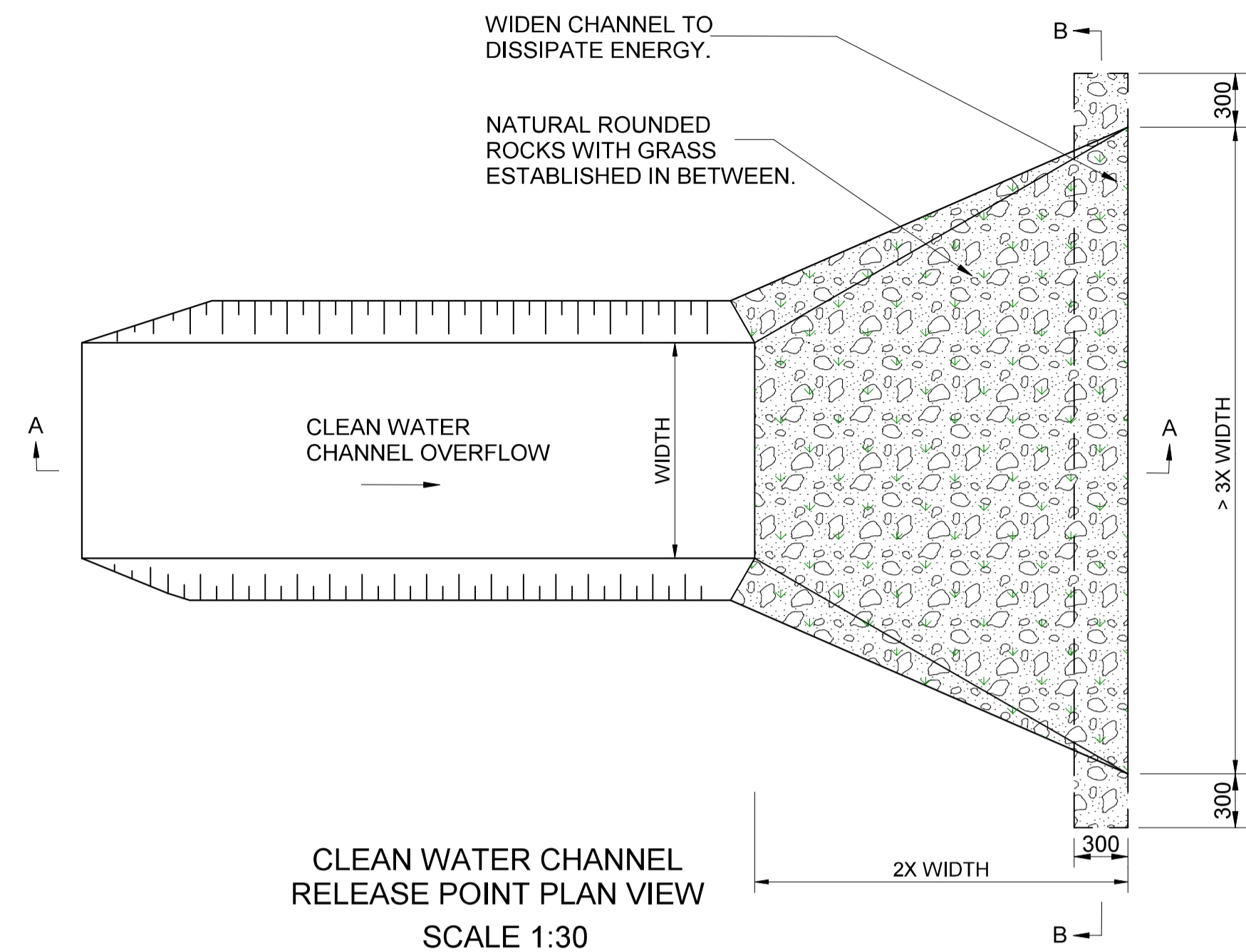
DECANT POINT DAM DETAIL

Scale: AS INDICATED **Plot Date:** 13/12/2022

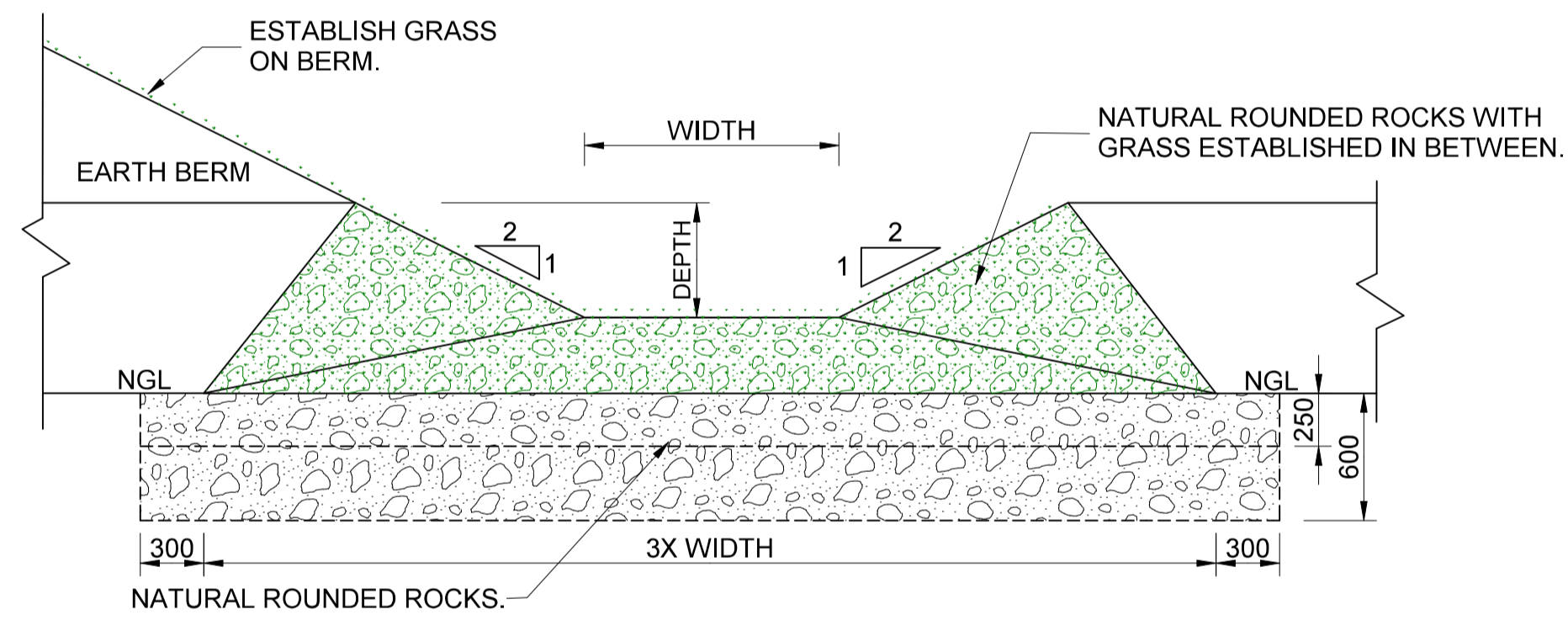
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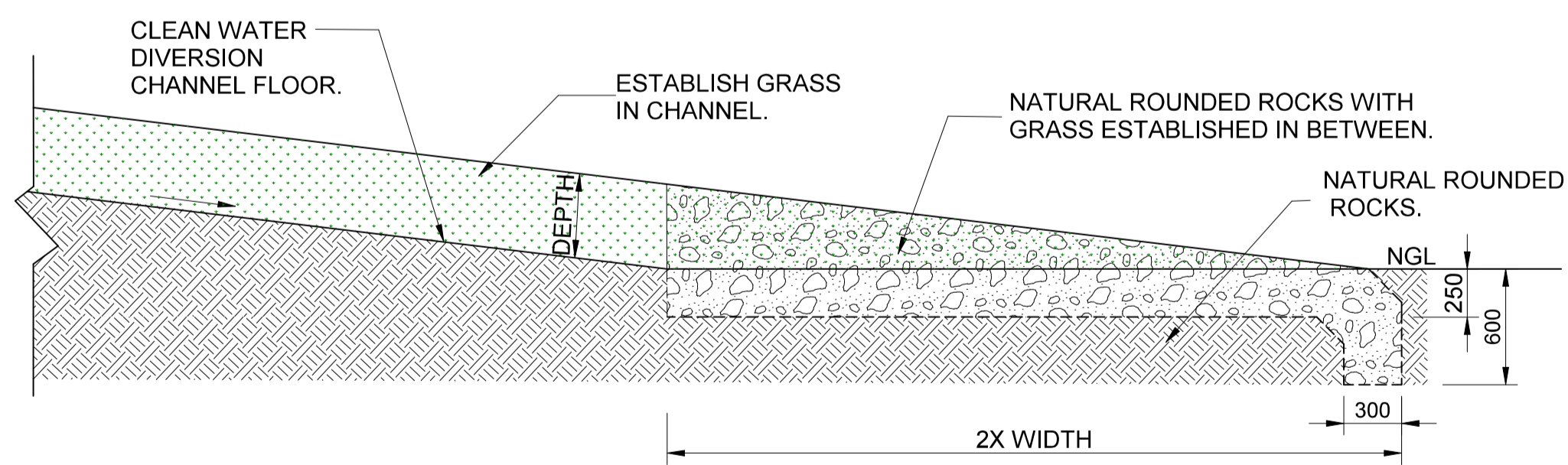
CLEAN WATER DIVERSION CHANNEL AND BERM DETAIL
SCALE 1:30



CLEAN WATER CHANNEL RELEASE POINT PLAN VIEW
SCALE 1:30



SECTION B-B
SCALE 1:30



SECTION A-A
SCALE 1:30

General Notes

ALL EARTHWORKS TO SANS 1200

GRASS TO BE WELL ESTABLISHED. PROVISION IS TO BE MADE BY CONTRACTOR TO ALLOW FOR ESTABLISHMENT OF GRASS WITHOUT EROSION DURING CONSTRUCTION PHASE.

ALL DIMENSIONS TO BE CONFIRMED WITH ENGINEER ON SITE PRIOR TO CONSTRUCTION

References

Drawing No.	Title
G2021/03/02/100-02	DECANT DAM LAYOUT

Amendments

Date	Checked	Done by	Description



GFK
GFK CONSULTING ENGINEERS

119 Deputasie Street
P O Box 2266 VRYHEID 3100
Tel / Fax: 034 982 3425

Designed:	Drawn:	Checked:
F.KRUGEL	M.KRUGEL	F.KRUGEL

Approvals:

Engineer (G F KRUGEL, Pr Eng, Date
ECSA Reg N° 910142):

Client:



KANGRA COAL (PTY) LTD

13 Fredman Drive, Fredman Towers
7th Floor, Sandown, 2196
Johannesburg
Tel: 011 783 7996

Approvals:

Client: _____ Date _____

Project Name:

