Klipspruit Life Extension Project:
Execution phase

KPSX Weltevreden PCD 4

Integrated Operation and Maintenance Manual and Emergency Preparedness Plan for KPSX Weltevreden PCD 4, Pump Station and Associated Pipelines

South 32

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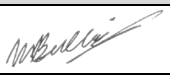
0	2021/09/23	JM		MB		JS	
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List of Abbreviations and Acronyms

Abbreviation / Acronym	Description
APP	Approved Professional Person
DSO	Dam Safety Office (of the Department of Water and Sanitation)
DWA	Department of Water Affairs (now Department of Water and Sanitation)
DHSWS	Department of Human Settlements, Water and Sanitation
DWS	Department of Water and Sanitation (now Department of Human Settlements, Water and Sanitation)
ELLS	Electric Leak Location Survey
FSL	Full Supply Level
FOC	Fibre-optic cable
HDPE	High Density Polyethylene
KPa	Kilopascal
KPS	Klipspruit Mine

Abbreviation / Acronym	Description
KPSX	Klipspruit Extension (KPSX) Project
MAP	Mean Annual Precipitation
masl	Metres above sea level
MCC	Motor control center
MSL	Mean Sea Level
NEMA	National Environmental Management Act
NOC	Non - overspill crest (of an embankment dam or concrete dam)
NWA	National Water Act, 1998 (Act No. 36, 1998)
O&M	Operation and Maintenance
PCD	Pollution Control Dam
PCPP	Phola Coal Processing Plant
PLC	Programmable Logic Controller
PPE	Personal Protection Equipment
RDF	Recommended Design Flood
RIO	Remote Input/Output
RL	Reduced Level
RSV	Resilient Valve
SCADA	Supervisory Control and Data Acquisition
SEF	Safety Evaluation Flood
uPVC	Unplasticized Polyvinyl Chloride
USBR	United States Bureau of Reclamation

1 Introduction

This manual is drawn up as per the client's instruction to generate an integrated Operation and Maintenance (O&M) manual for Pollution Control Dam 4 (PCD 4), PCD 4 Pump Station and associated pipelines of the dam.

As a Category I dam, this manual is not required in terms of Regulations 7; 8; 9 and 11 of the Regulations made by the Minister of Water Affairs in accordance with Government Gazette No 35062 of 24 February 2012 (Government Notice R. 139, National Water Act (36/1998): Regulations: Safety of dams) and in terms of Chapter 12 of the National Water Act, 1998 (Act 36 of 1998).

This manual describes the general O&M procedures to be performed to ensure the safe use of Pollution Control Dam 4 throughout its life. It outlines the routine inspections which must be undertaken and the records thereof which must be kept. In the event of unusual conditions arising, emergency planning procedures are outlined.

This manual must be kept up to date and available for use at PCD 4. Alteration to any procedures may only be done on the instruction of an experienced dam engineer or approved professional person (APP) specifically appointed by the owner of PCD 4 for the 'task'.

The operation and maintenance (O&M) procedures are the responsibility of the owner of the dam and must be complied with in terms of the National Water Act, 1998 (Act 36, 1998).

2 Description of the dam

The project area is located approximately 40 km west of Emalahleni (formerly known as Witbank), close to the town of Ogies, in Mpumalanga, South Africa. KPSX Weltevreden PCD 4 is located approximately 7.5 km north of Ogies, 2.5 km from the D432 road, between Ogies (R555) and Clewer Towns (R104).

Klipspruit Extension (KPSX) Weltevreden Pollution Control Dam 4 is a 2.9 m high (as built height) lined homogeneous earthfill embankment dam. The dam is an off-channel reservoir and is located on the farm Wildebeestfontein No 327JS Portion 8 and 15 (refer to Drawing No. KPSX-EP-11000-DRG-JJ-BP- 0001-01, titled SITE WIDE – BLOCKPLAN FOR PIT BD - LAYOUT).

The dam is owned by South32 Energy Coal Holdings South Africa (South Africa) and will be used as a buffer dam for the dirty water of the mine including dirty storm water runoff and pit dewatering water. Water from the PCD will be used for dust suppression and process water demands of the KPSX project and Phola Coal Processing Plant (PCPP) situated at South32's existing Klipspruit (KPS) operation situated approximately 3 km east of Ogies.

The PCD is rectangular in shape with the outer walls comprising of homogeneous earthfill embankments with a single compartment (see Drawing No. KPSX-EP-16260-DRG-WW-GA- 0101-01 in Appendix J).

The compartment is provided with a top intake and outlet through the pump intake structure to the pump station. The intake into the compartment comprises an inlet spillway (baffled chute) that is supplied from a silt trap and pump discharge chamber situated directly upstream of the southern embankment (see Drawing No. KPSX-EP-16260-DRG-WW-GA-0140-01 in Appendix J). The inlet spillway was designed as a baffled chute to reduce the velocity of inflow and protect the PCD’s lining system.

The outlet works of the compartment consists of a pump intake structure, comprising of a sump with various pump intake pipelines within the structure, access stairs to the sump and a walkway to the level measurement instrument pipe installed at the sump extending above the full supply level (FSL), (see Drawing No. KPSX-EP-16260-DRG-WW-GA-0120-01 in Appendix J). Water is abstracted through the suction pipes from the pump station, where the water is pumped to various demand nodes, reservoirs and dams in the larger water system of the project.

The perimeter wall of the compartment is constructed to the full non-overspill crest (NOC) level of the dam. The reservoir is fitted with a single spillway to discharge emergency flows. The spillway is sized to accommodate the design flood to prevent uncontrolled discharge from the compartment. The inlet structure and silt trap are accessible to maintenance vehicles without any need for additional access ramps. The PCD is designed to be non-trafficable.

The PCD is lined with a Class C single composite liner in accordance with environmental regulations. The liner comprises a 1.5 mm thick HDPE Geomembrane (primary liner) and a 150 mm thick geocell confinement layer filled with cement stabilised for protection of the high-density polyethylene (HDPE) geomembrane, shown in Figure 2-1. Further detail of the geocell filled with cement stabilised material and anchoring to concrete structures are shown in Appendix L, drawings KPSX-EP-16260-DRG-WW-DE-0103-01 and KPSX-EP-16260-DRG-WW-DE-0104-01. A herringbone subsoil drainage system under the liner is provided to control groundwater under the floor. The subsoil drainage system is also used for leak detection system in compliance with the NEMA Act. An Electric Leak Location Survey (ELLS) was done upon completion of the liner installation to identify possible leaks in the liner to be repaired.

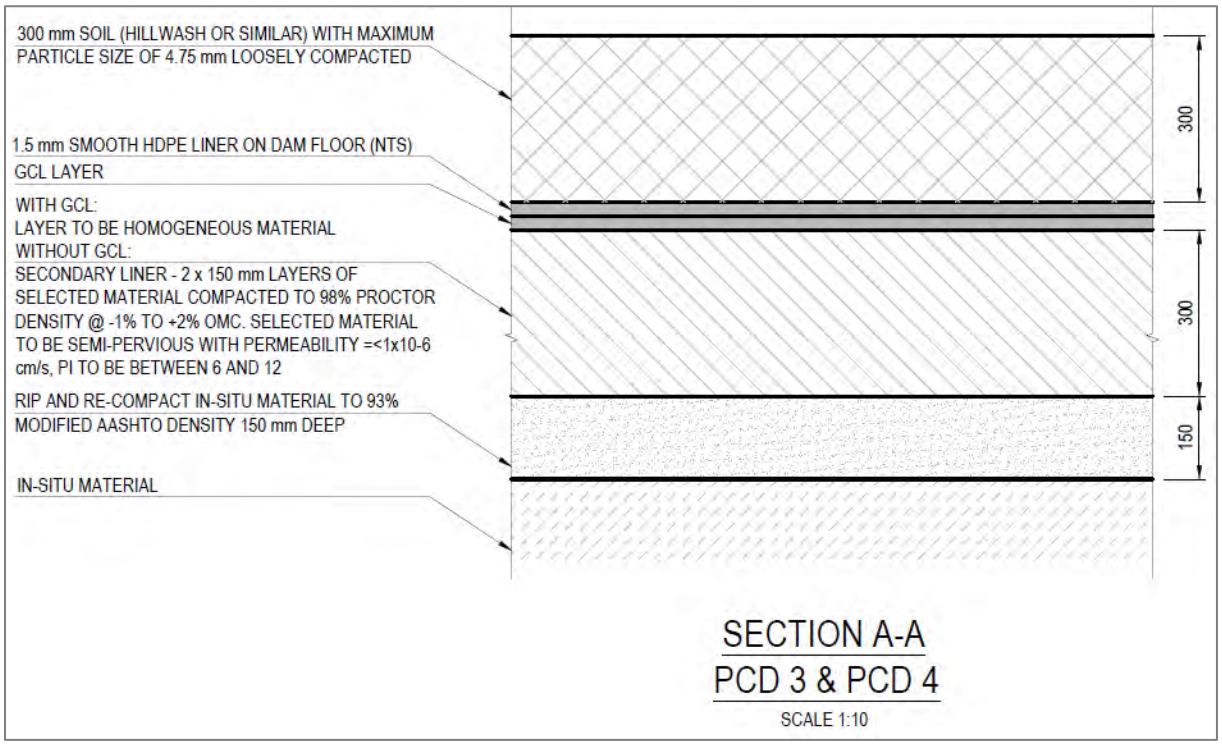


Figure 2-1: PCD 4 Class C single composite liner design for the dam basin (as per drawing KPSX-EP-16260-DRG-WW-DE-0103-01 in Appendix L)

The dam was designed by Zutari Consulting Engineers (previously Aurecon) with Mr AG Chemaly as the Lead Dam Engineer. The main construction was completed in 2019 by Masibuyisane Klipspruit Joint Venture.

The main features of KPSX Weltevreden PCD 4 are listed in the Table 2-1 (the levels are given to mean sea level (MSL)).

Table 2-1: Main features of the dam

Feature or Parameter	Description and/or Detail(s)
Type of dam	Lined homogeneous earthfill
Owner	South32 Energy Coal Holdings South Africa (South Africa)
Designer	Zutari (previously Aurecon)
Contractors	Masibuyisane Joint Venture (PCD and Pump station) Enl Zest (Electrical and Instrumentation)
Completion Date	2019
Location	25° 59' 31.11" S & 29° 03' 30.08" E
Nearest Town	Ogies
Farm Name	Wildebeestfontein No 327JS Portion 8 and 15
Purpose	Pollution Control Dam in terms of Regulation 704 of the NWA and process water
Classification	See DWS letter in Appendix B
Size Classification	Small
Hazard Potential Classification	Low
Category Classification	I

Feature or Parameter	Description and/or Detail(s)
River	None
Type of reservoir	Off channel storage dam on an unnamed watercourse of the Saalklap Spruit
Shape of reservoir	Rectangular in plan
Gross Storage Capacity	62 919.3 m^3
Nett Storage Capacity	62 919.3 m^3
Surface area at FSL	0.0199 km^2 (1.988 ha)
Total catchment area	0.0246 km^2 (2.46 ha). Taken as the surface area of the reservoir at where the upstream slope of the embankment meets NOC level that contributes to *'storm water'* runoff.
Mean Annual Precipitation (MAP)	720 mm
Maximum wall height of PCD 4 (in terms of Section 117*(c)*(i) 'Definitions' in Chapter 12: 'Safety of Dams' in the National Water Act, 1998 (Act No 36,1998).	2.9 m (1 550.4 masl – 1547.5 masl)
Crest length of the dam wall	698.5 m
Wall volume	26 121 m^3
NOC level	Reduced Level (RL) 1 550.40 masl
FSL	1 549.40 masl
Total freeboard (i.e. NOC – FSL)	1.00 m
Maximum base width	15.5 m
Crest width	4.0 m
Upstream face slope	1V:3H
Downstream face slope	1V:2.5H
Upstream slope protection	150 mm high woven geocells (each geocell filled with cement stabilised soil)
Downstream slope protection	Topsoil and grass (hydroseeded)
Internal drainage (this is actually an under-drainage system below the dam lining system)	Herringbone drains comprising 110 mm diameter slotted pipes at the branches and a 160 mm solid wall uPVC pipes for the central pipe. All slotted pipes will be surrounded by 19 mm single sized stone.
Foundation of the reservoir	Completely weathered to highly weathered, very closely jointed to medium jointed, medium soft to hard rock sandstone.
Type of spillway	Open channel. The PCD has a single spillway at the full supply level.
Length of spillway return channel to watercourse	Length of spillway channel = 57.5 m
Width of the spillway channel	6 m
Spillway capacity	17.835 m^3/s
Design flow into the compartment	0.77 m^3/s
Maximum probable storm rainfall	108 mm/hr (this is equivalent to 0.77 m^3/s)
Recommended Design Flood (RDF) – inflow	3.68 m^3/s

Feature or Parameter	Description and/or Detail(s)
Recommended Design Flood (RDF) – outflow	3.68 m^3/s ($Q_{out} \approx 1.00\ Q_{in}$)
Safety Evaluation Flood (SEF) – inflow	3.68 m^3/s + 0.77m^3/s = 4.45 m^3/s
Safety Evaluation Flood (SEF) – outflow	4.45 m^3/s ($Q_{out} \approx 1.00\ Q_{in}$)
RDF water level (masl)	RL 1 549.84 (0.44 m above FSL)
SEF water level (masl)	RL 1 549.89 (0.49 m above FSL)
Non-overspill crest (NOC) level	RL 1 549.40 masl
Inlet works	The inlet works comprises a silt trap and inlet sump that overflows into a short inlet canal that connects to the inlet chute of the compartment. The compartment has a 4 m wide reinforced concrete baffled chute (USBR Basin IX) approximately 11.6 m long down the embankment. The chute discharges into a bucket 4.405 m x 4 m x 0.75 m deep. Flow into the compartment is controlled by two (2) 1.4 m wide by 1.5 m high channel mounted sluice gates installed in the inlet channel upstream of the silt trap and inlet sump. Flow into the reservoir is controlled at the silt trap that discharge into the PCD. Water from the PIT BD dewatering system and the dirty water runoff (stockpile and terraces) through channels is discharged into the silt trap to reduce sedimentation in the PCD.
Outlet works	The dam has no ability to be scoured. Abstracting water through the pump intake structure and the pump station is the only way to empty the dam.
Energy dissipation (outlet works)	There is no energy dissipation structure at the outlet works as the dam has no ability to scour.
Monitoring instruments	Ultrasonic water level recorder(s) connected by FOC to a SCADA system in the Main Control Room for the Mine situated at KPSX Operations Centre Settlement pegs on the NOC of the embankments of the dam. Seepage measurements can be determined by following the procedure described: • Obtain SCADA data for submersible pump with respect to pumping intervals i.e. the time between the pump switching on to pump return water into PCD 4 and switching of the pump. • Calculate time between pumping intervals • Divide the pumped volume by the time interval o Leak detection sump of PCD 4: The pumped volume = 15.655 m^3 • Note seepage rates as calculated

3 Routine inspections

The dam must be inspected at intervals as described below for evidence of development of unusual conditions. Any condition which may affect the safety of the dam should be reported to the Director-General of the Department of Human Settlements, Water and Sanitation.

During the first filling of the dam, inspections must be carried out as follows:

(a) with the dam empty,

(b) with the water level at half of full supply level, and

(c) with the water level at full supply level.

Thereafter routine inspections should be carried out quarterly for the first year, biannually for years two and three and thereafter at yearly intervals. Unusual conditions are described in Section 4 and should be inspected at intervals as suggested.

A routine inspection check list for the dam is included in Appendix A as a form for recording observations. The comment column on this form should be completed or where space is limited, detailed information should be supplied on separate sheets. The form should be signed by the observer and owner of the dam. Changes in conditions from one routine inspection to the next should be monitored or rectified as necessary. The components of the dam that should be included in the routine inspections are discussed below.

3.1 Embankment

The slopes of the embankment must be inspected to detect any signs of seepage, cracking, movement, erosion or animal burrows. Vegetation on the slopes should be kept short and all trees must be removed when still young.

The extent of damp patches that appear on the downstream face must be marked with pegs so that changes in the affected area can be monitored. The appearance of seepage water must be carefully watched, and the clarity noted to determine if soil particles are being carried in the water. The position relative to the crest and distance along the crest must be recorded.

The position, width and length of cracks must also be marked and recorded. Relative movement of the crack must be measured by placing pegs on either side of the crack to monitor vertical and horizontal displacement.

The condition of the HDPE liner system on the upstream face of the embankment should be visually evaluated. Positions where there are exposed portions of the liner should be recorded along with any holes or tears in the liner system. The anchor system should be monitored for any possible defects.

The location and extent of wave or weather erosion should be noted. The slope protection on the upstream face should be inspected to detect any signs of movement or loss.

Appearance of ant’s nests and other animal holes should be recorded.

3.2 Spillway

The face and invert of the spillway channel entrance should be inspected for cracks. The position, width and length of cracks must be marked and recorded.

Erosion of the spillway channel should be noted and the need for repair considered.

The condition of the rip-rap lining of the spillway channel should be inspected and repaired or replaced where necessary.

3.3 Downstream toe

A strip 5 m wide measured from the downstream toe, should have its vegetation cut short and be carefully inspected for the appearance of seepage water. The appearance of seepage water, cracks or any movement and the position thereof must be observed and noted.

3.4 Inlet works

The condition of the inlet pipes should be inspected for any signs of corrosion or leakage (where possible). The sluice gates should be operated at every inspection to ensure that they are functioning correctly

3.5 Dam Basin

The condition of the HDPE liner system on the basin should be visually evaluated when possible. Positions where there are exposed portions of the liner should be recorded along with any holes or tears in the liner system.

Any signs of uplift of the HDPE liner from the basin shall be recorded

3.6 Monitoring

The two parameters used for long term monitoring is settlement of the embankments using installed settlement beacons along the crest of the embankment, and the performance of the HDPE liner through the leak detection sump of the PCD.

3.6.1 Settlement Beacons

Settlement beacons have been installed on the non-overspill crest (NOC) of PCD 4 at approximately 75 m centres (see positions on Drawing No KPSX-EP-16260-DRG-WW-LY-0101-01 in APPENDIX J). The beacons must be surveyed every quarter of the first year after construction and then yearly for the next two years, and thereafter after every five years. Refer to the form included in APPENDIX A.

3.6.2 Seepage

A leak detection sump has been incorporated with the subsoil drainage network underneath the lined floor of the dam. The subsoil network of the compartment drains to the leak detection sump. The sump is located on the downstream side of the north eastern corner of the embankment. Refer to the form included in APPENDIX A.

4 Unusual conditions

Changes in conditions from one routine inspection to the next should be carefully noted. If conditions that may affect the safety of the dam arise, expert advice should be called in as suggested below.

Unusual conditions that should be carefully noted are described below:

(a) Instabilities indicated by cracks, slips, sags and bulges in the slopes and/or movements in the crest of the dam and reservoir basin slopes should be noted and new seepage water discharge points observed on a weekly basis. The location and dimensions of movement or seepage should be determined, photographed and pegged to mark the position.

(b) The occurrence and slow development of any of the following at the dam surface should be inspected on a daily basis. The location and dimensions of movement or seepage should be determined, photographed and pegged to mark the position.

i. Turbid seepage water.

ii. Transverse and longitudinal cracks with opening widths larger than 5 mm, or cracks longer than 1 m.

iii. Observable displacement across a longitudinal crack.

iv. Ground movement of more than 100 mm between two inspections.

v. Concentrated settlement less than 25 m^2 in area.

vi. Settlement of the dam crest below the design level.

vii. Concentrated seepage discharges at new locations with flows larger than 0.2 ℓ/s.

viii. Leakage through or along the outlet pipe or any pipes through the embankment i.e. those of the sub-soil drainage system.

(c) If any of the circumstances described in section (b) develop suddenly then they must be inspected from twice a day up to hourly. Observations as described must be taken and the reservoir level must be lowered. A professional dam engineer must be consulted for advice.

5 Maintenance of the dam

5.1 Embankment

Shallow rooted vegetation on the downstream slope of the embankment must be kept cut to less than 1 m above the ground so that unusual conditions can be easily observed.

The faces of the embankment should be kept clear of trees. Ant's nests and animal holes should be removed as they could create leakage paths.

Erosion of the dam slopes should be repaired as soon as possible. The upstream face liner protection of the embankment should be repaired if severe wave benching occurs.

5.2 Spillway

The spillway channel, particularly the section lined with rip-rap, must be kept clean and free of all undesirable vegetation like trees and bushes. Other vegetation must be kept shorter than 300 mm.

Erosion of the rip-rap lined spillway channel should be monitored, and where necessary be repaired as soon as possible. Rockfill may be required to repair severe erosion on section.

5.3 Downstream toe

Vegetation in the 5 m wide strip downstream of the toe of the dam should be kept cut to less than 300 mm above ground to enable easy access and so that any unusual conditions can be observed.

5.4 Inlet works

It is recommended that the sluice gates are cycled once a month, in order to prevent the gates from seizing. The sluice gates should be inspected at least twice per year, with general maintenance activities carried out. Remove the cover tube, examine the spindle threads, remove all dirt build-up and lubricate the threads with all-purpose grease. The operating gearboxes are generally 'sealed for life', however they may require a light greasing occasionally. Lower and raise the gate fully. Check gate closure and adjust the stop collar if required. Inspect the seals for damage and deterioration and replace where necessary.

Technical details of the sluice gates are included in APPENDIX I.

5.5 Dam Basin

The dam basin of PCD 4 should be inspected whenever it is exposed. When the water that is returned to PCD 4 from the leak detection sump becomes abnormally high compared to normal operating conditions, the dam shall be emptied and inspected to locate the leak.

To conduct maintenance on the dam basin, PCD 4 shall be emptied to allow maintenance personnel to conduct the necessary repairs

5.6 Leak Detection Sump

The PCD is equipped with 1 leak detection sump, namely Leak Detection Sump, and can be found on drawing KPSX-EP-16260-DRG-WW-DE-0111-01.

5.6.1 Operating Philosophy

A sump pump per compartment is installed to drain the leak detection sump and pump the water back into the PCD 4. illustrates a typical leak detection sump pump set up.

The sump pump must switch on when the Level Switch High (LSH) is triggered and must switch off when Level Switch Low (LSL) is triggered. If the level in the sump rises to Level Switch High-High (LSHH) an alarm must be activated in the control room.

Sump pump can be easily removed from the sump pit via the quick coupling should repairs or maintenance be required.

The levels for these switches are indicated in Table 5-1:

Table 5-1: Leak Detection Sump Levels

Leak detection sump	Sensor Range (mm)	HH	H	L	LL
PCD4 – (GP243)	0 – 5420	90%	80%	30%	20%

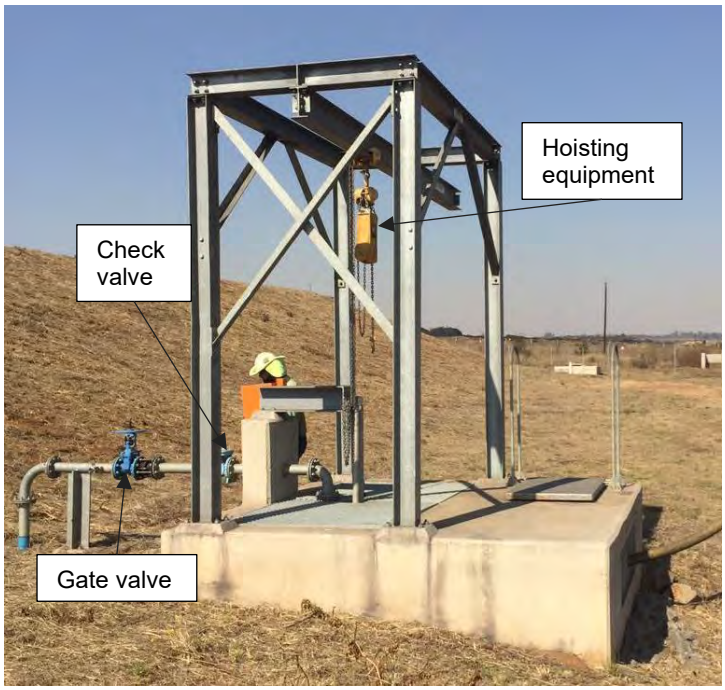


Figure 5-1: Typical Leak Detection Sump

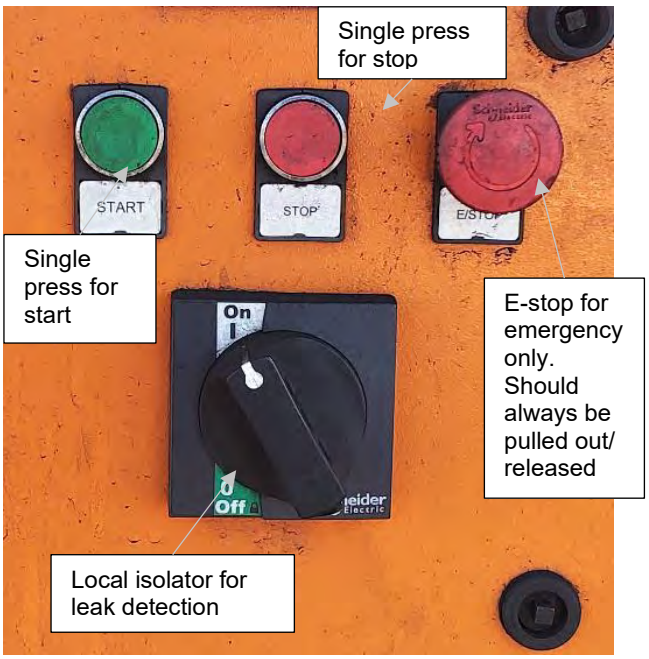


Figure 5-2: Sump Pump Control Panel

5.6.2 Determining the Status of the PCD Liner

The water quality of the water inside the sump must be tested **once monthly** to determine the source of the water inside the leak detection sump. Should the water not meet acceptable water quality due to high acidity of minerals levels, then it would indicate that the PCD has a possible leak which would require further inspections and possible maintenance on the liner of the PCD.

5.6.3 Sump Inspections

Attention! Extra precautions shall be taken when working in confined spaces and proper ventilation should be in place before entering any confined spaces to avoid suffocation.

A general inspection of the pump guide frame shall be carried out on a quarterly basis. Inspect the guide frame for corrosion damage and repair the areas where possible. Inspect for a build-up of scale or dry mud. If any build-up is noticed it must be cleaned off with a high-pressure washer. Inspect guide frame for deep scoring marks which could indicate obstructions on the guides, guides must then be inspected, and obstructions cleared, if left unattended it could cause the lifting of the pump to jam.

Twice a year, a thorough inspection of the guide frame and gantry crane shall be carried out. The steelwork must be visually inspected for rust, cracks or mechanical damage to paint. Rust shall be sanded down, and the area repainted immediately. Any cracks found must be immediately reported to the engineer and under no circumstances should the gantry crane be used until the damage has been assessed.

Mechanical - and instrumentation components shall be maintained as per the manufacturer's guidelines. Refer to Figure 5-1 and Figure 5-2.

The condition of the pipework and valves should be inspected for any signs of corrosion or leakage (where possible). The gate valve and chain blocks must be operated at every inspection to ensure that they are functioning correctly. Inspections must also be done on the gratings, manhole hatch, ladders and the hoisting structure for any corrosion or damage.

5.6.4 Sump Pump Maintenance

Attention! Proper Working Permits and Lockout Procedures should be in place on any live apparatus to prevent unauthorised operation before any work is carried out on equipment.

The chamber has a submersible pump with an automatic coupling with guide rail installed. Therefore, to remove the pump for inspections or maintenance, the hoist is linked to the stainless-steel cable that is connected to the automatic coupling. The guide rails ensure the pump is lifted out of the sump in a controlled manner.

The same process is followed to install the pump after inspections or maintenance. The pump is bolted onto the automatic coupling and then placed between the guides before it is lowered with the manual chain block situated above the guide rails.

It is recommended that scheduled maintenance should be done as prescribed in the Operation and Maintenance Manual that is included in the Contractor's Data Pack for the following pumps:

- KSB - KRT D 80-315

The valves should be opened and shut at least four times per year, lubricated and adjusted as necessary and seals or packing replaced where necessary.

5.6.5 Hoisting Equipment

See section 7.2.12.

5.7 Access

The access road to the dam and silt trap must be maintained to ensure easy access at all times.

6 Operating procedures

Water will be pumped into PCD 4 the Pit BD dewatering system and dirty water runoff (stockpile and terrace) through Channel 1001. Pit BD dewatering from the transfer tank is pumped into a collection sump at the start of the silt trap. The pit dewatering system therefore also goes through the silt trap.

In future water can be transferred to PCD 4 from KPS Buffer dam via the bi-directional pipeline which uses actuated valves to control, should these valves be installed.

The PCD is provided with a silt trap upstream of the dam inlet to remove silt upstream of the dam. The silt trap has two channels to allow one to be isolated and cleaned. Isolation of silt trap cell is manual through the operation of a sluice gate valve. The channels of the silt trap are controlled by a sharp crested weir that spills into a common inlet channel (4.00 m wide x 1.20 m high) that connects the inlet structure to the dam inlet spillway.

The inlet into the dam comprises a 4.00 m wide inlet spillway (baffled chute) that is connected to the inlet channel downstream of the silt trap. The spillway was designed as a baffled chute to protect the lining system of the PCD in accordance with procedures set out in the USBR publication 'Design of Small Dams', 1987. The capacity of the inlet works is designed to accommodate the maximum inflow combinations from the various pump stations. The design capacity of the inlet works is shown in Table 6-1.

Table 6-1: Inflows into PCD 4

Inflow	Inflow Number	Number Design Capacity (m^3/s)	Maximum Pump Capacity (m^3/s)
From Channel 1001	1	4.96	4.96
From PIT BD dewatering pumps	2	0.58	0.58
Total Dam Inlet Capacity	1 + 2		5.54

Water from PCD 4 can only be abstracted through the pipelines of the pump intake structure through the pump station. The dam cannot be scoured and to empty the dam, all water within the dam would need to be pumped out through the pump station.

The gross storage capacity for the compartment of PCD 4, i.e. with the non-recoverable water (dead storage), is shown in Figure 6-1, which is equal to the nett storage capacity of PCD 4, i.e. recoverable water available for usage, simply referred to as the storage capacity. The surface area curve for the compartment is shown in Figure 6-2.

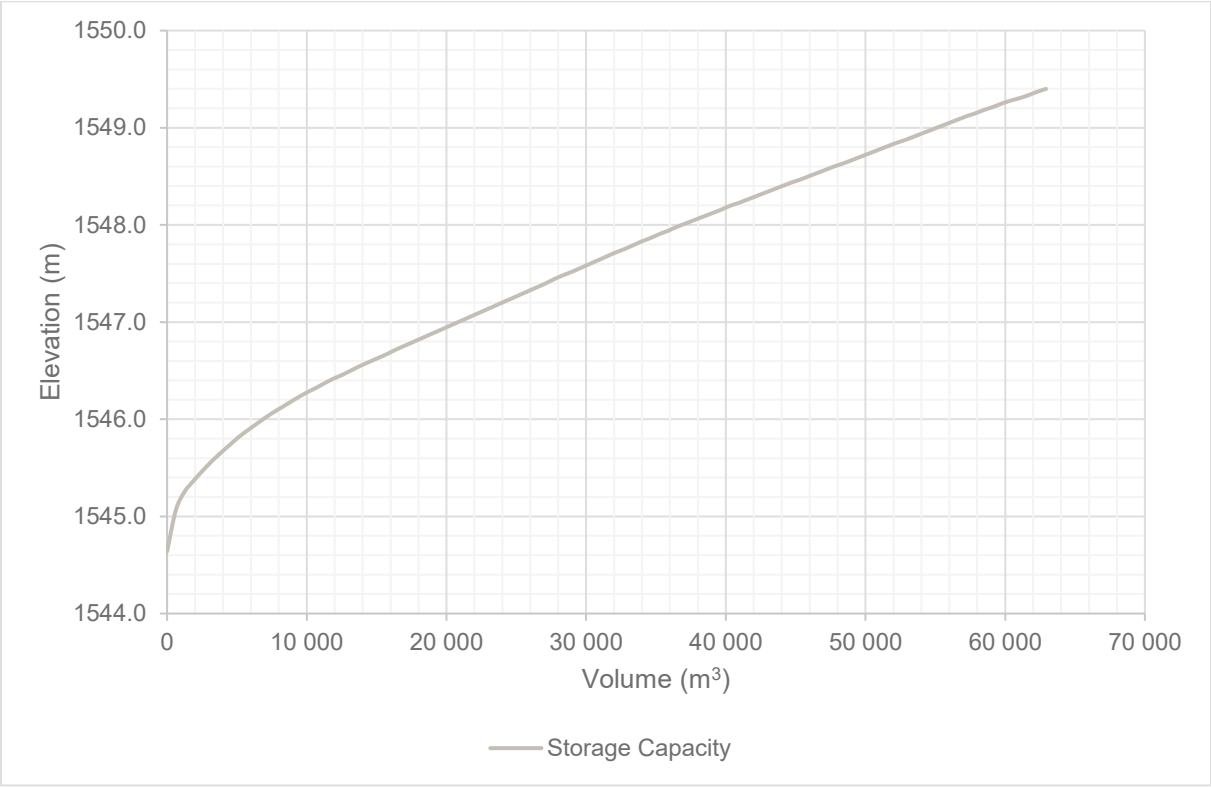


Figure 6-1: Storage capacity curve for PCD 4

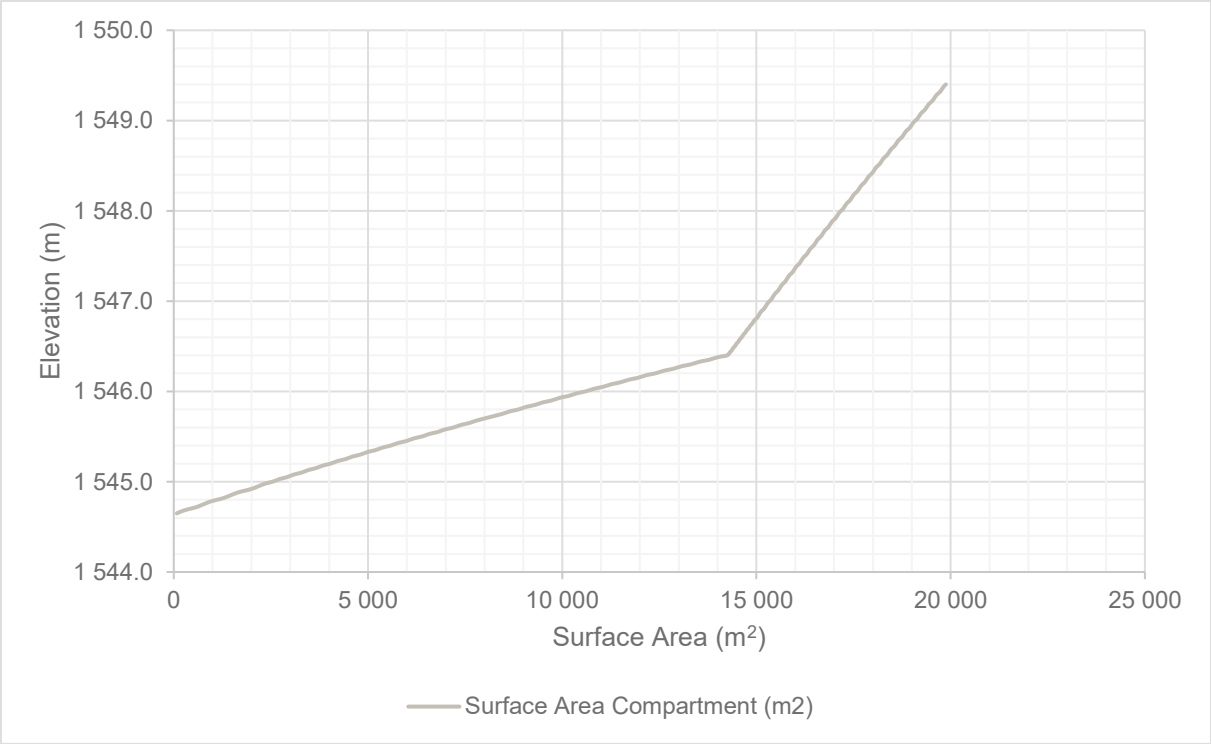


Figure 6-2: PCD 4 Surface area curve

6.1 Process Description

PCD 4 has a storage volume of 62 919.3 m^3. Water pumped from Pit BD will go to PCD 4 (via the pit dewatering system) or it will enter through the concrete lined dirty water channels, all collecting into Channel 1001 and discharging in the silt trap. In future water can be transferred to PCD 4 from PCD 1

dam via the pipeline to the Raw Water Reservoir, which would require an actuated valve to control the flow, should these valves be installed.

PCD 4 will supply the raw water demand via the Raw Water Reservoir. PCD 1 provides additional storage capacity to the PCD 4 system and water can be transferred to PCD 1 via 2 supply pipelines. PCD 4 directly supplies a filling point (Filling Point 1), shown in Figure 6-3, which is used for dust suppression. If a case arises where PCD 4 overflows, that amount of volume will spill into the environment.

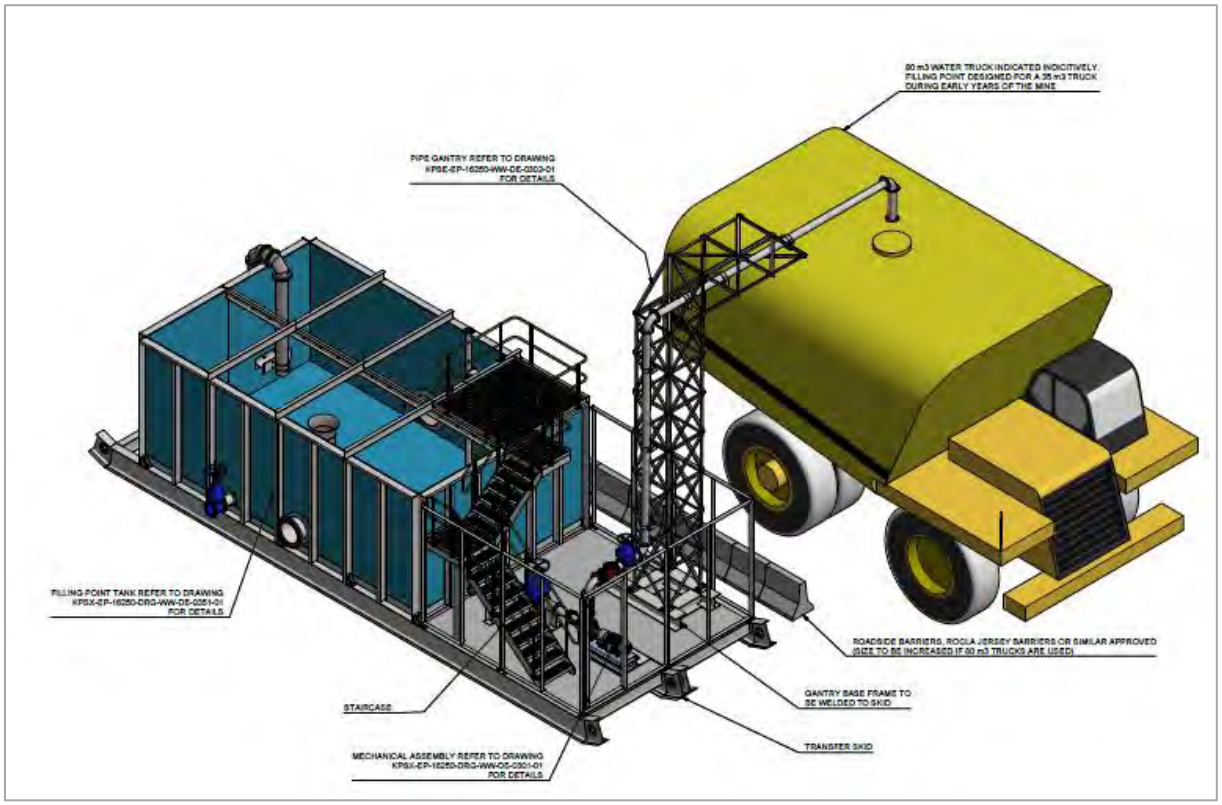


Figure 6-3: Filling point used to refill trucks for dust suppression

i. PCD 4 will receive water as follows:

- Pit BD runoff water through the dewatering system
- Dirty water runoff from the stockpiles and terraces through the concrete lined dirty water channel network, collecting in Channel 1001 which discharges into the silt trap.
- PCD 1 if future actuated valves are installed on the pipeline from PCD 1 to the Raw Water Reservoir.

ii. PCD 4 has three pump systems with individual pipelines:

- 1 duty without standby to filling point 1 – 1st priority of supply
- 1 duty and 1 standby to raw water reservoir – 2nd priority of supply
- 1 duty and 2 standby with 1 duty and 1 standby pipeline to PCD 1

The pumping system to PCD 1 will make use of one pump and one pipeline. The duty/standby pipeline will rotate automatically using the motorised valves. In the event of a 50/100-year flood, both lines will be used with 2 pumps. Provision for such an event will be made on the control room SCADA.

iii. All pipelines out of the pump station have flow meters

The PCD has a detection/subsoil drainage sump with a sump pump that pumps the water collected by the subsoil drainage system back into the PCD. The pump are normal, small submersible pumps with integral level switches.

6.2 Operating Description

During normal operating conditions, the pumps (see Table 7-1) operate in auto mode and will be rotated between standby pump and duty pump automatically. The pumps will start and stop based on the levels of Filling Point 1, the Raw Water Reservoir and PCD 1, see Table 7-2.

6.3 Description of Operation – When no Power is Available

Normal operating conditions of PCD 4 is dependent on a constant supply of electric power to the pump station, leak detection chamber and level monitoring system within the dam. In the unlikely event of a power failure or a prolonged power outage, PCD 4 can be operated by hand. The procedure is described below:

(a) The condition of the sluice gates should be noted, i.e., both channels are open. Both channels should be open if possible

(b) The level of the PCD shall be monitored daily

(c) The levels of the leak detection chamber shall be monitored daily

(d) Should PCD 4 spill, it should be noted to the mine manager. The dam level can only be lowered by dewatering into the pit if the situation requires this.

6.4 Maintenance

For pump or motor maintenance purposes the pump is selected to *'maintenance mode'* and isolation valves on both the suction and discharge sides of the pump closed (refer to Section 0).

These O&M manuals are mentioned for completeness but are not specifically required for dam safety purposes.

Hand operated scour valves are provided at low points along the pipeline to drain sections of the pipeline as required.

6.5 Component and Measurement Requirements

The equipment installed on the pipelines from PCD 4 to the various delivery points to measure the water flow is shown in Table 6-2.

Table 6-2: PCD 4 component and measurement requirements

Line / Equipment Description	Measured Value
Filling Point 1 supply flow meter	Volumetric flow, instantaneous and totalised
Raw water tank supply flow meter	Volumetric flow, instantaneous and totalised
PCD 1 supply pipeline 1 flow meter	Volumetric flow, instantaneous and totalised
PCD 1 supply pipeline 2 flow meter	Volumetric flow, instantaneous and totalised

6.6 Identification of Control Parameters

The summarized control parameters for PCD 4 are shown in Table 6-3.

Table 6-3: PCD 4 identification of control parameters

Description	Control Range
Filling point 1 storage tank	Maintain the tank level between the high- and low-level control limits.
Raw water storage tank	Maintain the tank level between the high- and low-level control limits.
PCD 4	Maintain the dam level between the high- and low-level control limits.

6.7 Alarms and Protection Interlocks

The alarms and protection interlocks for PCD 4 are shown in Table 6-4.

Table 6-4: PCD 4 alarms and protection interlocks

Description	Measured Variable	High/ Low	Value	Action
PCD 4	Level	LL	1545.065	Protection Interlock, trip pumps
PCD 4	Level	HH	1549.230	Notify control room operator to prevent over filling
PCD 4	Level	LL > HH	1545.065 > 1549.230	Refer to Table 7-2
Pump GP241 flow switch	Flow	L	N/A	Protection Interlock, trip to protect against dry run and dead head protection
Pump GP242A flow switch	Flow	L	N/A	Protection Interlock, trip to protect against dry run and dead head protection
Pump GP242B flow switch	Flow	L	N/A	Protection Interlock, trip to protect against dry run and dead head protection
Pump GP243A flow switch	Flow	L	N/A	Protection Interlock, trip to protect against dry run and dead head protection

Description	Measured Variable	High/ Low	Value	Action
Pump GP243B flow switch	Flow	L	N/A	Protection Interlock, trip to protect against dry run and dead head protection
Pump GP243C flow switch	Flow	L	N/A	Protection Interlock, trip to protect against dry run and dead head protection
Pump GP241 suction isolation valve position closed	Position	Close	N/A	Protection Interlock, trip to protect against dry run protection
Pump GP242A suction isolation valve position closed	Position	Close	N/A	Protection Interlock, trip to protect against dry run protection
Pump GP242B suction isolation valve position closed	Position	Close	N/A	Protection Interlock, trip to protect against dry run protection
Pump GP243A suction isolation valve position closed	Position	Close	N/A	Protection Interlock, trip to protect against dry run protection
Pump GP243B suction isolation valve position closed	Position	Close	N/A	Protection Interlock, trip to protect against dry run protection
Pump GP243C suction isolation valve position closed	Position	Close	N/A	Protection Interlock, trip to protect against dry run protection
Pump GP241 discharge pressure	Pressure	H L	400 kPa 100 kPa	Protection Interlock, trip to protect against dead head
Pump GP242A/B discharge pressure	Pressure	H L	500 kPa 100 kPa	Protection Interlock, trip to protect against dead head
Pump GP241A/B/C discharge pressure on pipeline 1	Pressure	H L	500 kPa 60 kPa	Protection Interlock, trip to protect against dead head
Pump GP241A/B/C discharge pressure on pipeline 2	Pressure	H L	500 kPa 60 kPa	Protection Interlock, trip to protect against dead head

7 Pump Station, Chambers and Pipelines

This section of the manual describes the general operation and maintenance (O&M) procedures to be performed to ensure the safe use of the PCD 4 mechanical components throughout its lifespan. Refer to Figure 7-1 to Figure 7-3 for the PCD 4 system diagrams. For all drawings relating to this section refer to Appendix K.