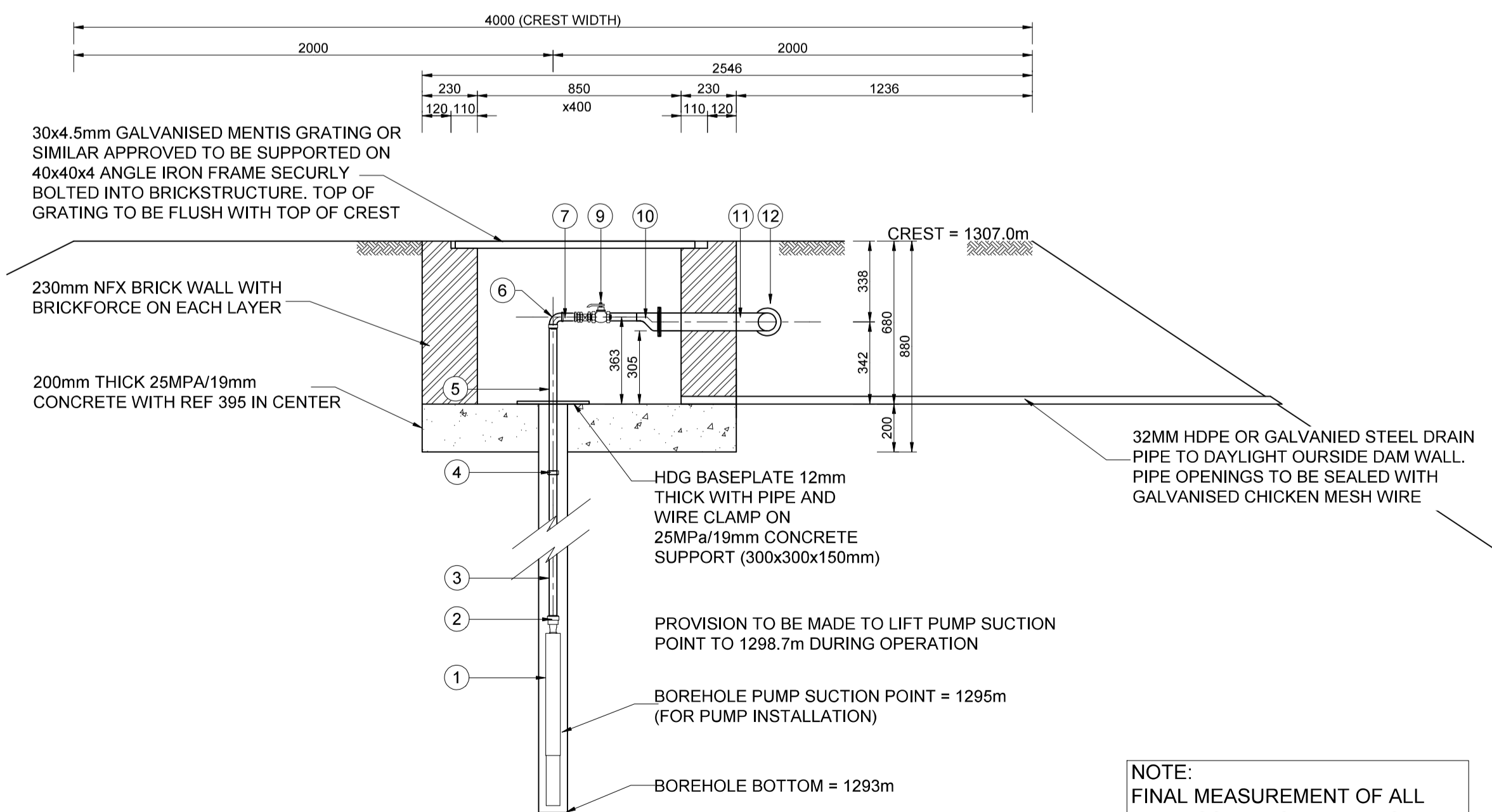
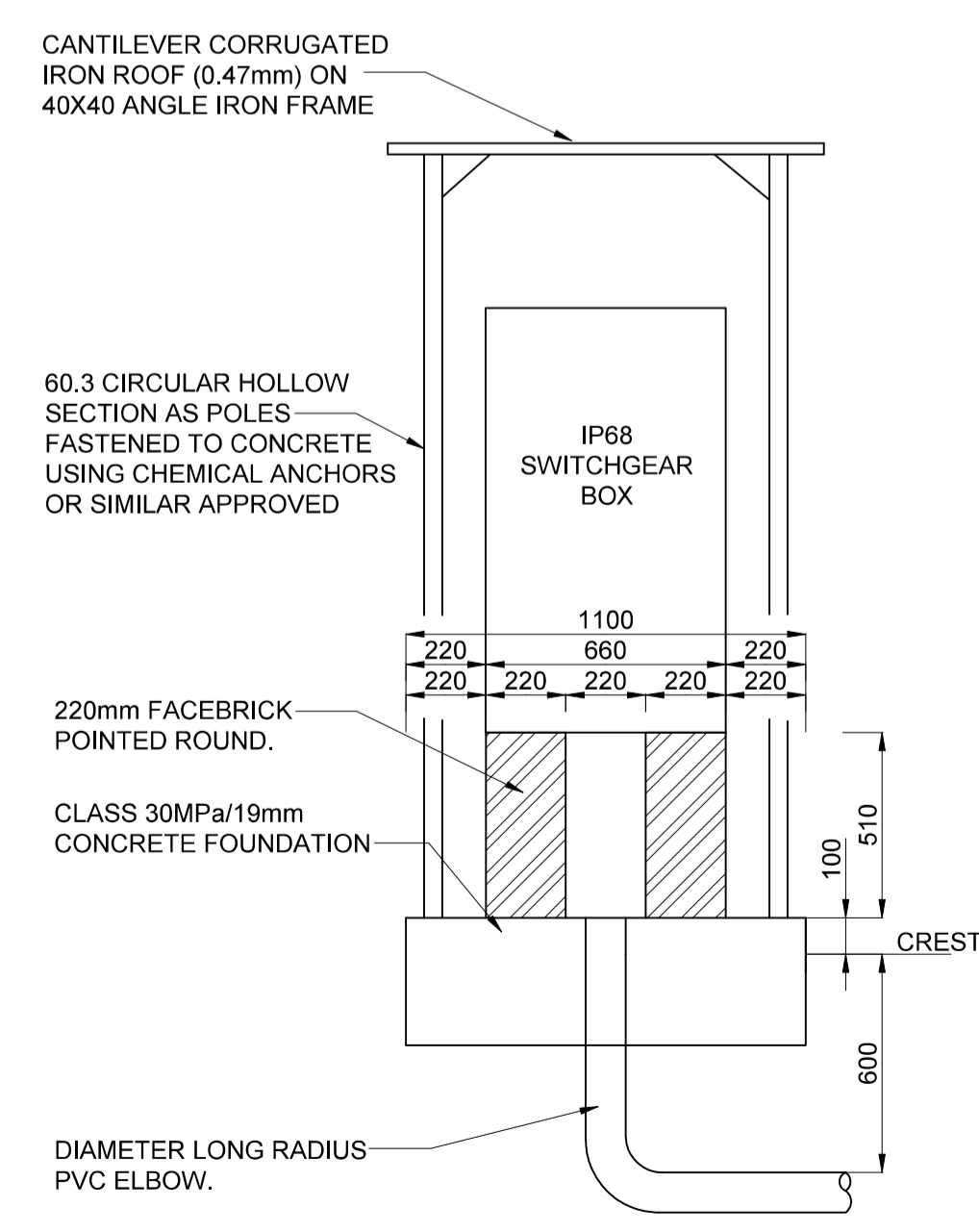
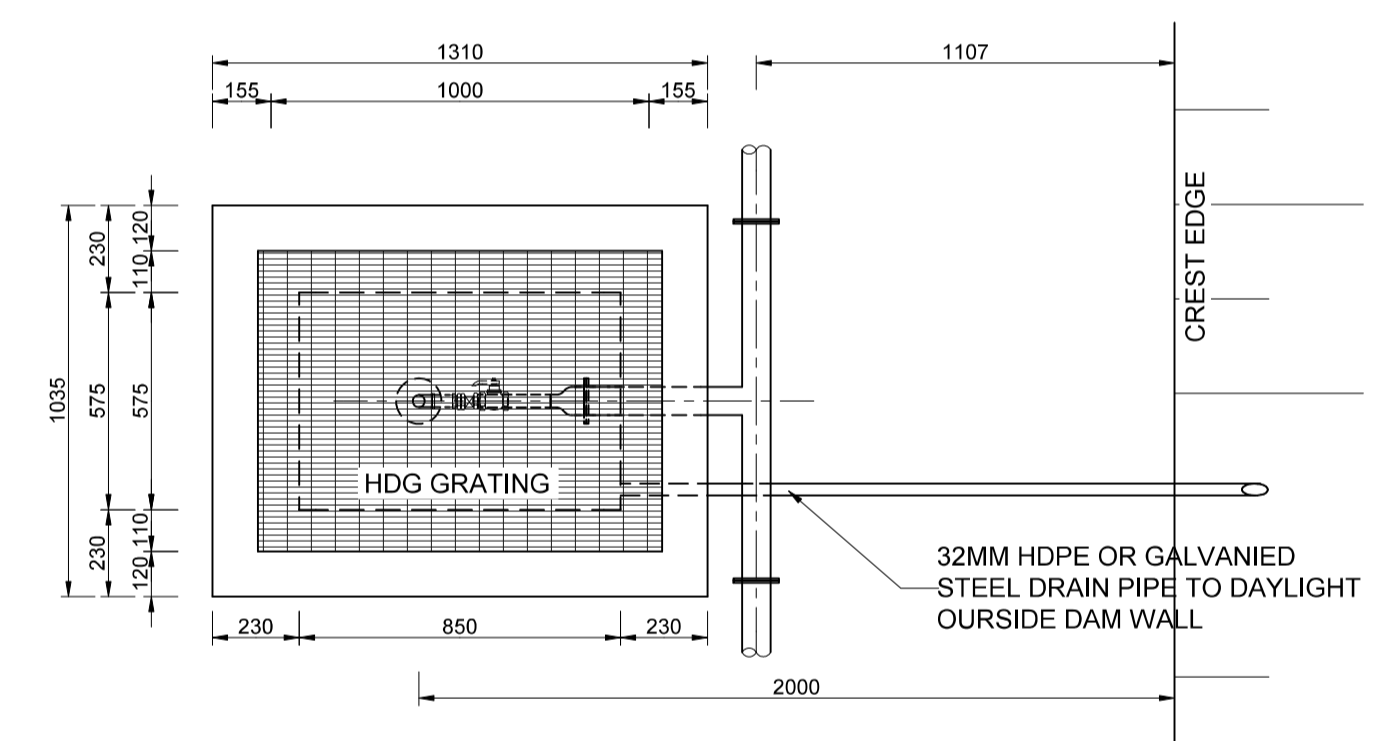
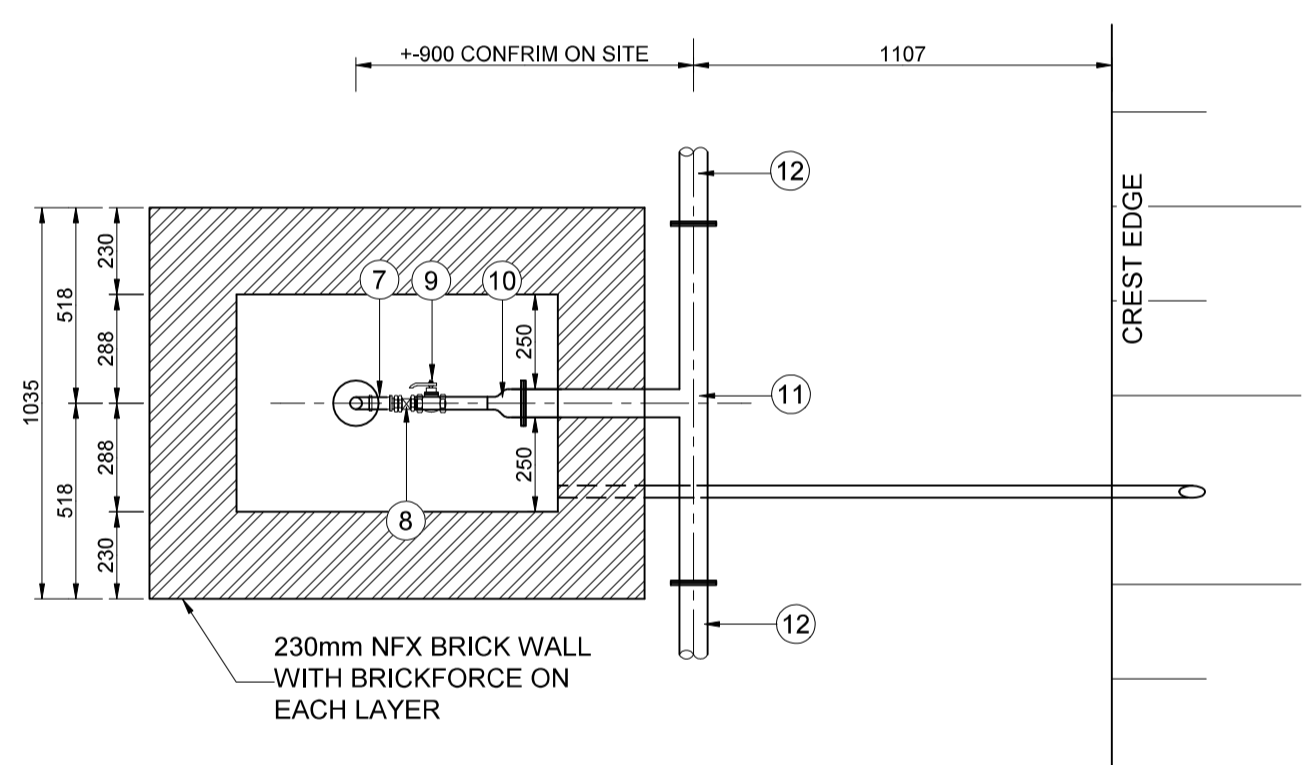