7.1 System Diagrams

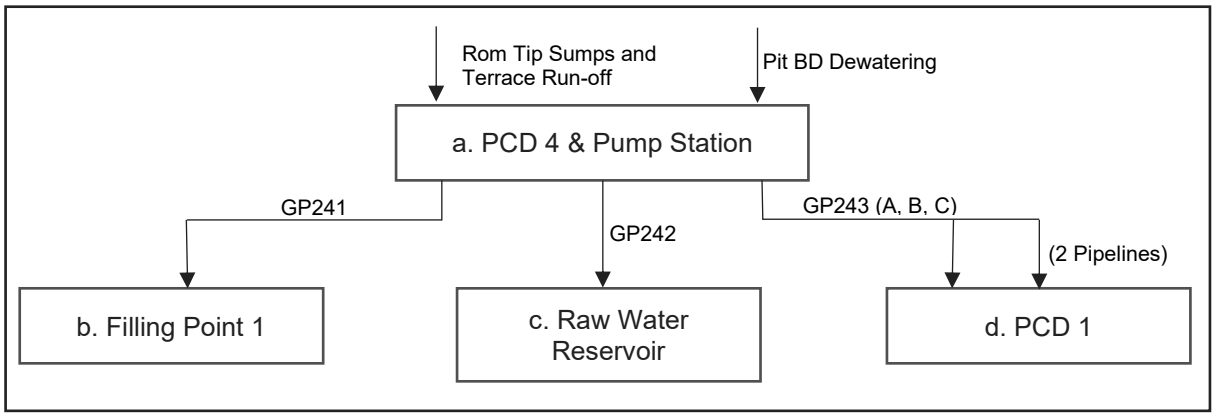


Figure 7-1: Overall PCD 4 System Diagram

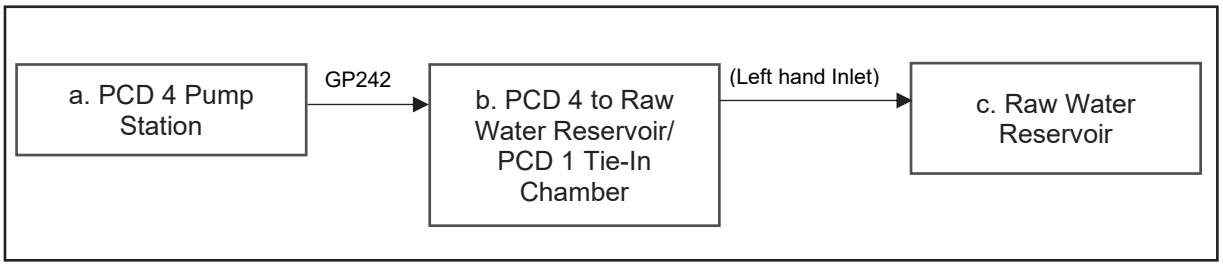


Figure 7-2: PCD 4 to Raw Water Reservoir System Diagram

Refer to section 7.2.3 for control philosophy to the pump sets GP243 referred to in Figure 7-3.

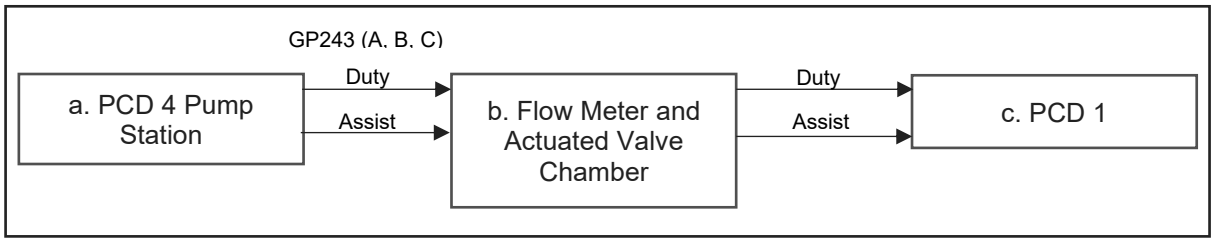


Figure 7-3: PCD 4 to PCD 1 System Diagram

7.2 PCD 4 Pump Station

Figure 7-4 illustrates the PCD 4 pump station. Refer to Section 7.6 for all Mechanical Equipment related maintenance.

Figure 7-4: PCD 4 Pump Station

7.2.1 General

PCD 4 has three pump systems with individual discharge pipelines:

- 1 duty pump without standby from **PCD 4 to the Truck Filling Point 1**. Pump **GP241** is a Cornell end-suction, centrifugal pump – **1st priority of supply**.
- 1 duty pump and 1 standby pump from **PCD 4 to Raw Water Reservoir**. Pump set **GP242A** and **GP242B** consists of two Cornell end-suction, centrifugal pumps that operate on a duty/standby cycle – **2nd priority of supply**.
- 1 duty pump, 1 assist and 1 standby pumps from **PCD 4 to PCD 1**. Pump set **GP243A**, **GP243B & GP243C** consists of three Cornell end-suction, centrifugal pumps that operates on a duty/assist /standby cycle – **3rd priority of supply**.

See **Error! Reference source not found.** for pump descriptions. All pump systems/ pipelines are supplied with flow meters and pressure gauges.

7.2.2 Operating Description

During normal operating conditions, the pumps (Figure 7-5) operate in auto mode and will be rotated between the duty- and standby pump automatically. The pumps will start and stop based on the levels indicated in Table 7-2.

Table 7-1: PCD 4 Pump Descriptions

Pump number	Description
GP241	1 Duty pump – 44 l/s @ 28.51 m head (22 kW) Pumps from PCD 4 to Filling Point Tank 1 via 1 pipeline
GP242A and GP242B	1 Duty and 1 standby pump – 93l/s @ 33.2 m head (46.9 kW) Pumps from PCD 4 to the PCD 4 tie-in chamber, where it ties into the PCD1 to Raw water reservoir pipeline pumping to the Raw water reservoir
GP243A, GP243B and GP243C	1 Duty, 1 assist and 1 standby pump with 1 duty pipeline and 1 assist pipeline - 291 l/s @ 31.5 m head Pumps from PCD 4 to PCD 1

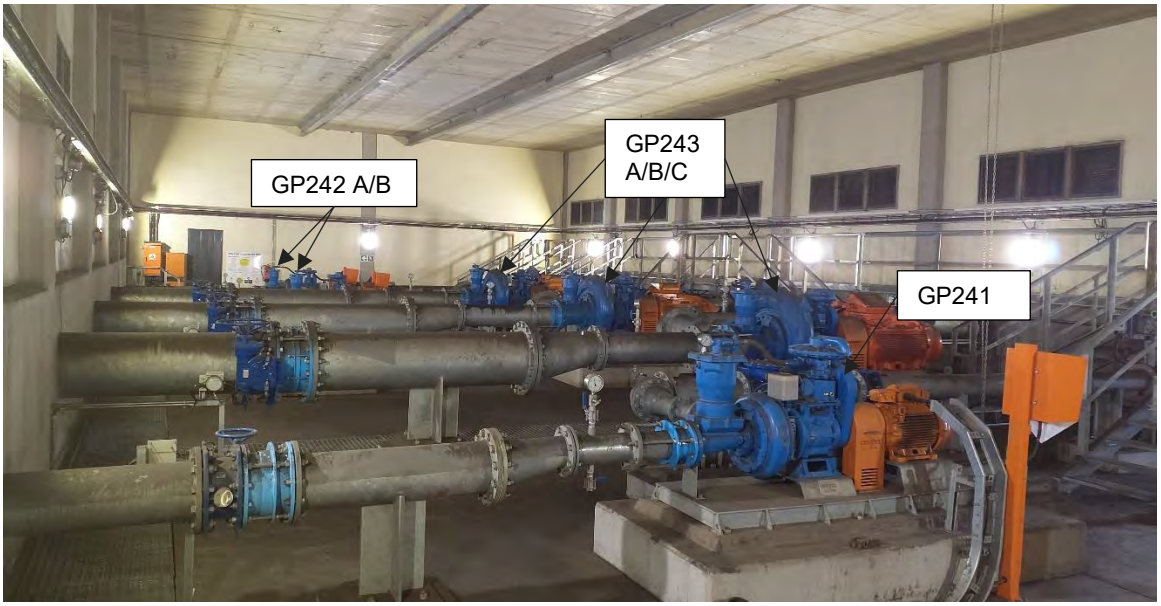


Figure 7-5: Mechanical Arrangement of Pump Systems for PCD 4

Table 7-2 indicates how the system will operate at the different PCD 4 water levels. Refer to the receiving system manuals which elaborates what the control parameters are for receiving water.

Table 7-2: PCD 4 Pump Operations at Different Levels

PCD 4	Action	Capacity (%)	Water Level (masl)	Volume of Compartment (m^3)
HH	Spill Warning	95%	1,549.228	59,775
H6	**Stop** - Dewatering pumps	90%	1,549.062	56,628
H5	**Start** – Assist/ Both pumps to PCD 1	70%	1,548.390	44,044
H4	**Start** - 1st Pump to PCD 1	50%	1,547.655	31,468
H3	**Stop** - Pumping to PCD 1	45%	1,547.462	28,311
H2	**Start** - Pumping to Raw Water Reservoir	21%	1,546.486	13,212
H1	**Start** - Pumping to Filling Point	10%	1,545.929	6,299
L	**Stop** - All pumps	4%	1,545.470	2,510
LL	Pump Safety Interlock	1%	1,544.995	637

7.2.3 Flood Control Operational Philosophy of Pump Set GP243A, GP243B and GP243C

These pump sets are only used in cases where PCD 4 reaches the High (H4) level and has the risk to spill because of high inflows, especially when there are heavy rains. The water is then transferred to PCD 1 using the larger pump sets GP243A, GP243B and GP243C in the configuration as stated in Figure 7-6. In the event where the H4 level of PCD 4 is reached, a single duty pump will start and pump through only one rising main illustrated in Figure 7-3 and Figure 7-6. There is an interlock between the two motorised, isolation valves on the two rising mains to PCD 1 to ensure water is pumped through only one pipeline with one pump running as long as PCD 4 does not reach level H5.

If the water level in PCD 4 rises to level H5 and a single duty pump cannot pump enough water compared to the inflows, an assist pump will be started. This will allow both isolation valves on the two motorised rising mains to open and water will be pumped from PCD 4 to PCD 1 using both the rising mains. The pumps are automatically cycled on the SCADA based on equal start/ stops for the GP243 pump sets. When the system is set to AUTO on the SCADA the isolation valves will automatically open as described in this section.

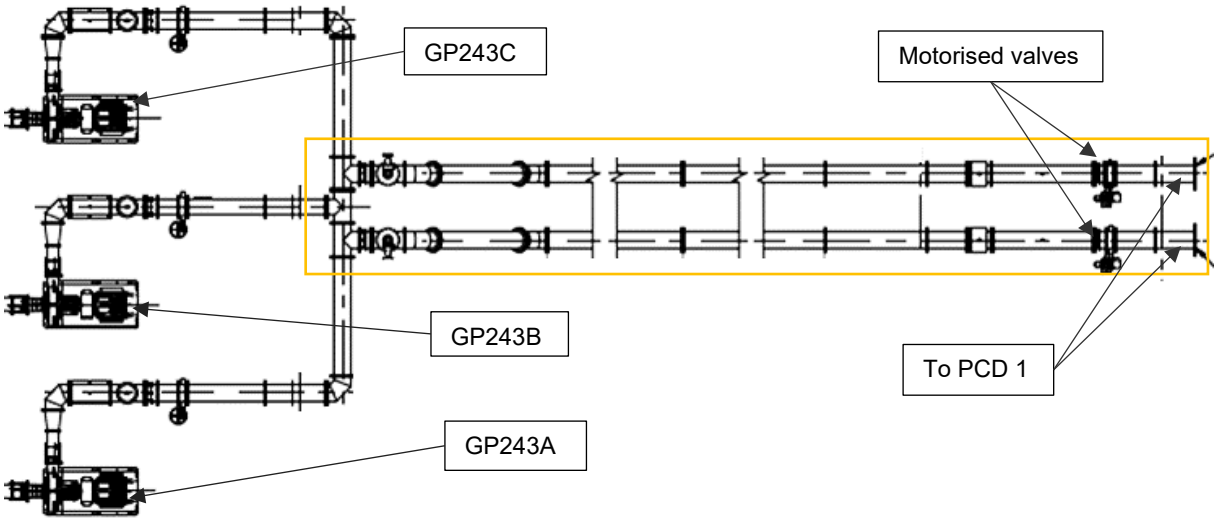


Figure 7-6: Isolation Valve Interlocks on Rising Main to PCD 1

7.2.4 PCD 4 Interlocks with PCD 1

There is an interlock between the pump sets of PCD 1 (GP212) and PCD 4 (GP242) to the Raw Water Reservoir. The PCD 1 pumps cannot start if PCD 4 pumps are running. The PCD 1 pumps will only operate if the dam level of PCD 4 becomes too low for the PCD 4 pumps to operate as illustrated in Table 7-2. This interlock is in place because the pipeline is not hydraulically designed for two pumps (PCD 1 and PCD 4) to operate in parallel.

The Tie-in chamber for the PCD 1 and PCD 4 interlock when pumping from PCD 4 or PCD 1 to the Raw Water Reservoir should be configured as indicated in section 7.3.2. All valves should be normally open, there are non-return valves to ensure water is only pumped to the Raw Water Reservoir.

7.2.5 Priming of Pump Sets

All of the pump sets are self-priming pumps. The pump sets have a priming valve on the suction side of the pump sets and a vacuum pump on the pump assembly as illustrated in Figure 7-7. The vacuum valve consists of a ball type float that moves up and down allowing air to be sucked through the vacuum valve until the pipe is full which then pushes the ball float upwards and closes the vacuum pipe to protect the vacuum pump against the ingress of water after the main pump is fully primed. Note that the priming

valve and pump must undergo regular maintenance and inspection as per the supplier (Cornell/ Centex pumps) O&M manual. The pumps can run dry while priming and lubrication is provided to keep the mechanical components free of friction and failing. The initial priming can take up to 15 minutes inside the PCD 4 pump station. This extended priming time however should only be after suction pipelines were drained for maintenance or inspections. Under normal operating conditions it should not be required for an extended priming time of more than 1 minute. The SCADA has a built-in delay on the no flow switches to allow for the priming of the pumps before tripping the pumps under the no flow safety interlock. For any further information, refer to the Cornell pump O&M manuals.

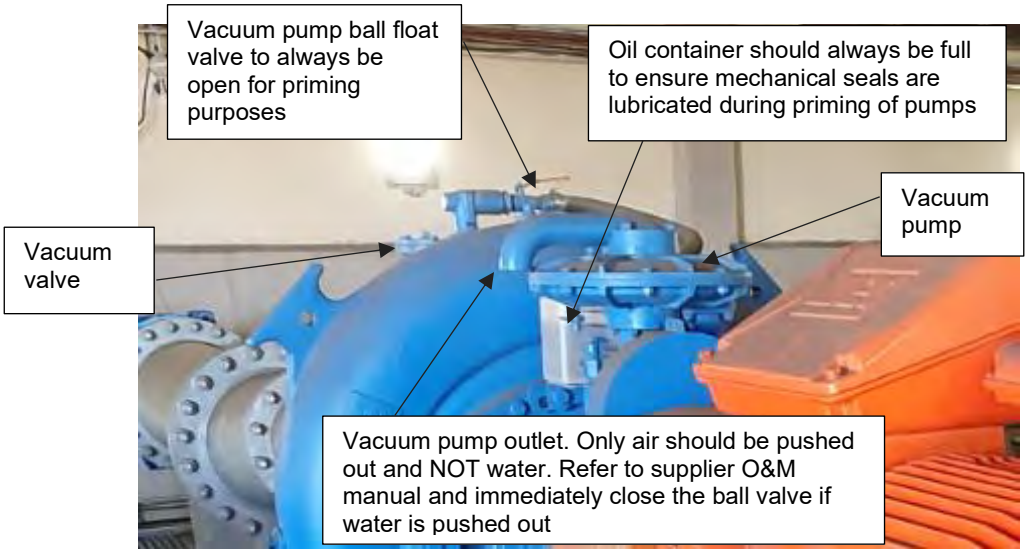


Figure 7-7: Self-Priming Components

7.2.6 Pump Start-Up Philosophy

Audible sirens and a strobe warning light will be used to notify personnel of automatic operation about to take place at relevant equipment during start-up. These sirens and warning lights will be active for a period of 10 seconds prior to start-up.

No local intervention is required for automatic start-up or shutdown unless the below discussed conditions are not in place or triggered.

7.2.6.1 Pump GP241 (to Filling Point 1)

If the pump receives a start-up signal in automatic mode, the sequence is as follow:

- Check level at Filling Point 1. Must be below 80%
- Check level in PCD 4. Must be above 4%
- Check that discharge and suction isolation valves are fully open (Figure 7-8).
- Signal alarm to start the pumps and start the pump.
- While running, check that flow switch is active (value higher than 5) and ensure pressure transmitter feedback is between set values (100 kPa – 400 kPa).

Figure 7-8: GP241 Pump Set-up for Pump Start-up

7.2.6.2 Pump Set GP242A and GP242B (to Raw Water Reservoir)

If the pump receives a start-up signal in automatic mode, the sequence is as follow:

- Check level in Raw water reservoir. Must be below 70%.
- Check that the PCD 1 pumps are not running.
- Check that the PCD 4 level is above 21%.
- Check that the Raw Water Reservoir is above 40% and below 55%.
- Check that discharge and suction isolation valves are fully open (Figure 7-9).
- Signal alarm to start the pumps and start the pump.
- While running, check that the flow switch is active (value higher than 5) and ensure pressure transmitter feedback is between set values (100 kPa – 500 kPa).

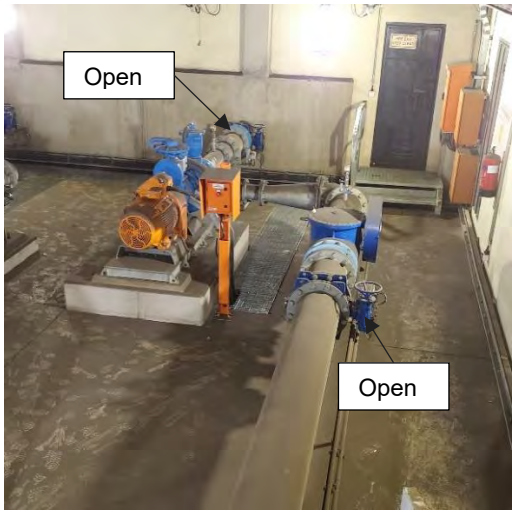


Figure 7-9: GP242 Pump Set-up for Pump Start-up

7.2.6.3 Pump Set GP243A and GP243B and GP243C (to PCD 1)

If the pump receives a start-up signal in automatic mode, the sequence is as follow:

- Check level at PCD 1. Must be below 89.5%.
- Check level in PCD 4. Must be above 50%.
- Check that discharge and suction isolation valves are fully open (Figure 7-10).
- Signal alarm to start the pumps and start the pump.
- While running, check flow switch is active (value higher than 5) and ensure pressure transmitter feedback is between set values (60 kPa – 500 kPa).

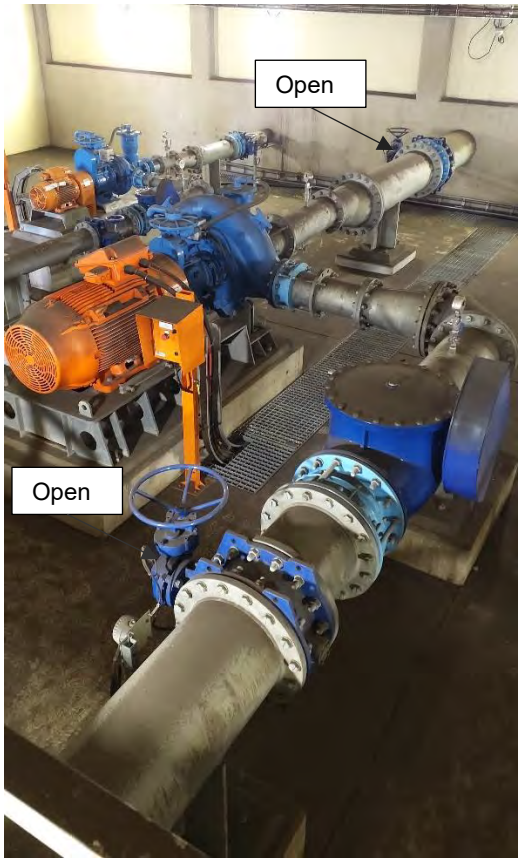


Figure 7-10: GP243 Pump Set-up

7.2.7 Pump Shut Down Philosophy

If any of these conditions below are met, the pump will shut down:

7.2.7.1 Pump GP241

- Flow switch value below a value of 5 (no flow trip).
- Any of the motor protection signals trigger (no flow, flow, pressure, overload current).
- Isolation suction valves are closed/ intermediate position.
- Isolation discharge valve is closed.
- PCD 4 level falls below 4%.
- Filling point 1 level reaches 80%.

7.2.7.2 Pump Set GP242A and GP242B

- Flow switch value below value of 5 (no flow trip).
- Any of the motor protection signals trigger (no flow, flow, pressure, overload current).
- Isolation suction valves are closed/ intermediate position.
- Isolation discharge valve is closed.
- Raw Water Reservoir is below 40% or above 55%.
- PCD 4 falls below 10%.

7.2.7.3 Pump Set GP243A, GP243B and GP243C

- Flow switch value below value of 5 (no flow trip).
- Any of the motor protection signals trigger (no flow, flow, pressure, overload current).
- Isolation suction valves are closed or set to an intermediate position.
- Isolation discharge valve is closed or set to an intermediate position.
- PCD 4 falls below 45%.
- If PCD 1 level is at or above 89.5%.

7.2.8 Scheduled Maintenance on Mechanical Equipment

It is recommended that scheduled maintenance should be done as prescribed in the OEM Operation and Maintenance Manuals included in the pump station and contractor data books:

- Cornell - 4NHTA Redi-Prime for **GP241**
- Cornell - 6NHTA Redi-Prime for **GP 242**
- Cornell - 10NHTA Redi-Prime for **GP243**
- Butterfly- and gate valves (EPNS, VAG, AVK)
- Flow meters (E&H)
- Air valves (Vacuvent)

For pump, motor or any valve related maintenance purpose the applicable pump(s) are selected to *Maintenance mode* and isolation valves on both the suction and discharge sides of the pumps closed.

Hand operated scour valves (see section 7.5) are provided at low points between the pump sets to drain sections of the pipeline between the pump suction and discharge as required.

7.2.9 Procedures to Perform Maintenance or Repairs to Pump Sets

Attention! Proper Working Permits and Lockout Procedures should be in place on any live apparatus to prevent unauthorised operation before any work is carried out on equipment.

The following procedure describes the minimum requirements to perform maintenance/repairs to the pumps. All work to be carried out in accordance with the relevant safe working and lock out procedures.

- Inform the control room of maintenance to be done and on which pump set.
- Should one wish to work on the duty unit (pump that is running) press E-stop push button and isolate the pump set at MCC panel. The standby unit will start automatically. Isolate the pump set by switching main isolator to “OFF” position and lock with padlock to avoid accidental start.
- Should one wish to work on the standby unit (pump that is not running) isolate the pump set at MCC panel. Isolate the pump set by switching main isolator to “OFF” position and lock with padlock to avoid accidental start.
- Push the E-stop switch in at E-Stop station to ensure double lockout.
- It is now acceptable to continue with maintenance and/or repairs on electric motor.
- To perform maintenance on the pump, continue by closing both suction and delivery isolation valves and perform the proper lockout procedure by locking the positions of the valves with approved locks and chains (see Figure 7-11).
- Open the vent on top of pump volute and start scouring process by opening the drain valves (see section 7.5).
- It is now safe to continue with maintenance and/or repairs on pump. Maintenance to pump set should strictly be done in accordance with the OEM’s O&M manuals.

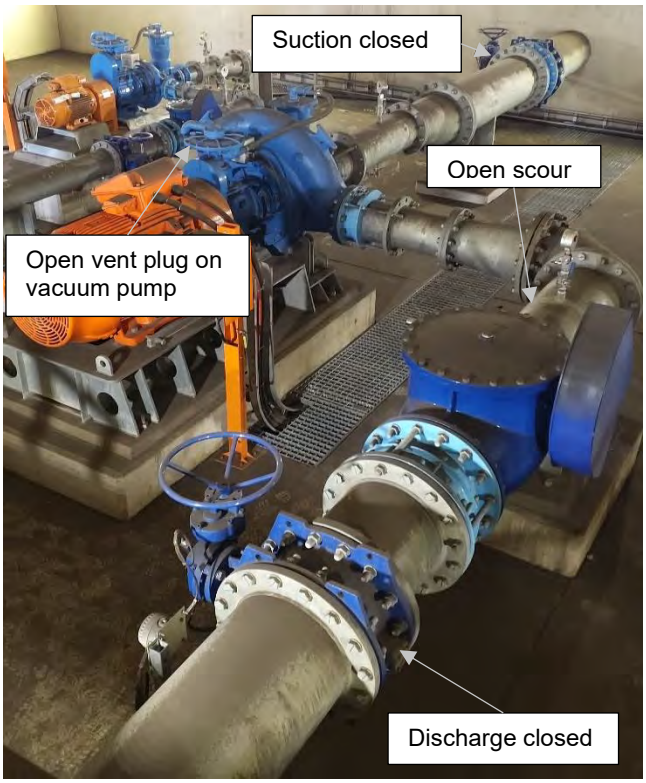


Figure 7-11: Equipment Configuration for Maintenance

7.2.10 Procedures to Fill Pump Line After Maintenance on Pump Set

The following describes the procedure to fill the pump line after maintenance/repairs to the pumps have been completed.

Attention! Proper Working Permits and Lockout Procedures should be in place on any live apparatus to prevent unauthorised operation before any work is carried out on equipment.

- Close all drain valves on pump line.
- Open suction isolating valve by just “cracking” open and allow filling of the pump line up to delivery isolating valve (Figure 7-12).
- Allow air to escape from vent valves (on top of pump volute or vacuum valve) and close when water starts bleeding from the valves.
- Open suction isolating valve fully. Check for any leaks and tighten.
- Open delivery isolating valve fully. Check again for leaks and tighten.
- Turn E-Stop at E-Stop station clockwise to allow mushroom switch to pop out (i.e. energised mode).
- Remove padlock from main isolator and turn to “ON” position and inform the control room to set the pump back into automatic mode.
- Wait for the pump start-up sequence and pump to start. Ensure pump is running on or close to the duty point referred to in section 0.

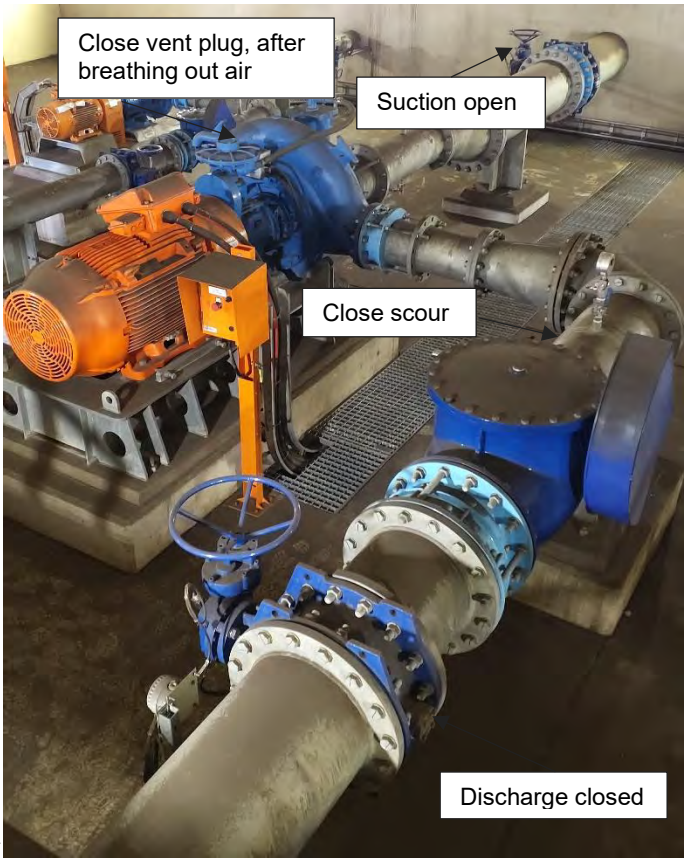


Figure 7-12: Equipment Configuration for Pump Line Filling

7.2.11 Procedure for Maintenance on the Pump Station Isolating- and Scour Valves

Attention! Proper Working Permits and Lockout Procedures should be in place on any live apparatus to prevent unauthorised operation before any work is carried out on equipment.

Should the pump station isolating valves need to be removed to perform additional maintenance, the following procedure should be followed:

a) Inform control room of maintenance to be done and on which pump set.

b) Should one wish to work on the duty unit (pump that is running) valves press E-stop push button and isolate the pump set at MCC panel. The standby unit will start automatically (if applicable). Isolate the pump set by switching main isolator to “OFF” position and lock with padlock to avoid accidental start.

c) Should one wish to work on the standby unit (pump that is not running) (if applicable) valves isolate the pump set at MCC panel. Isolate the pump set by switching main isolator to “OFF” position and lock with padlock to avoid accidental start.

d) Close the upstream isolation valve.

e) Close the nearest upstream and downstream isolation valve on the relevant pipeline that needs to be drained.

f) Scour the upstream and downstream pipe section through either the scour valve on the pipeline or scour valve inside the pump station.

g) Remove the dismantling joint upstream or downstream of the isolation valves (butterfly– or gate valve).

h) Remove the valve (isolation- or non-return valve) and re-install the valve after the required maintenance has been performed.

i) Ensure that the scour valves are closed.

j) Slowly open the closest upstream and downstream isolation valves and/or stop logs to refill the pipeline. Check for any leaks and tighten the bolts where necessary.

k) Open the isolation- or non-return valve which was removed for maintenance or replacement slowly to fill the section of pipeline.

l) Resume normal operating conditions once the pipeline has been completely filled and all isolation valves are open. Confirm with the control room that all valves are open and that limit switches are functional.

7.2.12 Hoisting Equipment

Manually operated chain hoists are installed in the pump stations and leak detection sumps.

The pump stations are equipped with one monorail with a manually operated chain hoist of 2-ton capacity. The purpose is to allow maintenance to be carried out for lifting pumps and motors. Other equipment such as the valves and pipework shall be removed with a mobi lift, lift table or similar.

The leak detection sumps are equipped with one monorail with a manually operated chain hoist of 500-kg capacity. The purpose is to allow maintenance to be carried out for lifting pumps, motors, valves, pipes etc.

The SWL as indicated on the monorails should never be exceeded. Manually operated chain hoists should only be operated by operators with necessary training and valid certificates.

Maintenance shall be done strictly in accordance with the procedures as explained the manufacturers Owner’s Manual.

Attention! Periodical inspection and servicing procedure may only be carried out by a serviceman authorised by the hoist manufacturer or service personnel adequately trained by the hoist manufacturer.

Load and deflection tests shall be carried out annually by an authorised institution at 125% of the SWL of the hoist. A test certificate shall be issued by the institution upon completion of the test to demonstrate that the tests have successfully passed, and the crane is safe to be used.

7.2.13 Ventilation System

The MCC room is equipped with an axial fan to pressurise the room that will prevent dust from outside entering the room. The ventilation system should be operational at all times. Inspections and maintenance of all fans are required as prescribed in the instruction manuals furnished by the manufacturer.

7.3 PCD 4 Pipelines

Attention! Inline isolating valves should not be closed when the pumps are in operation. The same accounts for isolation valves on air valves, all must be open.

7.3.1 PCD 4 to Filling Point 1

The PCD 4 to Filling Point 1 pipeline consists of a DN250 HDPE PE 100 PN 16 pipe below ground level with several sections of 600mm diameter concrete pipe sleeves at haul road crossings.

The rising main consist of the following installations that requires little maintenance:

- Scour valve chamber (close to pump station building) – 1 off
- Electromagnetic flow meter – 1 off (i.e. one at pump station)

The rising main starts at the PCD 4 pump station where it connects to the discharge side of Pump GP241 and ends at Filling Point 1.

Refer to drawing PSX-EP-16290-DRG-WW-LY-0421-01 for the layout and long section details.

7.3.2 PCD 4 to PCD 1

The PCD 4 to PCD 1 pipeline consists of two DN560 HDPE pipes which are mostly below ground level except for the wetland crossing section where it runs above ground. There are also several sections of 600mm diameter concrete pipe sleeves at haul road crossings.

The pipeline consists of the following sections which requires little maintenance:

- Scour valves above ground or chamber – 3 off
- Air valves above ground or in chambers – 4 off
- Electromagnetic flow meter – 2 off (i.e. one at pump station)

The pipelines start at the PCD 4 pump station where it connects to the discharge manifold of Pumps GP243A, GP243B and GP243C which then pumps to the inlet of PCD 1.

Refer to drawing KPSX-EP-16290-DRG-WW-LY-0441-01 for the layout and long section details.

7.3.3 PCD 4 to Raw Water Reservoir Tie-In Chamber

The PCD 4 to the Raw Water reservoir has two different sections of pipelines which is as follows:

- The first section is a rising main from PCD 4 to the PCD 4 tie-in chamber (Figure 7-17) which consists of a DN355 HDPE PE 100 PN 16 pipe below ground level.
- The second section is a combination of a rising- and gravity main from the PCD 4 tie-in chamber (section 0) to the Raw Water Reservoir which consists of a DN355 HDPE PE 100 PN 16 pipe below ground level with several sections of 600mm diameter concrete pipe sleeves at haul road crossings.

The complete sections of rising- and gravity mains consists of the following section which requires little maintenance:

- Scour valves above ground or chamber – 1 off
- Air valves above ground or in chambers – 1 off
- Electromagnetic flow meter – 1 off (i.e. one at pump station)

The pipelines start at the PCD 4 pump station where it connects to the discharge manifold of Pumps GP242A and GP242B which then pumps to the inlet of the Raw Water Reservoir.

Refer to following drawings for the layout and long section details:

- KPSX-EP-16290-DRG-WW-LY-0401-01
- KPSX-EP-16290-DRG-WW-LY-0161-01

The Tie-in chamber configuration to pump water from PCD 4 to the Raw Water Reservoir shall be as illustrated in section 0. Refer to drawing KPSX-EP-16290-DRG-WW-DE-0083-01 for details.

7.3.4 General Pipeline Maintenance

Although little maintenance is required on the rising and gravity mains, it is recommended that routine inspections should be carried out on the entire pipeline route to inspect for any possible leaks or possible damage caused to the pipeline. The operator inside the control room should have a good indication of possible leaks on the pipeline by checking the static pressures in the pipelines and where the pump duty points are whilst running.

Periodical maintenance is required on the following equipment installed on the entire pipeline routes:

- Air valves and air valve chambers
- Electromagnetic flow meters
- Scour valves and scour valve chambers
- Various isolation valves

The scouring systems should be operated as explained under section 7.5 of this manual.

Inspection and maintenance procedures for rising- and gravity mains:

Description	Weekly	Monthly			Annually
		1	3	6	
Inspect for leaks		x			
Inspect/dewater manhole or chambers		x			
Inspect air valves for leaks		x			
Exercise valves full cycle			x		
Inspect valves seals for leaks					x
Apply lubrication				x	
Inspect for corrosion				x	
Check flowmeters for operation		x			

Attention! All pressure-conducting lines must be de-pressurised and secured against reactivation before starting any servicing/ maintenance work. All joints and connections must be checked for tightness and firm seating when servicing/maintenance work has been completed.

The following checks within the scope of the standard servicing and maintenance intervals for the overall system are nonetheless recommended:

- Check for external leakages,
- Check for any damages,
- Check for fouling/ freedom of movement,
- Check for unusual noises.

All valves should be maintained as per OEM suppliers prescribed instruction manuals, the proposed schedules mentioned in this section is a general guide and regarded as good practice.

7.3.5 Draining Procedures of Pipelines

Attention! Proper Working Permits and Lockout Procedures should be in place on any live apparatus to prevent unauthorised operation before any work is carried out on equipment.

After all lockout procedures are in place for the relevant pump sets, close off the isolating valves on the discharge side of the pumps. Then, the next step would be to open the relevant gate valve on the lowest scouring point of the pipeline section. See section 7.5 for information on Scouring procedures.

7.3.6 Refilling Procedures of Pipelines

Attention! Proper Working Permits and Lockout Procedures should be in place on any live apparatus to prevent unauthorised operation before any work is carried out on equipment.

After a pipeline have been drained for maintenance or repairs, refilling is done by use of the relevant pumps at each of the pump station. The procedures are as follows:

a) Ensure that all scour valves are closed, and air valves are operational.

b) Make sure the pipeline is clear of people and safe to receive water.

c) Before starting the relevant pump to fill the pipeline, the operator should note that gate- and butterfly valves are not efficient for throttling purposes. It will generally be required to close the gate- or butterfly valve to approximately than 10% to fill the pipeline. The operator should open the valve in small increments by monitoring the pump discharge pressure using the pressure transmitter (Figure 7-13). The pump should not be allowed to operate below the normal minimum operating pressure (see section 0 for the hydraulic parameters at the pump) as this will normally result in the pump tripping on overload or running with cavitation noises. Care should be taken to prevent cavitation of the pump during this procedure. Note that the filling procedure only occurs during initial filling of the pipeline, or if the system needs to be refilled after draining it.

d) Once the entire rising main has been filled with water (this will be when the pressure gauge stops rising and reach a steady state), then only can the delivery isolation valve be opened fully, and normal operation of the pumps can resume.

Figure 7-13: Pressure transmitter

7.4 Flow Meter and Tie-in Chamber Valve Details

This section provides details of the operation and maintenance of the equipment at each chamber or tie-in point.

Attention! Extra precautions shall be taken when working in confined spaces and proper ventilation should be in place before entering any confined spaces to avoid suffocation. Inline isolating valves should not be closed when the pumps are in operation. Proper Working Permits and Lockout Procedures should be in place on any live apparatus to prevent unauthorised operation before any work is carried out on equipment.

7.4.1 PCD 4 Flow Meter Chamber

The operations and maintenance shall be in accordance with the descriptions in Figure 7-14 to 16, and Table 7-3.

Table 7-3: PCD 4 Flow Meter Chamber Operations and Maintenance

Equipment description	Operation	Maintenance
Butterfly valves (2 off)	**Local mode:** Turn the hand wheel clockwise to open and anti-clockwise to close. **Remote mode (if motorised):** refer to actuator control details in section 0.	Actuate every 3 months under no-flow conditions. Note: Valves may not be used for flow control. Valves should be maintained as per suppliers prescribed instruction manuals.
Exposed pipework with flanges and gaskets	**N/A**	Inspect for any leaks monthly, report if leaks are detected.
Flow meters (3 off)	**Automatic:** Data sent to SCADA **Manual:** Reading can be taken from local display unit	Refer to O&M manual for calibration requirements.
Access ladders, pipes, supports and gratings	**N/A**	Inspect for any damage or severe corrosion every six months. Report if defects are detected.

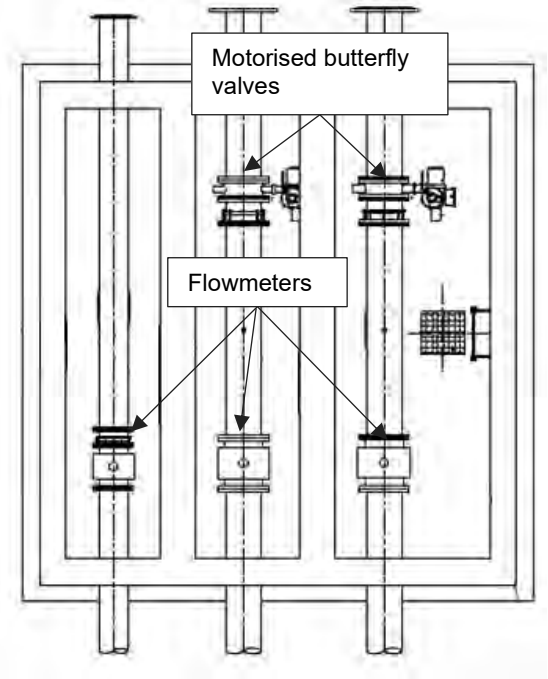


Figure 7-14: PCD 4 Flow Meter Chamber Schematic

Figure 7-15: PCD 4 Flow Meter Chamber Butterfly Valves

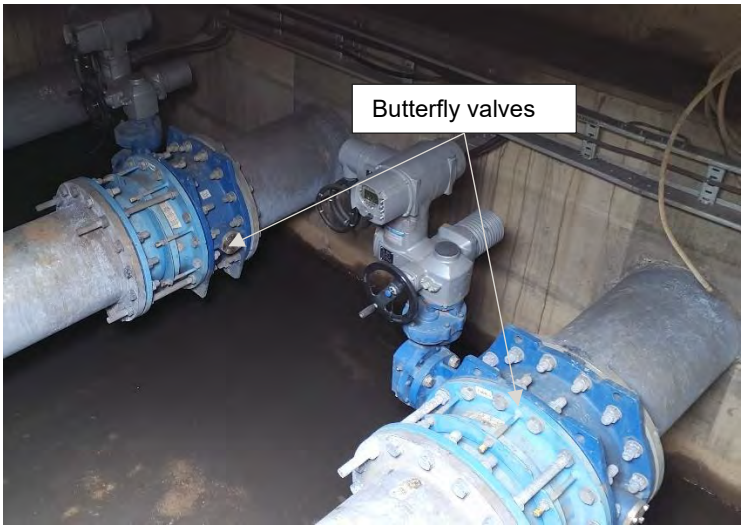


Figure 7-16: PCD 4 Flowmeters

The butterfly valves inside the PCD 4 flowmeter and valve chamber are automatically actuated when the SCADA system is in “auto” mode. These valves will open and closed based on the pump starts up’s of GP243 A, B and C.

7.4.2 PCD 4 to Raw Water Reservoir Tie-In Chamber

The operations and maintenance shall be in accordance with the descriptions in Table 7-4 and Figure 7-17 to Figure 7-19.

Table 7-4: PCD 4 to Raw Water Reservoir Tie-In Chamber

Equipment description	Operation	Maintenance
Air valve (1 off)	Remove mesh cover at op of air valve and clean out debris from plunger.	Inspect every month under flow conditions.
Gate valve (4 off) Bypass and air valve Isolation valves	**Manual only:** Turn the hand wheel clockwise to open and anti-clockwise to close.	Actuate every 3 months under no-flow conditions. Note: Valves may not be used for flow control. Valves should be maintained as per suppliers prescribed instruction manuals.
Check valve (1 off)	**N/A** automatically stop flow in one direction	Inspect every 3 months under flow conditions.
Exposed pipework with flanges and gaskets	**N/A**	Inspect for any leaks monthly, report if defects are detected.
Access ladders, pipes, supports and gratings	**N/A**	Inspect for any damage or severe corrosion every six months. Report if defects are detected.