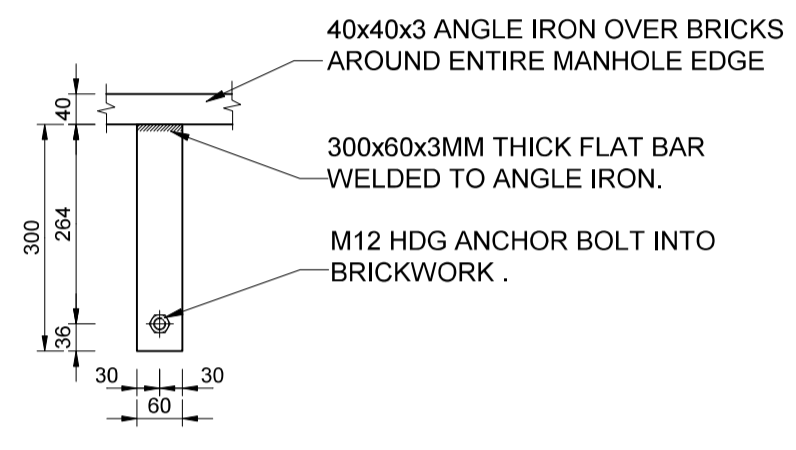
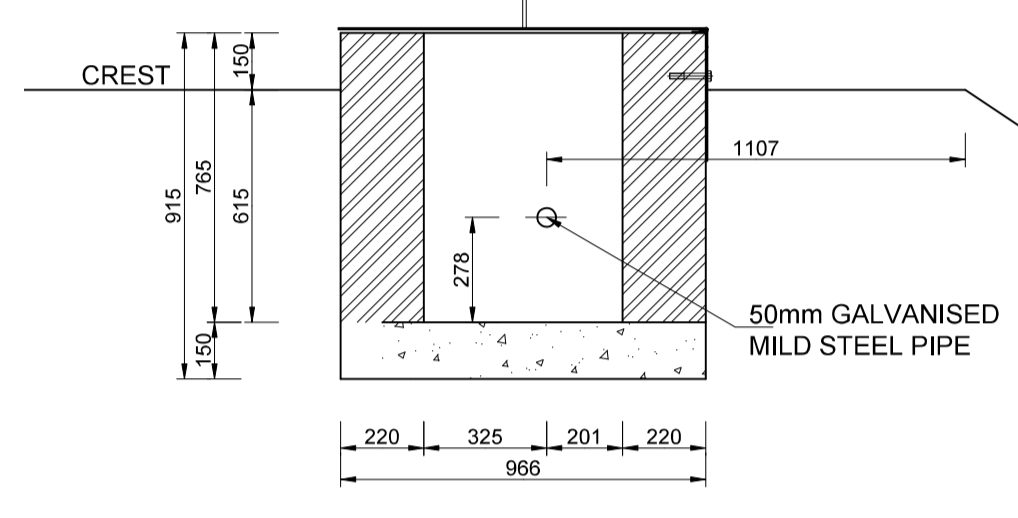