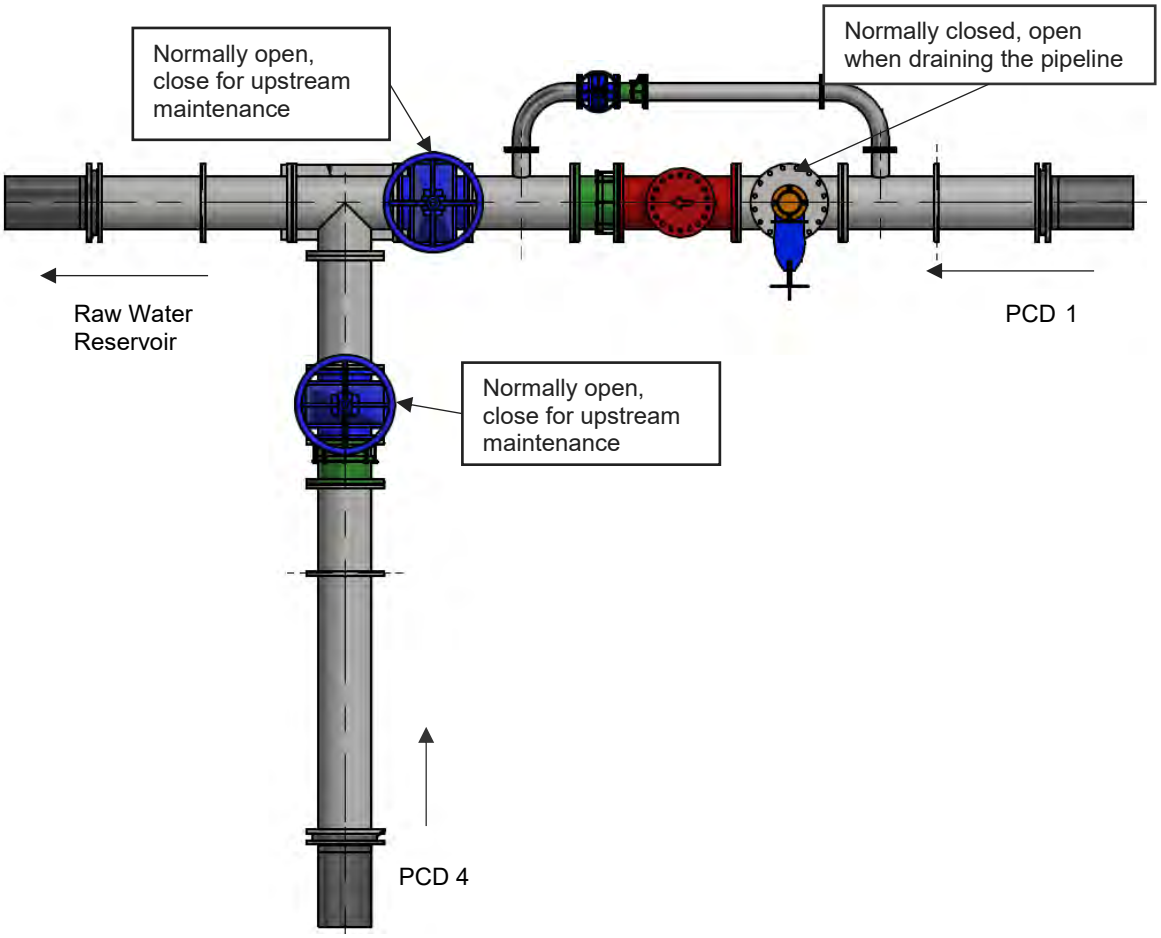


Figure 7-17: Tie-in Chamber for PCD 4 to Raw Water Reservoir

Figure 7-18: Tie-in Chamber for PCD 4 to Raw Water Reservoir Air Valves

Figure 7-19: Tie-in Chamber for PCD 4 to Raw Water Reservoir Gate Valves

7.5 Scouring Operations

7.5.1 Pipeline Scouring

The following should be noted before the pipeline, or a portion thereof is scoured:

Attention! Proper Working Permits and Lockout Procedures should be in place on any live apparatus to prevent unauthorised operation before any work is carried out on equipment.

- Scouring of pipelines shall only be done with the main pumps non-operational and the proper lockout procedures followed.
- Prior to scouring it must be ensured that all air-valves are functional, and all air-valve isolation valves are open to prevent vacuum conditions in the pipeline.
- It must be ensured that surrounding areas that will receive the scoured water are ready and clear of any equipment.

7.5.1.1 Scour Valve Chambers

The scour valve chambers are similar and consist of manually operated gate valves as described in section 0. Operation of the scouring system (both outdoor and in chambers) are explained below.

Dismantling joints are installed downstream of the gate valves to ensure ease of replacement. The components require little maintenance.

The gate valves are equipped with removable handles and are normally open when the hand wheels are turned to their most counter-clockwise position, i.e. closed when handle can't turn clockwise. Care should be taken when removing the handle and placing it back in correct manner.

Attention! Extra precautions shall be taken when working in confined spaces and proper ventilation should be in place before entering any confined spaces to avoid suffocation.

7.5.2 Scour Procedure for Different Types of Scours

The following scour valve configurations are used on the pipeline and pump stations:

7.5.2.1 Chamber and Pipeline Scours

The following procedure should be followed when using the **following scour valves (Figure 7-20 to Figure 7-25)** to drain the pipeline:

Attention! Extra precautions shall be taken when working in confined spaces and proper ventilation should be in place before entering any confined spaces to avoid suffocation.

a) The pumps should be non-operational and locked out for maintenance purposes.

b) Ensure all air valves are open.

c) Close inline isolating valves to isolate the section of the pipeline that must be drained.

d) Open the scour valve (RSV gate valve, see section 0) and allow the pipe/ pipe section to drain.

e) Ensure the scour valve is closed after the pipeline has been scoured.

f) The pipeline should be filled as described in section 7.3.6 of this document before the operation of the pump station is resumed.

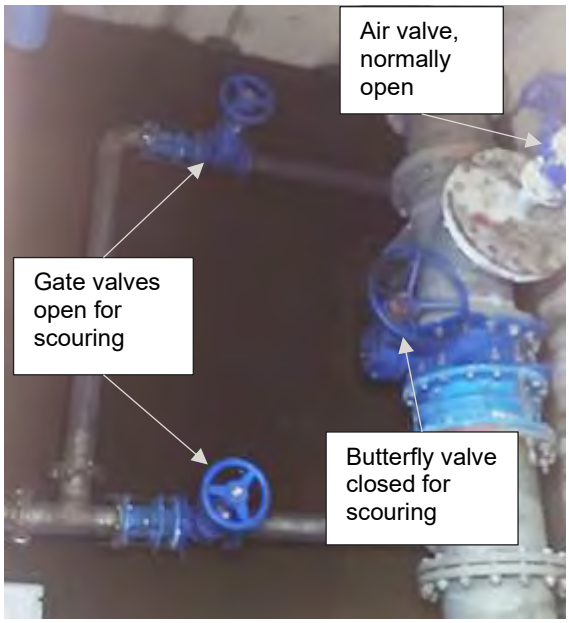


Figure 7-20: Typical Below Ground Scour Valve in Chamber

Figure 7-21: Typical Scour Chamber

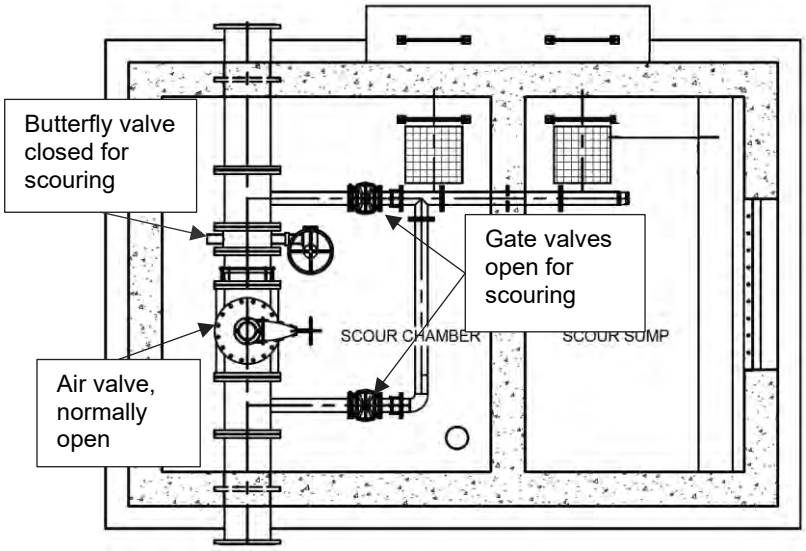


Figure 7-22: Typical Below Ground Scour Valve in Chamber Schematic

Figure 7-23: Typical Above Ground Scour Point for Below Ground Pipe (Type 1)

Figure 7-24: Typical Above Ground Scour Point for Below Ground Pipe (Type 2)

Figure 7-25: Typical Above Ground Scour Point for Pump Station Manifold

7.5.2.2 Scour for Pump Station (Inside)

The following procedure should be followed when using the **pump station scour valves (Figure 7-26)**:

a) The pumps should be non-operational and locked out for maintenance purposes.

b) Ensure all vent valves/plugs are open.

c) Close inline isolating valves to isolate the section of the pipeline that must be drained.

d) Open the scour valve (ball valve, see section 7.6.3) and allow the pipe/ pipe section to drain.

e) Ensure the scour valve is closed after the pipeline has been scoured.

f) The pipeline should be filled as described in section 7.3.6 of this document before the operation of the pump station is resumed.

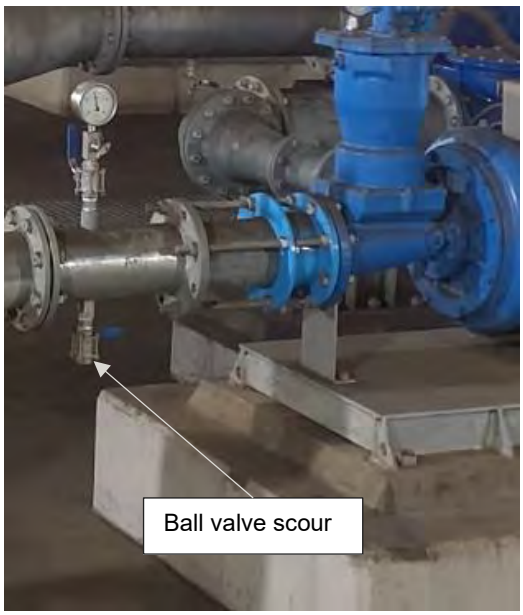


Figure 7-26: Typical Pump Station Scour

7.6 Mechanical Equipment

7.6.1 Butterfly Valves

Butterfly valves (Figure 7-27) are installed in the various pump stations and tie-in points and chambers for pipeline isolation. The valves shall be operated and maintained as described in the supplier O&M manual.

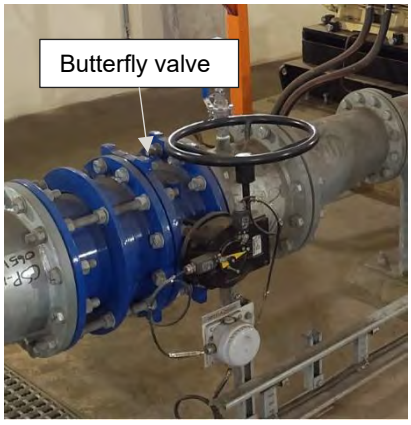


Figure 7-27: Butterfly Valve Illustration and Operation

Since these valves will be operated occasionally it is recommended that these valves be exercised on a quarterly basis under no-flow conditions. It is also important that these valves should not be used for flow control purposes.

7.6.2 RSV Gate Valves

Gate valves (Figure 7-28) are installed in the various pump stations and tie-in points and chambers. The valves shall be operated and maintained as described in the supplier O&M manual.

Figure 7-28: Gate Valve Illustration and Operation

Since these valves will be operated occasionally it is recommended that these valves be exercised on a quarterly basis under no-flow conditions. It is also important that these valves should not be used for flow control purposes.

7.6.3 Scouring Ball Valves

Scouring ball valves (see Figure 7-26) are installed in the various pump stations. These valves are used to scour a section of pipe for inspection and maintenance purposes. The valves shall be operated and maintained as described in the supplier O&M manual.

Since these valves will be operated occasionally it is recommended that these valves be exercised on a quarterly basis under no-flow conditions. It is also important that these valves should not be used for flow control purposes.

7.6.4 Motorised Valves

7.6.4.1 Control Philosophy

Valves that can be used in automatic mode is fitted with a motorised actuator. These actuators are pre-set as per the OEM requirements. The actuators shall be operated and maintained as described in the supplier O&M manual.

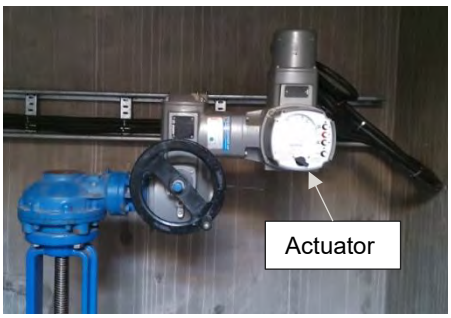


Figure 7-29: Motorised Valve Illustration

7.6.4.2 Operating Modes

The isolation valves that are actuated make use of an AUMA actuator. The valve can be operated in automatic or local mode by switching the selector switch. The following conditions are displayed on the valves display panel (Figure 7-30). The normal operation of the valve is in automatic/ remote mode. The valve cycle takes approximately 90 seconds to open or close under static conditions.

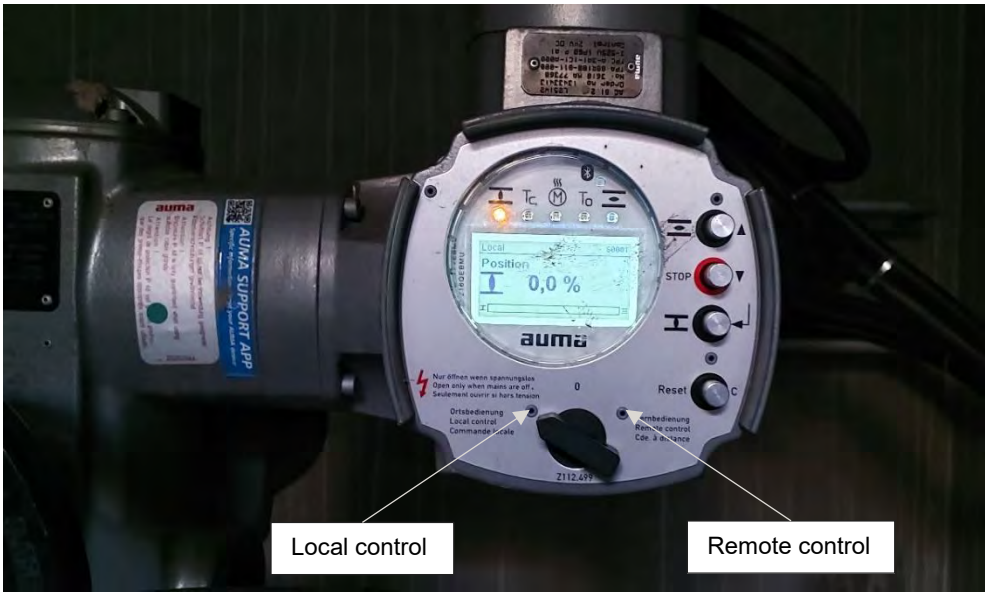


Figure 7-30: Actuator Control Illustration

7.6.5 Air Valves

Air valves (Figure 7-31) are installed at all high points of the pipeline route and at pump stations that requires minimum maintenance. The only malfunction of the air valves would be debris getting stuck inside the small orifice causing the air valve to leak and not function properly. The air valves can be maintained and repaired with the pipeline under full static or dynamic pressure by closing the gate valve between the pipeline and air valve although special care should be taken in case of latter.

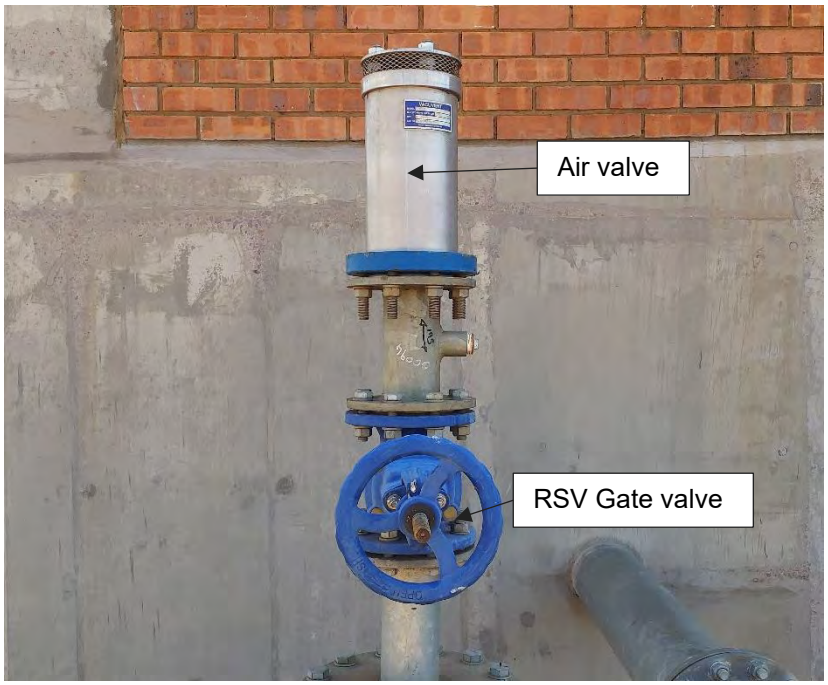


Figure 7-31: Typical Air Valve Installation

The following procedures should be followed when cleaning or repair leaking air valves:

- Close the isolating valve beneath the air valve.
- In case of leaking on small orifice valve remove only the small orifice valve and clean. Replace after cleaning.
- In case of leaking on large orifice, remove entire air valve by unbolting the air valve assembly from the isolating valve. Clean and/or replace parts as per OEM instruction manual.
- Reinstall the components in the correct sequence and secure top cover back on top of valve. Correct installation sequence of the components is important to ensure correct functioning and performance of the valves and avoid damaging of the pipeline.
- Open the isolating valve beneath the air valve to return it to a functional state. The air valve should not leak.

Attention! Extra precautions shall be taken when working in confined spaces and proper ventilation should be in place before entering any confined spaces to avoid suffocation.

The valves shall be repaired and maintained as described in the supplier O&M manual.

8 Dam break analysis

PCD 4 is an off-channel reservoir and the risk of a dam break flood occurring due to overtopping of the non-overspill crest is considered negligible due to the small catchment area.

The probable failure scenarios are a piping failure through the HDPE lining system of embankment or a sudden embankment collapse.

No dam break analysis was carried out for PCD 4 as it did not satisfy the criteria to be classified as a dam with a safety risk. The low embankment heights above NGL level would allow only a portion of the volume of PCD 4 to spill and the full capacity of the dam would not spill to the environment.

9 Emergency Preparedness Plan

This Emergency Preparedness Plan (EPP) must be implemented as necessary by the owner who should also maintain it and keep it up to date. Note that this is not an emergency evacuation plan. The owner's representative and the designated disaster management authority are responsible for warning and evacuation in the affected areas as necessary

9.1 Threatened area

As described in Section 7, a dam break analysis was not carried out for PCD 4. The area that the dam would likely spill in to would be contained within the mining boundary, most likely into Pit BD.

9.2 Emergency Planning

All role players (as discussed in Section 9.4) which may need to respond to any hazard occurrence in the surrounding area must be prepared for a quick and effective response in the event of a dam failure occurrence.

In the pro-active phase of disaster risk management, preparedness is defined as per the sections below.

9.2.1 Education and training

The role players (as discussed in Section 9.4) and the public directly implicated must be made aware of the emergency procedures discussed in Section 9.3.

9.2.2 Engineering and technical

The required inspection, operation and maintenance of the dam is discussed in 3 to 0 of this report. It is the owner's responsibility to ensure that the responsible role players (as discussed in Section 9.4) are acquainted with this report and that the necessary resources are provided to implement the required activities.

9.2.3 Emergency preparedness

The operator of the dam must be well acquainted with this report. The operator must know what procedures to follow in any emergency situation with guidance from this report as well as more detailed evacuation plans which are not set out in this report.

It is good practice to have the following items available to the operator of the dam for monitoring and emergency preparedness:

- O&M manual (this report)
- Pegs
- Paint
- Radio / cellphone
- Camera
- Lighting
- Generator
- Loud hailer

- Valve key
- Valve chamber keys
- Pump station key
- Warning signs
- Warning flags
- Personal Protection Equipment (PPE)
- Emergency contact details

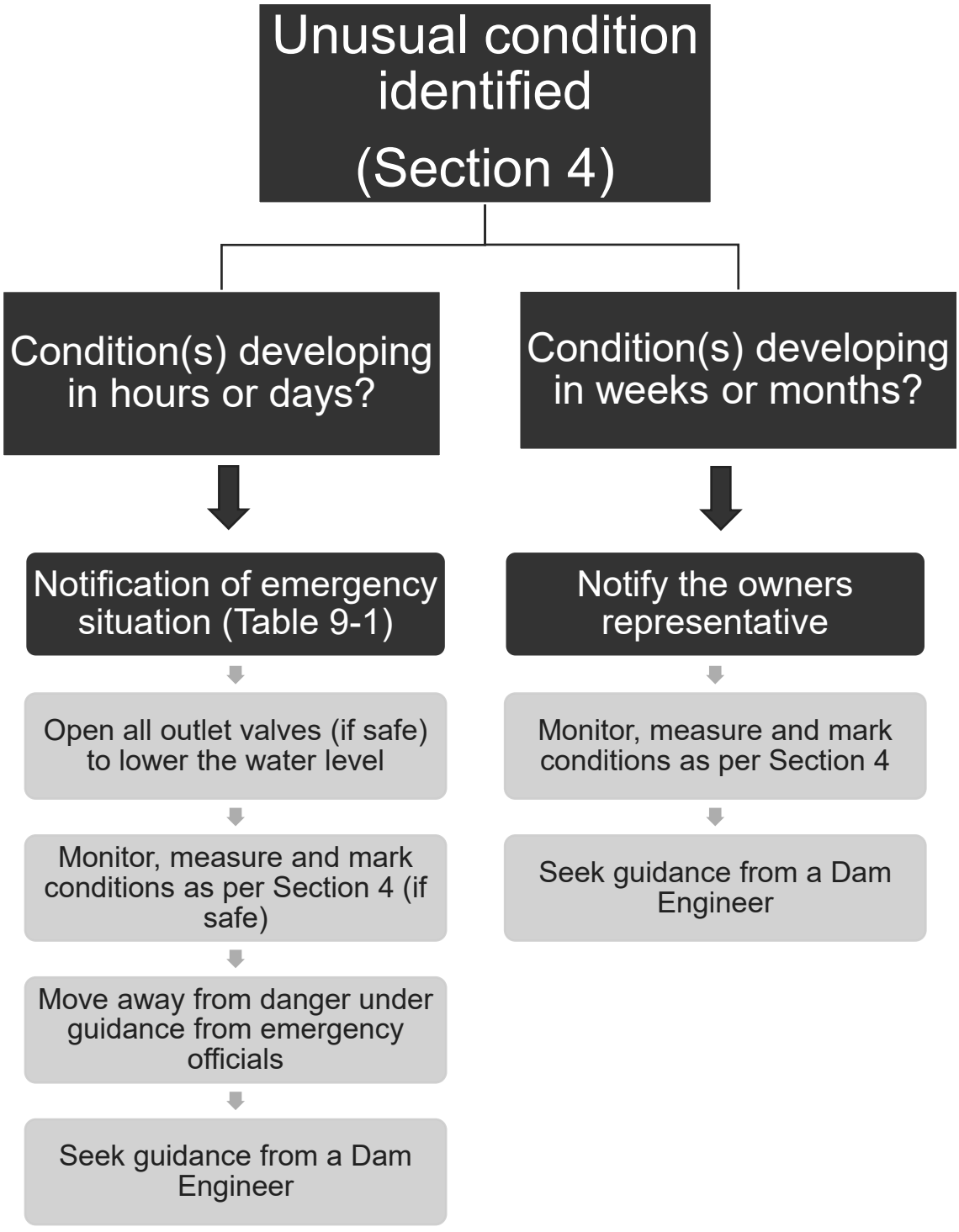
Keys to the security gates of the perimeter fence around the dam should be kept in a central location at the control room such that they can be accessed quickly during an emergency. Refer to Section 9.4 for contact details.

9.3 Emergency procedures

Conditions that indicate a potential emergency situation are described in Section 0, especially if the conditions arise rapidly (over several hours or days). If deemed necessary or if the unusual condition develops suddenly, all steps should be taken to drain the dam or lower the water level, by opening all valves or syphoning water.

It is the responsibility of the operator to assess the severity. The severity is indicated by the time of development of the unusual condition (Section 0).

9.3.1 Assess the severity



9.3.2 Notification procedures

The following procedures should be followed in the event of an emergency situation, in order:

1) Call the KPS Control Room who will notify Disaster Risk Management and emergency response units.
2) Warn the Owners of properties and Authorities of roads downstream of the dam of the emergency situation.
3) Warn and inform anybody who might be downstream of the dam at the time of the emergency situation.
4) Notify the owner of the dam.
5) Seek expert advice from an experienced dam engineer (see 8.3.3 below).
6) The Director-General of the Department of Human Settlements, Water and Sanitation (in the person of the Director: Dam Safety Regulation Chief: Dam Safety Office, telephone 012 - 338 7500) should immediately be notified as soon as a condition affecting the safety of the dam is identified, and a written report on the nature, extent and causes of the condition and the steps taken to improve the safety of the dam should be submitted to the Director-General within 30 days.

IN CASE OF EMERGENCY NOTIFY THE PARTIES ACCORDING TO STEPS 1 - 5 ON THE FOLLOWING PAGE

9.3.3 Expert advice

If the dam owner decides that a potential emergency situation is developing, expert advice in managing the dam through the event may be obtained from the following persons or institutions:

- The Specialist Dam Engineer previously involved with the dam (if possible)
- Any suitably experienced dam engineer
- Dam Safety Office (DSO) of the Directorate: Dam Safety Regulation of the Department of Human Settlements, Water and Sanitation (DHSWS)

Contact details are provided in Section 9.4.

ORDER OF NOTIFICATION

Table 9-1: Emergency Notification Protocol

	OPREATOR PROTOCOL	ADDITIONAL ACTIVIY AND INFORMATION
1	**Notification of Possible Emergency Situation to KPS Control Room** **Who:** Notifier: Public/Operator Notification to: KPS Control Room **How:** Dial: 013 643 3911 / 082 815 1928	Control Room notifies emergency services. Control Room notifies Disaster Management Unit. Disaster Management Unit to follow the relevant emergency response protocols.
2	**Notification of Possible Emergency Situation to Property Owners** **Who:** Notifier: Public/Operator/Emergency services/Disaster Management Unit Notification to: Property owners **How:** Identify properties and infrastructure and go from door to door to warn and notify those affected. The Disaster Management Unit and local emergency services must advise and assist.	Inform/notify the following: ■ All people downstream of the dam. ■ Properties located adjacent to the dam break flood line.
3	**Notification of Possible Emergency Situation to Public** **Who:** Notifier: Public/Operator/Emergency services/Disaster Management Unit Notification to: Public **How:** Identify any person downstream of the dam and verbally notify said person(s) of emergency situation.	Public to stay calm and wait for emergency services to arrive. In the case where the danger is imminent the Disaster Management Unit and emergency services will inform all persons to evacuate the area in immediate danger.
4	**Notification of Possible Emergency Situation to Owners representative** **Who:** Notifier: Operator Notification to: Owner's representative **How:** Contact and inform the relevant person/institution as set out in **Section 9.4**	The owners representative needs to assess the situation and ensure: ■ The Disaster Management Unit is aware and in control of the emergency situation. ■ The staff at the pump station and downstream infrastructure is aware of the situation. ■ An observer is sent to the dam to monitor the situation on site. ■ All outlet valves are opened to drain the dam. ■ A dam engineer is contacted to provide expert advice.
5	**Notification of Possible Emergency Situation to a Dam Engineer** **Who:** Notifier: Owner's representative Notification to: Specialist Dam Engineer **How:** Contact and inform the Dam Engineer who carried out the latest dam safety evaluation OR Contact and inform any suitably experienced dam engineer.	

9.4 Names and addresses of relevant persons/institutions

The persons and institutions that are responsible for the dam or should be contacted in the event of an emergency with their contact details are listed below. Note that these details and persons may change from time to time, and it is the responsibility of the dam owner that this list is updated to reflect any changes.

Operations Manager: KPSX Weltevreden PCD 4	
Name:	Dirk Miller
Cell phone:	082 928 1574
Telephone:	013 643 3800
Responsibility:	Evaluate gravity of emergency situation and, where appropriate, notify emergency response personnel (Emalahleni Disaster Management Unit, Road Traffic Inspectorate and SA Police).
Manager: Emalahleni District Municipality Disaster Management Unit	
Name:	AV Mlangeni
Cell phone:	N/A
Telephone:	013 690 6444 013 690 6222
Responsibility:	Co-ordinate Disaster Management Unit staff to patrol water course below dam to warn local communities to stay away from river banks.
Commanding Officer- SA Police Service, Phola	
Name:	Colonel Matlala
Cell phone:	079 495 3917
Telephone:	013 643 8605
Responsibility:	To monitor local Ogies / Phola community and control any dangerous situation arising To send patrol cars to downstream crossings of the Grootspruit watercourse to be on standby close to the road for vehicular and pedestrian traffic.

Commanding Officer - SA Police Service, Ogies	
Name:	Captain Mabena
Cell phone:	N/A
Telephone:	013 643 8402
Responsibility:	To monitor local Ogies / Phola community and control any dangerous situation arising To send patrol cars to downstream crossings of the Grootspruit watercourse to be on standby close to the road for vehicular and pedestrian traffic.
Ward Councillor – Local Community	
Name:	ML Mofokeng
Cell phone:	078 408 3878
Telephone:	013 690 6333
Responsibility:	Assist local authorities with communications to the residents
KPS Control Room	
Name:	KPS Control Room
Cell phone:	082 815 1928
Telephone:	013 643 3911
Responsibility:	Assist local authorities and the owner with resources to respond to the emergency

Appendices

Appendix A

Routine Inspection Check List for KPSX Weltevreden Pollution Control Dam 4

Date of inspection: …….... Water level on level instrument ……..m

Item	Inspection	Comment*
1.	**DOWNSTREAM FACE OF DAM**	
1.1	**Appearance of seepage water:**	
	Position(s)	
	Estimate of flow	
	Clarity of water	
1.2	**Appearance of damp patches:**	
	Position(s)	
	Area of patch	
1.3	**Appearance of settlement:**	
	Position(s)	
	Surface area	
	Maximum depth below normal slope	
1.4	**Appearance of bulges:**	
	Position(s)	
	Surface area	
	Maximum height above normal slope	
1.5	**Appearance of cracks:**	
	Position(s)	
	Direction #	
	Length	
	Width	
	Vertical displacement	
1.6	**Condition of vegetation:**	
	Grass	
	Removal of trees	
1.7	**Appearance of erosion**	
1.8	**Other**	
1.9	**General condition**	

Item	Inspection	Comment*
2.	**UPSTREAM FACE OF DAM**	
2.1	**Condition of slope protection:**	
	Condition of stabilised infill	
	Condition of geocells	
	Wash out of geocell(s)	
	Position(s)	
	Length	
	Width	
2.2	**Condition of HDPE liner**	
	Exposed Liner	
	Position(s)	
	Length	
	Width	
	Hole in liner	
	Position(s)	
	Length	
	Width	
	Tear in liner	
	Position(s)	
	Length	
	Width	
2.3	**Appearance of settlement:**	
	Position(s)	
	Surface area	
	Maximum depth below normal slope	
2.4	**Appearance of cracks:**	
	Position(s)	
	Direction #	
	Length	
	Width	
	Vertical displacement	
2.5	**Appearance of erosion/wave benching**	
2.6	**Other**	
2.7	**General condition**	

3.	EMBANKMENT CREST			
3.1	**Monitoring of settlement (annual only)**		**Benchmark level =** .....**masl**	
	Settle Beacon	Initial level (masl)	Present level (masl)	Vertical movement (mm)
	PCD 4-SB01	1550.634		
	PCD 4-SB02	1550.603		
	PCD 4-SB03	1550.602		
	PCD 4-SB04	1550.676		
	PCD 4-SB05	1550.811		
	PCD 4-SB06	1550.504		
	PCD 4-SB07	1550.459		
	PCD 4-SB08	1550.526		
	PCD 4-SB09	1550.515		

Item	Inspection	Comment*
3.2	**Appearance of settlement:**	
	Position(s)	
	Surface area	
3.3	**Appearance of cracks:**	
	Position(s)	
	Direction #	
	Length	
	Width	
	Depth	
	Distance between transverse cracks	
3.4	**Other**	
3.5	**General condition**	

Item	Inspection	Comment*
4.	**SPILLWAYS**	
4.1	**Appearance of erosion**	
4.2	**Vegetation in channel**	
4.3	**Blockages in channel**	
4.4	**Condition of rip-rap**	
4.5	**Other**	
4.6	**General condition**	
5.	**LEAK DETECTION SUMPS**	
5.1	**Monitoring of seepage water:**	
	Chamber No	Estimated flow (ℓ/s)
	Leak Detection Sump	
5.2	**Monitoring of water quality**	
	Clarity of water	
	Contaminant(s)	
5.3	**Open and close valves**	
5.4	**Leakage at pipe surround**	
5.5	**Leakage through closed valves**	
5.6	**Damage or corrosion**	
5.7	**Other**	
5.8	**General condition**	
6	**DOWNSTREAM TOE**	
6.1	**Appearance of seepage water:**	
	Position(s)	
	Estimate of flow	
	Clarity of water	
6.2	**Appearance of settlement or movement:**	
	Position(s)	
	Surface area	
	Maximum depth below normal slope	
6.3	**Other**	
6.4	**General condition**	

Item	Inspection	Comment*
7	**INLET WORKS**	
7.1	**Open and close sluice gates**	
7.2	**Leakage around sluice gates**	
7.3	**Condition of access stairs**	
7.4	**Leakage at inlet pipes**	
7.5	**Silt built up depth**	
7.6	**Damage or corrosion**	
7.7	**Other**	
7.8	**General condition**	
8	**OUTLET WORKS**	
8.1	**Lift and lower stoplogs**	
8.2	**Condition of screens**	
8.3	**Condition of staircases**	
8.4	**Leakage at pipe surround**	
8.5	**Leakage through closed valves**	
8.6	**Open and close valves**	
8.7	**Damage or corrosion**	
8.8	**Other**	
8.9	**General condition**	
9.	**BASIN**	
9.1	**Condition of HDPE Liner**	
	Exposed Liner	
	Position(s)	
	Length	
	Width	
	Hole in liner	
	Position(s)	
	Length	
	Width	
	Tear in liner	
	Position(s)	
	Length	
	Width	
9.2	**Other**	
9.3	**General condition**	

* Give description of observations of each component of the dam by commenting on the different items, e.g. good, poor, none, what action should be taken and any further applicable comment.

Photographs of a particular condition are useful and provide much more information than a description.

\# Cracks parallel to the crest of the dam = longitudinal
Cracks perpendicular to crest of the dam = transverse

_____	_____
Signature of the Observer	**Signature of the Owner or the Owner's representative who is responsible for PCD 4.**
_____	_____
Date	**Date**

Appendix B

Classification of KPSX Weltevreden PCD 4

Letter from the Dam Safety Office (DSO) of the Directorate: Dam Safety Regulation of the Department of Water and Sanitation

Not applicable as the dam was not classified as a Dam with a Safety Risk

Appendix C

KPSX Weltevreden Pollution Control Dam 4 Locality Map

Refer to KPSX Blockplan, drawing KPSX-EP-11000-DRG-JJ-BP-0001-01

Appendix D

KPSX Weltevreden Pollution Control Dam 4 Dam Break Analysis

Not applicable as the dam was not classified as a Dam with a Safety Risk

Appendix E

KPSX Pollution Control Dam 4 Gross Capacity Table

Percentage of full supply level depth	Water level (masl)	Capacity of the Compartment (m^3)	Percentage of full supply level depth	Water level (masl)	Capacity of the Compartment (m^3)
100%	1,549.40	62,919	75%	1,548.57	47,189
99%	1,549.37	62,290	74%	1,548.54	46,560
98%	1,549.34	61,661	73%	1,548.50	45,931
97%	1,549.31	61,032	72%	1,548.47	45,302
96%	1,549.28	60,403	71%	1,548.44	44,673
95%	1,549.25	59,773	70%	1,548.40	44,044
94%	1,549.22	59,144	69%	1,548.37	43,414
93%	1,549.19	58,515	68%	1,548.33	42,785
92%	1,549.15	57,886	67%	1,548.30	42,156
91%	1,549.12	57,257	66%	1,548.26	41,527
90%	1,549.09	56,627	65%	1,548.23	40,898
89%	1,549.05	55,998	64%	1,548.20	40,268
88%	1,549.02	55,369	63%	1,548.16	39,639
87%	1,548.98	54,740	62%	1,548.12	39,010
86%	1,548.95	54,111	61%	1,548.09	38,381
85%	1,548.91	53,481	60%	1,548.05	37,752
84%	1,548.88	52,852	59%	1,548.02	37,122
83%	1,548.85	52,223	58%	1,547.98	36,493
82%	1,548.81	51,594	57%	1,547.94	35,864
81%	1,548.78	50,965	56%	1,547.91	35,235
80%	1,548.74	50,335	55%	1,547.87	34,606
79%	1,548.71	49,706	54%	1,547.83	33,976
78%	1,548.67	49,077	53%	1,547.79	33,347
77%	1,548.64	48,448	52%	1,547.75	32,718
76%	1,548.61	47,819	51%	1,547.72	32,089

Percentage of full supply level depth	Water level (masl)	Capacity of the Compartment (m^3)	Percentage of full supply level depth	Water level (masl)	Capacity of the Compartment (m^3)
50%	1,547.68	31,460	25%	1,546.67	15,730
49%	1,547.64	30,830	24%	1,546.63	15,101
48%	1,547.60	30,201	23%	1,546.59	14,471
47%	1,547.56	29,572	22%	1,546.55	13,842
46%	1,547.52	28,943	21%	1,546.51	13,213
45%	1,547.48	28,314	20%	1,546.46	12,584
44%	1,547.44	27,684	19%	1,546.42	11,955
43%	1,547.40	27,055	18%	1,546.38	11,325
42%	1,547.36	26,426	17%	1,546.33	10,696
41%	1,547.32	25,797	16%	1,546.28	10,067
40%	1,547.28	25,168	15%	1,546.23	9,438
39%	1,547.24	24,539	14%	1,546.18	8,809
38%	1,547.20	23,909	13%	1,546.12	8,180
37%	1,547.16	23,280	12%	1,546.07	7,550
36%	1,547.12	22,651	11%	1,546.01	6,921
35%	1,547.08	22,022	10%	1,545.94	6,292
34%	1,547.04	21,393	9%	1,545.88	5,663
33%	1,547.00	20,763	8%	1,545.81	5,034
32%	1,546.96	20,134	7%	1,545.73	4,404
31%	1,546.92	19,505	6%	1,545.65	3,775
30%	1,546.88	18,876	5%	1,545.56	3,146
29%	1,546.84	18,247	4%	1,545.47	2,517
28%	1,546.80	17,617	3%	1,545.37	1,888
27%	1,546.76	16,988	2%	1,545.26	1,258
26%	1,546.72	16,359	1%	1,545.07	629

**1544.640 masl is the lowest level available for the gross storage capacity of the dam*

Appendix F

KPSX Pollution Control Dam 4 Nett Capacity Table

Gross storage for PCD 4 is equal to the nett storage capacity.

Appendix G

KPSX Pollution Control Dam 4 Surface Area Table

Percentage of full supply level depth	Water level (masl)	Surface Area of the Compartment (m^2)	Percentage of full supply level depth	Water level (masl)	Surface Area of the Compartment (m^2)
100%	1,549.40	19,877	75%	1,548.57	14,908
99%	1,549.37	19,678	74%	1,548.54	14,709
98%	1,549.34	19,480	73%	1,548.50	14,510
97%	1,549.31	19,281	72%	1,548.47	14,312
96%	1,549.28	19,082	71%	1,548.44	14,113
95%	1,549.25	18,883	70%	1,548.40	13,914
94%	1,549.22	18,685	69%	1,548.37	13,715
93%	1,549.19	18,486	68%	1,548.33	13,517
92%	1,549.15	18,287	67%	1,548.30	13,318
91%	1,549.12	18,088	66%	1,548.26	13,119
90%	1,549.09	17,890	65%	1,548.23	12,920
89%	1,549.05	17,691	64%	1,548.20	12,721
88%	1,549.02	17,492	63%	1,548.16	12,523
87%	1,548.98	17,293	62%	1,548.12	12,324
86%	1,548.95	17,094	61%	1,548.09	12,125
85%	1,548.91	16,896	60%	1,548.05	11,926
84%	1,548.88	16,697	59%	1,548.02	11,728
83%	1,548.85	16,498	58%	1,547.98	11,529
82%	1,548.81	16,299	57%	1,547.94	11,330
81%	1,548.78	16,101	56%	1,547.91	11,131
80%	1,548.74	15,902	55%	1,547.87	10,932
79%	1,548.71	15,703	54%	1,547.83	10,734
78%	1,548.67	15,504	53%	1,547.79	10,535
77%	1,548.64	15,305	52%	1,547.75	10,336
76%	1,548.61	15,107	51%	1,547.72	10,137

Percentage of full supply level depth	Water level (masl)	Surface Area of the Compartment (m^2)	Percentage of full supply level depth	Water level (masl)	Surface Area of the Compartment (m^2)
50%	1,547.68	9,939	25%	1,546.67	4,969
49%	1,547.64	9,740	24%	1,546.63	4,771
48%	1,547.60	9,541	23%	1,546.59	4,572
47%	1,547.56	9,342	22%	1,546.55	4,373
46%	1,547.52	9,144	21%	1,546.51	4,174
45%	1,547.48	8,945	20%	1,546.46	3,975
44%	1,547.44	8,746	19%	1,546.42	3,777
43%	1,547.40	8,547	18%	1,546.38	3,578
42%	1,547.36	8,348	17%	1,546.33	3,379
41%	1,547.32	8,150	16%	1,546.28	3,180
40%	1,547.28	7,951	15%	1,546.23	2,982
39%	1,547.24	7,752	14%	1,546.18	2,783
38%	1,547.20	7,553	13%	1,546.12	2,584
37%	1,547.16	7,355	12%	1,546.07	2,385
36%	1,547.12	7,156	11%	1,546.01	2,186
35%	1,547.08	6,957	10%	1,545.94	1,988
34%	1,547.04	6,758	9%	1,545.88	1,789
33%	1,547.00	6,559	8%	1,545.81	1,590
32%	1,546.96	6,361	7%	1,545.73	1,391
31%	1,546.92	6,162	6%	1,545.65	1,193
30%	1,546.88	5,963	5%	1,545.56	994
29%	1,546.84	5,764	4%	1,545.47	795
28%	1,546.80	5,566	3%	1,545.37	596
27%	1,546.76	5,367	2%	1,545.26	398
26%	1,546.72	5,168	1%	1,545.07	199

**1544.640 masl is the empty level for the surface area of the dam*

Appendix H

KPSX Weltevreden Pollution Control Dam 4 Draw Down Table

PCD 4 cannot be scoured

Appendix I

Data Sheets - Selected

I. Geomembranes – Smooth and textured HDPE geomembranes

AKS Lining Systems (Pty) Ltd

Technical Data: Flat Die Extruded Smooth Geoliner

Smooth Geoliner is produced from HDPE resin that conforms to the requirements of the GRI-GM13 specification.

Properties	Units	Test Method	Test Frequency (1)	Min Average Values				
Thickness. Minimum Avg.(**4**)	mm	ASTM D 5199	Per roll	1	1.5	2	2.5	3
Formulated Density	g/cc	ASTM D 792	90 000kg/ approx. every 60 rolls	≥0.94	≥0.94	≥0.94	≥0.94	≥0.94
Tensile Properties - Minimum Avg. (**2**)								
Yield Strength	kN/m	ASTM D 6693 Type IV Dogbone	9 000kg / approx. every 5 rolls	15	22	29	37	44
Yield Elongation	%			12	12	12	12	12
Break Strength	kN/m			27	40	53	67	80
Break Elongation	%			700	700	700	700	700
Tear Resistance. Minimum Avg.	N	ASTM D 1004	20 000kg / approx. every 12 rolls	125	187	249	311	374
Puncture Resistance. Minimum Avg.	N	ASTM D 4833	20 000kg/ approx. every 12 rolls	320	480	640	800	960
Dimensional Stability	%	ASTM D 1204		±2	±2	±2	±2	±2
Rapid tensile test (300mm/min)	visual	ASTM D6693	90 000kg / approx. every 60 rolls	No Separation Visible				
Carbon Black Content	%	ASTM D 4218	9 000kg / approx. every 5 rolls	2 - 3	2 - 3	2 - 3	2 - 3	2 - 3
Carbon Black Dispersion	Category	ASTM D 5596	20 000kg / approx. every 12 rolls	cat.1 or cat.2	cat.1 or cat.2	cat.1 or cat.2	cat.1 or cat.2	cat.1 or cat.2
Oxidative Induction Time (OIT) (min. avg.) (**3**)								
Standard OIT	minutes	ASTM D 3895	90 000kg / approx. every 60 rolls	100	100	100	100	100
— or —								
High Pressure OIT	minutes	ASTM D 5885		400	400	400	400	400
Stress Crack Resistance (SP - NCTL)	Hours	ASTM D 5397 Appendix	180 000kg / approx. every 110 rolls	500	500	500	500	500
Oven Aging at 85°C		ASTM D 5721						
Standard OIT (min. avg.) retained after 90 days	%	ASTM D 3895	Per Formulation	55	55	55	55	55
— or —								
High Pressure OIT (min. avg.) retained after 90 days	%	ASTM D 5885		80	80	80	80	80
UV Resistance - % retained after 1600 hrs.		ASTM D 7238	Per Formulation					
High Pressure OIT (min. avg.)	%	ASTM D 5885		50	50	50	50	50

1) Based on Standard Roll dimensions. One batch is approx. 180 000kg or 2 railcars.
2) Tensile results based on Avg values of MD and TD. 5 specimens in each direction.
3) AKS Lining Systems has the right to select either test method to evaluate OIT.
4)Lowest Individual of 10 Values = -10%

All values are nominal, except when specified as maximum or minimum.

The information provided for reference purposes only and is not intended as a warranty or guarantee. Final decision on suitability of product remains the sole responsibility of user. AKS Lining Systems assumes no liability in connection with the use of this information.

For further information on this product, please contact us at the following address:

P O Box 1066, Cape Gate, South Africa, 7562
Tel: +27 21 983 2700
Fax: +27 21 982 1597

www.aks.co.za

AKS Lining Systems (Pty) Ltd

Technical Data: Flat Die Extruded Mono or Dual Textured HDPE

Textured geomembrane liner is produced from HDPE resin that conforms to the requirements of the GRI-GM13 specification.