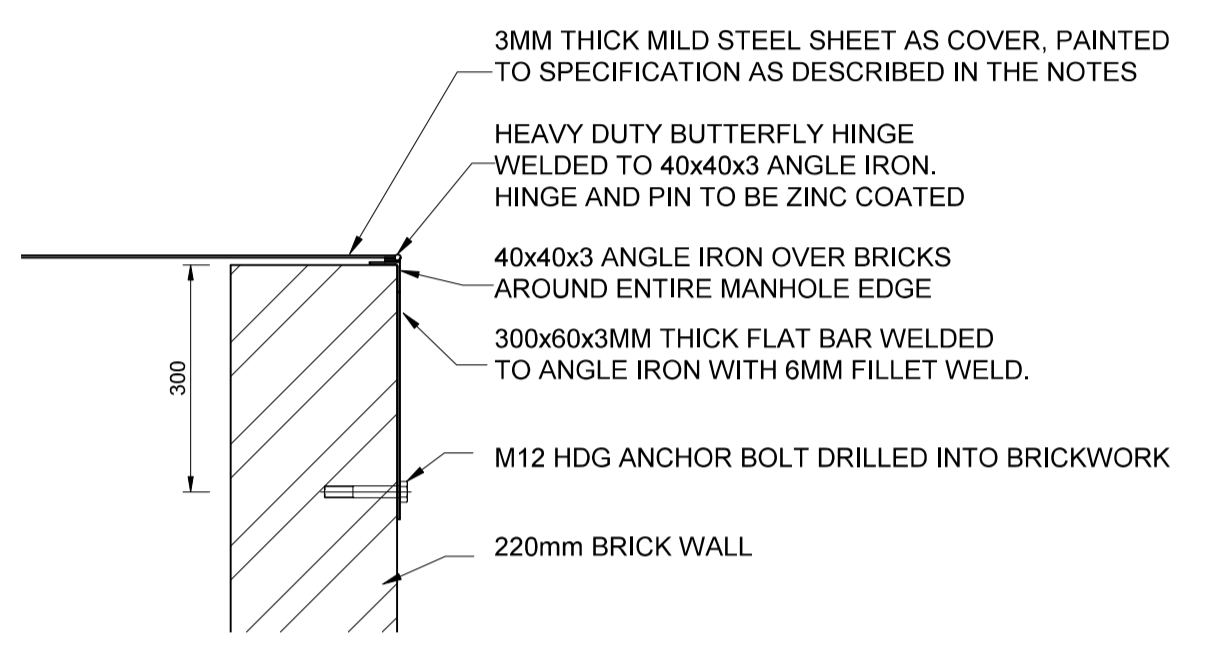
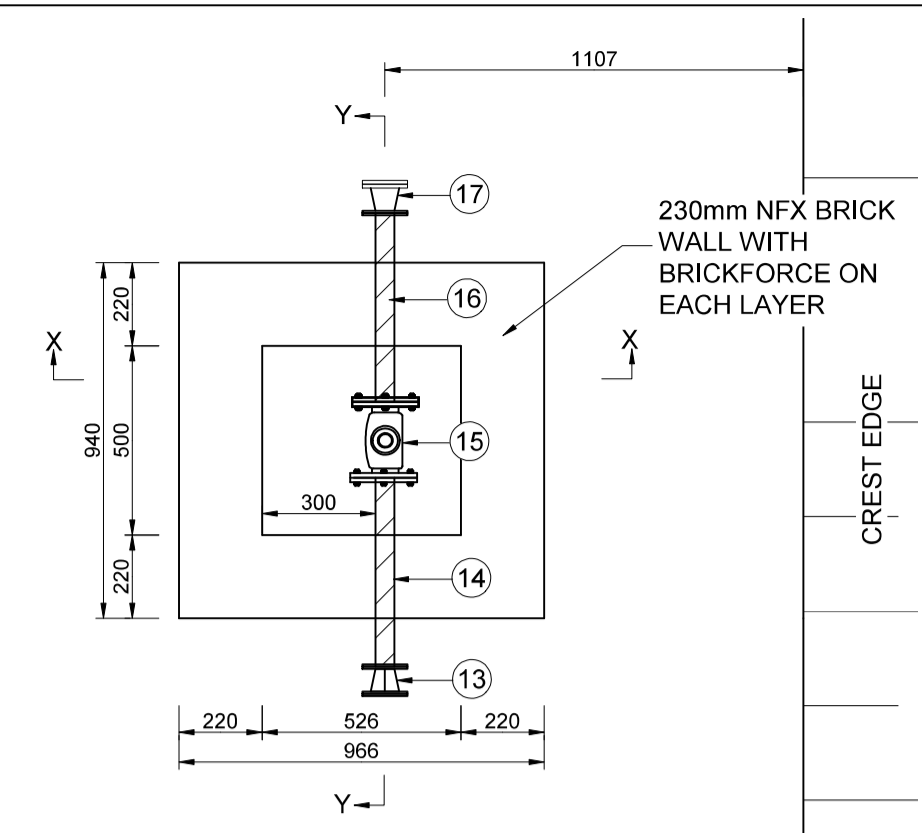