Properties	Units	Test Method	Test Frequency (1)	Min Average Values			
Thickness. Minimum Avg. (**4**)	mm	ASTM D 5994	Per roll	1	1.5	2.00	2.5
Asperity Height Minimum Avg.	mm	ASTM D7466	Every 2 rolls	0.65	0.65	0.65	0.65
Formulated Density	g/cc	ASTM D 792	90 000kg/ approx. every 60 rolls	≥0.94	≥0.94	≥0.94	≥0.94
Tensile Properties - Minimum Avg. (**2**)							
Yield Strength	kN/m	ASTM D 6693 Type IV Dogbone	9 000kg / approx. every 5 rolls	15	22	29	37
Yield Elongation	%			12	12	12	12
Break Strength	kN/m			10	16	21	26
Break Elongation	%			400	400	400	400
Tear Resistance. Minimum Avg.	N	ASTM D 1004	20 000kg / approx. every 12 rolls	125	187	249	311
Puncture Resistance. Minimum Avg.	N	ASTM D 4833	20 000kg/ approx. every 12 rolls	267	400	534	667
Dimensional Stability	%	ASTM D 1204		±2	±2	±2	±2
Rapid tensile test (300mm/min)	visual	ASTM D6693	90 000kg / approx. every 60 rolls	No Separation Visible			
Carbon Black Content	%	ASTM D 4218	9 000kg / approx. every 5 rolls	2 - 3	2 - 3	2 - 3	2 - 3
Carbon Black Dispersion	Category	ASTM D 5596	20 000kg / approx. every 12 rolls	cat.1 or cat.2	cat.1 or cat.2	cat.1 or cat.2	cat.1 or cat.2
Oxidative Induction Time (OIT) (min. avg.) (**3**)							
Standard OIT	minutes	ASTM D 3895	90 000kg / approx. every 60 rolls	100	100	100	100
— or —							
High Pressure OIT	minutes	ASTM D 5885		400	400	400	400
Stress Crack Resistance (SP - NCTL)	Hours	ASTM D 5397 Appendix	180 000kg / approx. every 110 rolls	500	500	500	500
Oven Aging at 85°C		ASTM D 5721					
Standard OIT (min. avg.) retained after 90 days	%	ASTM D 3895	Per Formulation	55	55	55	55
— or —							
High Pressure OIT (min. avg.) retained after 90 days	%	ASTM D 5885		80	80	80	80
UV Resistance - % retained after 1600 hrs.		ASTM D 7238	Per Formulation				
High Pressure OIT (min. avg.)	%	ASTM D 5885		50	50	50	50

1) Based on Standard Roll dimensions. One batch is approx. 180 000kg or 2 railcars.
2) Tensile results based on Avg values of MD and TD. 5 specimens in each direction.
3) AKS Lining Systems has the right to select either test method to evaluate OIT.
4) Lowest individual of 10 values = -10%

All values are nominal, except when specified as maximum or minimum.

The information provided for reference purposes only and is not intended as a warranty or guarantee. Final decision on suitability of product remains the sole responsibility of user. AKS Lining Systems assumes no liability in connection with the use of this information.

For further information on this product, please contact us at the following address:

P O Box 1066, Cape Gate, South Africa, 7562
Tel: +27 21 983 2700
Fax: +27 21 982 1597

www.aks.co.za

II. Geocells – Woven polypropylene stitched three dimensional shaped cells

Johannesburg +2711 922 3300
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East London +2743 727 1055
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TECHNICAL DATA SHEET

Product Name MULTI-CELL®

Reference No: DS ERSN 0501-09/2013 Rev1

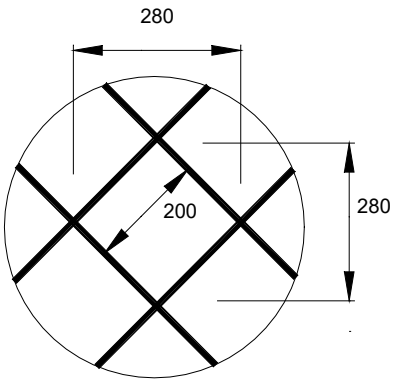
Date of Issue 31 July 2014

Description A polymeric homogenous sheet bonded to form four-sided cells in a diamond shaped lattice pattern bordered by an external tensioning frame, Patent No. 2003/3945

Mass / panel	Height	75 mm	kg	4.5	SANS 10221
		100 mm		6.5	
		150 mm		9.5	
		200 mm		13.5	
Parent product	Laminated polypropylene slit-film woven tape				
	Thickness		mm	0.65	SANS 10221
Tensile Strength	Parent	Strength	kN/m	26	SANS 10221
		Elongation	%	21	
	Seam	Strength	kN/m	4	
		Elongation	%	12	
Cell size		Side	mm	200 x 200	
		Diagonal		280 x 280	
Panel size		Packaged	mm	450 x 750	
		Expanded		10 000 x 5 000	

The above results represent laboratory averages

Note: special size or height **Multi-Cell®** panels can be made to order.



Kaytech reserves the right to make technical modifications to its products

The information given in Kaytech's documentation is to the best of our knowledge true and correct. However, new research results and practical experience can make revisions necessary. No guarantee or liability can be drawn from the information mentioned herein. Furthermore, it is not Kaytech's intention to violate patents or licenses.

III. Mechanical components – Selected data sheets

INSTALLATION, OPERATION AND MAINTENANCE MANUAL.

Including the EPNS MK 2 RESILIENT SEAL VALVE, RISING SPINDLE RSV AND THE POLYURATHANE LINED RISING SPINDLE GATE VALVE

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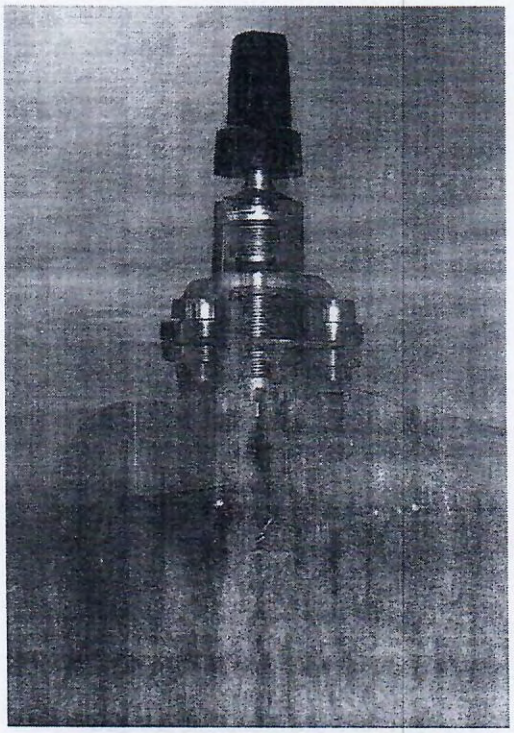
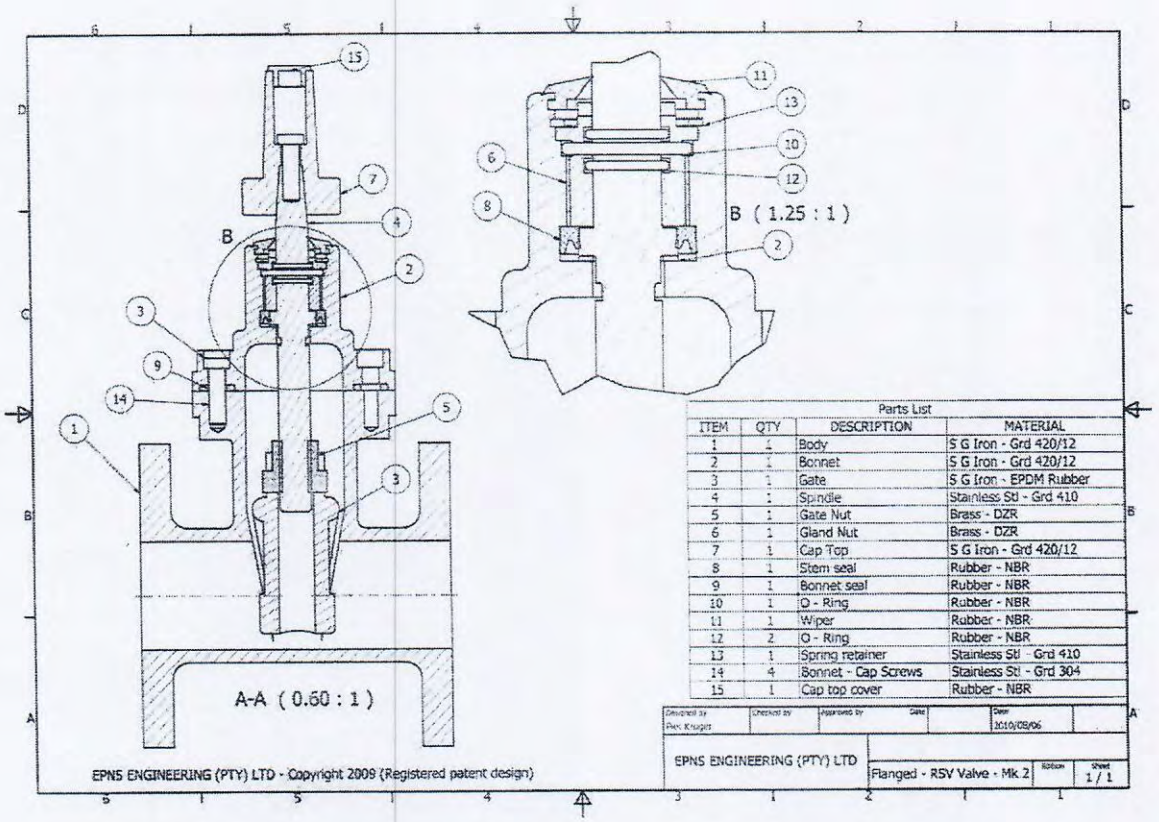
Valves always need to be worked on in the fully depressurised condition, unless otherwise specified and if not fully depressurised, limited actions and special precautions need to be observed.

The user needs to be aware of the weight of the valve and associated equipment, as well as the pressures and conditions encountered, including toxicity, media and environmental conditions.

INTRODUCTION TO THE EPNS MK 2 RESILIENT SEAL VALVE





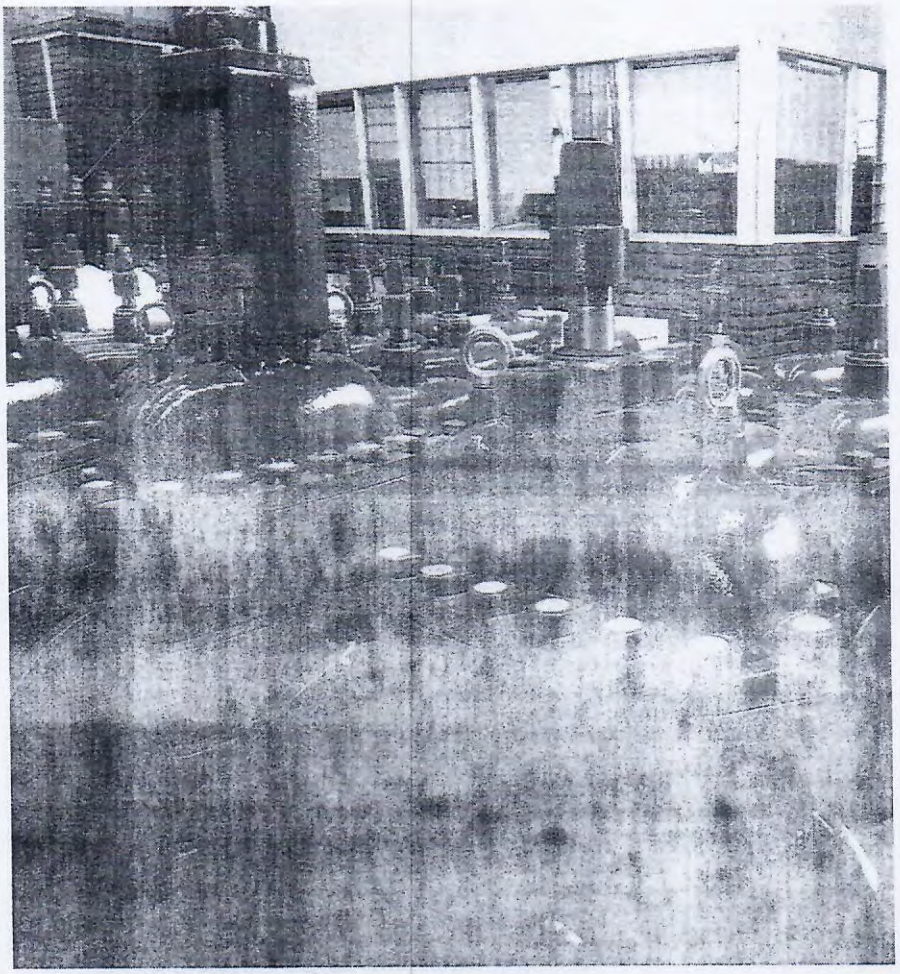
Parts List

ITEM	QTY	DESCRIPTION	MATERIAL
1	1	Body	S G Iron - Grd 420/12
2	1	Bonnet	S G Iron - Grd 420/12
3	1	Gate	S G Iron - EPDM Rubber
4	1	Spindle	Stainless Stl - Grd 410
5	1	Gate Nut	Brass - DZR
6	1	Gland Nut	Brass - DZR
7	1	Cap Top	S G Iron - Grd 420/12
8	1	Stem seal	Rubber - NBR
9	1	Bonnet seal	Rubber - NBR
10	1	O - Ring	Rubber - NBR
11	1	Wiper	Rubber - NBR
12	2	O - Ring	Rubber - NBR
13	1	Spring retainer	Stainless Stl - Grd 410
14	4	Bonnet - Cap Screws	Stainless Stl - Grd 304
15	1	Cap top cover	Rubber - NBR

EPNS RSV Valves are supplied in Flanged and Socketed designs, in both Non-Rising Spindle (Internal Spindle) and Rising Spindle versions.

Up to DN300 the EPNS RSV Mk2 Non-Rising spindle has a Screw type Gland which is contained in the bonnet spindle assembly housing, locked in place with a stainless steel circlip, and protected with a rubber wiper or dust excluder.

Valves DN350 and above have a bolted type gland with protected cap screws as illustrated below. Note also the Rising Spindle valve and the provided lifting eye-bolts on these large valves.



INSTALLATION

1) Before installing the valve, inspect for damage and any foreign matter that may have collected in shipping or storage.

2) When valves are fitted with lifting eye-bolts these must be used to lift the valve. Never lift the valve by the handwheel or by slings attached to the handwheel.

3) With Flanged valves inspect the pipe line and mating flanges, again making sure the pipe is free of foreign material and the flanges are clean and have no damaged portions which might compromise the flange to flange sealing.

4) Ensure that the correct gasket and bolt set is available for the valve size, pressure rating, and media.

5) Mate the valve with the flanges, with the gasket positioned and insert the bolts.

6) Tighten bolts loosely until all are in place and the valve and flanges line up and the flanges are parallel.

7) Tighten bolts in diagonal sequence until correct torque levels are obtained as recommended in WSA 109, or as required by the gasket manufacturer.

8) With Socketed valves a similar procedure is undertaken to ensure that the pipe spigot is clean and no foreign matter is contained in the valve or pipe. Check the socket seal is in place and undamaged. Ensure that an adequate lead in is prepared on the spigot so as to not damage or push out the socket seal in the valve body. Lubricate the seal with rubber acceptable seal lubricant such as soft-soap.

9) Depending on the thrust layout for the socketed valve being installed either slide the valve socket over the pipe and push until the spigot enters the seal, or alternatively if the valve is to be restrained for end thrust such as with cast in feet, ensure that this is done first and is adequately cured before the pipe is introduced into the valve.

OPERATION

Right-hand or Clockwise Closing Valves.

1) These valves are closed in a clock-wise direction, when viewed from above the valve. The Cap-Tops are normally painted RED, and the direction of closing is indicated with a closing arrow on the hand wheel. (If fitted)

2) Valves are either closed with a hand wheel or a T-Bar operating hand-lever which fits onto the cap-top. Although Cap-Top engagement dimensions according to SABS 664 and SABS 665 are the same for sizes DN50 right through to DN300, it is advised to have larger T-Bars for the larger valves – say DN150 up, because it is fairly easy to

exceed the maximum operational torque on a DN50 or DN75 mm valve with a T-bar capable of applying the maximum operational torque to a DN300 valve.

3) Close the valve in this clockwise direction until the closed stop is reached. Do not exceed the maximum operational torque as specified in the table below. Do not leave the valve in a semi-open position or use it as a flow limiter or in a throttled condition. It was not designed for that service.

4) For valves supplied with gearboxes the closing direction is the same. It is important to be aware that the gearbox multiplies the input torque so that care must be exercised, especially on smaller valves, that the maximum operational torque on the spindle is not exceeded.

5) For valves fitted with actuators the actuator must be set so that the maximum operational torque is not exceeded. Actuators should be set to operate on position opening or closing switches rather than torque limits, which should also be set for safety purposes. Reference must be made to the actuators setting instructions.

Left-hand or Anti-Clockwise Closing Valves.

1) These valves are closed in an anti-clock-wise direction, when viewed from above the valve. The Cap-Tops are normally painted BLACK, and the direction of closing is indicated with a closing arrow on the hand wheel. (If fitted)

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Table of Maximum Operational Torque (MOT)

Nominal Bore (mm)	MOT (Nm)
50	50
65	65
80	80
100	100
150	150
200	200
250	250
300	300

MAINTENANCE

The EPNS RSV is designed to be maintenance free. Non-Rising Spindle valves have a fully enclosed gland, pre-lubricated and sealed.

Rising spindle valves have a conventional gland packing which can be adjusted to give drip free sealing.

If after many years maintenance free service it required to replace stem o-rings in non-rising spindle valves the following procedure can be adopted:-

This procedure must only be carried out by suitably qualified and trained persons.

Refer to the sectional drawing at the beginning of this manual.

1) The gland can be removed with the valve either under pressure or depressurised. If under pressure open the valve to the full open position and turn the spindle hard, but within the functional torque, to hold down the spindle collar against the bottom of the gland cavity. This captures the gate in the full open position and holds the spindle down despite fluid pressure trying to push the spindle upwards.

2) Remove any actuator, hand wheel or cap top.

3) The rubber dust shield or wiper can then be removed with a screw driver.

4) Remove the spring retainer clip or circlip with a suitable pair of circlip pliers.

5) The gland can then be unscrewed making use of the special tool developed by EPNS (Illustrated below)

6) Remove the gland, clean the gland and the cavity of any foreign materials and contaminates.

7) With the gland removed from the spindle both external and internal O-rings can be replaced on the gland with correct sized O-rings obtainable from EPNS, or even suitably sourced elsewhere.

8) Lightly lubricate the gland and the spindle and replace the gland taking care to see that the O-rings are not pinched or damaged.

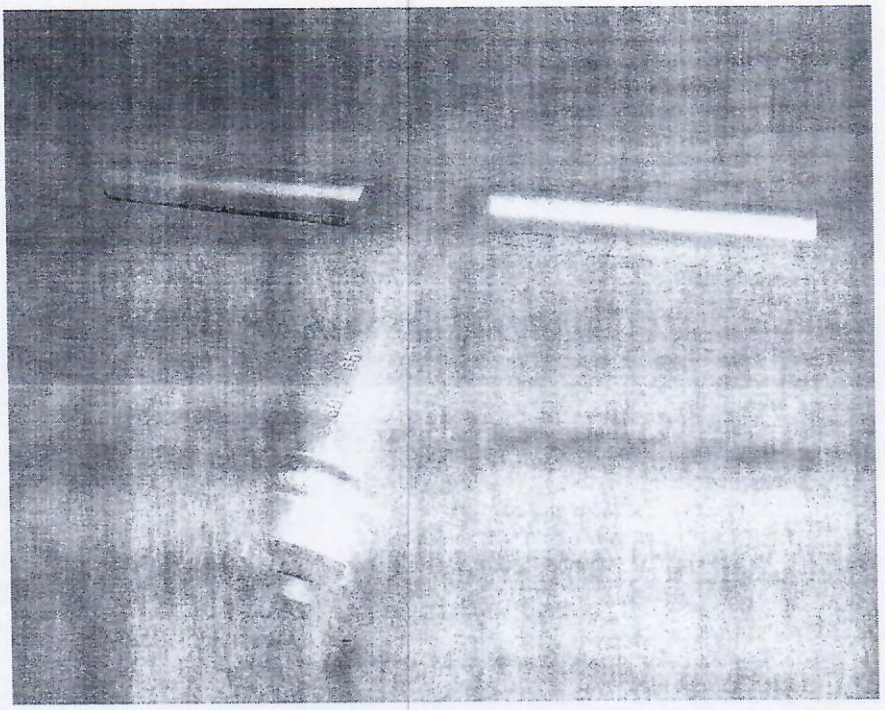
9) Tighten the gland using the assembly tool illustrated below.

10) Replace the spring retainer (circlip) making sure it clips into its groove.
11) Replace the rubber dust seal/wiper if necessary with a new one.

12) Replace the actuating items be they cap-top, hand-wheel,
Gearbox or actuator.

Illustration of the special tool designed by EPNS for Gland Removal.

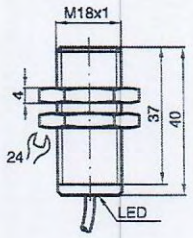
(Note:- It is essential to utilise the correct size tool for the valve size under maintenance. The valve size or sizes for which the tool applies are stamped on the tool body.)



Inductive proximity switches

NBB5-18GM40-Z0

Basic series
5 mm embeddable

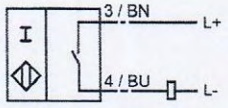


CE

Switching element function	DC Make function
Rated operating distance s_n	5 mm
Installation	embeddable
Assured operating distance s_a	0 ... 4,05 mm
Reduction factor r_{Al}	0,34
Reduction factor r_{Cu}	0,31
Reduction factor r_{V2A}	0,72
Operating voltage U_B	5 ... 60 V
Switching frequency f	0 ... 500 Hz
Hysteresis H	1 ... 10 typ. 5 %
Reverse polarity protection	tolerant
Short circuit protection	pulsing
Voltage drop U_d	≤ 5 V
Operating current I_L	2 ... 100 mA
Off-state current I_r	0 ... 0,5 mA typ.
Indication of the switching state	all direction LED, yellow
Standards	EN 60947-5-2
Ambient temperature	-25 ... 70 °C (248 ... 343 K)
Connection type	2 m, PVC cable
Cable version	PA
Core cross-section	0.34 mm²
Housing material	brass, nickel-plated
Sensing face	PBT
Protection degree	IP67

Connection_type:

Z0



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2003-04-10

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Ide all

FEATURES

Housing	Cylindrical thread design
Housing	Standard
Thread size	M18 x 1
Diameter	Ø 18 mm
Sensing range S_n	8 mm
Safe sensing range S_a	6.48 mm
Installation type	Flush
Switching frequency	1,000 Hz
Connection type	Male connector M12, 4-pin
Switching output	PNP
Output function	Complementary
Electrical wiring	DC 4-wire
Enclosure rating	IP67 1)

1) According to EN 60529.

MECHANICS/ELECTRONICS

Supply voltage	10 V DC ... 30 V DC
Ripple	≤ 10 %
Voltage drop	≤ 2 V 1)
Current consumption	10 mA 2)
Time delay before availability	≤ 100 ms
Hysteresis	5 % ... 15 %
Reproducibility	≤ 2 % 3) 4)
Temperature drift (of S_r)	± 10 %
EMC	According to EN 60947-5-2
Continuous current I_a	≤ 200 mA
Short-circuit	

protection	✓
Reverse polarity protection	✓
Power-up pulse protection	✓
Shock and vibration resistance	30 g, 11 ms/10 Hz ... 55 Hz, 1 mm
Ambient operating temperature	–25 °C ... +75 °C
Housing material	Metal, Nickel-plated brass
Sensing face material	Plastic, PA 66
Housing length	69 mm
Thread length	52 mm
Tightening torque, max.	≤ 40 Nm
Items supplied	Mounting nut, brass, nickel-plated (2x)
UL File No.	NRKH.E181493
MTTFd: mean time to dangerous failure	1,893 years

1) At I_a max.
2) Without load.
3) Ub and Ta constant.
4) Of Sr.

REDUCTION FACTORS

Note	The values are reference values which may vary
St37 steel (Fe)	1
Stainless steel (V2A, 304)	Approx. 0.8
Aluminum (Al)	Approx. 0.45
Copper (Cu)	Approx. 0.4
Brass (Br)	Approx. 0.4

INSTALLATION NOTE

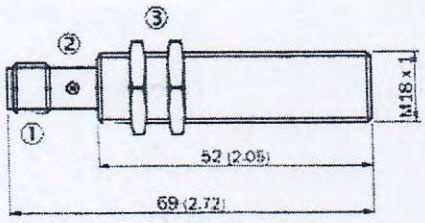
Remark	Associated graphic see "Installation"
B	36 mm
C	18 mm
D	24 mm
F	64 mm

CLASSIFICATIONS

ECl@ss 5.0	27270101
ECl@ss 5.1.4	27270101
ECl@ss 6.0	27270101
ECl@ss 6.2	27270101
ECl@ss 7.0	27270101
ECl@ss 8.0	27270101
ECl@ss 8.1	27270101
ECl@ss 9.0	27270101
ETIM 5.0	EC002714
ETIM 6.0	EC002714
UNSPSC 16.0901	39122230

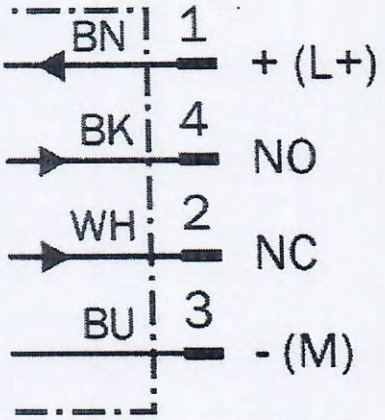
Show all | Hide all

Technical drawings



Dimensional drawing IME18 Standard, connector, flush

Installation note Flush installation



Connection diagram Cd-006

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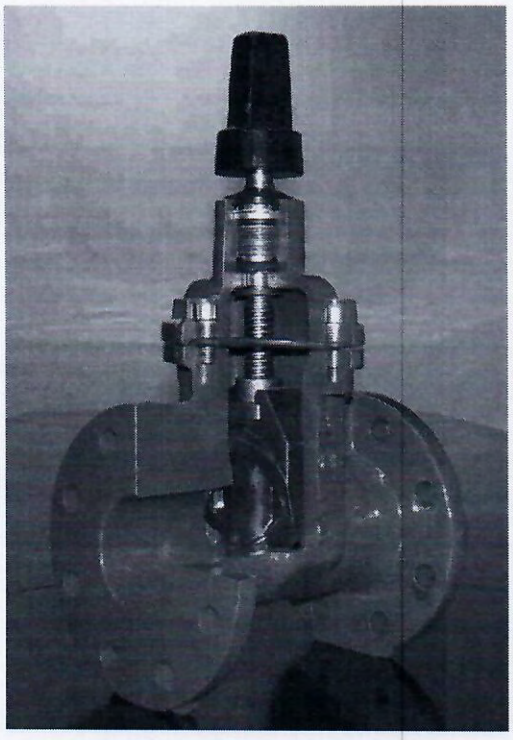

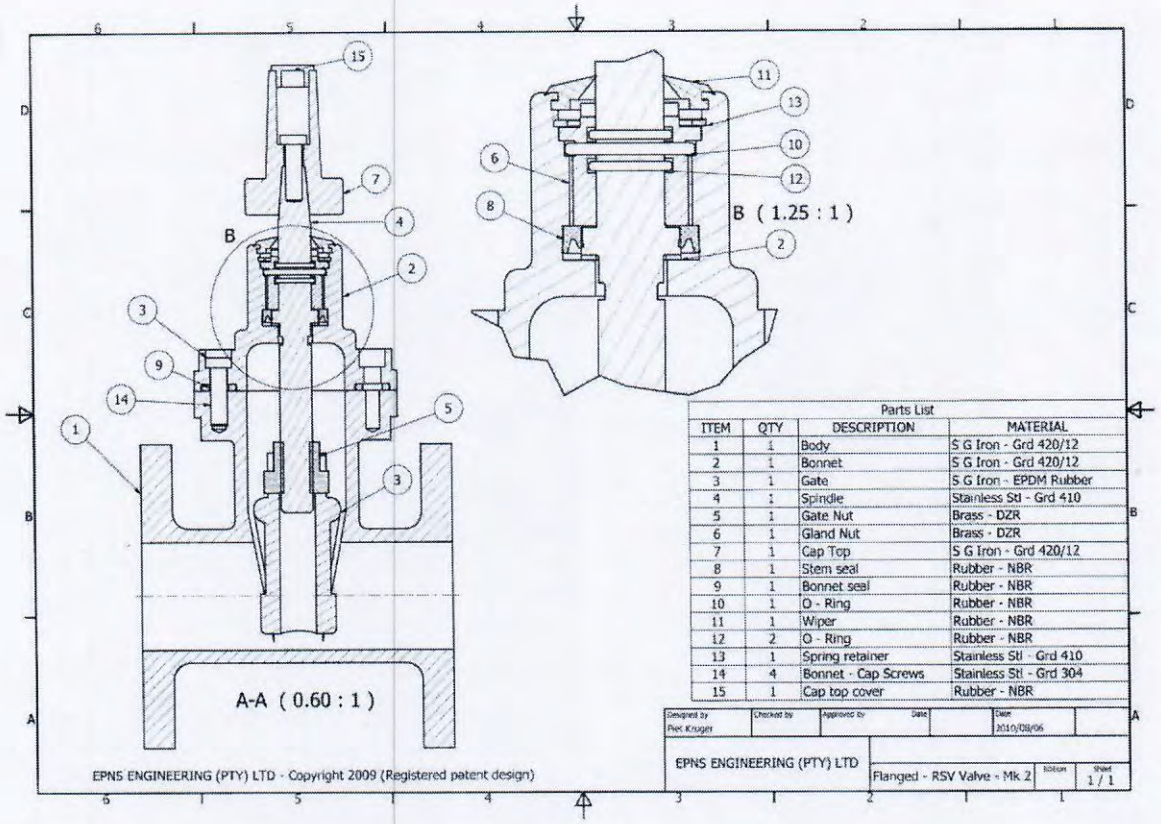

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Valves DN350 and above have a bolted type gland with protected cap screws as illustrated below. Note also the Rising Spindle valve and the provided lifting eye-bolts on these large valves.

INSTALLATION

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3) With Flanged valves inspect the pipe line and mating flanges, again making sure the pipe is free of foreign material and the flanges are clean and have no damaged portions which might compromise the flange to flange sealing.

4) Ensure that the correct gasket and bolt set is available for the valve size, pressure rating, and media.

5) Mate the valve with the flanges, with the gasket positioned and insert the bolts.

6) Tighten bolts loosely until all are in place and the valve and flanges line up and the flanges are parallel.

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2) Valves are either closed with a hand wheel or a T-Bar operating hand-lever which fits onto the cap-top. Although Cap-Top engagement dimensions according to SABS 664 and SABS 665 are the same for sizes DN50 right through to DN300, it is advised to have larger T-Bars for the larger valves – say DN150 up, because it is fairly easy to exceed the maximum operational torque on a DN50 or DN75 mm valve with a T-bar capable of easily applying the maximum operational torque to a DN300 valve.

3) Close the valve in this anti-clockwise direction until the closed stop is reached. Do not exceed the maximum operational torque as specified in the table below. Do not leave the valve in a semi-open position or use it as a flow limiter or in a throttled condition. It was not designed for that service.

4) For valves supplied with gearboxes the closing direction is the same. It is important to be aware that the gearbox multiplies the input torque so that care must be

exercised, especially on smaller valves, that the maximum operational torque on the spindle is not exceeded.

5) For valves fitted with actuators the actuator must be set so that the maximum operational torque is not exceeded. Actuators should be set to operate on position opening or closing switches rather than torque limits, which should also be set for safety purposes. Reference must be made to the actuators setting instructions.

Table of Maximum Operational Torque (MOT)

Nominal Bore (mm)	MOT (Nm)
50	50
65	65
80	80
100	100
150	150
200	200
250	250
300	300

MAINTENANCE

The EPNS RSV is designed to be maintenance free. Non-Rising Spindle valves have a fully enclosed gland, pre-lubricated and sealed.

Rising spindle valves have a conventional gland packing which can be adjusted to give drip free sealing.

If after many years maintenance free service it required to replace stem o-rings in non-rising spindle valves the following procedure can be adopted:-

This procedure must only be carried out by suitably qualified and trained persons.

Refer to the sectional drawing at the beginning of this manual.

1) The gland can be removed with the valve either under pressure or depressurised. If under pressure open the valve to the full open position and turn the spindle hard, but within the functional torque, to hold down the spindle collar against the bottom of the gland cavity. This captures the gate in the full open position and holds the spindle down despite fluid pressure trying to push the spindle upwards.

2) Remove any actuator, hand wheel or cap top.

3) The rubber dust shield or wiper can then be removed with a screw driver.

4) Remove the spring retainer clip or circlip with a suitable pair of circlip pliers.

5) The gland can then be unscrewed making use of the special tool developed by EPNS (Illustrated below)

6) Remove the gland, clean the gland and the cavity of any foreign materials and contaminates.

7) With the gland removed from the spindle both external and internal O-rings can be replaced on the gland with correct sized O-rings obtainable from EPNS, or even suitably sourced elsewhere.

8) Lightly lubricate the gland and the spindle and replace the gland taking care to see that the O-rings are not pinched or damaged.

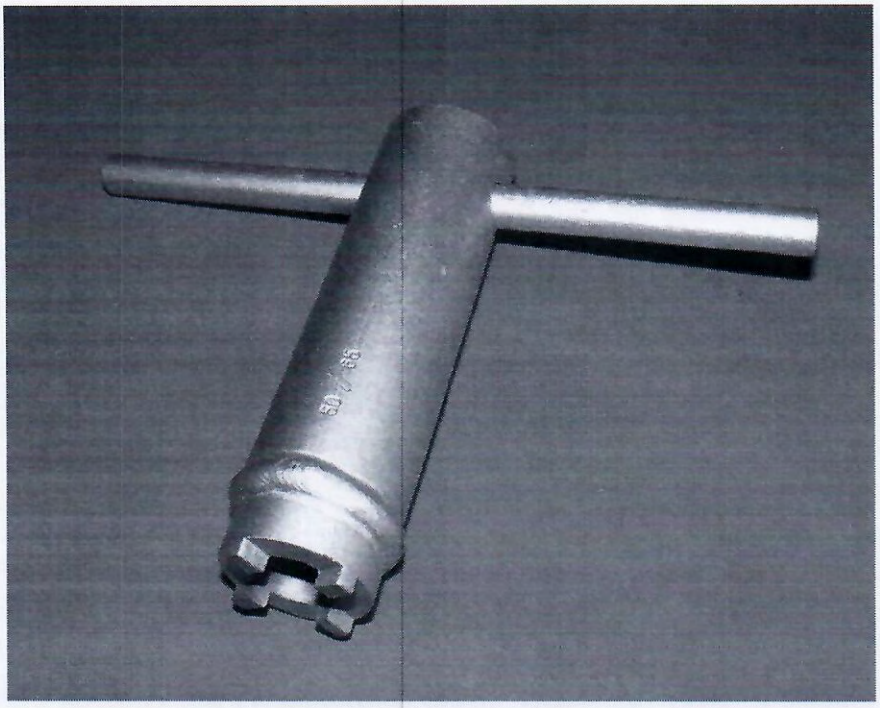
9) Tighten the gland using the assembly tool illustrated below.

10) Replace the spring retainer (circlip) making sure it clips into its groove.
11) Replace the rubber dust seal/wiper if necessary with a new one.

12) Replace the actuating items be they cap-top, hand-wheel,
Gearbox or actuator.

Illustration of the special tool designed by EPNS for Gland Removal.

(Note:- It is essential to utilise the correct size tool for the valve size under maintenance. The valve size or sizes for which the tool applies are stamped on the tool body.)



Gereg Sewage & Water Equipment (Pty) Ltd.

Reg. No. 99/02945

FULTON SLUICE GATES
MILD AND STAINLESS STEEL FABRICATIONS

P.O. Box 18122
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PROJECT: **Klipspruit ~ Extension (KPSX)**

ORDER NO: **SAK 422253**

GEREG JOB NO'S: **18 / 086**

"OPERATING & MAINTENANCE INSTRUCTIONS FOR CHANNEL TYPE SLUICEGATES"

OPERATION:

Unless otherwise specified, clockwise rotation of the handwheel closes the gate. This is the case whether geared or non-geared. In all cases unnecessary force on the handwheel when operating is to be avoided. Rising spindles have a stop collar to prevent bending of the shaft, when fully closed.

LUBRICATION:

All rising spindles should have grease applied to the threaded portion at intervals, determined by the frequency of operation & prevailing atmospheric conditions. Cover tubes have been supplied to prevent the ingress of dirt while in the fully open position.
Old or dirty grease should be cleaned off from time to time & a good medium grade grease re-applied.
All bearings are provided with grease nipples & should be greased with a good quality medium grease every 6 to 12 months. Do not over grease as this could damage the housing seals.
Neoprene gate seals & sealing faces should be sprayed with a silicone based aerosol every 3 to 6 months.

MAINTENANCE:

Generally, the maintenance requirements of sluicegates are minimal, & only after many years of service it may be necessary to re-adjust the seals. Should the sluices be in frequent operation, the bronze thrust (lifting) nut may need replacing after a long period of time.
If components are removed for maintenance purpose, all stainless steel bolts & nuts should have copper or nickel grease applied before re-assembly.

Installation, Operation, and
Maintenance manual

895381_22.0

Flygt 3153

FLYGT
a xylem brand

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1 Introduction and Safety

1.1 Introduction

Purpose of the manual

The purpose of this manual is to provide necessary information for working with the unit. Read this manual carefully before starting work.

Read and keep the manual

Save this manual for future reference, and keep it readily available at the location of the unit.

Intended use

WARNING:

Operating, installing, or maintaining the unit in any way that is not covered in this manual could cause death, serious personal injury, or damage to the equipment and the surroundings. This includes any modification to the equipment or use of parts not provided by Xylem. If there is a question regarding the intended use of the equipment, please contact a Xylem representative before proceeding.

Other manuals

See also the safety requirements and information in the original manufacturer's manuals for any other equipment furnished separately for use in this system.

1.2 Safety terminology and symbols

About safety messages

It is extremely important that you read, understand, and follow the safety messages and regulations carefully before handling the product. They are published to help prevent these hazards:

- Personal accidents and health problems
- Damage to the product and its surroundings
- Product malfunction

Hazard levels

Hazard level	Indication
DANGER:	A hazardous situation which, if not avoided, will result in death or serious injury
WARNING:	A hazardous situation which, if not avoided, could result in death or serious injury
CAUTION:	A hazardous situation which, if not avoided, could result in minor or moderate injury
NOTICE:	Notices are used when there is a risk of equipment damage or decreased performance, but not personal injury.

Special symbols

Some hazard categories have specific symbols, as shown in the following table.

Electrical hazard	Magnetic fields hazard
Electrical Hazard:	CAUTION:

1.3 User safety

All regulations, codes, and health and safety directives must be observed.

The site

- Observe lockout/tagout procedures before starting work on the product, such as transportation, installation, maintenance, or service.
- Pay attention to the risks presented by gas and vapors in the work area.
- Always be aware of the area surrounding the equipment, and any hazards posed by the site or nearby equipment.

Qualified personnel

This product must be installed, operated, and maintained by qualified personnel only.

Protective equipment and safety devices

- Use personal protective equipment as needed. Examples of personal protective equipment include, but are not limited to, hard hats, safety goggles, protective gloves and shoes, and breathing equipment.
- Make sure that all safety features on the product are functioning and in use at all times when the unit is being operated.

1.4 Ex-approved products

Follow these special handling instructions if you have an Ex-approved unit.

Personnel requirements

These are the personnel requirements for Ex-approved products in potentially explosive atmospheres:

- All work on the product must be carried out by certified electricians and Xylem-authorized mechanics. Special rules apply to installations in explosive atmospheres.
- All users must know about the risks of electric current and the chemical and physical characteristics of the gas, the vapor, or both present in hazardous areas.
- Any maintenance for Ex-approved products must conform to international and national standards (for example, IEC/EN 60079-17).

Xylem disclaims all responsibility for work done by untrained and unauthorized personnel.

Product and product handling requirements

These are the product and product handling requirements for Ex-approved products in potentially explosive atmospheres:

- Only use the product in accordance with the approved motor data.
- The Ex-approved product must never run dry during operation. The volute must be filled with liquid during operation. Dry running during service and inspection is only permitted outside the classified area.
- Before you start work on the product, make sure that the product and the control panel are isolated from the power supply and the control circuit, so they cannot be energized.
- Do not open the product while it is energized or in an explosive gas atmosphere.

- Intrinsically safe circuits are normally required for the automatic level-control system by the level regulator if mounted in zone 0.
- The yield stress of fasteners must be in accordance with the approval drawing and the product specification.
- Do not modify the equipment without approval from an Ex-approved Xylem representative.
- Only use original Xylem spare parts that are provided by an Ex-approved Xylem representative.
- The thermal detectors that are fitted to the stator windings must be connected correctly to a separate motor control circuit and in use. The detectors disconnect the power supply to the motor timely. This action prevents the rise of temperatures above the temperature value for the approval classification.
- The width of flameproof joints is more than the values specified in the tables of the IEC 60079-1 standard.
- The gap of flameproof joints is less than the values specified in Table 1 of the IEC 60079-1 standard.
- The flameproof joints are NOT intended to be repaired.

Guidelines for compliance

Compliance is fulfilled only when you operate the unit within its intended use. Do not change the conditions of the service without the approval of an Ex-approved Xylem representative. When you install or maintain explosion proof products, always comply with the directive and applicable standards (for example, IEC/EN 60079-14).

Minimum permitted liquid level

See the dimensional drawings of the product for the minimum permitted liquid level according to the approval for explosion proof products. If the information is missing on the dimensional drawing, the product must be fully submerged. Level-sensing equipment must be installed if the product can be operated at less than the minimum submersion depth.

Monitoring equipment

For additional safety, use condition-monitoring devices. Examples of condition-monitoring devices include, but are not limited to, the following:

- Level indicators
- Temperature detectors in addition to the stator thermal detectors

Any thermal detectors or thermal protection devices delivered with the pump must be installed and in use at all times.

1.5 Special hazards

1.5.1 Biological hazards

The product is designed for use in liquids that can be hazardous to your health. Observe these rules when you work with the product:

- Make sure that all personnel who may come into contact with biological hazards are vaccinated against diseases to which they may be exposed.
- Observe strict personal cleanliness.

WARNING: Biological Hazard

Infection risk. Rinse the unit thoroughly with clean water before working on it.

1.5.2 Wash the skin and eyes

Follow these procedures for chemicals or hazardous fluids that have come into contact with your eyes or your skin:

Condition	Action
Chemicals or hazardous fluids in eyes	1. Hold your eyelids apart forcibly with your fingers. 2. Rinse the eyes with eyewash or running water for at least 15 minutes. 3. Seek medical attention.
Chemicals or hazardous fluids on skin	1. Remove contaminated clothing. 2. Wash the skin with soap and water for at least 1 minute. 3. Seek medical attention, if necessary.

1.6 Protecting the environment

Emissions and waste disposal

Observe the local regulations and codes regarding:

- Reporting of emissions to the appropriate authorities
- Sorting, recycling and disposal of solid or liquid waste
- Clean-up of spills

Exceptional sites

CAUTION: Radiation Hazard

Do NOT send the product to Xylem if it has been exposed to nuclear radiation, unless Xylem has been informed and appropriate actions have been agreed upon.

1.7 End of life product disposal

Handle and dispose of all waste in compliance with local laws and regulations.

EU only: Correct disposal of this product – WEEE Directive on waste electrical and electronic equipment

This marking on the product, accessories or literature indicates that the product should not be disposed of with other waste at the end of its working life.

To prevent possible harm to the environment or human health from uncontrolled waste disposal, please separate these items from other types of waste and recycle them responsibly to promote the sustainable reuse of material resources.

Waste from electrical and electronic equipment can be returned to the producer or distributor.

1.8 Spare parts

CAUTION:

Only use the manufacturer's original spare parts to replace any worn or faulty components. The use of unsuitable spare parts may cause malfunctions, damage, and injuries as well as void the warranty.

1.9 Warranty

For information about warranty, see the sales contract.

2 Transportation and Storage

2.1 Examine the delivery

2.1.1 Examine the package

1. Examine the package for damaged or missing items upon delivery.
2. Record any damaged or missing items on the receipt and freight bill.
3. If anything is out of order, then file a claim with the shipping company.
   If the product has been picked up at a distributor, make a claim directly to the distributor.

2.1.2 Examine the unit

1. Remove packing materials from the product.
   Dispose of all packing materials in accordance with local regulations.
2. To determine whether any parts have been damaged or are missing, examine the product.
3. If applicable, unfasten the product by removing any screws, bolts, or straps.
   Use care around nails and straps.
4. If there is any issue, then contact a sales representative.

2.2 Transportation guidelines

2.2.1 Precautions

DANGER: Crush Hazard

Moving parts can entangle or crush. Always disconnect and lock out power before servicing to prevent unexpected startup. Failure to do so could result in death or serious injury.

Position and fastening

The unit can be transported either horizontally or vertically. Make sure that the unit is correctly fastened during transportation, and cannot roll or fall over.

2.2.2 Lifting

Always inspect the lifting equipment and tackle before starting any work.

WARNING: Crush Hazard

1) Always lift the unit by its designated lifting points. 2) Use suitable lifting equipment and ensure that the product is properly harnessed. 3) Wear personal protective equipment. 4) Stay clear of cables and suspended loads.

NOTICE:

Never lift the unit by its cables or hose.

Lifting equipment

Lifting equipment is always required to handle the unit. The lifting equipment must fulfill the following requirements:

- The minimum height between the lifting hook and the floor must be sufficient to lift the unit. Contact a Xylem representative for more information.
- The lifting equipment must be able to hoist the unit straight up and down, preferably without the need for resetting the lifting hook.
- The lifting equipment must be correctly anchored and in good condition.
- The lifting equipment must support the weight of the entire assembly. Only authorized personnel may use the lifting equipment.
- Two sets of lifting equipment must be used to lift the unit for repair work.
- The lifting equipment must be dimensioned to lift the unit with any remaining pumped media in it.
- The lifting equipment must not be oversized.

CAUTION: Crush Hazard

Over-dimensioned lifting equipment can lead to injury. A site-specific risk analysis must be done.

2.3 Temperature ranges for transportation, handling and storage

Handling at freezing temperature

At temperatures below freezing, the product and all installation equipment, including the lifting gear, must be handled with extreme care.

Make sure that the product is warmed up to a temperature above the freezing point before starting up. Avoid rotating the impeller/propeller by hand at temperatures below the freezing point. The recommended method to warm the unit up is to submerge it in the liquid which will be pumped or mixed.

NOTICE:

Never use a naked flame to thaw the unit.

Unit in as-delivered condition

If the unit is still in the condition in which it left the factory - all packing materials are undisturbed - then the acceptable temperature range during transportation, handling and storage is: -50°C (-58°F) to +60°C (+140°F).

If the unit has been exposed to freezing temperatures, then allow it to reach the ambient temperature of the sump before operating.

Lifting the unit out of liquid

The unit is normally protected from freezing while operating or immersed in liquid, but the impeller/propeller and the shaft seal may freeze if the unit is lifted out of the liquid into a surrounding temperature below freezing.

Follow these guidelines to avoid freezing damage:

1. Empty all pumped liquid, if applicable.
2. Check all liquids used for lubrication or cooling, both oil and water-glycol mixtures, for the presence of unacceptable amounts of water. Change if needed.

Water-glycol mixtures: Units equipped with an internal closed-loop cooling system are filled with a mixture of water and 30% glycol. This mixture remains a flowing liquid at temperatures down to -13°C (9°F). Below -13°C (9°F), the viscosity increases such that the

glycol mixture will lose its flow properties. However, the glycol-water mixture will not solidify completely and thus cannot harm the product.

2.4 Storage guidelines

Storage location

The product must be stored in a covered and dry location free from heat, dirt, and vibrations.

NOTICE:
Protect the product against humidity, heat sources, and mechanical damage.

NOTICE:
Do not place heavy weights on the packed product.

Freezing precautions

The unit is frost-proof while operating or immersed in liquid, but the impeller/propeller and the shaft seal may freeze if the unit is lifted out of the liquid into a surrounding temperature below freezing.

Follow these guidelines to avoid freezing damage:

When	Guideline
Before storage	• The unit must be allowed to run for a short time after raising it to discharge remaining pumped liquid. This does not apply to impeller/propeller units. • The discharge opening must be covered in a suitable way, or placed facing down so that any still remaining pumped liquid runs out. • If present, the cooling jacket must be drained manually by opening the air vent screws at the top of the cooling jacket.
After storage	If the impeller/propeller is frozen, it must be thawed by immersing the unit in liquid before operating the unit. NOTICE: Never use a naked flame to thaw the unit.

Long-term storage

If the unit is stored more than six months, then the following apply:

- Before operating the unit after storage, it must be inspected with special attention to the seals and the cable entry.
- The impeller/propeller must be rotated every other month to prevent the seals from sticking together.

Packaging material stacking limit

If the packaging material has an indicated stacking limit, then it is valid for 23°C (73°F) and 50% relative humidity. Depending on the material, other temperature and humidity ranges can reduce the stacking limit.

3 Product Description

3.1 Pump design

The pump is submersible, and driven by an electric motor.

For a list of pump version and corresponding motor type, see *Technical Reference* on page 67.

Intended use

The product is intended for moving wastewater, sludge, raw and clean water. Always follow the limits that are given in *Technical Reference* on page 67. If there is a question regarding the intended use of the equipment, please contact a local sales and service representative before proceeding.

DANGER: Explosion/Fire Hazard

Special rules apply to installations in explosive or flammable atmospheres. Do not install the product or any auxiliary equipment in an explosive zone unless it is rated explosion-proof or intrinsically-safe. If the product is EN/ATEX-, MSHA- or FM-approved, then see the specific EX information in the Safety chapter before taking any further actions.

NOTICE:

Do NOT use the unit in highly corrosive liquids.

Spare parts

- Modifications to the unit or installation should only be carried out after consulting with Xylem.
- Original spare parts and accessories that are authorized by Xylem are essential for compliance. The use of other parts can invalidate any claims for warranty or compensation. For more information contact your Xylem representative.

Pressure class

LT	Low head
MT	Medium head
HT	High head
SH	Super high head

Experior™ product concept

Experior™ is a product concept including N-technology, Premium efficiency motor, and the intelligent control SmartRun™.

Parts

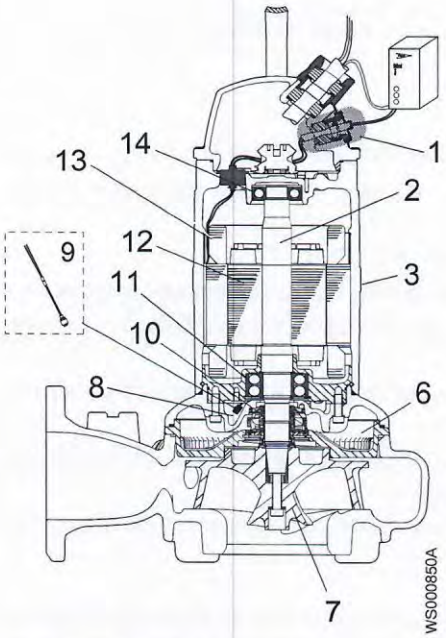


Figure 1: Without cooling jacket

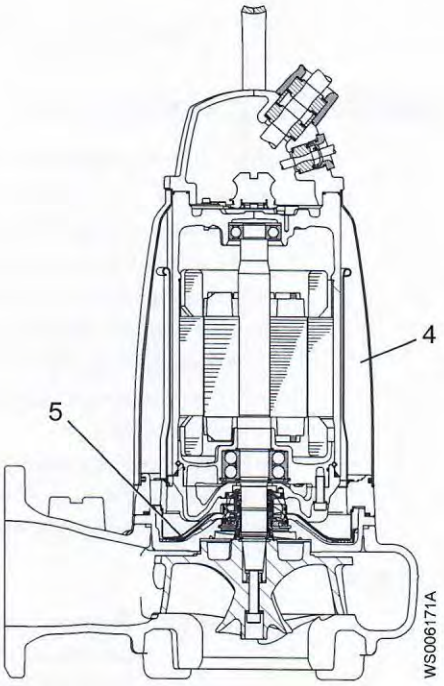


Figure 2: With cooling jacket

Position	Denomination	Description
1	Monitoring sensor	Optional sensor. For information about sensors, see *Monitoring equipment* on page 12.
2	Shaft	Stainless steel, with an integrated rotor
3	Cooling without jacket	The pump is cooled by the ambient liquid.
4	Cooling with jacket	The motor is cooled by a closed loop system. An integrated coolant pump circulates the coolant whenever the pump is operated.
5	Flow diffuser	Provides heat transfer from the coolant to the pumped fluid.
6	Seal housing	Includes a coolant that lubricates and cools the seals; the housing acts as a buffer between the pumped fluid and the electric motor
7	Impeller	N-impeller, a semi-open, two-vane impeller
8	Inspection chamber	Equipped with an FLS10 leakage sensor to prevent damages to the motor
9	FLS10	For information about FLS10, see *Monitoring equipment* on page 12.
10	Mechanical seals	Made of one of the following alternatives: • Alternative 1 – Inner seal: corrosion-resistant cemented carbide WCCR/WCCR – Outer seal: corrosion-resistant cemented carbide WCCR/WCCR • Alternative 2 – Inner seal: corrosion-resistant cemented carbide/Aluminum oxide WCCR/Al_2O_3 – Outer seal: silicon carbide RSiC/RSiC
11	Main bearings	Consisting of a two-row angular contact ball bearing
12	Motor	For information about the motor, see *Technical Reference* on page 67.
13	Thermal contact/ Thermistors	For information about the thermal contact and thermistors, see *Monitoring equipment* on page 12.

Position	Denomination	Description
14	Support bearing	Consisting of a two-row ball bearing

3.2 Monitoring equipment

The following applies to the monitoring equipment of the pump:

- The stator incorporates three thermal contacts connected in series that activate the alarm and stops the pump at overtemperature
- The thermal contacts open at 140°C (285°F).
- Ex-approved pumps must have thermal contacts connected to the control panel.
- The sensors must be connected to either the MiniCAS II monitoring equipment or an equivalent equipment.
- The monitoring equipment must be of a design that makes automatic restart impossible.
- The pump is supplied with an inspection sensor FLS 10 for sensing the presence of any liquid in the inspection chamber.
- Information in the junction box shows if the pump is equipped with optional sensors.

Optional sensors

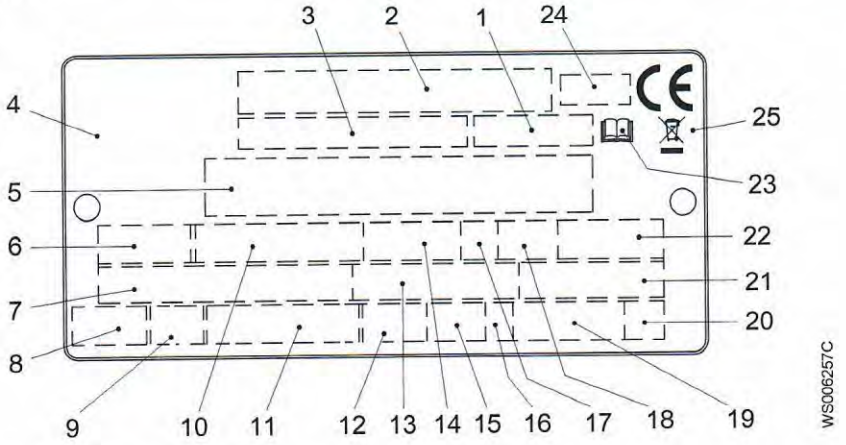
Thermistor Thermistors are optional sensors for measuring the temperature. They are connected in series in the stator and activate the alarm at overtemperature. Thermistors are not applicable to Ex-approved pumps.

NOTICE:

Thermistors must never be exposed to voltages higher than 2.5 V. If the voltage exceeds this value, for example when the control circuit is tested, then the thermistors will be destroyed.

3.3 The data plate

The data plate is a metal label that is located on the main body of the products. The data plate lists key product specifications. Specially approved products also have an approval plate.



1. Curve code or Propeller code
2. Serial number
3. Product number
4. Country of origin
5. Additional information
6. Phase; type of current; frequency
7. Rated voltage
8. Thermal protection
9. Thermal class
10. Rated shaft power

11. International standard
12. Degree of protection
13. Rated current
14. Rated speed
15. Maximum submergence
16. Direction of rotation: L=left, R=right
17. Duty class
18. Duty factor
19. Product weight
20. Locked rotor code letter
21. Power factor
22. Maximum ambient temperature
23. Read installation manual
24. Notified body, only for EN-approved Ex products
25. WEEE-Directive symbol

Figure 3: The data plate

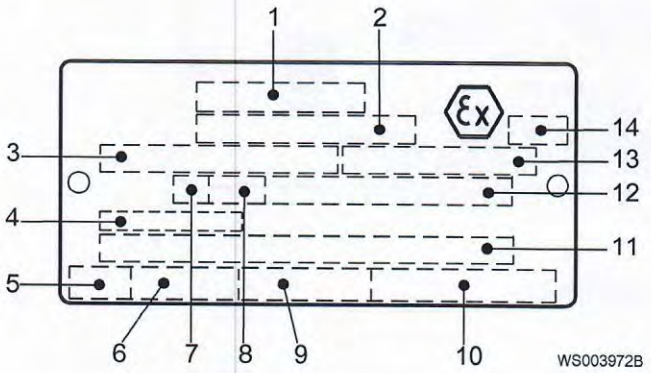
3.4 Approvals

Product approvals for hazardous locations

Pump	Approval
• 3153.091 • 3153.095 • 3153.390 • 3153.670 • 3153.810 • 3153.830 • 3153.850 • 3153.870	European Norm (EN) • ATEX Directive • EN 60079-0:2012/A11:2013, EN 60079-1:2014, EN 13463-1:2009, EN 13463-5:2011 • Ⓔx I M2 c Ex db I Mb • Ⓔx II 2 G c Ex db IIB T3 Gb
	IEC • IECEx scheme • IEC 60079-0, IEC 60079-1 • Ex d I Mb • Ex d IIB T3 Gb
	FM (FM Approvals) • Explosion proof for use in Class I, Div. 1, Group C and D • Dust ignition proof for use in Class II, Div. 1, Group E, F and G • Suitable for use in Class III, Div. 1, Hazardous Locations
	CSA Ex • Explosion proof for use in Class I, Div. 1, Group C and D

EN approval plate

This illustration describes the EN approval plate and the information that is contained in its fields.

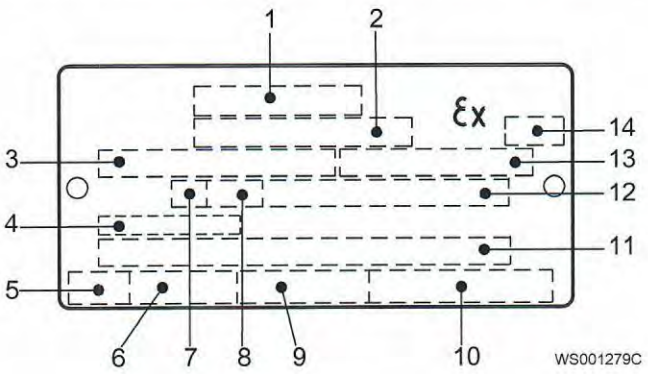


1. Approval
2. Approval authority and Approval number
3. Approved for drive unit
4. Cable entry temperature
5. Stall time
6. Starting current or Rated current
7. Duty class
8. Duty factor
9. Input power
10. Rated speed
11. Additional information
12. Maximum ambient temperature
13. Serial number
14. ATEX marking

IEC approval plate

This illustration describes the IEC approval plate and the information that is contained in its fields.

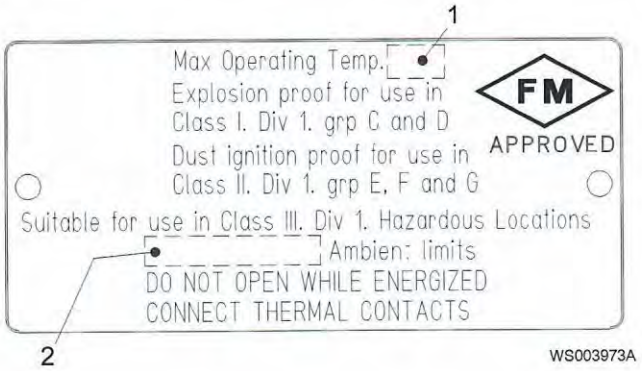
International Norm; not for EU member countries.



1. Approval
2. Approval authority and Approval number
3. Approved for drive unit
4. Cable entry temperature
5. Stall time
6. Starting current or Rated current
7. Duty class
8. Duty factor
9. Input power
10. Rated speed
11. Additional information
12. Maximum ambient temperature
13. Serial number
14. ATEX marking

FM approval plate

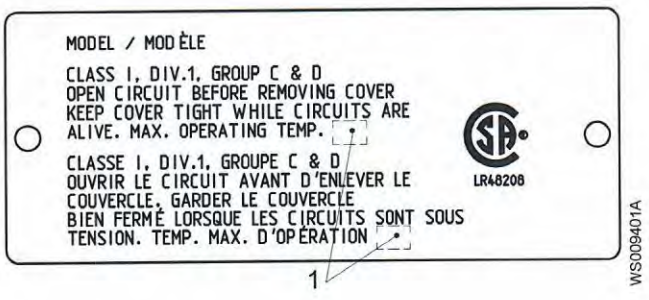
This illustration describes the FM approval plate and the information that is contained in its fields.



1. Temperature class
2. Maximum ambient temperature

CSA approval plate

This illustration describes the CSA approval plate and the information that is contained in its fields.



1. Temperature class

3.5 Product denomination

Reading instruction

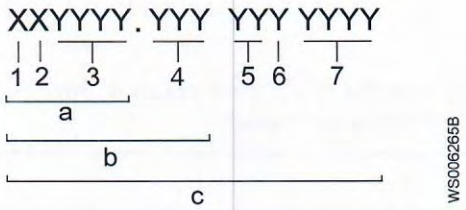
In this section, code characters are illustrated accordingly:

X = letter

Y = digit

The different types of codes are marked up with a, b and c. Code parameters are marked up with numbers.

Codes and parameters



Type of Callout	Number	Indication
Type of code	a	Sales denomination
	b	Product code
	c	Serial number
Parameter	1	Hydraulic end
	2	Type of installation
	3	Sales code
	4	Version
	5	Production year
	6	Production cycle
	7	Running number

4 Installation

4.1 Install the pump

Before starting work, make sure that the safety instructions in the chapter *Introduction and Safety* on page 3 have been read and understood.

DANGER: Electrical Hazard

Before starting work on the unit, make sure that the unit and the control panel are isolated from the power supply and cannot be energized. This applies to the control circuit as well.

DANGER: Inhalation Hazard

Before entering the work area, make sure that the atmosphere contains sufficient oxygen and no toxic gases.

WARNING: Electrical Hazard

The permanent-magnet motor generates voltage when the shaft rotates, even if power sources are disconnected. Never perform any electrical work if the shaft could rotate.

4.1.1 Hazardous atmospheres

DANGER: Explosion/Fire Hazard

Special rules apply to installations in explosive or flammable atmospheres. Do not install the product or any auxiliary equipment in an explosive zone unless it is rated explosion-proof or intrinsically-safe. If the product is EN/ATEX-, MSHA- or FM-approved, then see the specific EX information in the Safety chapter before taking any further actions.

WARNING: Explosion/Fire Hazard

Do not install CSA-approved products in locations that are classified as hazardous in the National Electric Code(TM), ANSI/NFPA 70-2005.

General requirements

These requirements apply:

- Use the pump dimensional drawing in order to ensure proper installation.
- In S-, T-, and Z-installations the pump must be equipped with cooling jacket

Before installing the pump, do the following:

- Provide a suitable barrier around the work area, for example, a guard rail.
- Make sure that equipment is in place so that the unit cannot roll or fall over during the installation process.
- Check the explosion risk before you weld or use electric hand tools.
- Check that the cable and cable entry have not been damaged during transport.

- Always remove all debris and waste material from the sump, inlet piping, and discharge connection, before you install the pump.
- Always check the impeller rotation before lowering the pump into the pumped liquid.
- If the unit has a permanent magnet motor, then ensure that you have read and understood all safety instructions regarding permanent magnet motors.

NOTICE:

Do not run the pump dry.

NOTICE:

Never force piping to make a connection with a pump.

Authority regulation

Vent the tank of a sewage station in accordance with local plumbing codes.

Fasteners

- Only use fasteners of the correct size and material.
- Replace all corroded or damaged fasteners.
- Make sure that all the fasteners are correctly tightened and that there are no missing fasteners.

4.1.2 Install with P-installation

In the P-installation, the pump is installed on a stationary discharge connection, and operates either completely or partially submerged in the pumped liquid. These requirements and instructions only apply when the installation is made according to the dimensional drawing.

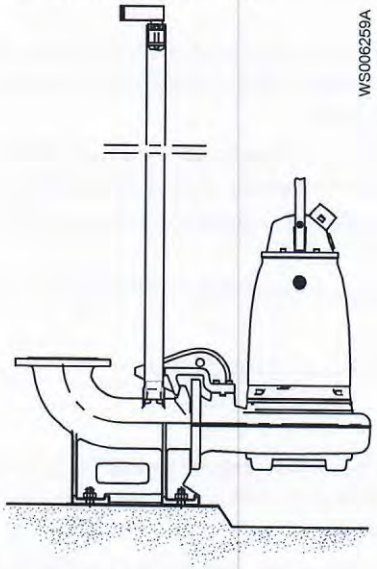


Figure 4: P-installation

These items are required:

- Guide bars
- Guide bar bracket for attaching the guide equipment to the access frame or to the upper part of the sump
- Level regulators or other control equipment for start, stop, and alarm
- Cable holder for holding the cable and regulating the height of the level regulators
- Access frame (with covers) to which the upper guide bar bracket and cable holder can be attached
- Discharge connection for connecting the pump to the discharge line

The discharge connection has a flange which fits the pump housing flange and a bracket for attaching the guide equipment.

- Fasteners for the discharge connection
- Anchor bolts

1. Run a cable between the sump and the stator and monitoring equipment.

   Make sure that the cable is not sharply bent or pinched.
2. Install the access frame:
   a) Place the access frame in position and align it horizontally.
   b) Grout the frame in place.
3. Grout the anchor bolts in place.

   Be careful when you align and position the discharge connection in relation to the access frame.
4. Place the discharge connection in position, and tighten the nuts.
5. Install the guide bars:
   a) Secure the guide bars in the bracket.
   b) Check that the guide bars are placed vertically. Use a level or a plumb line.
6. Connect the discharge pipe to the discharge connection.
7. Prepare for the level regulator:
   a) Bolt the cable holder to the access frame.
   b) Attach the level regulator cable to the cable holder and adjust the height of the level regulator.
   c) Protect bolts and nuts with a corrosion-preventive compound.
8. Lower the pump along the guide bars.
9. Secure the motor cable:
   a) Fasten the permanent lifting device to the pump and to the access frame. For example, you can use a stainless-steel lifting chain with shackles.
   b) Fasten the cable to the cable holder.

      Make sure that the cable cannot be sucked into the pump inlet or that it is neither sharply bent, or pinched. Support straps are required for deep installations.
   c) Connect the motor cable and the starter and monitoring equipment according to the separate instructions.

      Make sure that the impeller rotation is correct. For more information, see *Check the impeller rotation* on page 34.

Clean all debris from the sump before starting the pump.

4.1.3 Install with S-installation

In the S-installation, the pump is transportable and intended to operate either completely or partially submerged in the pumped liquid. The pump is equipped with a connection for hose or pipe and stands on a base stand.

These requirements and instructions only apply when the installation is made according to the dimensional drawing. For information about the different installation types, see Parts List.

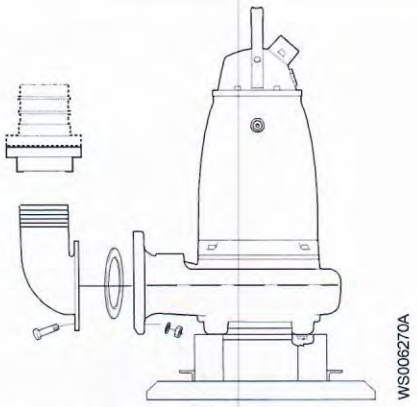


Figure 5: S-installation

1. Run the cable so that it has no sharp bends. Make sure that it is not pinched, and cannot be sucked into the pump inlet.
2. Connect the discharge line.
3. Lower the pump into the sump.
4. Place the pump on the base and make sure it cannot fall over or sink.

   Alternatively, the pump can be suspended with a lifting chain just above the sump bottom. Make sure that the pump cannot rotate at start-up or during operation.
5. Connect the motor cable and the starter and monitoring equipment according to the separate instructions.

   Make sure that the impeller rotation is correct. For more information, see *Check the impeller rotation* on page 34.

4.1.4 Install with T/Z-installation

In the T-installation, the pump is installed in a vertical position in a dry well next to the wet sump. These requirements and instructions only apply when the installation is made according to the dimensional drawing.

In the Z-installation, the pump is installed in a horizontal position on a support stand in a dry well next to the wet sump, and a bell-mouth is connected to the inlet pipe. These requirements and instructions are for Z-installations that comply to the dimensional drawing.

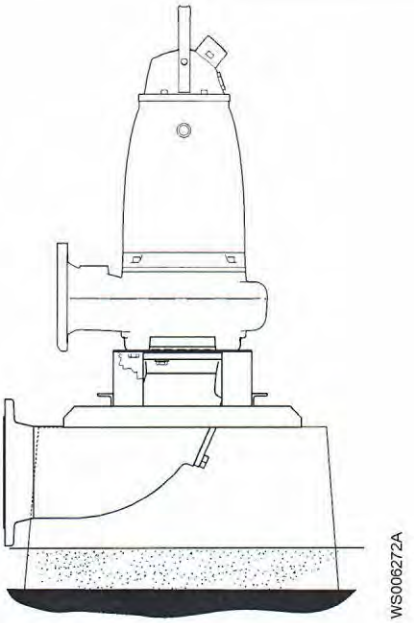


Figure 6: T-installation

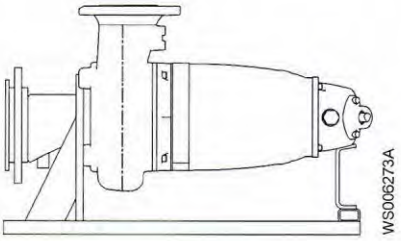
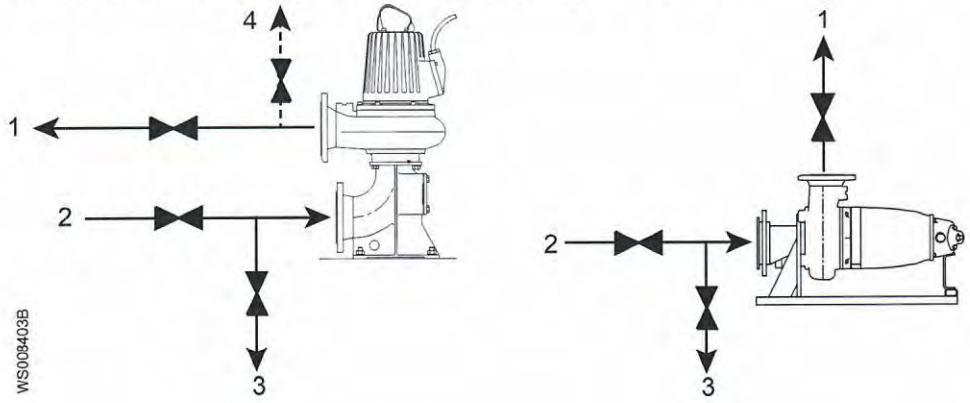


Figure 7: Z-installation

These items are required:

- Support stand and anchor bolts for anchoring the pump to a base
- Inlet elbow for connecting the suction line and discharge line
- Shut-off valves that allow you to remove the pump from service



1. Outlet line
2. Inlet line
3. Line to drain
4. Air vent

Figure 8: T-, Z-installation shutoff and air vent valves (generic pumps shown)

- Air vent on the discharge side between the pump and the check valve
- Level regulators or other control equipment for start, stop, and alarm

NOTICE:

The risk of freezing is particularly high in T- or Z-installations.

1. Fasten the pump:
   a) Use the anchor bolts to bolt the support stand to the concrete base.
   b) Bolt the pump to the support stand and the suction connection.
2. Make sure that the pump is vertical for the T-installation or horizontal for the Z-installation.
3. Connect the suction line and discharge line.

4. Connect the motor cable and the starter and monitoring equipment according to the separate instructions.

   Make sure that the impeller rotation is correct. For more information, see *Check the impeller rotation* on page 34.
5. Make sure that the weight of the pump does not put strain on the piping.

4.2 Make the electrical connections

4.2.1 General precautions

DANGER: Electrical Hazard

Before starting work on the unit, make sure that the unit and the control panel are isolated from the power supply and cannot be energized. This applies to the control circuit as well.

WARNING: Electrical Hazard

Risk of electrical shock or burn. A certified electrician must supervise all electrical work. Comply with all local codes and regulations.

WARNING: Electrical Hazard

There is a risk of electrical shock or explosion if the electrical connections are not correctly carried out, or if there is fault or damage on the product. Visually inspect equipment for damaged cables, cracked casings or other signs of damage. Make sure that electrical connections have been correctly made.

WARNING: Electrical Hazard

The permanent-magnet motor generates voltage when the shaft rotates, even if power sources are disconnected. Never perform any electrical work if the shaft could rotate.

WARNING: Crush Hazard

Risk of automatic restart.

CAUTION: Electrical Hazard

Prevent cables from becoming sharply bent or damaged.

NOTICE:

Leakage into the electrical parts can cause damaged equipment or a blown fuse. Keep the cable ends dry at all times.

Requirements

These general requirements apply for electrical installation:

- The supply authority must be notified before installing the pump if it will be connected to the public mains. When the pump is connected to the public power supply, it may cause flickering of incandescent lamps when started.
- The mains voltage and frequency must agree with the specifications on the data plate. If the pump can be connected to different voltages, then the connected voltage is specified by a yellow sticker close to the cable entry.
- The fuses and circuit breakers must have the proper rating, and the pump overload protection (motor protection breaker) must be connected and set to the rated current according to the data plate and if applicable the cable chart. The starting current in direct-on-line start can be up to six times higher than the rated current.
- The fuse rating and the cables must be in accordance with the local rules and regulations.
- If intermittent operation is prescribed, then the pump must be provided with monitoring equipment supporting such operation.
- If stated on the data plate, then the motor is convertible between different voltages.
- The thermal contacts/thermistors must be in use.
- For FM-approved pumps, a leakage sensor must be connected and in use in order to meet approval requirements.

Cables

These are the requirements to follow when you install cables:

- The cables must be in good condition, not have any sharp bends, and not be pinched.
- The cables must not be damaged and must not have indentations or be embossed (with markings, etc.) at the cable entry.
- The cable entry seal sleeve and washers must conform to the outside diameter of the cable.
- The minimum bending radius must not be below the accepted value.
- If using a cable which has been used before, a short piece must be peeled off when refitting it so that the cable entry seal sleeve does not close around the cable at the same point again. If the outer sheath of the cable is damaged, then replace the cable.

  Contact a sales or authorized service representative.
- The voltage drop in long cables must be taken into account. The drive unit's rated voltage is the voltage measured at the cable connection point in the pump.
- The screened cable must be used according to the European CE and EMC requirements if a Variable Frequency Drive (VFD) is used. For more information, contact a sales or authorized service representative (VFD-supplier).
- Make sure that the cable is long enough for maintenance work.
- For SUBCAB® cables, the twisted pair copper foil must be trimmed.
- All unused conductors must be insulated.

4.2.2 Grounding (earthing)

Grounding (earthing) must be done in compliance with all local codes and regulations.

DANGER: Electrical Hazard

All electrical equipment must be grounded (earthed). Test the ground (earth) lead to verify that it is connected correctly and that the path to ground is continuous.

WARNING: Electrical Hazard

If the power cable is jerked loose, then the ground (earth) conductor must be the last conductor to come loose from its terminal. Make sure that the ground (earth) conductor is longer than the phase conductors at both ends of the cable.

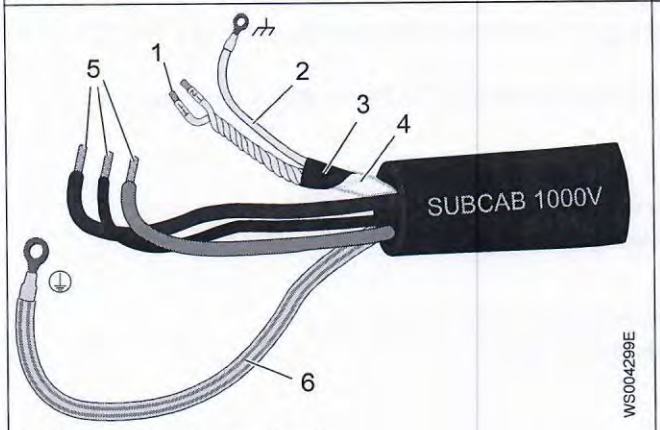
WARNING: Electrical Hazard

Risk of electrical shock or burn. You must connect an additional ground- (earth-) fault protection device to the grounded (earthed) connectors if persons are likely to come into contact with liquids that are also in contact with the pump or pumped liquid.

4.2.3 Prepare the SUBCAB® cables

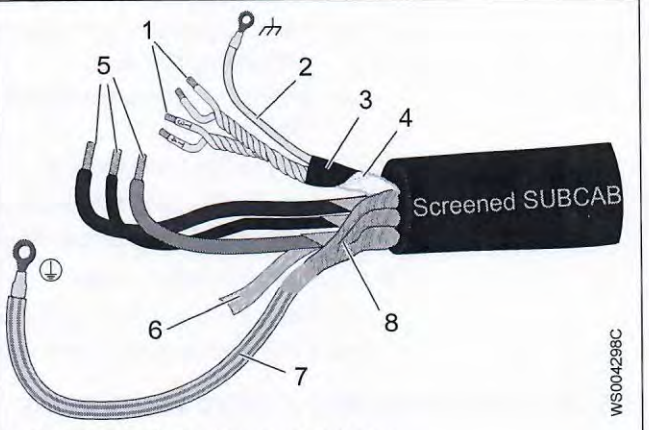
This section applies to SUBCAB® cables with twisted-pair control cores.

The prepared SUBCAB® cable



1. T1+T2 twisted pairs in control element
2. Drain wire in control element (bare aluminum wire)
3. Screened aluminum pt-foil
4. Insulation sheath (jacket) or PT-foil for control element
5. Power cores
6. Ground (earth) core

The prepared screened SUBCAB® cable



1. T1+T2 and T3+T4 twisted pairs in control element
2. Drain wire in control element (bare aluminum wire)
3. Screened aluminum pt-foil
4. Insulation sheath (jacket) for control element
5. Power cores
6. Aluminum foil
7. Ground (earth) core with green/yellow shrink hose
8. Uncovered screen/braided wire

1. Peel off the outer sheath at the end of the cable.
2. Prepare the control element:
   a) Peel the sheath (if applicable) and the aluminum foil.
      The aluminum foil is a screen and is conductive. Do not peel more than necessary, and remove the peeled foil.

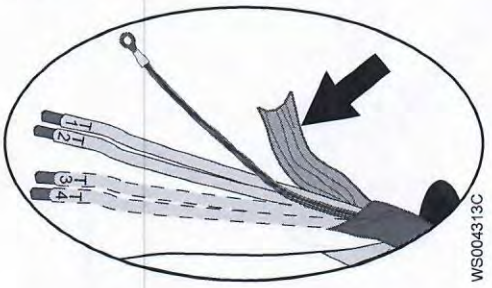


Figure 9: Aluminum foil on control element.

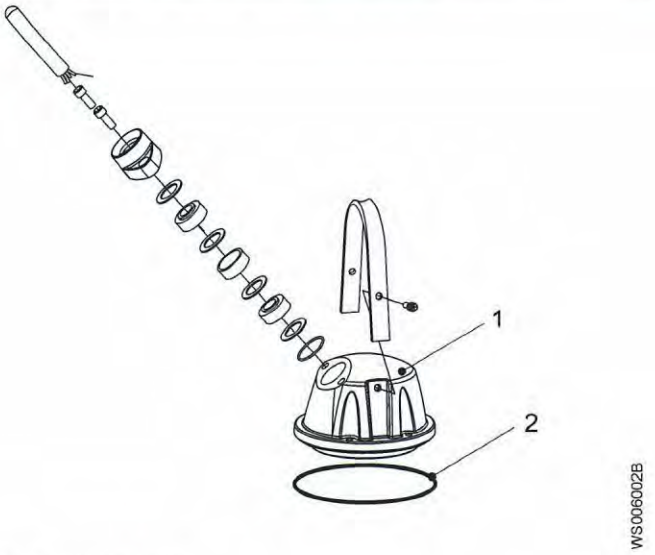
   b) Put a white shrink hose over the drain wire and the cable terminal.
   c) Fit a cable lug on the drain wire.
   d) Twist T1+T2 and T3+T4.
   e) Put a shrink hose over the control element.
      Make sure that the conductive aluminum foil and drain wire is covered.
3. Prepare the ground (earth) core for SUBCAB™ cable:

a) Peel the yellow-green insulation from the ground (earth) core.
b) Check that the ground (earth) core is at least 10% longer than the phase cores in the cabinet.
c) If applicable, put a cable lug on the ground core.

4. Prepare the ground (earth) core for screened SUBCAB™ cable:
   a) Untwist the screens around the power cores.
   b) Put a yellow-green shrink hose over the ground (earth) core.
      Leave a short piece uncovered.
   c) If applicable, put a cable lug on the screened ground core.
   d) Twist all power core screens together to create a ground (earth) core and fit a cable terminal to the end.
   e) Check that the ground (earth) core is at least 10% longer than the phase cores in the cabinet.
5. Connect to ground (earth):
   - Screw: Fit cable terminals to the ground (earth) core and the power cores.
   - Terminal block: Leave the core ends as they are.
6. Prepare the main leads:
   a) Remove the aluminum foil around each power core.
   b) Peel the insulation from each power core.

4.2.4 Connect the motor cable to the pump

NOTICE:
Leakage into the electrical parts can cause damaged equipment or a blown fuse. Keep the end of the motor cable dry at all times.



1. Entrance cover
2. O-ring

For more information about the cable entry, see the Parts list.

1. Remove the entrance cover and the O-ring from the stator housing.
   This provides access to the terminal board.
2. Check the data plate to see which connections are required for the power supply.
3. Arrange the connections on the terminal board in accordance with the required power supply.
   Links (jumper strips) are not used with the Y/D start.

4. Connect the mains leads (L1, L2, L3, and ground (earth)) according to applicable cable chart.

   The ground (earth) lead must be100 mm (4.0 in.) longer than the phase leads in the junction box of the unit.
5. Make sure that the pump is correctly connected to ground (earth).
6. Connect the control leads to the applicable terminal board.
7. Make sure that any thermal contacts incorporated in the pump are properly connected to the terminal board.
8. Install the entrance cover and the O-ring on the stator housing.
9. Fasten the screws on the entrance flange so that the cable insertion assembly bottoms out.

4.2.5 Connect the motor cable to the starter and monitoring equipment

If there are two power cables, then the cable that is connected to T1 and T2 is labeled. If a separate control cable is used, then the control leads in the power cable are never connected.

DANGER: Explosion/Fire Hazard

Special rules apply to installations in explosive or flammable atmospheres. Do not install the product or any auxiliary equipment in an explosive zone unless it is rated explosion-proof or intrinsically-safe. If the product is EN/ATEX-, MSHA- or FM-approved, then see the specific EX information in the Safety chapter before taking any further actions.

NOTICE:

Either thermal contacts or thermistors are incorporated in the pump.

NOTICE:

Thermal contacts must never be exposed to voltages higher than 250 V, breaking current maximum 5 A. It is recommended that they are connected to 24 V over separate fuses to protect other automatic equipment.

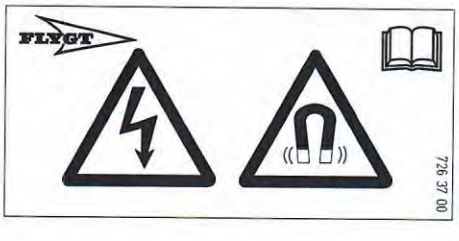
1. If thermal contacts are included in the pump installation, then connect the T1 and T2 control conductors to the MiniCAS II monitoring equipment.

   NOTICE:

   The thermal contacts are incorporated in the stator. Connect them to 24 V over separate fuses to protect other automatic equipment.
2. If thermistors are included in the pump installation, and screened or auxiliary cable is used, then connect T1(1) and T2(2) to the thermistor relay or MAS 711, and T3(3) and T4 (4) to MiniCAS II or MAS 711.
3. Connect the mains leads (L1, L2, L3, and ground (earth)) to the starter equipment.

   For information about the phase sequence and the color codes of the leads, see Cable charts.
4. Applicable for permanent magnet motor; ensure that the warning label is attached to the cable end. In case the label is missing, attach the spare label to the cable end.

   The label is delivered with the pump.



5. Check the functionality of the monitoring equipment:
   a) Check that the signals and the tripping function work properly.
   b) Check that the relays, lamps, fuses, and connections are intact.

   Replace any defective equipment.

4.2.6 Cable charts

Description

This topic contains general connection information. It also provides cable charts that show connection alternatives for use with different cables and power supply.

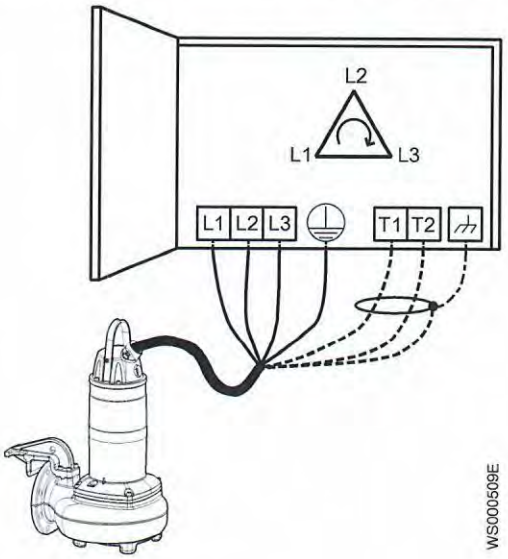
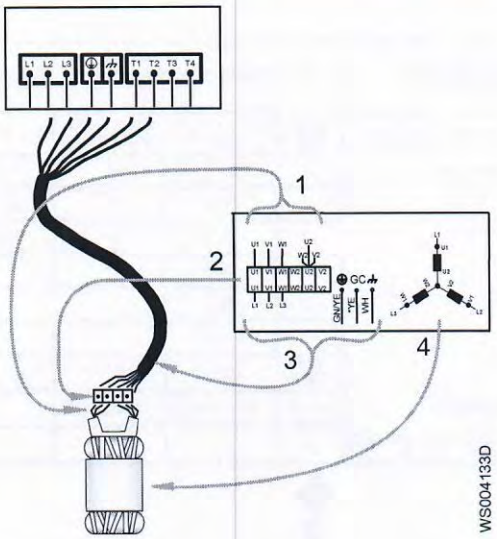


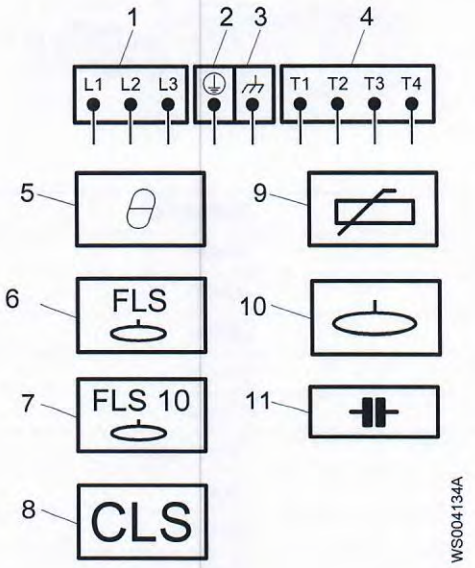
Figure 10: Phase sequence

Connection locations

The figures in this section illustrate how to interpret the connection strip symbols.



1. Stator leads
2. Terminal board
3. Power cable leads
4. Stator (internal connection illustrated)



1. Starter equipment and mains leads (L1, L2, L3)
2. ground (earth)
3. Functional ground
4. Control leads (T1, T2, T3, T4)
5. Thermal contact
6. FLS
7. FLS 10
8. CLS
9. Thermistor
10. Level sensor
11. Capacitor

4.2.6.1 Colors and markings of leads

Motor Connection		Colors and marking of the main leads				
COLOR STANDARD	STATOR LEADS	Mains 3~	SUBCAB 7GX Screenflex 7GX	SUBCAB 4GX Screenflex 4GX	SUBCAB AWG	SUBCAB Screened
BN = Brown BK = Black WH = White OG = Orange GN = Green GN/YE = Green-Yellow RD = Red GY = Grey BU = Blue YE = Yellow	U1,U5 = RD U2 = GN V1,V5 = BN V2 = BU W1,W5 = YE W2 = BK T1,T2 = WH or YE	L1	BK 1	BN	RD	BN
		L2	BK 2	BK	BK	BK
		L3	BK 3	GY	WH	GY
		L1	BK 4	-	-	-
		L2	BK 5	-	-	-
		L3	BK 6	-	-	-
		⏚	GN/YE	GN/YE	GN/YE	**Screen/PE from cores
		⏚	Screen (WH)	Screen (WH)	-	Screen (WH)
		GC	-	-	YE	-

*SUBCAB AWG
* * Ground conductor is stranded around core
GC=Ground check

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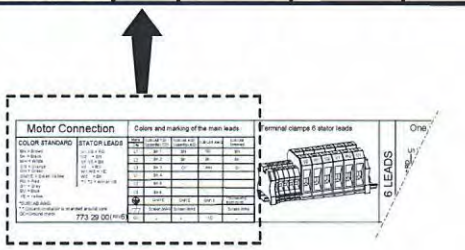


WS004551D

Color code standard

Code	Description
BN	Brown
BK	Black
WH	White
OG	Orange
GN	Green
GNYE	Green-Yellow
RD	Red
GY	Grey
BU	Blue
YE	Yellow

4.2.6.2 Motor connection

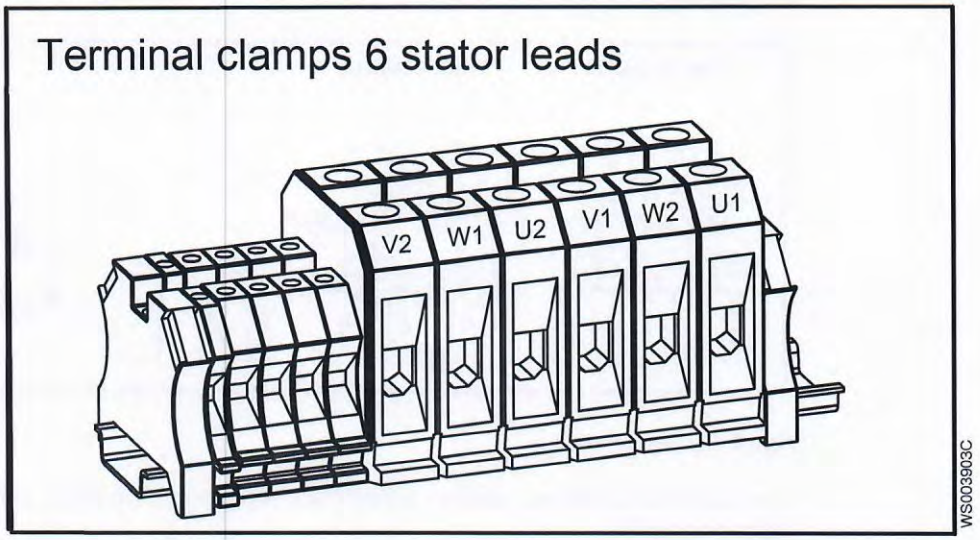


Figure 11: Terminal clamps, 6 stator leads

4.2.6.3 Connections included

- *6-leads connection* on page 29
- *9-leads connection* on page 31
- *Screened cable connection* on page 31

6-leads connection

One cable (left) and two cables (right) Y-connection. For 3153, only the one-cable diagram applies.