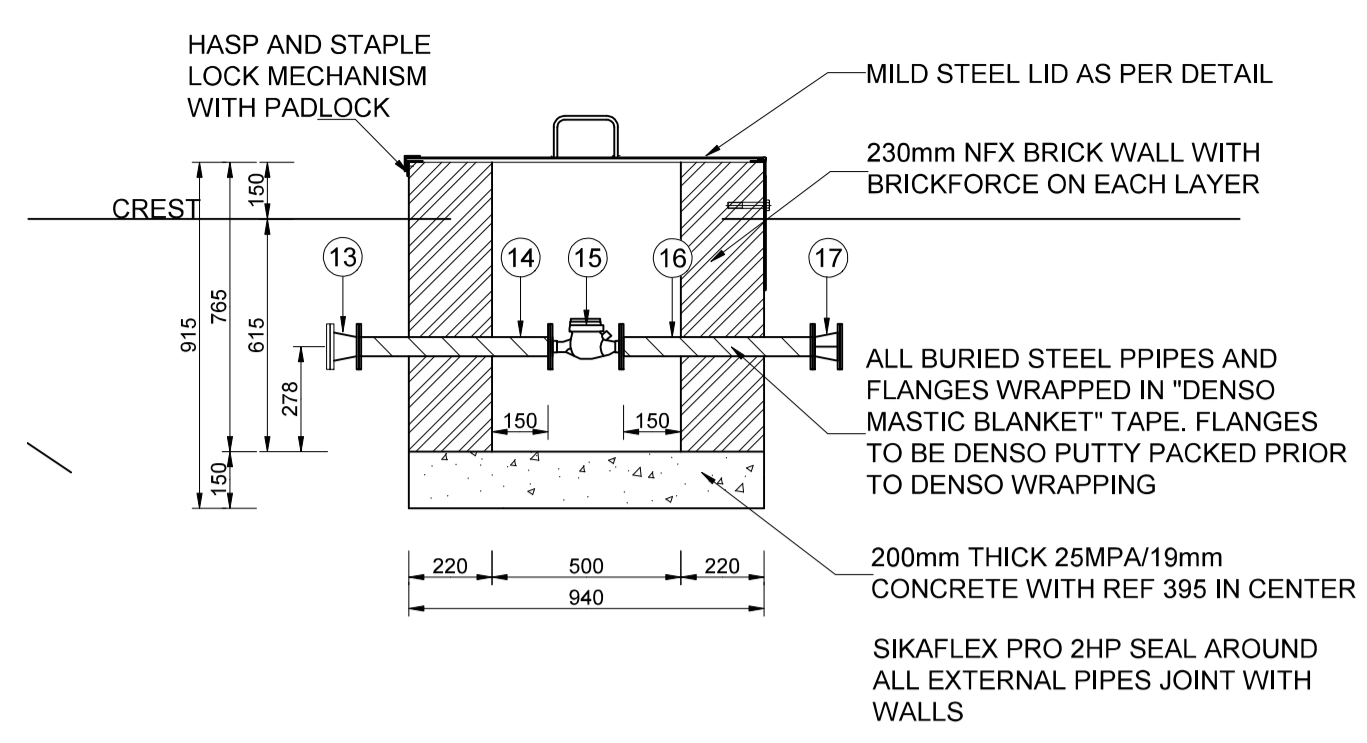
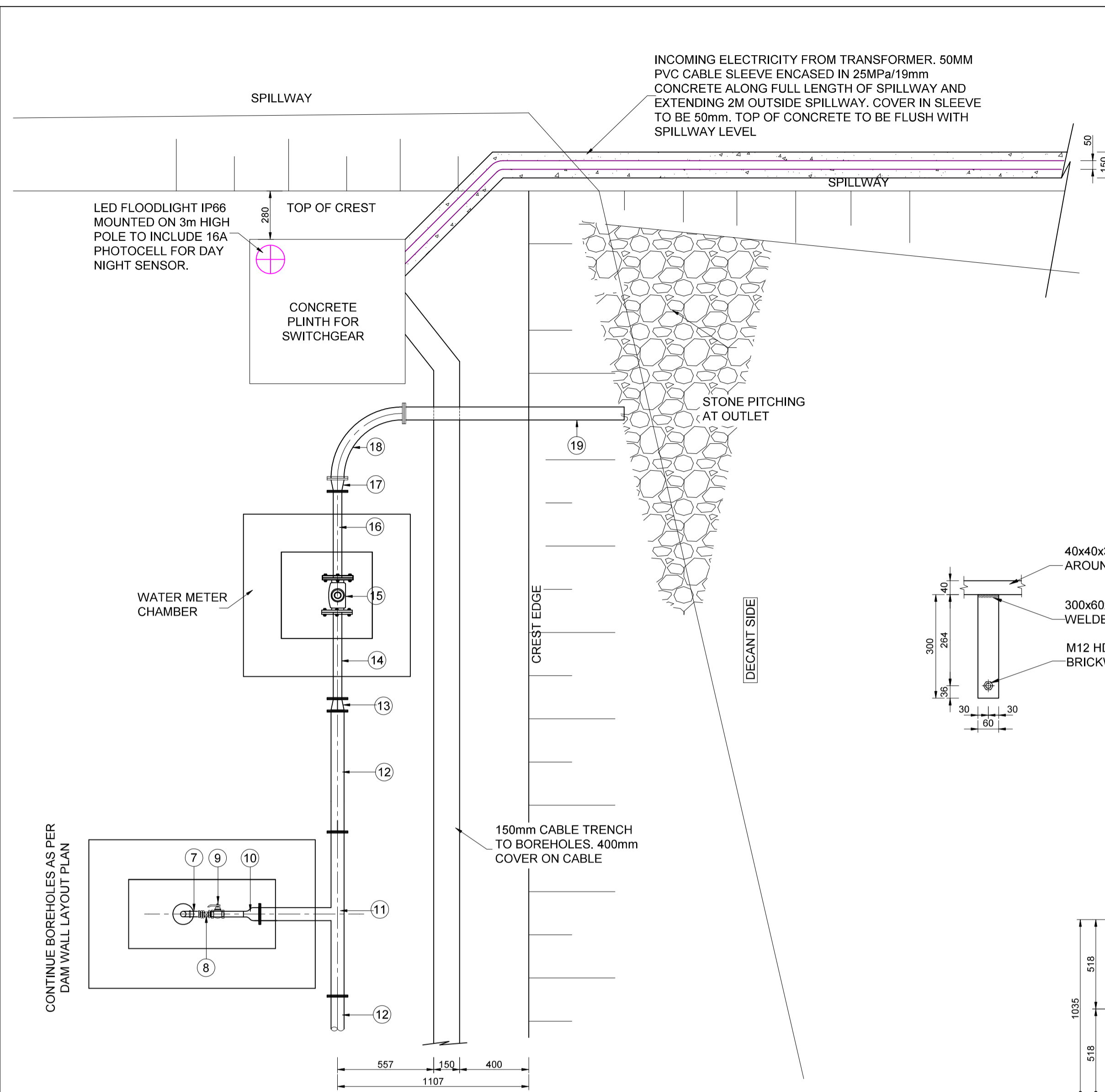
MAQUASA DECANT