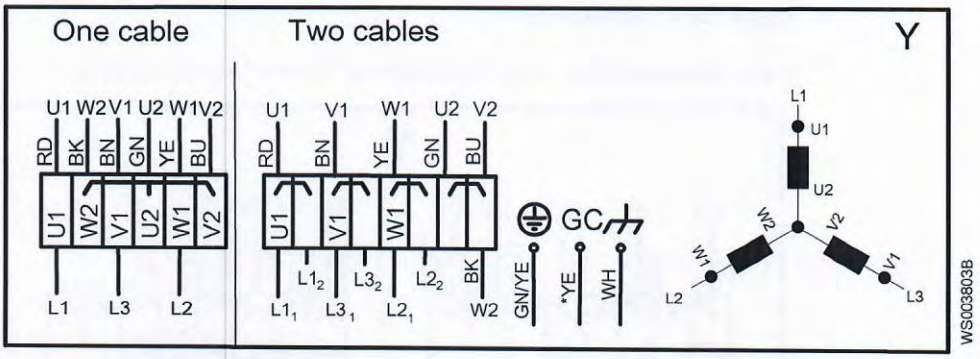


Figure 12: Y-connection

One cable (left) and two cables (right) D-connection. For 3153, only the one-cable diagram applies.

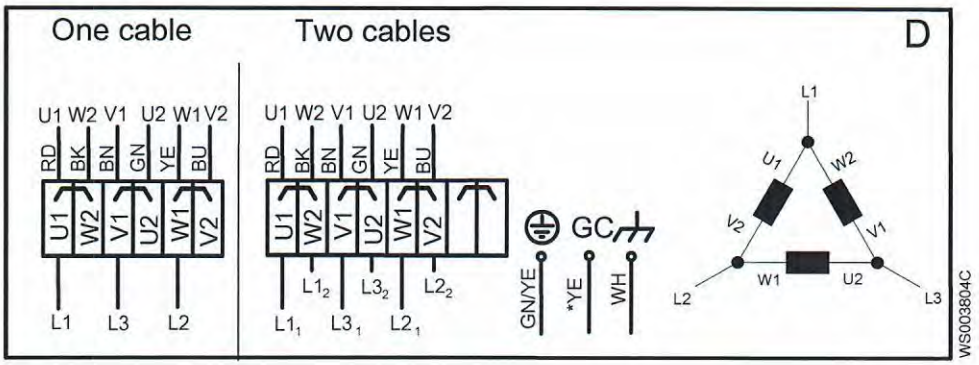


Figure 13: D-connection

One cable (left) and two cables (right)Y/ D-connection. For 3153, only the one-cable diagram applies.

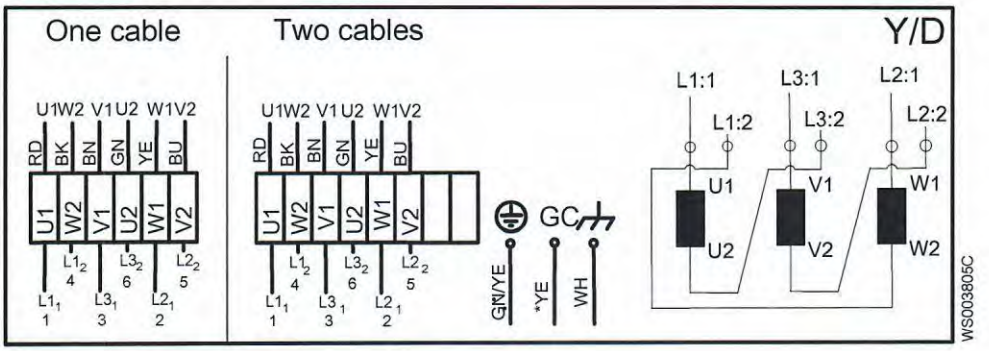


Figure 14: Y/D-connection

Y and D-connection, only applicable to 70 mm^2 terminal clamp.

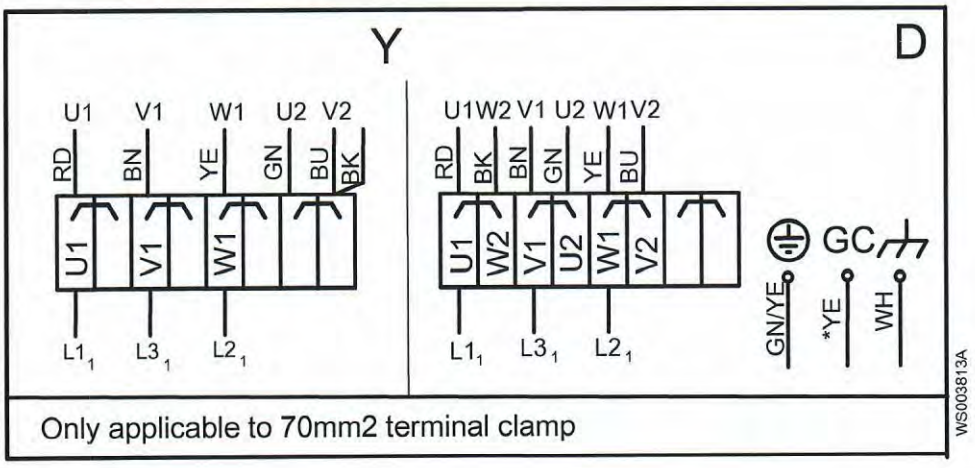


Figure 15: Y or D-connection

9-leads connection

One cable (left) and two cables (right) Y-parallel connection. For 3153, only the one-cable diagram applies.

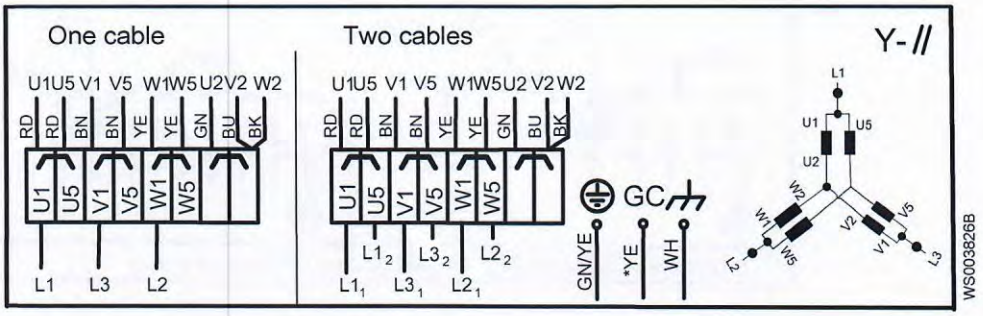


Figure 16: Y-parallel connection

One cable (left) and two cables (right) Y-serial connection. For 3153, only the one-cable diagram applies.

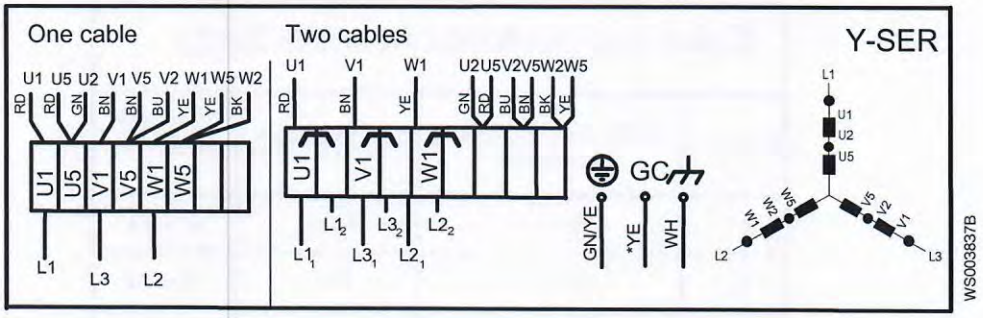


Figure 17: Y-serial connection

Screened cable connection

Cable without separate ground conductor. Screen as ground conductor.

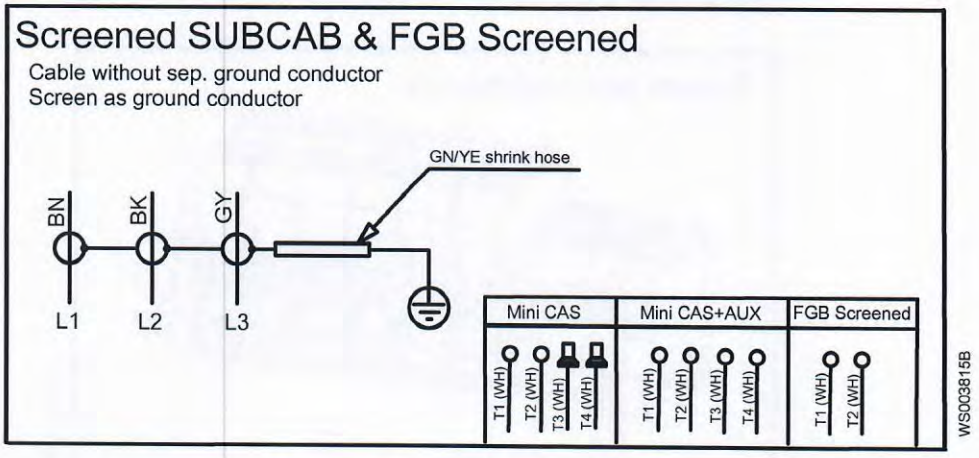


Figure 18: Screened SUBCAB and FGB Screened

* For screened SUBCAB T3 and T4 shall also be twisted separately.

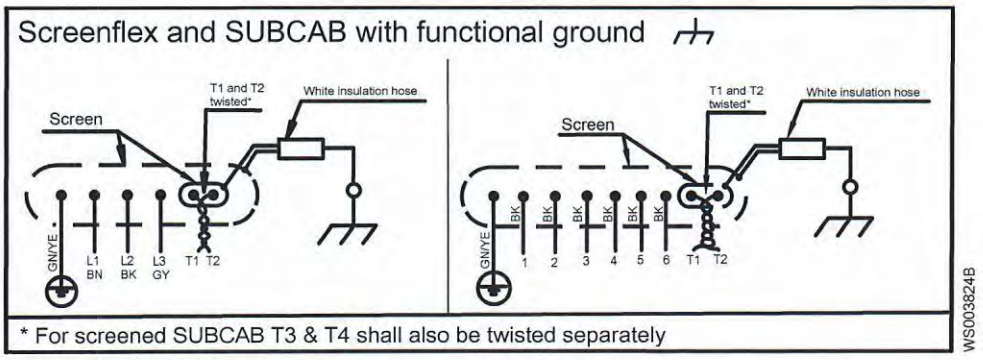


Figure 19: Screenflex and SUBCAB with functional ground

4.2.7 Sensor connection

4.2.7.1 Connection to the pump

Color and marking of control leads

Control	SUBCAB 4GX/7G and Screenflex	SUBCAB AWG	SUBCAB Screened
T1	WH T1	OG	WH T1
T2	WH T2	BU	WH T2
T3	-	-	WH T3
T4	-	-	WH T4

WS003843B

Figure 20: Color and marking of control leads

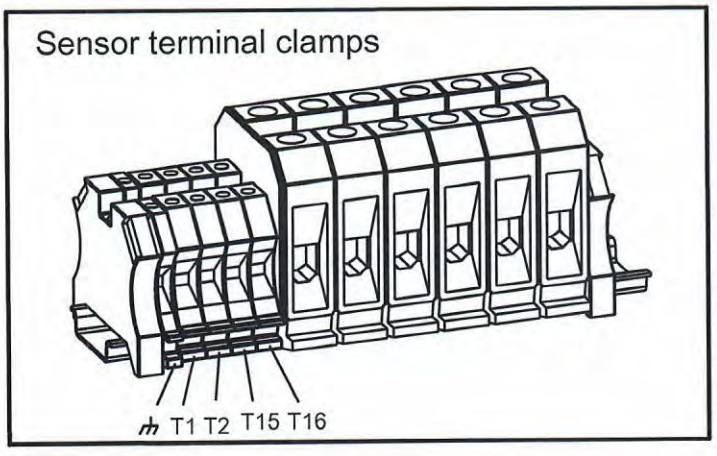
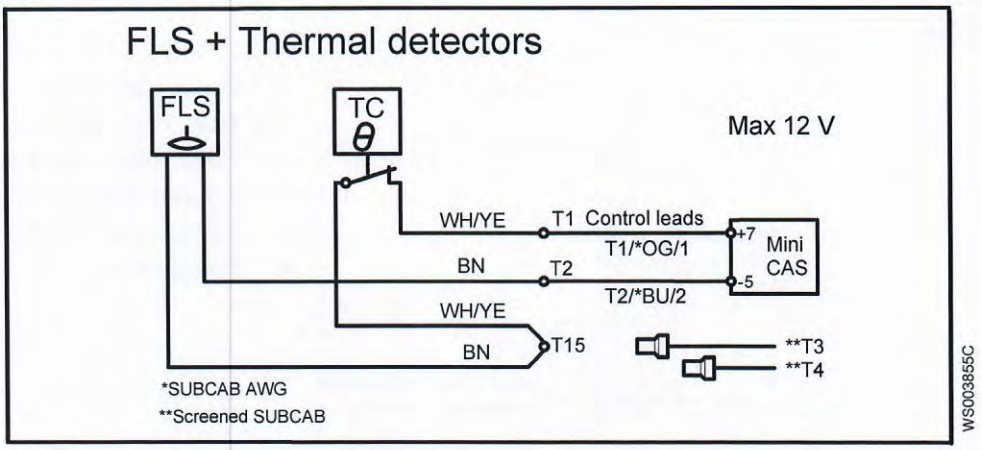


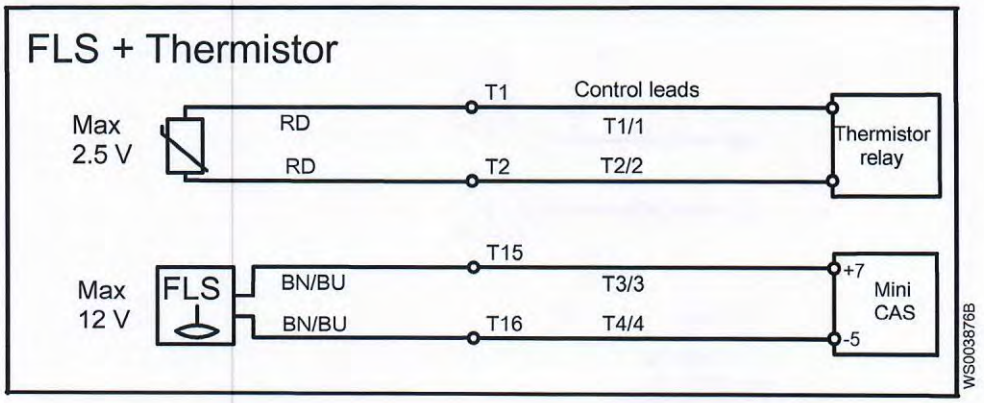
Figure 21: Sensor terminal clamps

FLS 10 and Thermal detectors



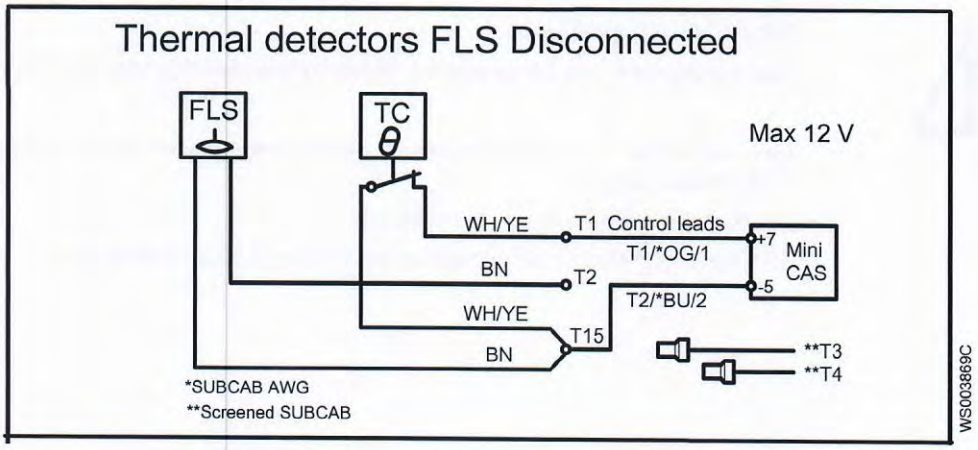
∞ Ohm	Overtemperature
1200 Ohm	OK
430 Ohm	Leakage

FLS 10 and Thermistor



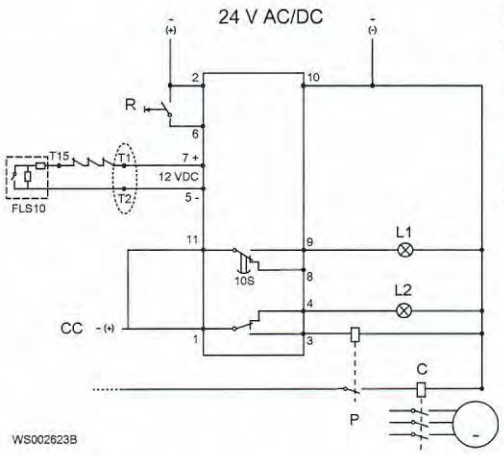
T=25°C (77°F)	R ≤ 100 Ohm
T=135°C (275°F) (T_{REF} -5°C (23°F))	R ≤ 550 Ohm
T=145°C (293°F) (T_{REF} +5°C (41°F))	R ≤ 1330 Ohm

Thermal detectors, FLS disconnected



4.2.7.2 Connection to the monitoring equipment

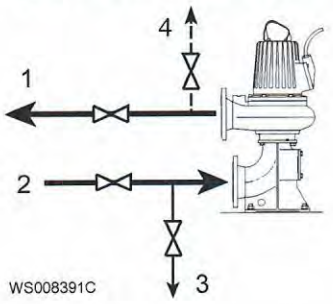
MiniCAS II



C Pump contactor
CC Control circuit
L1 Caution light (leakage)
L2 Caution light (stator over-temperature)
P Pump main supply
R Reset switch

4.3 T-installation: Bleed air before starting pump

1. Open the valve on the air vent line and bleed out the air. See the following figure.



1. Outlet line
2. Inlet line
3. Line to drain
4. Air vent

Figure 22: T-installation

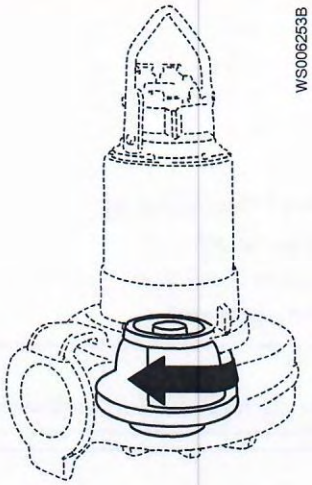
2. Close the valve on the air vent line before the pump is started.

4.4 Check the impeller rotation

CAUTION: Crush Hazard

The starting jerk can be powerful. Make sure nobody is close to the unit when it is started.

1. Start the motor.
2. Stop the motor after a few seconds.
3. Check that the impeller rotates according to this illustration.



The correct direction of impeller rotation is clockwise when you look at the pump from above.

4. If the impeller rotates in the wrong direction, then transpose two phase leads (3-phase) and do this procedure again.

5 Operation

5.1 Precautions

Before taking the unit into operation, check the following:

- All recommended safety devices are installed.
- The cable and cable entry have not been damaged.
- All debris and waste material has been removed.

NOTICE:

Never operate the pump with the discharge line blocked, or the discharge valve closed.

WARNING: Crush Hazard

Risk of automatic restart.

Distance to wet areas

WARNING: Electrical Hazard

Risk of electrical shock or burn. You must connect an additional ground- (earth-) fault protection device to the grounded (earthed) connectors if persons are likely to come into contact with liquids that are also in contact with the pump or pumped liquid.

CAUTION: Electrical Hazard

Risk of electrical shock or burn. The equipment manufacturer has not evaluated this unit for use in swimming pools. If used in connection with swimming pools then special safety regulations apply.

Noise level

NOTICE:

The sound power level of the product is lower than 70 dB(A). However, in some installations the resulting sound pressure level may exceed 70 dB(A) at certain operating points on the performance curve. Make sure that you understand the noise level requirements in the environment where the product is installed. Failure to do so may result in hearing loss or violation of local laws.

5.2 Estimate zinc anode replacement intervals

The mass and surface area of the zinc anodes are designed to protect the pump surface for 1 year in sea water with an average temperature of 20°C (68°F). Shorter inspection intervals and anode replacement can be required, depending upon the water temperature and the chemical composition as well as the presence of other metals in the vicinity of the pump.

The rate of zinc consumption, and the appropriate inspection intervals, can be estimated by measuring how much zinc is consumed during the first two months following installation.

Anodes are replaced when the anode mass is reduced to a selected fraction of its initial mass. The recommended interval for the selection fraction is 0.25-0.50 (25-50%).

1. Remove, weigh, and reinstall one or more of the exterior zinc anodes before starting up the pump.
2. After two months, remove and weigh the same zinc anode or anodes again.

3. Divide the lapsed time in days (between steps 1 and 2) by the anode weight loss in grams to get the calculated anode consumption rate (days/gram).
   If multiple anodes were weighed, then use the anode which has lost the most weight for this calculation.
4. Calculate future replacement intervals so that they occur when the selected fraction of zinc is remaining.

5.3 Start the pump

CAUTION: Crush Hazard

The starting jerk can be powerful. Make sure nobody is close to the unit when it is started.

NOTICE:

Make sure that the rotation of the impeller is correct. For more information, see Check the impeller rotation.

1. Remove the fuses or open the circuit breaker, and check that the impeller can rotate freely.

WARNING: Crush Hazard

Never put your hand into the pump housing.

2. Conduct insulation test phase to ground. To pass, the value must exceed 5 megaohms.
3. Check that the monitoring equipment works.
4. Start the pump.

6 Maintenance

Precautions

Before starting work, make sure that the safety instructions in the chapter *Introduction and Safety* on page 3 have been read and understood.

DANGER: Crush Hazard

Moving parts can entangle or crush. Always disconnect and lock out power before servicing to prevent unexpected startup. Failure to do so could result in death or serious injury.

WARNING: Biological Hazard

Infection risk. Rinse the unit thoroughly with clean water before working on it.

CAUTION: Crush Hazard

Make sure that the unit cannot roll or fall over and injure people or damage property.

Make sure that you follow these requirements:

- Check the explosion risk before you weld or use electrical hand tools.
- Allow all system and pump components to cool before you handle them.
- Make sure that the product and its components have been thoroughly cleaned.
- Make sure that the work area is well-ventilated before you open any vent or drain valves, remove any plugs, or disassemble the unit.
- Do not open any vent or drain valves or remove any plugs while the system is pressurized. Make sure that the pump is isolated from the system and that pressure is relieved before you disassemble the pump, remove plugs, or disconnect piping.

Ground continuity verification

A ground (earth) continuity test must always be performed after service.

Maintenance guidelines

During the maintenance and before reassembly, always remember to perform these tasks:

- Clean all parts thoroughly, particularly O-ring grooves.
- Change all O-rings, gaskets, and seal washers.
- Lubricate all springs, screws, O-rings with grease.

During the reassembly, always make sure that existing index markings are in line.

The reassembled drive unit must always be insulation-tested and the reassembled pump must always be test-run before normal operation.

6.1 Torque values

All screws and nuts must be lubricated to achieve correct tightening torque. Screws that are screwed into stainless steel must have the threads coated with suitable lubricants to prevent seizing.

If there is a question regarding the tightening torques, then contact a sales or authorized service representative.

Screws and nuts

Table 1: Stainless steel, A2 and A4, torque Nm (ft-lbs)

Property class	M4	M5	M6	M8	M10	M12	M16	M20	M24	M30
50	1.0 (0.74)	2.0 (1.5)	3.0 (2.2)	8.0 (5.9)	15 (11)	27 (20)	65 (48)	127 (93.7)	220 (162)	434 (320)
70, 80	2.7 (2)	5.4 (4)	9.0 (6.6)	22 (16)	44 (32)	76 (56)	187 (138)	364 (268)	629 (464)	1240 (915)
100	4.1 (3)	8.1 (6)	14 (10)	34 (25)	66 (49)	115 (84.8)	248 (183)	481 (355)	–	–

Table 2: Steel, torque Nm (ft-lbs)

Property class	M4	M5	M6	M8	M10	M12	M16	M20	M24	M30
8.8	2.9 (2.1)	5.7 (4.2)	9.8 (7.2)	24 (18)	47 (35)	81(60)	194 (143)	385 (285)	665 (490)	1310 (966.2)
10.9	4.0 (2.9)	8.1 (6)	14 (10)	33 (24)	65 (48)	114 (84)	277 (204)	541 (399)	935 (689)	1840 (1357)
12.9	4.9 (3.6)	9.7 (7.2)	17 (13)	40 (30)	79 (58)	136 (100)	333 (245)	649 (480)	1120 (825.1)	2210 (1630)

Hexagon screws with countersunk heads

For hexagon socket head screws with countersunk head, maximum torque for all property classes must be 80% of the values for property class 8.8 above.

6.2 Change the coolant

This image shows the plugs that are used to change the coolant.

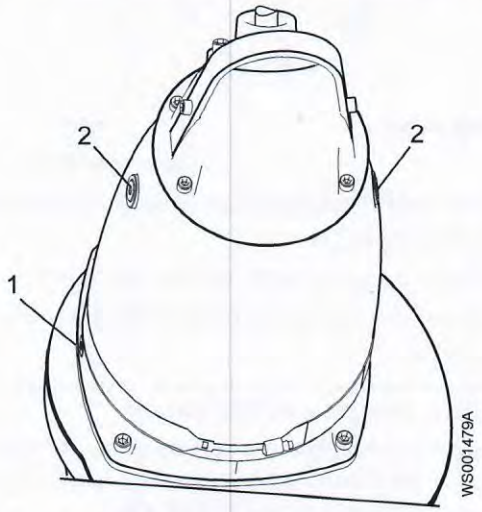


Figure 23: With a cooling jacket

1. Inspection plug
2. Coolant plugs

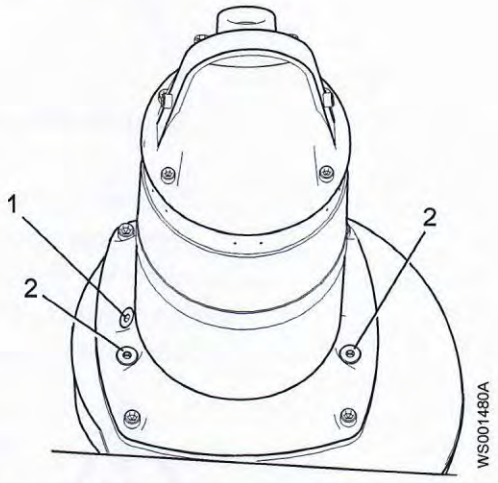


Figure 24: Without a cooling jacket

6.2.1 Empty the coolant

CAUTION: Compressed Gas Hazard

Air inside the chamber may cause parts or liquid to be propelled with force. Be careful when opening. Allow the chamber to de-pressurize before removal of the plug.

1. Empty the coolant in the inspection chamber:
   a) Remove the inspection plug.

Figure 25: With a cooling jacket

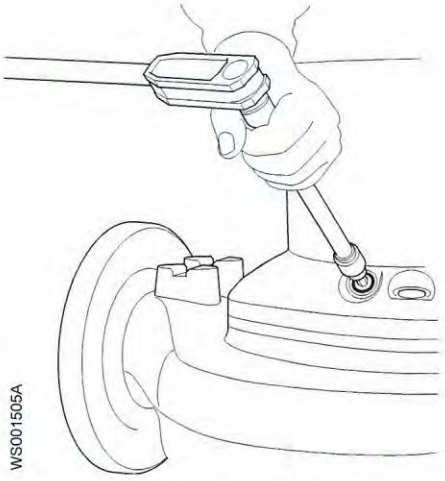


Figure 26: Without a cooling jacket

   b) Pump out any coolant from the inspection chamber, as shown here.

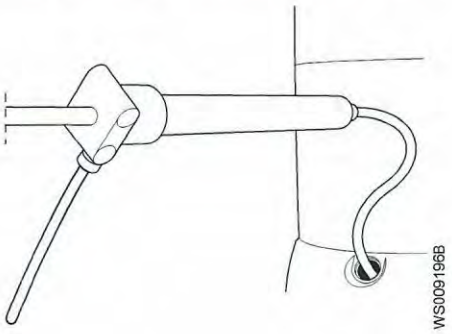


Figure 27: With a cooling jacket

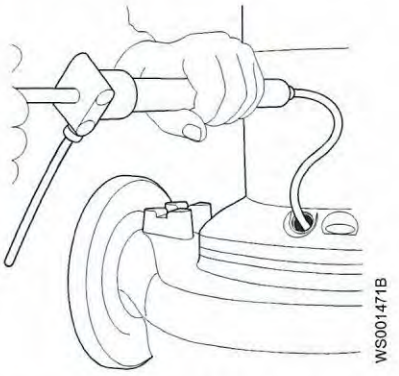


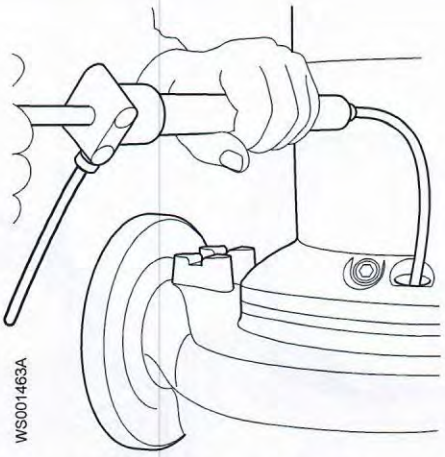
Figure 28: Without a cooling jacket

   c) Fit a new O-ring and re-install the inspection plug. Tighten the plug.
      Tightening torque: 44 Nm (33 ft-lbs)
2. To empty the coolant with the pump upright, do the following:
   This method is applicable only for pumps without cooling jackets.
   a) Remove the coolant plugs.

CAUTION: Compressed Gas Hazard

Air inside the chamber may cause parts or liquid to be propelled with force. Be careful when opening. Allow the chamber to de-pressurize before removal of the plug.

   b) Use a pump to remove the coolant.



3. If it is necessary to separate the drive unit from the hydraulic unit, then do the following:
   a) Carefully open the coolant plugs to relieve any built-up pressure inside the cooling jacket.

CAUTION: Compressed Gas Hazard

Air inside the chamber may cause parts or liquid to be propelled with force. Be careful when opening. Allow the chamber to de-pressurize before removal of the plug.

   b) After venting any built-up pressure in the cooling jacket, re-install the coolant plugs.
   c) Remove the pump housing screws.
   d) Remove the drive unit from the pump housing.

NOTICE:

Do not allow the weight of the pump to rest on any portion of the impeller. The impeller must not be allowed to make contact with the concrete floor or other hard or rough surfaces.

4. To empty the coolant with the pump in a horizontal position, do the following:
   a) Place the pump horizontally, so that one of the coolant plugs is at the lowest point of the pump, to ensure that the coolant will drain completely.

      It is important to empty all of the coolant.
   b) Place a container under the pump.
   c) Remove the coolant plugs and empty the coolant.

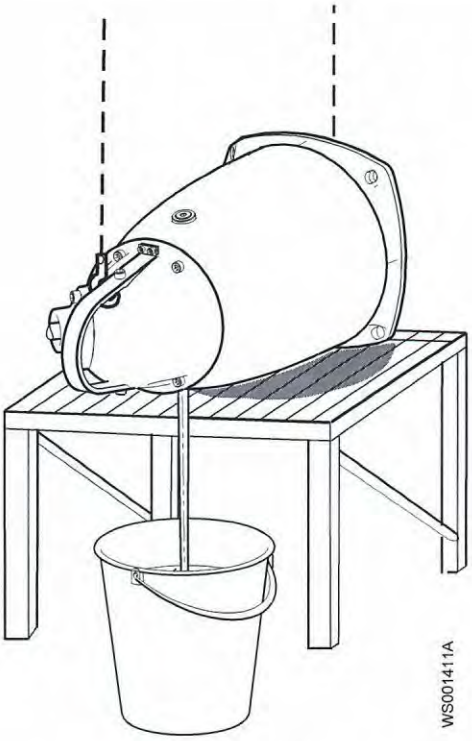


Figure 29: With a cooling jacket

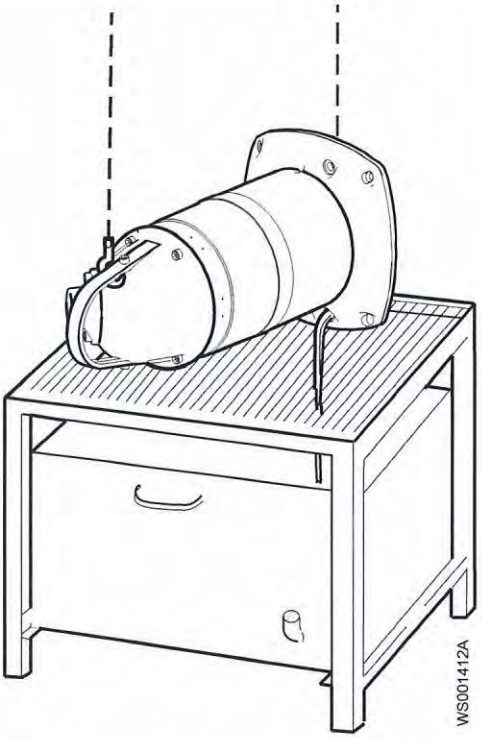


Figure 30: Without a cooling jacket

6.2.2 Fill with coolant

Use a coolant that is a mixture of 70% deionized or distilled water, and 30% DOWCAL 200™ monopropylene glycol. If DOWCAL 200™ from Dow Chemical Company is not available, then contact your local Xylem representative. The monopropylene glycol must fulfill the Xylem material standard M0800.82.0002.

NOTICE:

Deionized or distilled water must be used in the water-glycol mixture.

If the pumped liquid includes potable water or substances to be ingested, then contact a sales or authorized service representative.

1. Fill with coolant until it overflows through the opposite hole, as shown here.

Pump	Quantity, L (qt.)	
	With cooling jacket	Without cooling jacket
3153	10.5 (11.2)	2.2 (2.3)

Figure 31: With cooling jacket

Figure 32: Without cooling jacket

2. Fit new O-rings and re-install the coolant plugs. Tighten the plugs.
   Tightening torque: 44 Nm (33 ft-lb)

6.3 Service the pump

Type of maintenance	Purpose	Inspection interval
Initial inspection	A Xylem-authorized personnel checks the pump condition. From the results, the personnel recommends the intervals for the periodical inspection and overhaul for the installation.	Within the first year of operation.
Periodical inspection	The inspection prevents operational interruptions and machine breakdowns. The measures to increase performance and pump efficiency are decided for each application. They can include such things as impeller trimming, wear part control and replacement, control of zinc-anodes and control of the stator.	Up to 12,000 hours or three years, whichever comes first. Applies to normal applications and operating conditions at media (liquid) temperatures <40°C (104°F).
Overhaul	The overhaul lengthens the operating lifetime of the product. It includes the replacement of key components and the measures that are taken during an inspection.	Up to 24,000 hours or six years, whichever comes first. Applies to normal applications and operating conditions at media (liquid) temperatures <40°C (104°F).

NOTICE:

Shorter intervals may be required when the operating conditions are extreme, for example with very abrasive or corrosive applications or when the liquid temperatures exceed 40°C (104°F).

6.3.1 Inspection

Service item	Action
Cable	1. If the outer jacket is damaged, replace the cable. 2. Check that the cables do not have any sharp bends and are not pinched.
Connection to power	Check that the connections are properly secured.
Electrical cabinets	Check that they are clean and dry.
Impeller	1. Check the impeller clearance. 2. Adjust the impeller, if necessary.

Service item	Action
Inspection chamber	1. Drain all liquid, if any. 2. Check the resistance of the leakage sensor. Normal value approximately1200 ohms, alarm approximately 430 ohms.
Insulation	Use a megger maximum 1000 V. 1. Check that the resistance between the ground (earth) and phase lead is more than 5 megohms. 2. Conduct a phase-to-phase resistance check.
Junction box	Check that it is clean and dry.
Level regulators	Check the condition and functionality.
Lifting device	Check that the local safety regulations are followed.
Lifting handle	1. Check the screws. 2. Check the condition of the lifting handle and the chain. 3. If necessary, replace.
O-rings	1. Replace the oil plug O-rings. 2. Replace the O-rings at the entrance or junction cover. 3. Grease the new O-rings.
Overload protection and other protections	Check the correct settings.
Personnel safety devices	Check the guard rails, covers, and other protections.
Rotation direction	Check the impeller rotation.
Seal housing	1. Fill with new coolant, if necessary. 2. Check that the freezing point is lower than -13°C (9°F).
Terminal board	Check that the connections are properly secured.
Thermal contacts	Normally closed circuit; interval 0–1 ohm.
Thermistor	Check the resistance is between 20–250 ohms and the measured voltage is maximum 2 V DC.
Voltage and amperage	Check the running values.

6.3.2 Overhaul

The basic repair kit includes O-rings, seals, and bearings.

For an overhaul, do the following in addition to the tasks listed under Inspection.

Service item	Action
Support and main bearing	Replace the bearings with new bearings.
Mechanical seal	Replace with new seal units.

6.3.3 Service in case of alarm

For information about indication values for sensors, see *Sensor connection* on page 32.

Alarm source	Action
FLS10	1. Drain the fluid in the inspection chamber. 2. Check the coolant level. Fill with new coolant if necessary. 3. Check the freezing point (lower than -13°C or 9°F). Check the inspection chamber again after one week of operation. If leakage has occurred, then do the following: 1. Drain the fluid. 2. Change the mechanical seal unit. 3. Replace with new coolant.

Alarm source	Action
The thermistor/Thermal contact	1. Check the coolant level (pump with cooling jacket). 2. Check the start and stop levels.
The overload protection	Check that the impeller can rotate freely.

6.4 Replace the impeller

Required tools:

- 12 mm hexagon bit adapter with an extension of at least a 100 mm (4 in)
- Rod (wood or plastic) for locking the impeller in place

CAUTION: Cutting Hazard

Worn parts can have sharp edges. Wear protective clothing.

NOTICE:

When laying the pump on its side, do not allow the weight of the pump to rest on any portion of the impeller. The impeller must not be allowed to make contact with the concrete floor or other hard and rough surfaces.

NOTICE:

If you fail with the impeller installation, you must redo the installation procedure from the beginning.

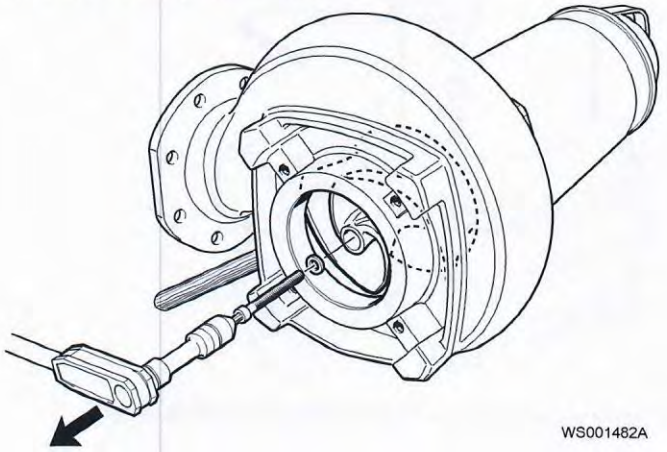
6.4.1 Replace the impeller for wet installation

6.4.1.1 Remove the impeller: wet installation

CAUTION: Cutting Hazard

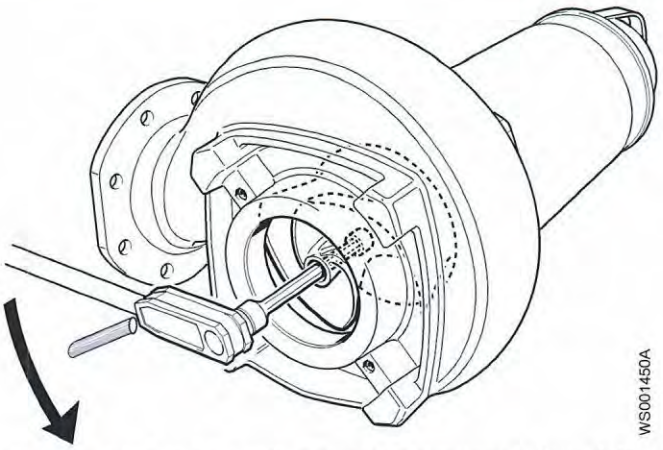
Sharp edges. Wear protective clothing.

1. Place the pump in a horizontal position.
2. Remove the impeller:
   a) Remove the flush valve cover and its O-ring.
   b) Lock the impeller in place by inserting a rod through the hole.
   c) Remove the impeller screw.

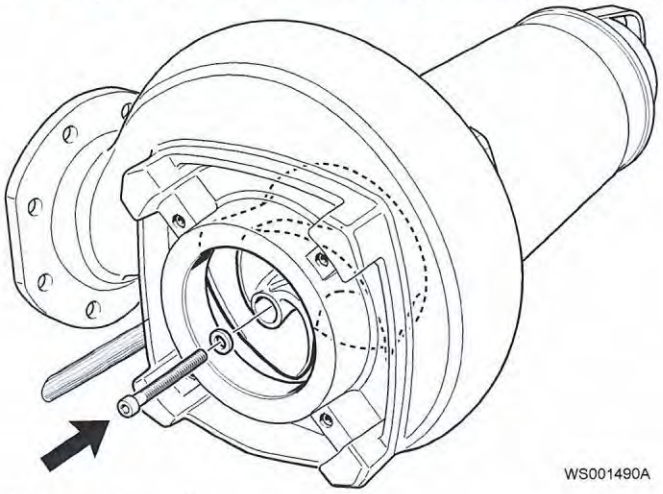


WS001482A

   d) Turn the adjustment screw counterclockwise until the impeller breaks free from the shaft.

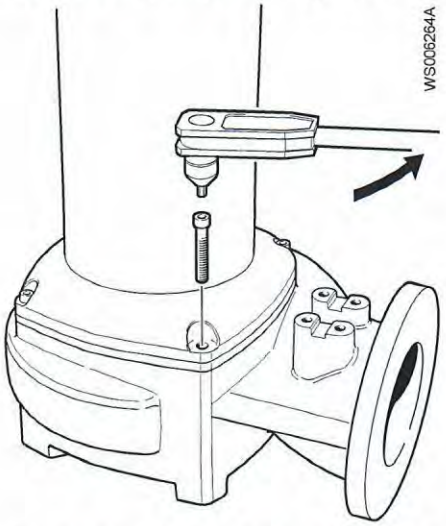


e) Hand-tighten the impeller screw to prevent it from falling off.

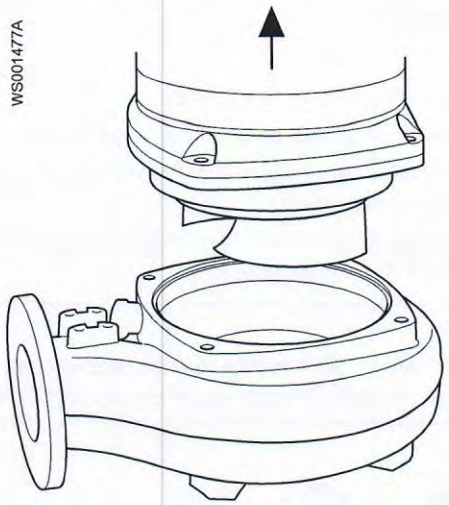


f) Remove the rod.

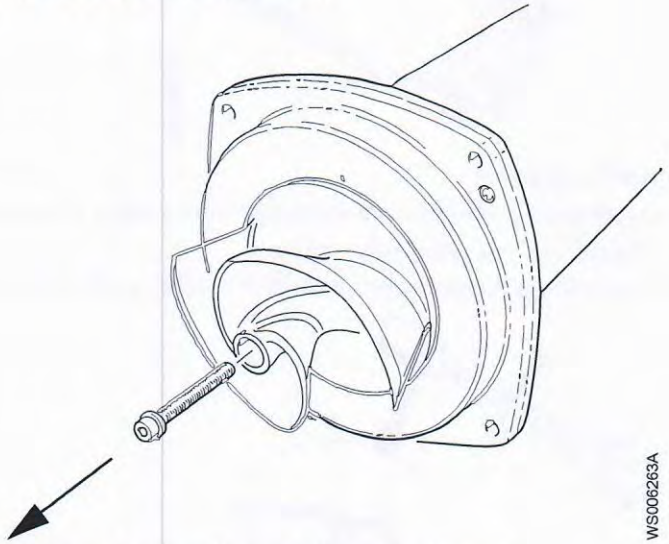
3. Raise the pump.
4. Remove the drive unit from the pump housing:
   a) Remove the pump housing screws.



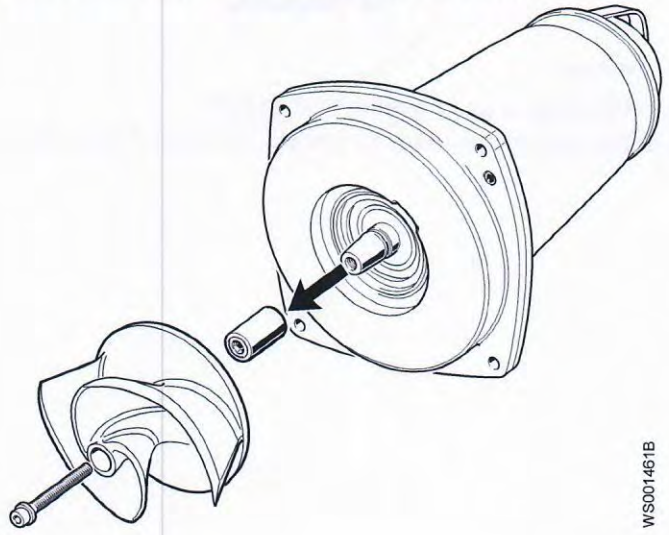
b) Remove the drive unit from the pump housing.



5. Remove the impeller:
   a) Place the drive unit horizontally.
   b) Remove the impeller screw.



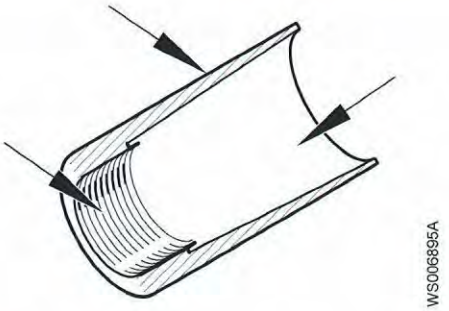
   c) Remove the impeller and the conical sleeve.



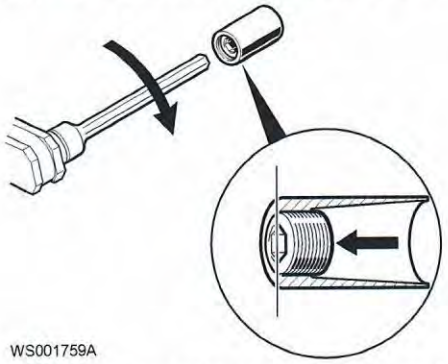
6.4.1.2 Install the impeller: wet installation

1. Prepare the shaft:
   a) Polish off any flaws with a fine emery cloth.
      The end of the shaft must be clean and free from burrs.
   b) Coat the inner conic, the outer cylindrical surfaces, and the thread of the conical sleeve with a thin layer of grease.
      The proper lubrication is grease for bearings, for example Exxon Mobil Unirex N3, Mobil Mobilith SHC 220 or equivalent.

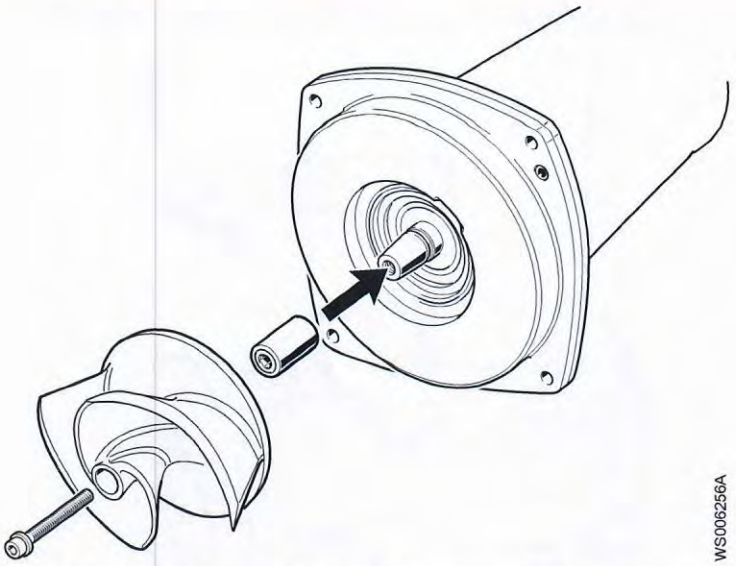
   NOTICE:
   Surplus grease can cause the impeller to become loose. Remove surplus grease from conical and/or cylindrical surfaces of shafts and/or sleeves.



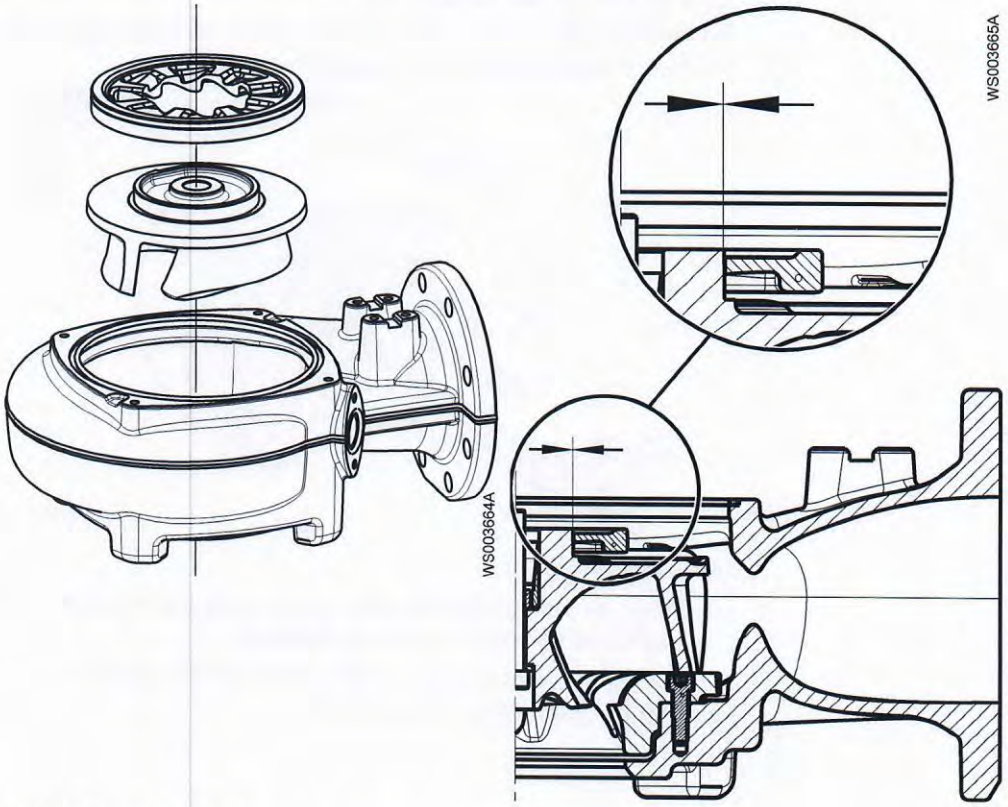
2. Mount the impeller:
   a) Lubricate the threads of the impeller screw and the washer.
      Always use a new impeller screw.
   b) Adjust the adjustment screw so that it is flush with the sleeve.



   c) Fit the sleeve and impeller to the shaft.
   d) Hand-tighten the impeller screw to prevent it from falling off.

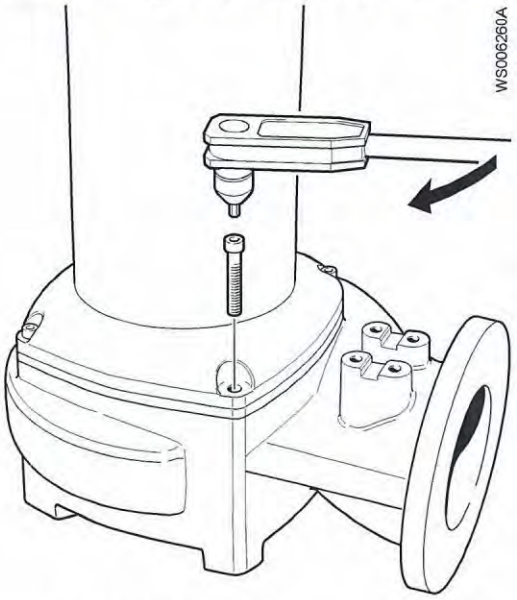


3. If applicable, check that the clearance between the impeller and the insert ring is maximum 1 mm (0.04 in) radial. If not, send the pump for service.
   The insert ring is pressed into the seal housing cover.

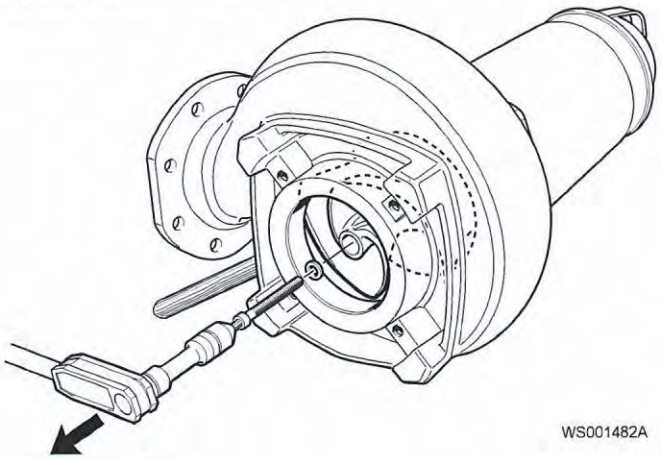


4. Fit the pump housing:
   a) Fit a new and lubricated O-ring on the seal housing cover.
   b) Lubricate the pump housing screws.
   c) Raise the drive unit.
   d) Place the drive unit into the pump housing.
   e) Adjust its position so that the inspection hole is on the same side as the flush valve.
   f) Tighten the screws in diagonal sequence.

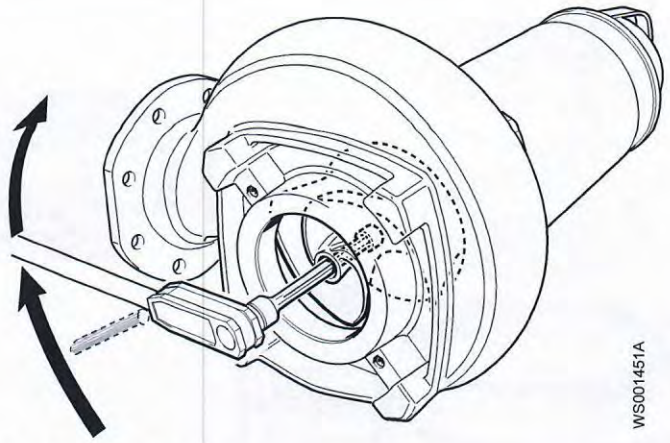
For tightening torque, see *Torque values* on page 39.



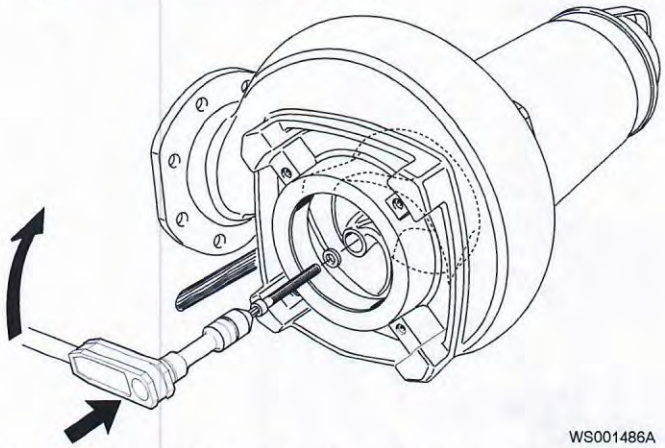
5. Remove the impeller screw:
   a) Place the pump horizontally.
   b) Lock the impeller in place by inserting a rod through the hole.
   c) Remove the impeller screw and the washer.



6. Adjust the impeller:
   a) Using a hexagon-bit adapter, turn the adjustment screw clockwise until the impeller makes contact with the pump housing.
      For tightening torque, see *Torque values* on page 39.
   b) Tighten it a further 1/8 turn (45°).



7. Fasten the impeller:
   a) Fit the lubricated washer and impeller screw.
   b) Tighten the impeller screw.
      For tightening torque, see *Torque values* on page 39.
   c) Tighten it a further 1/8 turn (45°).

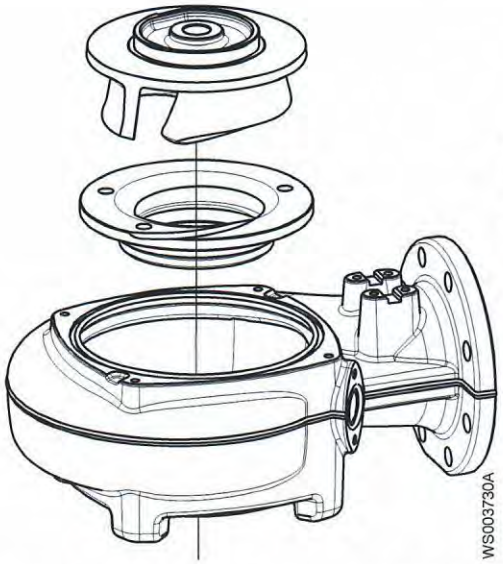


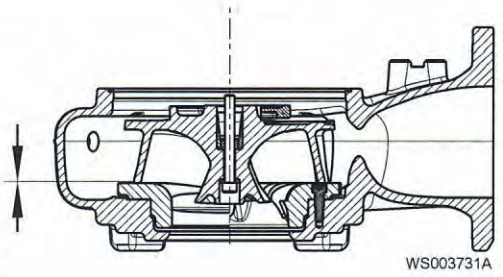
   d) Remove the rod that is used to lock the impeller.
   e) Fit the O-ring and flush valve cover and fasten it with screws.
      For tightening torque, see *Torque values* on page 39.
   f) Check that the impeller can rotate freely.

WARNING: Crush Hazard

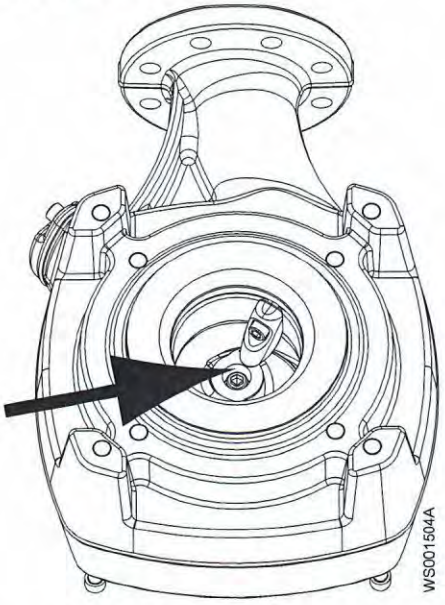
Beware of the pinch point hazard between the rotating impeller and the guide pin.

8. Check that the clearance between the impeller and the insert ring is 0.1–0.5 mm (0.004–0.02 in).





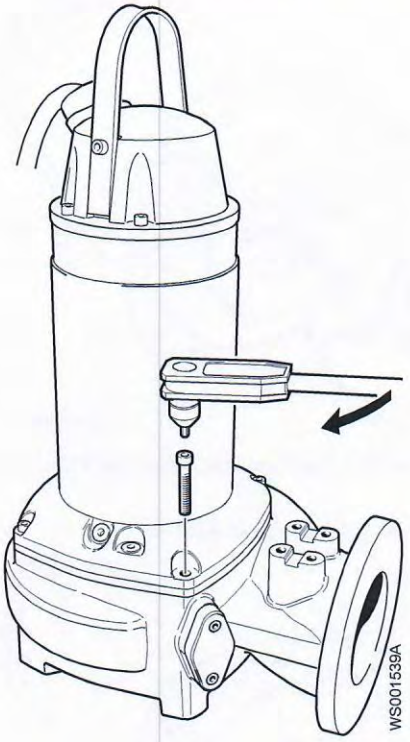
9. If applicable, adjust the clearance to 0.1–0.5 mm (0.004–0.02 in) between the guide pin and the impeller.



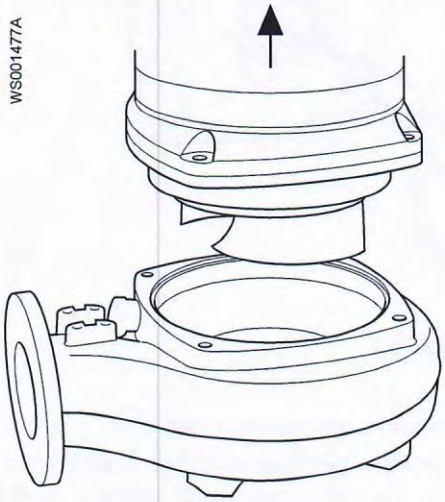
6.4.2 Replace the impeller for dry installation

6.4.2.1 Remove the impeller: dry installation

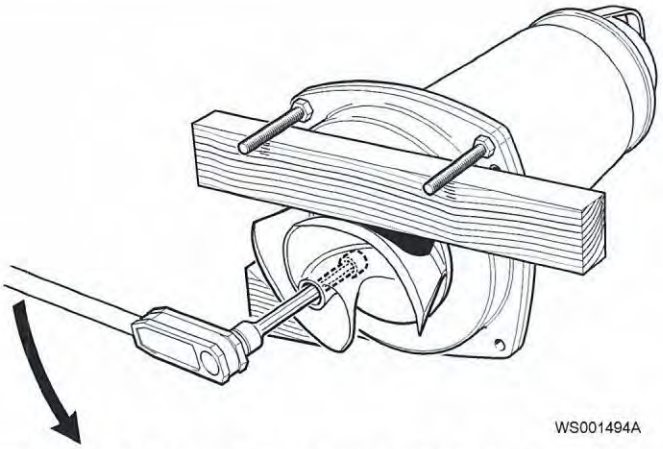
1. Remove the drive unit from the pump housing:
   a) Remove the pump housing screws.



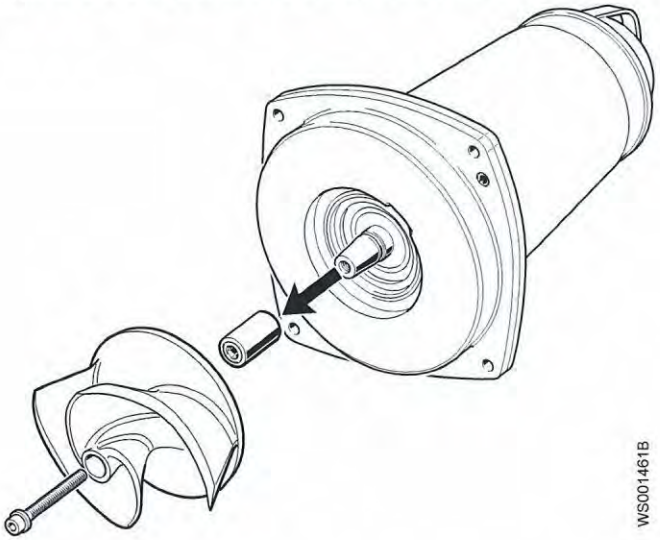
b) Remove the drive unit from the pump housing.



2. Remove the impeller:
   a) Place the drive unit horizontally.
   b) Lock the impeller as shown in the figure.
   c) Remove the impeller screw.



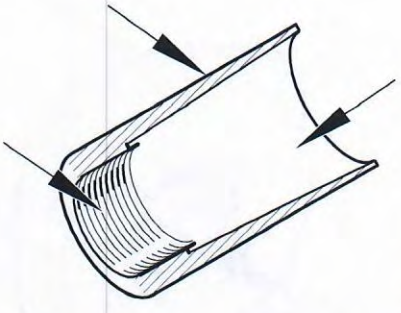
d) Turn the adjustment screw counterclockwise until the impeller breaks free from the shaft.
e) Remove the impeller and the conical sleeve.



6.4.2.2 Install the impeller: dry installation

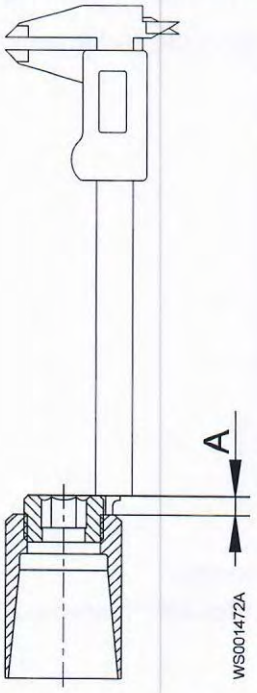
1. Prepare the shaft:
   a) Polish off any flaws with a fine emery cloth.
      The end of the shaft must be clean and free from burrs.
   b) Coat the inner conic, the outer cylindrical surfaces, and the thread of the conical sleeve with a thin layer of grease.
      The proper lubrication is grease for bearings, for example Exxon Mobil Unirex N3, Mobil Mobilith SHC 220 or equivalent.

NOTICE:
Surplus grease can cause the impeller to become loose. Remove surplus grease from conical and/or cylindrical surfaces of shafts and/or sleeves.

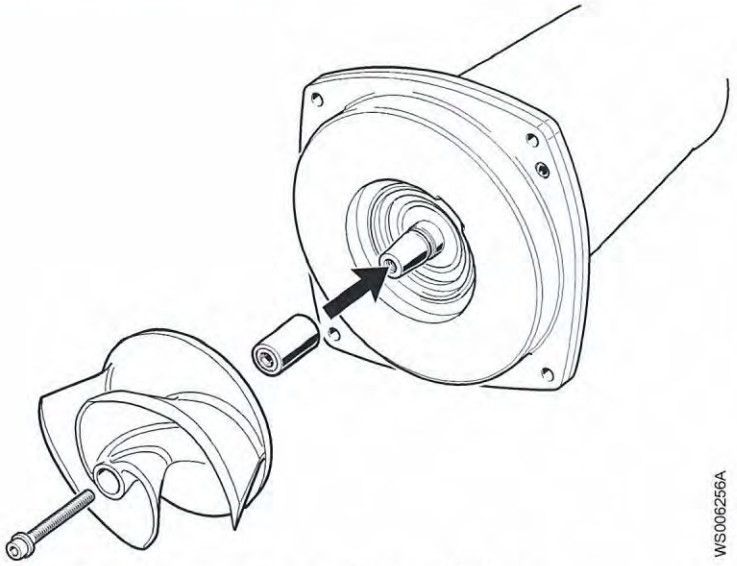


2. Mount the impeller:
   a) Lubricate the threads of the impeller screw and the washer.
      Always use a new impeller screw.
   b) Unscrew the adjustment screw approximately 5 mm (0.2 in.).

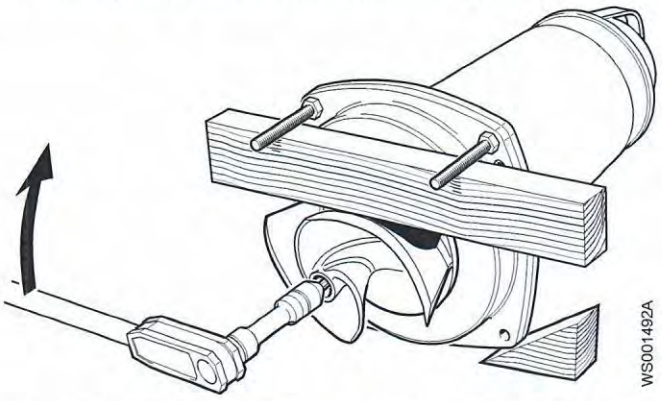
   c) Measure and note the distance A.



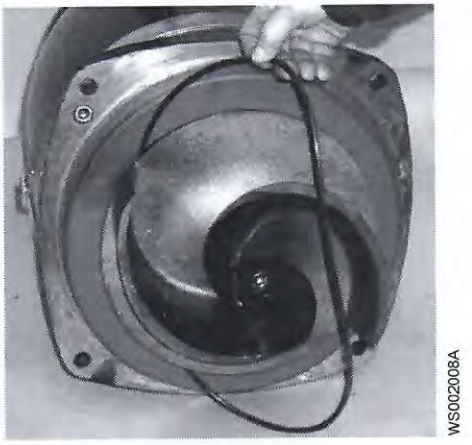
   d) Fit the sleeve and the impeller to the shaft.



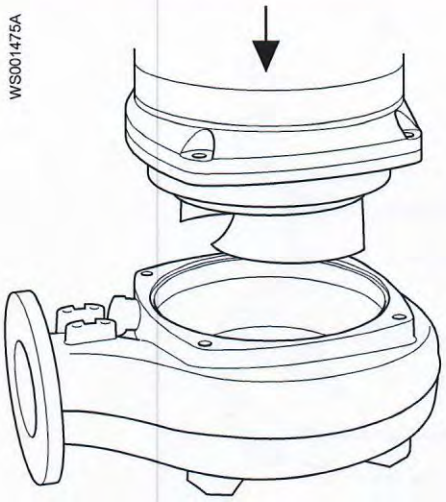
e) Fit the impeller screw and washer and tighten.



3. Make sure that the O-ring is removed from the seal housing cover.

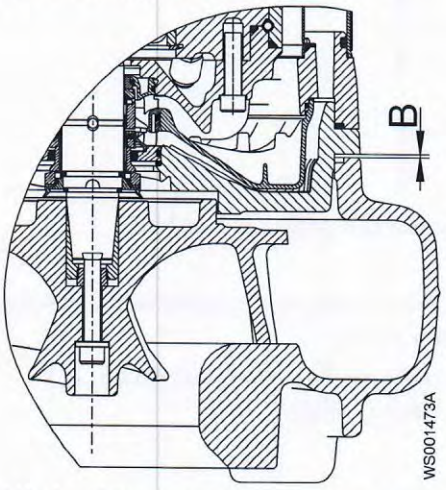


4. Measure the trim distance:
   a) Place the drive unit in the pump housing.
      Make sure that the drive unit is parallel with the pump housing by hand-tightening the pump housing screws.

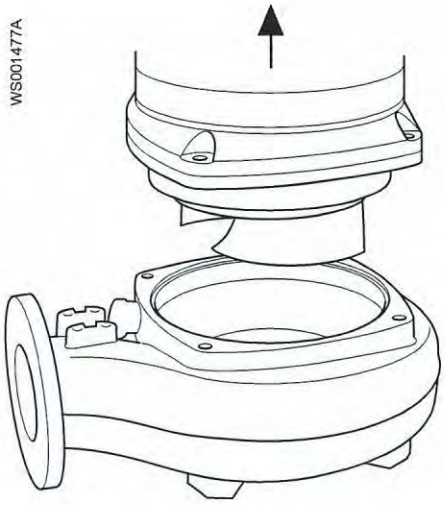


b) Check the distance between the seal housing cover and the pump housing with a feeler gauge.
Check diagonally at four points.

c) Note the largest distance B.

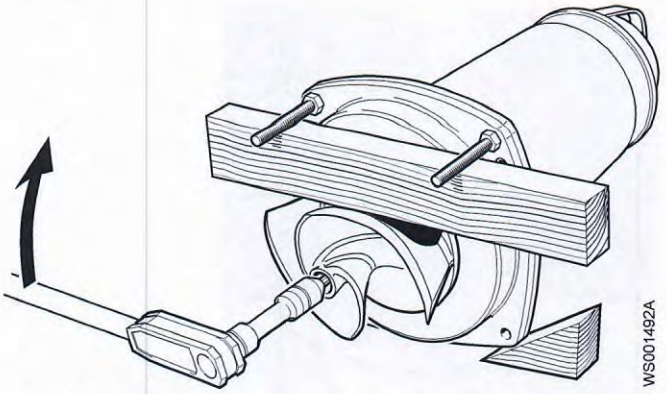


d) Lift the drive unit out of the pump housing and remove the impeller and conical sleeve.

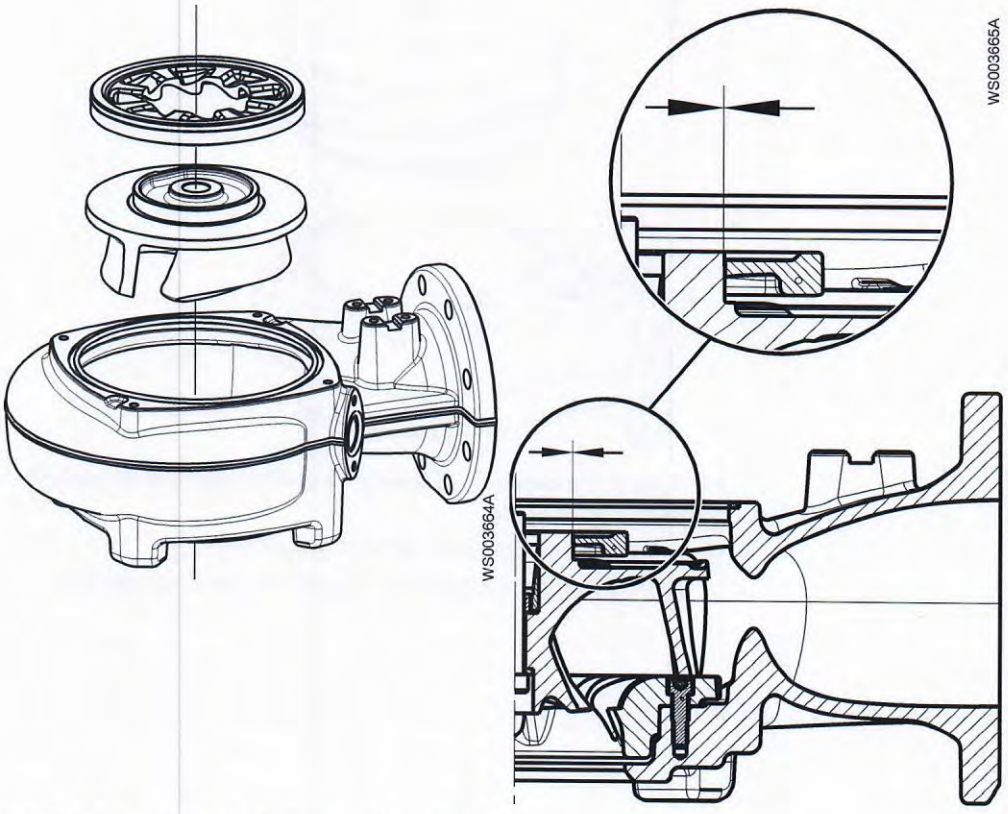


5. Trim to the correct distance:
   a) Calculate the measure C according to the formula shown in the image.

   b) Turn the adjustment screw until C is reached.
6. Fasten the impeller:
   a) Fit the sleeve, impeller, lubricated washer with a lubricated impeller screw.
   b) Tighten the impeller screw.
      For tightening torque, see *Torque values* on page 39.
   c) Tighten it further 1/8 turn (45°).

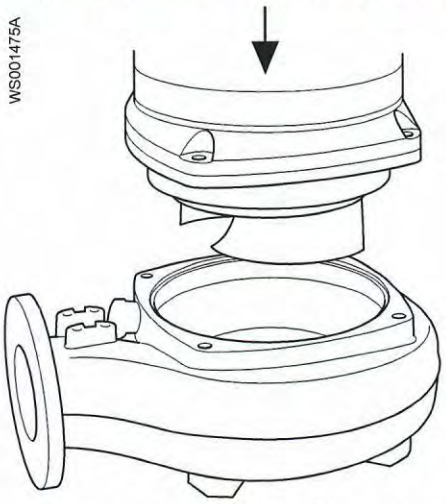


7. If applicable, check that the clearance between the impeller and the insert ring is maximum 1 mm (0.04 in.) radial. If not, send the pump for service.
   The insert ring is pressed into the seal housing cover.

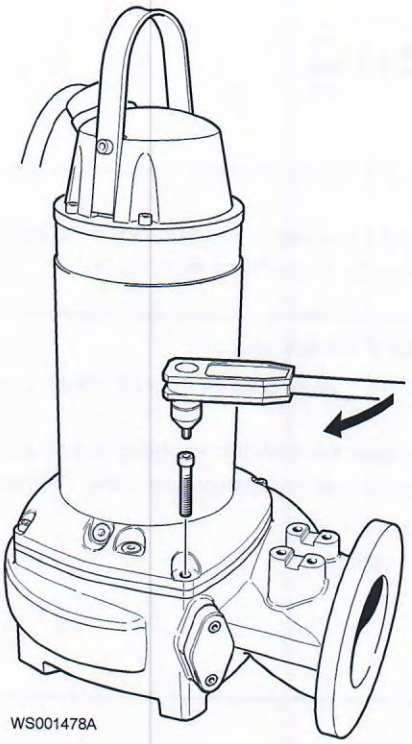


8. Install the drive unit in the pump housing:
   a) Fit a new and lubricated O-ring to the seal housing cover.

b) Place the drive unit in the pump housing.



c) Adjust the position of the drive unit so that the inspection hole is on the same side as the flush valve.
d) Tighten the lubricated screws diagonally.
For tightening torque, see *Torque values* on page 39.



If you need to adjust the impeller, redo the replace the impeller procedure from the beginning.

7 Troubleshooting

Introduction

DANGER: Electrical Hazard

Troubleshooting a live control panel exposes personnel to hazardous voltages. Electrical troubleshooting must be done by a qualified electrician.

Follow these guidelines when troubleshooting:

- Disconnect and lock out the power supply except when conducting checks that require voltage.
- Make sure that no one is near the unit when the power supply is reconnected.
- When troubleshooting electrical equipment, use the following:
  - Universal instrument multimeter
  - Test lamp (continuity tester)
  - Wiring diagram

7.1 The pump does not start

DANGER: Crush Hazard

Moving parts can entangle or crush. Always disconnect and lock out power before servicing to prevent unexpected startup. Failure to do so could result in death or serious injury.

WARNING: Electrical Hazard

The permanent-magnet motor generates voltage when the shaft rotates, even if power sources are disconnected. Never perform any electrical work if the shaft could rotate.

NOTICE:

Do NOT override the motor protection repeatedly if it has tripped. Doing so may result in equipment damage.

Cause	Remedy
An alarm signal has been triggered on the control panel.	Check that: • The impeller rotates freely. • The sensor indicators do not indicate an alarm. • The overload protection is not tripped.

Cause	Remedy
The pump does not start automatically, but can be started manually.	Check that: • The start level regulator is functioning. Clean or replace if necessary. • All connections are intact. • The relay and contactor coils are intact. • The control switch (Man/Auto) makes contact in both positions. Check the control circuit and functions.
The installation is not receiving voltage.	Check that: • The main power switch is on. • There is control voltage to the start equipment. • The fuses are intact. • There is voltage in all phases of the supply line. • All fuses have power and that they are securely fastened to the fuse holders. • The overload protection is not tripped. • The motor cable is not damaged.
The impeller is stuck.	Clean: • The impeller • The sump in order to prevent the impeller from clogging again.

If the problem persists, then contact a sales or authorized service representative.

Always state the serial number of the product, see *Product Description* on page 10.

7.2 The pump does not stop when a level sensor is used

DANGER: Crush Hazard

Moving parts can entangle or crush. Always disconnect and lock out power before servicing to prevent unexpected startup. Failure to do so could result in death or serious injury.

WARNING: Electrical Hazard

The permanent-magnet motor generates voltage when the shaft rotates, even if power sources are disconnected. Never perform any electrical work if the shaft could rotate.

Cause	Remedy
The pump is unable to empty the sump to the stop level.	Check that: • There are no leaks from the piping and/or discharge connection. • The impeller is not clogged. • The non-return valve(s) are functioning properly. • The pump has adequate capacity. For information: Contact a sales or authorized service representative.

Cause	Remedy
There is a malfunction in the level-sensing equipment.	• Clean the level regulators. • Check the functioning of the level regulators. • Check the contactor and the control circuit. • Replace all defective items.
The stop level is set too low.	Raise the stop level.

If the problem persists, then contact a sales or authorized service representative.
Always state the serial number of the product, see *Product Description* on page 10.

7.3 The pump starts-stops-starts in rapid sequence

Cause	Remedy
The pump starts due to back-flow which fills the sump to the start level again.	Check that: • The distance between the start and stop levels is sufficient. • The non-return valve(s) work(s) properly. • The length of the discharge pipe between the pump and the first non-return valve is sufficiently short.
The self-holding function of the contactor malfunctions.	Check: • The contactor connections. • The voltage in the control circuit in relation to the rated voltages on the coil. • The functioning of the stop-level regulator. • Whether the voltage drop in the line at the starting surge causes the contactor's self-holding malfunction.

If the problem persists, then contact a sales or authorized service representative.
Always state the serial number of the product, see *Product Description* on page 10.

7.4 The pump runs but the motor protection trips

DANGER: Crush Hazard

Moving parts can entangle or crush. Always disconnect and lock out power before servicing to prevent unexpected startup. Failure to do so could result in death or serious injury.

WARNING: Electrical Hazard

The permanent-magnet motor generates voltage when the shaft rotates, even if power sources are disconnected. Never perform any electrical work if the shaft could rotate.

NOTICE:

Do NOT override the motor protection repeatedly if it has tripped. Doing so may result in equipment damage.

Cause	Remedy
The motor protection is set too low.	Set the motor protection according to the data plate and if applicable the cable chart.
The impeller is difficult to rotate by hand.	• Clean the impeller. • Clean out the sump. • Check that the impeller is properly trimmed.
The drive unit is not receiving full voltage on all three phases.	• Check the fuses. Replace fuses that have tripped. • If the fuses are intact, then notify a certified electrician.
The phase currents vary, or they are too high.	Contact a sales or authorized service representative.
The insulation between the phases and ground in the stator is defective.	1. Use an insulation tester. With a 1000 V DC megger, check that the insulation between the phases and between any phase and ground is > 5 megaohms. 2. If the insulation is less, then do the following: Contact a sales or authorized service representative.
The density of the pumped fluid is too high.	Make sure that the maximum density is 1100 kg/m3 (9.2 lb/US gal) • Change the impeller, or • Change to a more suitable pump • Contact a sales or authorized service representative.
There is a malfunction in the overload protection.	Replace the overload protection.

If the problem persists, then contact a sales or authorized service representative.

Always state the serial number of the product, see *Product Description* on page 10.

7.5 The pump delivers too little or no water

DANGER: Crush Hazard

Moving parts can entangle or crush. Always disconnect and lock out power before servicing to prevent unexpected startup. Failure to do so could result in death or serious injury.

WARNING: Electrical Hazard

The permanent-magnet motor generates voltage when the shaft rotates, even if power sources are disconnected. Never perform any electrical work if the shaft could rotate.

NOTICE:

Do NOT override the motor protection repeatedly if it has tripped. Doing so may result in equipment damage.

Cause	Remedy
The impeller rotates in the wrong direction.	• If it is a 3-phase pump, then transpose two phase leads. • If it is a 1-phase pump, then do the following: Contact a sales or authorized service representative.
One or more of the valves are set in the wrong positions.	• Reset the valves that are set in the wrong position. • Replace the valves, if necessary. • Check that all valves are correctly installed according to media flow. • Check that all valves open correctly.
The impeller is difficult to rotate by hand.	• Clean the impeller. • Clean out the sump. • Check that the impeller is properly trimmed.
The pipes are obstructed.	To ensure a free flow, clean out the pipes.
The pipes and joints leak.	Find the leaks and seal them.
There are signs of wear on the impeller, pump, and casing.	Replace the worn parts.
The liquid level is too low.	• Check that the level sensor is set correctly. • Depending on the installation type, add a means for priming the pump, such as a foot valve.

If the problem persists, then contact a sales or authorized service representative.
Always state the serial number of the product, see *Product Description* on page 10.

8 Technical Reference

8.1 Application limits

Data	Description
Liquid temperature	40°C (104°F) maximum For P-installations without a cooling jacket, the pump can be operated only when the sump level is at least 10 mm (0.4 in) above the stator housing. Warm-liquid version: 70°C (158°F) maximum Warm-liquid version must have cooling jacket.
pH of the pumped media (liquid)	5.5–14
Liquid density	1100 kg/m³ (9.2 lb per US gal) maximum
Depth of immersion	Maximum 20 m (65 ft)
Other	For the specific weight, current, voltage, power ratings, and speed of the pump, see the data plate of the pump.

8.2 Motor data

Feature		Description
Motor type	Versions .091, .095, .181, .185, .350, .390, .660, .670	Squirrel-cage induction motor
	Versions .800, .810, .820, .830, .840, .850	• Squirrel-cage induction motor • Line-started, permanent-magnet synchronous motor
	Versions .860, .870	Line-started, permanent-magnet synchronous motor
Frequency		50 Hz or 60 Hz
Supply		3-phase
Starting method		• Direct on-line • Star-delta • Soft starter • Variable Frequency Drive (VFD)
Maximum starts per hour		30 evenly-spaced starts per hour
Code compliance		IEC 60034-1
Voltage variation without overheating		±10%, if it does not run continuously at full load
Voltage imbalance tolerance		2%
Stator insulation class		H (180°C [356°F])

Motor encapsulation

Motor encapsulation is in accordance with IP68.

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The original instruction is in English. All non-English instructions are translations of the original instruction.

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CE =C= DECLARATION OF CONFORMITY

Cheng Day Machinery Works Co., Ltd.
173, Wen Chiu Road, Ta Chia Chen, Taichung,
Taiwan, R.O.C.

We declare under our sole responsibility that the products：

Manual chain block：TYB Series：TYB-050,100,160,200,300,320,500,750,1000
Plain Trolley：PT Series：PT-050,100,200,300,500,750,1000
Geared Trolley：GT Series：GT-050,100,200,300,500,750,1000
Working load limit：for 0.5t to 10t

to which this declaration relates is in conformity with the following Machinery Directive and Standard.

Machinery Directive 89/392/EEC 1989
Machinery Directive 91/368/EEC 1991
Machinery Directive 93/ 44/EEC 1993
Council Directive 98/ 37/EEC 1998
EN ISO 12100-1 and EN ISO 12100-2(Safety of machines)

Issued by DET NORSKE VERITAS REGION NORGE, Veritas veien 1,
1322 Hovik, Norway.
Certificate no.：99-OSL-SM-0294

The technical construction file of this unit is and will remain available on manufacturer's premises for any inspection purposes.

Cheng Day Machinery Works Co., Ltd.

Pan

I. D. Pan
Manager
Quality Assurance Dept.

MANUAL CHAIN BLOCK

CAPACITIES：0.5 TO 10 TONS

OPERATION AND PART MANUAL

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WARNING

The use of hoisting equipment presents the possibility of personal Injury Or property damage. Before using hoist, person who will install, operate Or maintenance should read this manual carefully. For safe performance, Please follow all instructions and recommendations contained herein. Most important, please keep this manual for current and future usage.

(Ⅰ)Installation

1.Unpacing：
After removing the chain block from its packing carton, carefully check to be sure there has been no damages during shipment.

2. Installation：
(A) First to be sure the mounting Support, including trolley, should Be designed to withstand the loads and force imposed by chain block.
(B) After mounting and before Placing in service, check the hoist for proper operation, as follows：
(1) It is important to examine the Load chain before use to ensure that there is no twist.
(2) The chain block is always Rigged to lift in a straight line from hook to hook.
(3) The upper and lower hooks Must always be free to swivel.
(C) Test running under no load. Facing warning label to the hand wheel side (opposite of name plate), pull right hand chain to raise lower hook, then pull the Left hand chain to lower the lower hook.

(Ⅱ) Operation
1. Safety rules for operation
(A) Be sure that the attachments to both Upper and lower hooks are firmly Seated in the saddles of the hooks.
(B) Sling should always seated inside the safe latch.
(C) Observe that the load chain hangs Straight from block to lower hook Without twisting.
(D) First to raise the load only enough to clear the ground lever or support, and check to be sure that brake will hold the load.
(E) Do not load the chain block Beyond the rated capacity.
(F) Do not lift people or loads over people.
(G) Do not operate chain block with other than manual power.
(H) Do not operate damage or malfunctioning chain block.
(I) Do not warp the load chain around the load.
(J) Do not leave the load suspended in the air unattended.
(K) Do not lower the hook to a point where the chain become taut between the sprocket and slack end pin.
(L) Do not drag load against floor, block design for vertical lifting only.
(M) Do not suspend a load with two hoist.
(N) Do not tie knots in the load chain, nor should bolts be used to joint it.
(O) Do not turn over lower hook of double fall model, it will arise twist of load chain.
(P) Do not allow dirt and hard grease gather in the sprocket and hand wheel.
Q) Do not lift load with the point of Hook.

2. Operation

WARNING

Since dealing with heavy load may involve unexpected danger, all the safety rules(ref. previous section) must be followed and the Operator must read and understood all the contents in this Maual.