Drawing Description:

STANDARD CLEAN WATER DIVERSION CHANNEL AND BERM

Scale: 1:30 Plot Date: 19/04/2022

Drawing No: G2021/03/02/100-07



Item	Description
1	Submersible Vansan VSP SN 403/11 borehole pump and motor
2	32ND Adaptor for HDPE pipe
3	32ND PN10 HDPE Pipe
4	32ND Female adaptor for HDPE pipe to HDG steel pipe
5	32ND 500mm Long HDG steel pipe
6	32ND HDG Elbow
7	32 x25mm Reducing bush
8	25ND Non-return valve
9	25ND Ball valve
10	100mm long 25mm HDG straight pipe piece male threaded on one side, welded to 25x30 eccentric enlarger flanged on end. Items can be separate.
11	75ND HDPE PN 10 Flanged Tee
12	75ND HDPE Pipe flanged on ends to connect to Tee
13	75x50 ND Galvanised Mild Steel Concentric reducer flanged on both ends
14	50ND Galvanised Mild Steel, 500mm long straight pipe piece flanged on ends
15	50ND Woltman Water Meter or similar approved
16	50ND Galvanised Mild Steel, 500mm long straight pipe piece flanged on ends
17	75x50 ND Galvanised Mild Steel Concentric reducer flanged on both ends
18	75ND HDPE Segmented long radius 90 deg bend, flanged on ends
19	75ND HDPE PN 10 Strained pipe piece, 1000mm long flanged on one end

NOTE: SIMILAR APPROVED BASE OR STRUCTURE FOR POLE MOUNTED SWITCH GEAR CAN BE USED UPON CONFIRMATION FROM ENGINEER

General Notes and Specifications

References

Amendments

Date	Checked	Done by	Description
13/12/2022	F KRUGEL	B MUHL	BOREHOLE POSITION

CONSULTING ENGINEERS CC

 119 Deputasie Street

 P O Box 2266 VRYHEID 3100

 Tel / Fax: 034 982 3425

Designed:	Drawn:	Checked:
B MUHL	B MUHL	F KRUGEL

Approval Engineer:

 13/12/2022

 Date

 Engineer: G F KRUGEL, Pr.

 Eng. ECSA Reg N° 910142

Client:

KANGRA COAL (PTY) LTD

 7th Floor Fredman Towers,

 13 Fredman drive

 Sandown

 2196

 Tel: 011 783 7996

Approval Client:

 Client: _____ Date _____

Project Name:

MAQUASA DECANT

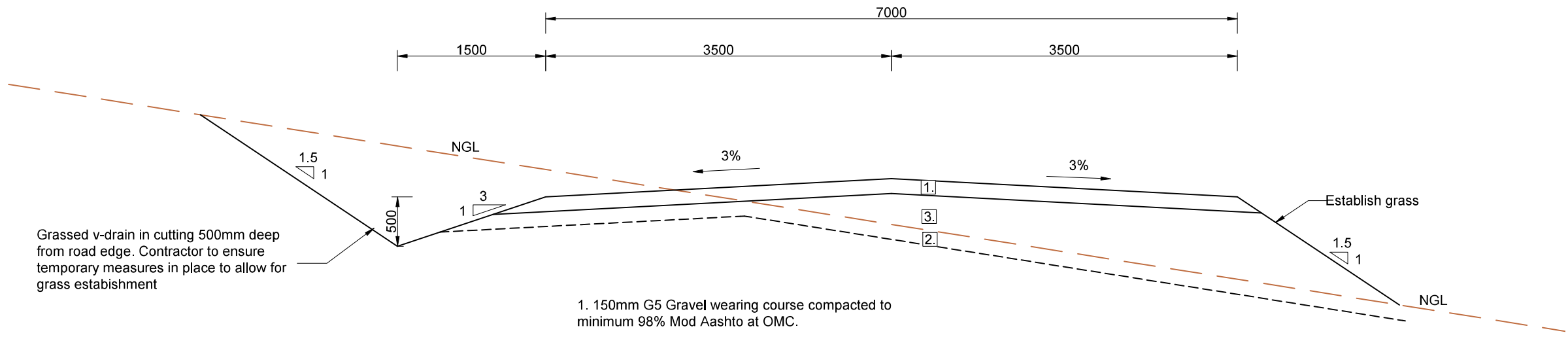
Drawing Description:

BOREHOLE PIPES AND PUMP DETAIL

Scale: AS INDICATED

Plot Date: 13/12/2022

Drawing Sequence N°: G2021/03/02/100-08 REV 1



Grassed v-drain in cutting 500mm deep from road edge. Contractor to ensure temporary measures in place to allow for grass establishment

1. 150mm G5 Gravel wearing course compacted to minimum 98% Mod Aashto at OMC.
2. Remove topsoil to 150mm, stockpile and maintain. Shape, 200mm rip, water if required and recompact in-situ layer to minimum 90% Mod Aashto at OMC.
3. Fill with G7-G9 material or better and compact to 95% Mod Aashto at OMC.

TYPICAL ROAD CROSS-SECTION
SCALE 1:50

General Notes and Specifications

References

Drawing No.	Title

Amendments

Date	Checked	Done by	Description

CONSULTING ENGINEERS CC

119 Deputasie Street
P O Box 2266 VRYHEID 3100
Tel / Fax: 034 982 3425

Designed:	Drawn:	Checked:
B MUHL	B MUHL	F KRUGEL

Approvals:

19/01/2023
 Engineer (G F KRUGEL, Pr Eng, ECSA Reg N° 910142);

Client:

KANGRA

KANGRA COAL (PTY) LTD

13 Fredman Drive,
Fredman Towers, 7th Floor
Sandown
2196
Tel: 011 783 7996

Approvals:

Client: _____ Date: _____

Project Name:

MAQUASA DECANT

Drawing Description:

ACCESS ROAD
TYPICAL SECTION

Scale: AS INDICATED	Plot Date: 2022/12/09
Drawing Sequence N°: G2021/03/02/100-09	