After proper installation, the chain block is ready for normal operation. The Operator should be aware of following points while using the block.
(A) The operator must have a clear and unobstructed view of entire working
area before operating the chain block.
(B) The operator must check that the Entire working area is safe and secure before operating the chain block.
(C) The operator must be surd that the Length of load chain will allow the Load hook to rest on the lowest level on which the load rest.

(Ⅲ) Inspection：
1. Daily Inspection
Before starting daily operation, check the following：
(A) Brake mechanisms.
(B) Lubrication of load chain.
(C) Wear, damaged links or foreign Material of load chain.
(D) Damage, crack, twist, latch, Engagement and latch operation Of hook.
Any deficiencies found need to be Corrected before putting the chain block into service.

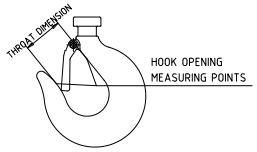
2. Periodic Inspection
For normal service, the periodic inspections are to be performed yearly.
For heavy service, the periodic inspections are to be performed semiannually.

WARNING

Only a qualify and appointed person should perform this inspection. The person who do the inspection should make records of apparent external conditions to provide the sasis for continuing evaluation.

It is necessary to disassemble the chain block for periodic inspections. The periodic inspections are to include the daily inspection items and the following.
(A) Hooks must replace when：
(1) It is opened and make the latch to Disengage the tip.
(2) Hook shows crack, deformation or Wear in excess of 5% of its original size.

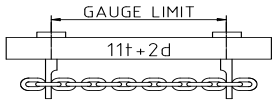
(3) If opening dimension is greater than following chart. (Measure hook throat opening per following sketch shown below



Block Capacity	New Hook Throat Dimension	Hook Opening Limit Max. Allowable
0.5T	28mm	31mm
1.0T	36mm	40mm
1.6T	38mm	42mm
2.0T	40mm	44mm
3.0-3.2T	50mm	55mm
5.0T	60mm	66mm
7.5-10T	65mm	72mm

(B)load chain should be well lubricated and remove excess .lubricant from chain.

(1) Measuring load chain and hand chain wear per following chart：



	Chain dia	No. of link to measure	New chain length (mm)	Max length allowance for service (mm)
0.5T	5.0	11	175	180
1.0T	6.3	11	221	227
1.6T	7.1	11	245	251
2.0T	8.0	11	280	287
3.0T	7.1	11	245	251
3.2-10T	10.0	11	350	360
Hand Chain	5.0	15	373	382

(2) In case the wear is within the limit, sometimes it is possible to reverse load chain, end for end, and allow a new section to take the wear.

(3) Each hand chain only allow one unwedded connecting link.

(C) Check hook block, chain guide, stripper, dead end bolt, slack end pin, shaft, gears.

(D) Inspect ratchet and pawl.

(E) Check loosing bolts, nuts, pins, or rivit.

Warning

After reassembling, and before putting into service, a non-destructive type test is recommended.

Warning

Any deficiencies found are to be corrected before hoist is return to service. Always use the chain block Manufacturer's recommended parts when repairing.

(Ⅳ) Lubrication, care and repair：

1. Lubrication

(A) Always well lubricated load chain with any available lubricant.

(B) Do not put any grease or lubricant over brake surface.

(C) When chain block is under periodic inspection or repair, following locations should be lubricated by using shell alvania epo grease or equivalent.

(1) gear
(2) chain guide
(3) load sheave
(4) hook collar
(5) hook block
(6) ratchet teeth only
(7) pawl and stud
(8) thread of hand wheel
(9) dead end bolt

2. Case

(A) Do not drop the chain block.

(B) Protect chain block from weather, water, heat and mud, etc……

(C) If chain block need more than ordinary effort to operate, it is iikely to be defective or overloaded.

(D) If load chain is jumping, not working smoothly, you should unload and do necessary inspection and maintenance or repair.

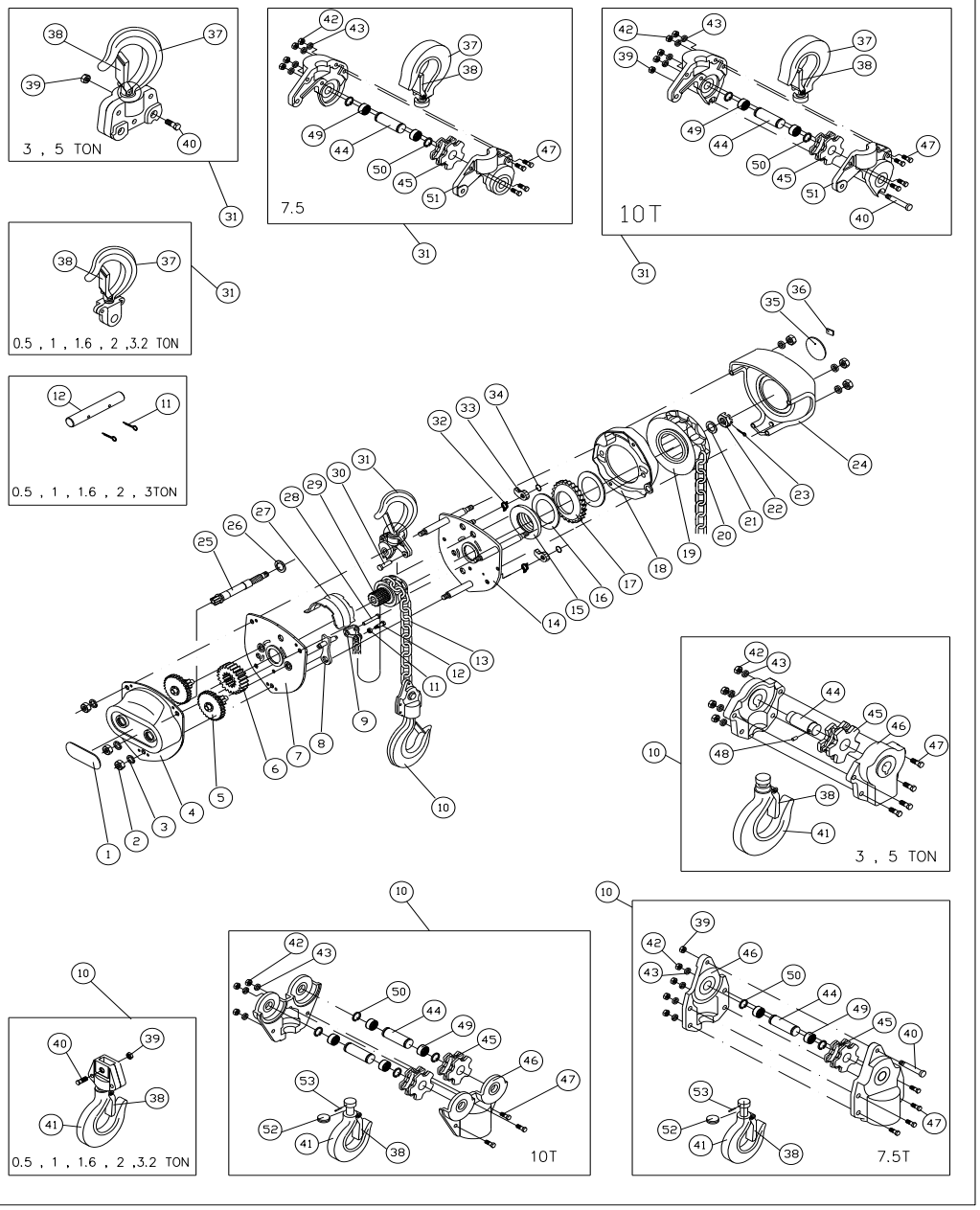
(E) Always keep chain block clean after used.

3. Repair

Warning

Only your dealer's appointed qualified person is allowed to do the repair of chain block.

(V) EXPLODED VIEW:



ㄗ n ㄘBILL OF MATERIAL ㄩ

KEY NO.	PART NO.	PART NAME	QTY REQ
1	B1903	NAME PLATE	1
2	B1421	HEX NUT	6
3	B1441	SPRING LOCK WASHER	6
4	B1201	GEAR COVER WITH BUSHINGS	1
5	B1202	2nd GEAR ASSEMBLY	2
6	B1203	4th GEAR	1
7	B1204	GEAR SIDE PLATE WITH BUSHINGS	1
8	B1205	STRIPPER ASSEMBLY	1
9	B1206	LOAD CHAIN SLACK END ANCHORAGE	1
10	B1207	LOWER HOOK ASSEMBLY	1
11	B1422	NYLON LOCK NUT	1
	B1471	CUTTER PIN	2
12	B1401	DEAD END BOLT	1
	B1208	SLACK END ANCHORAGE PIN	1
13	B1901	LOAD CHAIN	1
14	B1209	BRAKE SIDE PLATE WITH BUSHINGS	1
15	B1210	HUB	1
16	B1211	FRICTION WASHER	2
17	B1212	RATCHET	1
18	B1213	RATCHET COVER	1
19	B1214	HAND WHEEL	1
20	B1902	HAND CHAIN	1
21	B1442	FLAT WASHER	1
22	B1423	CASTLE NUT	1
23	B1472	CUTTER PIN	1
24	B1215	HAND WHEEL COVER	1
25	B1216	1st GEAR	1
26	B1217	FLAT WASHER	1

KEY NO.	PART NO.	PART NAME	QTY REQ
27	B1218	CHAIN GUIDE	1
28	B1219	SLACK END ANCHORAGE PIN	1
29	B1220	LOAD SHEAVE	1
30	B1221	UPPER HOOK PIN	1
31	B1222	UPPER HOOK ASSEMBLY	1
32	B1223	PAWL SPRING	2
33	B1224	PAWL	2
34	B1461	SNAP RING	2
35	B1904	WARING LABEL	1
36	B1905	CLASS LABEL	1
37	B1225	TOP HOOK	1
38	B1226	SAFETY LATCH ASSEMBLY	1
39	B1424	NYLON LOCK NUT	1
40	B1402	DEAD END BOLT	1
41	B1227	BOTTOM HOOK	1
42	B1425	HEX NUT	4/7/8
43	B1443	SPRING LOCK WASHER	4/7/8
44	B1228	SHEAVE SHAFE	1/2/3
45	B1229	SHEAVE WHEEL	1/2/3
46	B1230	LOWER HOOK BLOCK HALF	2
47	B1403	HEX RECESS BOLT	4/7/8
48	B1473	SPRING PIN	1
49	B1231	NEEDLE BEARING	4/6
50	B1462	SNAP RING	4/6
51	B1232	UPPER HOOK BLOCK HALF	2
52	B1233	NEEDLE BEARING	1
53	B1474	SPRING PIN	1

Appendix J

Instrumentation Data Sheets - Selected

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FLOW METER

DOC NUMBER	REV.
KPSX-EP-16290-DST-II-0009	1

BY	REV.	DESCRIPTION	DATE
SM	1	GENERAL UPDATE	11/27/2019
SM	0	FOR CONSTRUCTION	11/27/2018

SHEET 1 OF 1

DATE: 11/29/2019

C&I ENG	PROCESS	MECH/ PIPING
RM	MB	CN

PROJECT: KLIPSPRUIT EXTENSION PROJECT — PROJECT No.: 113452

GENERAL	1	Tag number	CL211-FIT-001
	2	Description	Pit H Dewatering Pump - Flow Indicating Transmitter
	3	P&ID	KPSX-EP-16290-DRG-II-PI-0001-01
	4	Line number	GP101-WP002
	*5	Manufacturer	Endress & Hauser
	*6	Model No.	Promag W 400
	7	Function	Record [ ] Indicate [X] Control [ ] Blind [ ] Transmit [X] Integrate [ ] Other [ ]
	8	Mounting	In-line [X] Clamp on [ ] Other [ ]
	9	IP rating	IP67
	10	Hazardous area class.	For use in non-hazardous areas
	11	Ex protection level[1]	N/A
	12	-	
INSTALLED ENVIRONMENT	P13	Ambient temperature	-5 ...45°C
	P14	Atmosph. conditions	Corrosive [ ] Dusty [X] Dust Precipitation [2mm/Week]
	P15	Relative Humidity	80%
PROCESS DATA	P16	Fluid code	RW
	P17	Fluid description	Raw Water
	P18	Fluid conductivity[4] *(µS/cm)*	>50 µS/cm
	P19	Fluid homogenity	N/A
	P20	Particle size *(mm)*	0mm
	P21	Specific gravity	1.0
	P22	Viscosity *(cP)*	1.0
	P23	Measurend variable	Flow
	P24	Maximum velocity *(m/s)*	1.614
	P25	Flow: Min/ Normal/ Max *(l/s)*	105 / 110 / 121
	P26	Pressure: Min/ Max *(kPa)*	400 / 700 / 850
	P27	Temperature: Min/ Max *(°C)*	5 / 25 / 45
	P28	Possible vacuum	Yes
	P29	Properties	Corrosive [ ] Abbrasive [ ] Matrial build-up [No]
	P30	pH	3.5 to 7.5
PROCESS CONNECTION	M31	Line size, schedule	300mm
	M32	Line material	Carbon Steel
	M33	Connection type, spec	Flanged, SANS 1123 Table 1600/3
	M34	Other - specify	N/A
ELEMENT	35	Element tag no.	CL211-FE-001
	*36	Element arrangement[2]	N/A
	*37	No of traverses required[3]	N/A
	38	Type	Ultrasonic [ ] Doppler [ ] Electromagentic [X] Tubine [ ] Coriolis [ ]
	*39	Model No.	N/A
	*40	Tube material	Stainless Steel 1.4301
	*41	Liner	Hard rubber
	*42	Electrode type	Standard
	*43	Electrode material	Standard
	44	Grounding rings[3]	1.4435/316L
	*45	Measurement range	666.67 l/s
	*46	Operating pressure range	0…….1600kPa
	*47	Operating temp range	0…….80°C
	*48	Temperature compensation	N/A
	49	Cable length	15 meters
TRANSMITTER	*50	Model No.	Promag W 400
	51	Power supply	Auxilliary power, 110 VAC, 50Hz
	*52	Unit power consumption	15 VA
	53	Electrical connection	M20 x 1,5
	54	Accuracy	< 0,5%
	55	Output	4…20 mA isolated
	56	Local display	Multi-line digital display
	57	Calibrated range	**0....125 l/s**
	58	Communication	HART [X] Profibus DP [ ] Profibus PA [ ] Other
	59	Mounting	Compact [ ] Remote [X]
	60	Reverse flow indication	Yes
	61	Surge protection	Signal and power lines, 1kA (10/350) µS/cm, 20 kA (8/20) µS/cm
SWITCH	62	Programmable outputs	Totalizer
	63	Contract type / rating	Potential free contact, 2 A @ 230 VAC
	64	No of outputs	Standard

NOTES

1. Transmitter to be remote version for wall-mount housing

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LEVEL INSTRUMENT

DOC NUMBER	REV.
KPSX-EP-16290-DST-II-0010	0

BY	REV.	DESCRIPTION	DATE
SM	0	FOR CONSTRUCTION	11/30/2018

SHEET 1 OF 1 — DATE: 12/4/2018

C&I ENG	PROCESS	MECH/ PIPING
SM	LS	RM

PROJECT: KLIPSPRUIT EXTENSION PROJECT — PROJECT No.: 113452

GENERAL	1	Tag number	CL211-LIT-001	A
	2	Description	PCD 1 Dam - Level Indication Transmitter	A
	3	P&ID	KPSX-EP-16290-DRG-II-PI-0001-01	A
	4	Application	Level Monitoring	A
	5	Vessel number / Material	CL211	A
	M6	Vessel int. ø / Height	N/A | 7272mm	A
	7	Vessel orientation / Type	Vertical	A
	8	Line number / Schedule	N/A	A
	9	Line size / Material	N/A	A
	*10	Manufacturer / Vendor	**Vega Controls**	A
	*11	Model No.	**VEGAPULS WL S61**	A
	12	Function	Record [ ] Indicate [X] Control [ ] Blind [ ] Transmit [X] Integrate [ ] Other [ ]	0
	13	Mounting	Flush [ ] Surface [ ] Yoke [ ] Flanged [ ] Other [X] Thread G1½A	A
	14	IP rating	IP 66	A
	15	Hazardous area class.	N/A	A
	16	Ex protection level[1]	N/A	A
	17	-		A
				A
INSTALLED ENVIRONMENT	P18	Ambient temperature	-5.....45°C	0
	P19	Atmosph. conditions	Corrosive [ ] Dusty [X] Dust Precipitation 2mm/Week	0
	P20	Relative Humidity	80%	0
				A
PROCESS DATA	P21	Fluid code	RW	0
	P22	Fluid description	RAW WATER	0
	P23	Process di-electric constant	N/A	0
	P24	Specific gravity	1.0	0
	P25	Viscosity (cP)	1.0	0
	P26	Particle size (mm)	N/A	A
	P27	Level: Min/ Normal/ Max	450mm | 2500mm | 7200mm	0
	P28	Pressure: Min/ Max	0kPa | 0kPa | 0kPa	A
	P29	Temperature: Min/ Max	Ambient | Ambient | Ambient	0
	P30	Measurement conditions	Normal	A
	P31	Possible vacuum	N/A	A
	P32	Properties	Corrosive [No] Abbrasive [No] Matrial build-up [N/A]	0
	P33	pH	3.5 to 7.5	A
	P34	-		A
				A
ELEMENT	35	Element tag no.	N/A	A
	36	Type	Ultrasonic [ ] Radar [X] Capacitive [ ] Laser [ ] Other ad G1½A	0
	*37	Model No.	N/A	A
	*38	Material	PBT	A
	*39	Measurement range	0....8m	A
	*40	Beam angle	10°	A
	*41	Blocking distance	250mm	A
	M42	Process connection	Thread G1½A	A
	M43	Mounting position / Location	Top	A
	*44	Operating pressure range	-100 … +200 kPa	A
	*45	Operating temp range	-40 … +60 °C	A
	46	Temperature compensation	N/A	A
	47	Cable length	12m	A
	48	Orient. Install. kit / * connect.	N/A	A
				A
TRANSMITTER	*49	Model No.	VEGAPULS WL S61	A
	50	Power supply	24VDC Loop Powered	A
	*51	Unit power consumption	N/A	A
	52	Electrical connection	M20 x 1,5	A
	53	Accuracy	< 5 mm	A
	54	Output	4…20 mA isolated	A
	55	Local display	VEGADIS 82	A
	56	Calibrated range	0....7000mm	0
	57	Communication	HART [X] Profibus DP [ ] Profibus PA [ ] Other	0
	58	Mounting	Compact [X] Remote [ ]	0
	59	Surge protection	Signal and power lines, 1kA (10/350) µS/cm, 20 kA (8/20) µS/cm	0
				0
SWITCH	60	Programmable outputs	N/A	0
	61	Contract type / rating	N/A	0
	62	No of outputs	N/A	0

NOTES 1.

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LEVEL INSTRUMENT

DOC NUMBER	REV.
KPSX-EP-16290-DST-II-0012	0

BY	REV.	DESCRIPTION	DATE
SM	0	FOR CONSTRUCTION	11/30/2018

SHEET 1 OF 1 — DATE: 12/4/2018

C&I ENG	PROCESS	MECH/ PIPING
SM	LS	RM

PROJECT: KLIPSPRUIT EXTENSION PROJECT — PROJECT No.: 113452

GENERAL	1	Tag number	CL211-LIT-003	A
	2	Description	PCD 1 Dam - Level Indication Transmitter	A
	3	P&ID	KPSX-EP-16290-DRG-II-PI-0001-01	A
	4	Application	Level Monitoring	A
	5	Vessel number / Material	CL211	A
	M6	Vessel int. ø / Height	N/A | 7272mm	A
	7	Vessel orientation / Type	Vertical	A
	8	Line number / Schedule	N/A	A
	9	Line size / Material	N/A	A
	*10	Manufacturer / Vendor	**Vega Controls**	A
	*11	Model No.	**VEGAPULS WL S61**	A
	12	Function	Record [ ] Indicate [X] Control [ ] Blind [ ] Transmit [X] Integrate [ ] Other [ ]	0
	13	Mounting	Flush [ ] Surface [ ] Yoke [ ] Flanged [ ] Other [X] Thread G1½A	A
	14	IP rating	IP 66	A
	15	Hazardous area class.	N/A	A
	16	Ex protection level[1]	N/A	A
	17	-		A
				A
INSTALLED ENVIRONMENT	P18	Ambient temperature	-5.....45°C	0
	P19	Atmosph. conditions	Corrosive [ ] Dusty [X] Dust Precipitation 2mm/Week	0
	P20	Relative Humidity	80%	0
				A
PROCESS DATA	P21	Fluid code	RW	0
	P22	Fluid description	RAW WATER	0
	P23	Process di-electric constant	N/A	0
	P24	Specific gravity	1.0	0
	P25	Viscosity (cP)	1.0	0
	P26	Particle size (mm)	N/A	A
	P27	Level: Min/ Normal/ Max	100mm | 500mm | 1500mm	0
	P28	Pressure: Min/ Max	0kPa | 0kPa | 0kPa	A
	P29	Temperature: Min/ Max	Ambient | Ambient | Ambient	0
	P30	Measurement conditions	Normal	A
	P31	Possible vacuum	N/A	A
	P32	Properties	Corrosive [No] Abbrasive [No] Matrial build-up [N/A]	0
	P33	pH	3.5 to 7.5	A
	P34	-		A
				A
ELEMENT	35	Element tag no.	N/A	A
	36	Type	Ultrasonic [ ] Radar [X] Capacitive [ ] Laser [ ] Other ad G1½A	0
	*37	Model No.	N/A	A
	*38	Material	PBT	A
	*39	Measurement range	0....8m	A
	*40	Beam angle	10°	A
	*41	Blocking distance	250mm	A
	M42	Process connection	Thread G1½A	A
	M43	Mounting position / Location	Top	A
	*44	Operating pressure range	-100 … +200 kPa	A
	*45	Operating temp range	-40 … +60 °C	A
	46	Temperature compensation	N/A	A
	47	Cable length	12m	A
	48	Orient. Install. kit / * connect.	N/A	A
				A
TRANSMITTER	*49	Model No.	VEGAPULS WL S61	A
	50	Power supply	24VDC Loop Powered	A
	*51	Unit power consumption	N/A	A
	52	Electrical connection	M20 x 1,5	A
	53	Accuracy	< 5 mm	A
	54	Output	4…20 mA isolated	A
	55	Local display	VEGADIS 82	A
	56	Calibrated range	0....2000mm	0
	57	Communication	HART [X] Profibus DP [ ] Profibus PA [ ] Other	0
	58	Mounting	Compact [X] Remote [ ]	0
	59	Surge protection	Signal and power lines, 1kA (10/350) µS/cm, 20 kA (8/20) µS/cm	0
				0
SWITCH	60	Programmable outputs	N/A	0
	61	Contract type / rating	N/A	0
	62	No of outputs	N/A	0

NOTES 1.

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LEVEL INSTRUMENT

DOC NUMBER	REV.
KPSX-EP-16290-DST-II-0014	0

BY	REV.	DESCRIPTION	DATE
SM	0	FOR CONSTRUCTION	11/30/2018

SHEET 1 OF 1 — DATE: 12/4/2018

C&I ENG	PROCESS	MECH/ PIPING
SM	LS	RM

PROJECT: KLIPSPRUIT EXTENSION PROJECT — PROJECT No.: 113452

GENERAL	1	Tag number	CL214-LIT-001	A
	2	Description	PCD 1 Leak Detection Sump - Level Indication Transmitter	A
	3	P&ID	KPSX-EP-16290-DRG-II-PI-0001-01	A
	4	Application	Level Monitoring	A
	5	Vessel number / Material	CL214	A
	M6	Vessel int. ø / Height	N/A | 3560mm	A
	7	Vessel orientation / Type	Vertical	A
	8	Line number / Schedule	N/A	A
	9	Line size / Material	N/A	A
	*10	Manufacturer / Vendor	**Vega Controls**	A
	*11	Model No.	**VEGAPULS WL S61**	A
	12	Function	Record [ ] Indicate [X] Control [ ] Blind [ ] Transmit [X] Integrate [ ] Other [ ]	0
	13	Mounting	Flush [ ] Surface [ ] Yoke [ ] Flanged [ ] Other [X] Thread G1½A	A
	14	IP rating	IP 66	A
	15	Hazardous area class.	N/A	A
	16	Ex protection level[1]	N/A	A
	17	-		A
				A
INSTALLED ENVIRONMENT	P18	Ambient temperature	-5.....45°C	0
	P19	Atmosph. conditions	Corrosive [ ] Dusty [X] Dust Precipitation 2mm/Week	0
	P20	Relative Humidity	80%	0
				A
PROCESS DATA	P21	Fluid code	RW	0
	P22	Fluid description	RAW WATER	0
	P23	Process di-electric constant	N/A	0
	P24	Specific gravity	1.0	0
	P25	Viscosity (cP)	1.0	0
	P26	Particle size (mm)	N/A	A
	P27	Level: Min/ Normal/ Max	450mm | 2500mm | 3560mm	0
	P28	Pressure: Min/ Max	0kPa | 0kPa | 0kPa	A
	P29	Temperature: Min/ Max	Ambient | Ambient | Ambient	0
	P30	Measurement conditions	Normal	A
	P31	Possible vacuum	N/A	A
	P32	Properties	Corrosive [No] Abbrasive [No] Matrial build-up [N/A]	0
	P33	pH	3.5 to 7.5	0
	P34	-		A
				A
ELEMENT	35	Element tag no.	N/A	A
	36	Type	Ultrasonic [ ] Radar [X] Capacitive [ ] Laser [ ] Other ad G1½A	0
	*37	Model No.	N/A	A
	*38	Material	PBT	A
	*39	Measurement range	0....8m	A
	*40	Beam angle	10°	A
	*41	Blocking distance	250mm	A
	M42	Process connection	Thread G1½A	A
	M43	Mounting position / Location	Top	A
	*44	Operating pressure range	-100 … +200 kPa	A
	*45	Operating temp range	-40 … +60 °C	A
	46	Temperature compensation	N/A	A
	47	Cable length	12m	A
	48	Orient. Install. kit / * connect.	N/A	A
				A
TRANSMITTER	*49	Model No.	VEGAPULS WL S61	A
	50	Power supply	24VDC Loop Powered	A
	*51	Unit power consumption	N/A	A
	52	Electrical connection	M20 x 1,5	A
	53	Accuracy	< 5 mm	A
	54	Output	4…20 mA isolated	A
	55	Local display	VEGADIS 82	A
	56	Calibrated range	0....3560mm	0
	57	Communication	HART [X] Profibus DP [ ] Profibus PA [ ] Other	0
	58	Mounting	Compact [X] Remote [ ]	0
	59	Surge protection	Signal and power lines, 1kA (10/350) µS/cm, 20 kA (8/20) µS/cm	0
				0
SWITCH	60	Programmable outputs	N/A	0
	61	Contract type / rating	N/A	0
	62	No of outputs	N/A	0

NOTES 1.

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FLOW METER

DOC NUMBER	REV.
KPSX-EP-16290-DST-II-0017	1

BY	REV.	DESCRIPTION	DATE
LS	1	GENERAL UPDATE	11/27/2019
SM	0	FOR CONSTRUCTION	11/27/2018

SHEET 1 OF 1

DATE: 11/29/2019

C&I ENG	PROCESS	MECH/ PIPING
RM	MB	CN

PROJECT: KLIPSPRUIT EXTENSION PROJECT — PROJECT No.: 113452

GENERAL	1	Tag number	GP211-FIT-001
	2	Description	PCD 1 to Filling Point 2 - Flow Indicating Transmitter
	3	P&ID	KPSX-EP-16290-DRG-II-PI-0001-02
	4	Line number	GP211-WP002
	*5	Manufacturer	Endress & Hauser
	*6	Model No.	Promag W 400
	7	Function	Record [ ] Indicate [X] Control [ ] Blind [ ] Transmit [X] Integrate [ ] Other [ ]
	8	Mounting	In-line [X] Clamp on [ ] Other [ ]
	9	IP rating	IP67
	10	Hazardous area class.	For use in non-hazardous areas
	11	Ex protection level[1]	N/A
	12	-	
INSTALLED ENVIRONMENT	P13	Ambient temperature	-5 ...45°C
	P14	Atmosph. conditions	Corrosive [ ] Dusty [X] Dust Precipitation [2mm/Week]
	P15	Relative Humidity	80%
PROCESS DATA	P16	Fluid code	RW
	P17	Fluid description	Raw Water
	P18	Fluid conductivity[4] *(µS/cm)*	>50 µS/cm
	P19	Fluid homogenity	N/A
	P20	Particle size *(mm)*	0mm
	P21	Specific gravity	1.0
	P22	Viscosity *(cP)*	1.0
	P23	Measurend variable	Flow
	P24	Maximum velocity *(m/s)*	1.866
	P25	Flow: Min/ Normal/ Max *(l/s)*	47 / 53 / 61
	P26	Pressure: Min/ Max *(kPa)*	150 / 200 / 250
	P27	Temperature: Min/ Max *(°C)*	5 / 25 / 45
	P28	Possible vacuum	Yes
	P29	Properties	Corrosive [ ] Abbrasive [ ] Matrial build-up [No]
	P30	pH	3.5 to 7.5
PROCESS CONNECTION	M31	Line size, schedule	200mm
	M32	Line material	Carbon Steel
	M33	Connection type, spec	Flanged, SANS 1123 Table 1600/3
	M34	Other - specify	N/A
ELEMENT	35	Element tag no.	GP211-FE-001
	*36	Element arrangement[2]	N/A
	*37	No of traverses required[3]	N/A
	38	Type	Ultrasonic [ ] Doppler [ ] Electromagentic [X] Tubine [ ] Coriolis [ ]
	*39	Model No.	N/A
	*40	Tube material	Stainless Steel 1.4301
	*41	Liner	Hard rubber
	*42	Electrode type	Standard
	*43	Electrode material	Standard
	44	Grounding rings[3]	1.4435/316L
	*45	Measurement range	305.56 l/s
	*46	Operating pressure range	0…….1600kPa
	*47	Operating temp range	0…….80°C
	*48	Temperature compensation	N/A
	49	Cable length	15 meters
TRANSMITTER	*50	Model No.	Promag W 400
	51	Power supply	Auxilliary power, 110 VAC, 50Hz
	*52	Unit power consumption	15 VA
	53	Electrical connection	M20 x 1,5
	54	Accuracy	< 0,5%
	55	Output	4…20 mA isolated
	56	Local display	Multi-line digital display
	57	Calibrated range	**0....75 l/s**
	58	Communication	HART [X] Profibus DP [ ] Profibus PA [ ] Other
	59	Mounting	Compact [ ] Remote [X]
	60	Reverse flow indication	Yes
	61	Surge protection	Signal and power lines, 1kA (10/350) µS/cm, 20 kA (8/20) µS/cm
SWITCH	62	Programmable outputs	Totalizer
	63	Contract type / rating	Potential free contact, 2 A @ 230 VAC
	64	No of outputs	Standard

NOTES

1. Transmitter to be remote version for wall-mount housing

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FLOW METER

DOC NUMBER	REV.
KPSX-EP-16290-DST-II-0020	1

BY	REV.	DESCRIPTION	DATE
LS	1	GENERAL UPDATE	11/27/2019
SM	0	FOR CONSTRUCTION	11/27/2018

SHEET 1		DATE
OF 1		11/29/2019
C&I ENG	PROCESS	MECH/ PIPING
RM	MB	CN

PROJECT	KLIPSPRUIT EXTENSION PROJECT	PROJECT No.	113452

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FLOW METER

DOC NUMBER	REV.
KPSX-EP-16290-DST-II-0023	1

BY	REV.	DESCRIPTION	DATE
LS	1	GENERAL UPDATE	11/27/2019
SM	0	FOR CONSTRUCTION	11/27/2018

SHEET 1 OF 1

DATE: 11/29/2019

C&I ENG	PROCESS	MECH/ PIPING
RM	MB	CN

PROJECT: KLIPSPRUIT EXTENSION PROJECT — PROJECT No.: 113452

GENERAL	1	Tag number	GP213-FIT-001
	2	Description	PCD 1 to KPS Buffer Dam - Flow Indicating Transmitter
	3	P&ID	KPSX-EP-16290-DRG-II-PI-0001-02
	4	Line number	GP213-WP001
	*5	Manufacturer	Endress & Hauser
	*6	Model No.	Promag W 400
	7	Function	Record [ ] Indicate [X] Control [ ] Blind [ ] Transmit [X] Integrate [ ] Other [ ]
	8	Mounting	In-line [X] Clamp on [ ] Other [ ]
	9	IP rating	IP67
	10	Hazardous area class.	For use in non-hazardous areas
	11	Ex protection level[1]	N/A
	12	-	
INSTALLED ENVIRONMENT	P13	Ambient temperature	-5 ...45°C
	P14	Atmosph. conditions	Corrosive [ ] Dusty [X] Dust Precipitation 2mm/Week
	P15	Relative Humidity	80%
PROCESS DATA	P16	Fluid code	RW
	P17	Fluid description	Raw Water
	P18	Fluid conductivity[4] *(µS/cm)*	>50 µS/cm
	P19	Fluid homogenity	N/A
	P20	Particle size *(mm)*	0mm
	P21	Specific gravity	1.0
	P22	Viscosity *(cP)*	1.0
	P23	Measurend variable	Flow
	P24	Maximum velocity *(m/s)*	1.787
	P25	Flow: Min/ Normal/ Max *(l/s)*	119 / 122 / 134
	P26	Pressure: Min/ Max *(kPa)*	1000 / 1200 / 1250
	P27	Temperature: Min/ Max *(°C)*	5 / 25 / 45
	P28	Possible vacuum	Yes
	P29	Properties	Corrosive [ ] Abbrasive [ ] Matrial build-up No
	P30	pH	3.5 to 7.5
PROCESS CONNECTION	M31	Line size, schedule	300mm
	M32	Line material	Carbon Steel
	M33	Connection type, spec	Flanged, SANS 1123 Table 1600/3
	M34	Other - specify	N/A
ELEMENT	35	Element tag no.	GP213-FE-001
	*36	Element arrangement[2]	N/A
	*37	No of traverses required[3]	N/A
	38	Type	Ultrasonic [ ] Doppler [ ] Electromagentic [X] Tubine [ ] Coriolis [ ]
	*39	Model No.	N/A
	*40	Tube material	Stainless Steel 1.4301
	*41	Liner	Hard rubber
	*42	Electrode type	Standard
	*43	Electrode material	Standard
	44	Grounding rings[3]	1.4435/316L
	*45	Measurement range	666.67 l/s
	*46	Operating pressure range	0…….1600kPa
	*47	Operating temp range	0…….80°C
	*48	Temperature compensation	N/A
	49	Cable length	15 meters
TRANSMITTER	*50	Model No.	Promag W 400
	51	Power supply	Auxilliary power, 110 VAC, 50Hz
	*52	Unit power consumption	15 VA
	53	Electrical connection	M20 x 1,5
	54	Accuracy	< 0,5%
	55	Output	4…20 mA isolated
	56	Local display	Multi-line digital display
	57	Calibrated range	**0....140 l/s**
	58	Communication	HART [X] Profibus DP [ ] Profibus PA [ ] Other
	59	Mounting	Compact [ ] Remote [X]
	60	Reverse flow indication	Yes
	61	Surge protection	Signal and power lines, 1kA (10/350) µS/cm, 20 kA (8/20) µS/cm
SWITCH	62	Programmable outputs	Totalizer
	63	Contract type / rating	Potential free contact, 2 A @ 230 VAC
	64	No of outputs	Standard

NOTES

1. Transmitter to be remote version for wall-mount housing

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FLOW SWITCH

DOCUMENT NUMBER	REV.
KPSX-EP-16290-DST-II-0037	01

BY	REV	NAME	DATE
SM	01	GENERAL UPDATE	3/12/2019
SM	0	FOR CONSTRUCTION	11/30/2018

SHEET 1 OF 1 — DATE: 3/13/2019

C&I ENG	PROCESS	MECH/ PIPING
RM	MB	CN

PROJECT: KLIPSPRUIT EXTENSION PROJECT — PROJECT No.: 113452

Instrument Tag No.	Description	Line No	Line Size (mm)	P&ID	Rev No
GP211-FSL-001	Raw Water Pump GP211 Discharge- Flow Switch Low	GP211-WP002	200	KPSX-EP-16290-DRG-II-PI-0001-02	A

GENERAL	*1	Manufacturer			**IFM**					A
	*2	Model No.			**SI5000**					A
	3	Function			Flow Monitor					A
	4	Mounting			Inline					A
	5	IP rating			IP67					A
	6	Hazardous area class.			N/A					A
	7	Ex protection level1			N/A					A
	8	Required SIL rating			N/A					A
	9	Line Material			Carbon Steel					A
INSTALLED ENVIRONMENT	P10	Ambient temperature for operation			-5....45°C					A
	P11	Atmospheric conditions			Corrosive	**Yes**	Dusty	**X**	Dust precipitation	A
	P12	Relative Humidity			80%					A
SWITCH CHARACTERISTICS	13	Enclosure material			Stainless Steel 316L					A
	*14	Mechanism			N/A					A
	15	Setpoint			**48 cm/s**					A
	16	Local display (Yes / No)	Adjustable set point		LED's		Yes			A
	*17	Smart / Communication			N/A					A
	M18	Remote / Compact			Compact					A
	M19	Fail safe			N/A					A
	20	Range			3....300 cm/s					A
ELEMENT CHARACTERISTICS	21	Element material			316SS					A
	22	Type / Probe insertion depth			Thermal Dispersion		45mm			A
	*23	Response time from flow to no flow			Adjustable					A
	*24	Response time from no flow to flow			Adjustable					A
	*25	Accuracy			±2....±5 cm/s					A
	*26	Repeatibility			1...5 cm/s					A
	27	Process Connection / Process connection material			ADAPTER M18x1,5 - G 1/2		316L SS			01
	28	Temperature element			N/A					A
PROCESS DATA	P29	Fulid code		-	RW					A
	P30	Fluid desc.		-	RAW WATER					A
	P31	Specific gravity	Fluid pH	-	1.0		3.5 to 7.5			01
	P32	Viscosity		cP	1.0					A
	P33	Flow Min / Max		l/s	40		90			A
	P34	Temperature Min / Max		ºC	-5		45			A
	P35	Pressure Min / Max		kPa	0		250			A
	P36	Max solid particle content (%)		%	N/A					A
	P37	Particle Size		mm	0					A
	P38	Maximum Velocity		cm/s	286					A
ELECTRICAL CHARACTERISTICS	39	Power supply			24VDC					A
	40	Contact rating			PNP					A
	*41	Unit power consumption			<60mA					A
	42	Isolation voltage			N/A					A
	43	Conductor termination			N/A					A
	44	Type and quantity of contacts			1 PNP SWITCH					A
	45	Cable entry			M12 Plug					A
	46									<<

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NOTES
1. Instrument to be supplied with a stainless steel tag
2.

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FLOW SWITCH

DOCUMENT NUMBER	REV.
KPSX-EP-16290-DST-II-0038	01

BY	REV	NAME	DATE
SM	01	GENERAL UPDATE	3/12/2019
SM	0	FOR CONSTRUCTION	11/30/2018

SHEET 1 OF 1 — DATE: 3/13/2019

C&I ENG	PROCESS	MECH/ PIPING
RM	MB	CN

PROJECT: KLIPSPRUIT EXTENSION PROJECT — PROJECT No.: 113452

Instrument Tag No.	Description	Line No	Line Size (mm)	P&ID	Rev No
GP212A-FSL-001	Raw Water Pump GP212A discharge- Flow Switch Low	GP212A-WP002	250	KPSX-EP-16290-DRG-II-PI-0001-02	A
GP212B-FSL-001	Raw Water Pump GP212B discharge- Flow Switch Low	GP212B-WP002	250	KPSX-EP-16290-DRG-II-PI-0001-02	A

GENERAL	*1	Manufacturer			**IFM**				A
	*2	Model No.			**SI5000**				A
	3	Function			Flow Monitor				A
	4	Mounting			Inline				A
	5	IP rating			IP67				A
	6	Hazardous area class.			N/A				A
	7	Ex protection level1			N/A				A
	8	Required SIL rating			N/A				A
	9	Line Material			Carbon Steel				A
INSTALLED ENVIRONMENT	P10	Ambient temperature for operation			-5....45°C				A
	P11	Atmospheric conditions			Corrosive	**Yes**	Dusty	**X**	Dust precipitation		A
	P12	Relative Humidity			80%						A
SWITCH CHARACTERISTICS	13	Enclosure material			Stainless Steel 316L				A
	*14	Mechanism			N/A				A
	15	Setpoint			**61 cm/s**				A
	16	Local display (Yes / No)	Adjustable set point		LED's		Yes		A
	*17	Smart / Communication			N/A				A
	M18	Remote / Compact			Compact				A
	M19	Fail safe			N/A				A
	20	Range			3....300 cm/s				A
ELEMENT CHARACTERISTICS	21	Element material			316SS				A
	22	Type / Probe insertion depth			Thermal Dispersion		45mm		A
	*23	Response time from flow to no flow			Adjustable				A
	*24	Response time from no flow to flow			Adjustable				A
	*25	Accuracy			±2....±5 cm/s				A
	*26	Repeatibility			1...5 cm/s				A
	27	Process Connection / Process connection material			ADAPTER M18x1,5 - G 1/2		316L SS		01
	28	Temperature element			N/A				A

PROCESS DATA	P29	Fulid code		-	RW		A
	P30	Fluid desc.		-	RAW WATER		A
	P31	Specific gravity	Fluid pH	-	1.0	3.5 to 7.5	01
	P32	Viscosity		cP	1.0		A
	P33	Flow Min / Max		l/s	70	150	A
	P34	Temperature Min / Max		ºC	-5	45	A
	P35	Pressure Min / Max		kPa	0	550	A
	P36	Max solid particle content (%)		%	N/A		A
	P37	Particle Size		mm	0		A
	P38	Maximum Velocity		cm/s	305		A

ELECTRICAL CHARACTERISTICS	39	Power supply	24VDC		A
	40	Contact rating	PNP		A
	*41	Unit power consumption	<60mA		A
	42	Isolation voltage	N/A		A
	43	Conductor termination	N/A		A
	44	Type and quantity of contacts	1 PNP SWITCH		A
	45	Cable entry	M12 Plug		A
	46				<<

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NOTES
1. Instrument to be supplied with a stainless steel tag
2.

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FLOW SWITCH

DOCUMENT NUMBER	REV.
KPSX-EP-16290-DST-II-0039	01

BY	REV	NAME	DATE
SM	01	GENERAL UPDATE	3/12/2019
SM	0	FOR CONSTRUCTION	11/30/2018

SHEET 1 OF 1 — DATE: 3/13/2019

C&I ENG	PROCESS	MECH/ PIPING
RM	MB	CN

PROJECT: KLIPSPRUIT EXTENSION PROJECT — PROJECT No.: 113452

Instrument Tag No.	Description	Line No	Line Size (mm)	P&ID	Rev No
GP213A-FSL-001	Raw Water Pump GP213A discharge- Flow Switch Low	GP213A-WP002	300	KPSX-EP-16290-DRG-II-PI-0001-02	A
GP213B-FSL-001	Raw Water Pump GP213B discharge- Flow Switch Low	GP213B-WP002	300	KPSX-EP-16290-DRG-II-PI-0001-02	A

GENERAL	*1	Manufacturer			**IFM**				A
	*2	Model No.			**SI5000**				A
	3	Function			Flow Monitor				A
	4	Mounting			Inline				A
	5	IP rating			IP67				A
	6	Hazardous area class.			N/A				A
	7	Ex protection level1			N/A				A
	8	Required SIL rating			N/A				A
	9	Line Material			Carbon Steel				A
INSTALLED ENVIRONMENT	P10	Ambient temperature for operation			-5....45°C				A
	P11	Atmospheric conditions			Corrosive	**Yes**	Dusty	**X**	A
	P12	Relative Humidity			80%				A
SWITCH CHARACTERISTICS	13	Enclosure material			Stainless Steel 316L				A
	*14	Mechanism			N/A				A
	15	Setpoint			**64 cm/s**				A
	16	Local display (Yes / No)	Adjustable set point		LED's		Yes		A
	*17	Smart / Communication			N/A				A
	M18	Remote / Compact			Compact				A
	M19	Fail safe			N/A				A
	20	Range			3....300 cm/s				A
ELEMENT CHARACTERISTICS	21	Element material			316SS				A
	22	Type / Probe insertion depth			Thermal Dispersion		45mm		A
	*23	Response time from flow to no flow			Adjustable				A
	*24	Response time from no flow to flow			Adjustable				A
	*25	Accuracy			±2....±5 cm/s				A
	*26	Repeatibility			1...5 cm/s				A
	27	Process Connection / Process connection material			ADAPTER M18x1,5 - G 1/2		316L SS		01
	28	Temperature element			N/A				A

PROCESS DATA	P29	Fulid code		-	RW		A
	P30	Fluid desc.		-	RAW WATER		A
	P31	Specific gravity	Fluid pH	-	1.0	3.5 to 7.5	01
	P32	Viscosity		cP	1.0		A
	P33	Flow Min / Max		l/s	100	200	A
	P34	Temperature Min / Max		°C	-5	45	A
	P35	Pressure Min / Max		kPa	0	1250	A
	P36	Max solid particle content (%)		%	N/A		A
	P37	Particle Size		mm	0		A
	P38	Maximum Velocity		cm/s	283		A

ELECTRICAL CHARACTERISTICS	39	Power supply	24VDC		A
	40	Contact rating	PNP		A
	*41	Unit power consumption	<60mA		A
	42	Isolation voltage	N/A		A
	43	Conductor termination	N/A		A
	44	Type and quantity of contacts	1 PNP SWITCH		A
	45	Cable entry	M12 Plug		A
	46				<<

<<

NOTES
1. Instrument to be supplied with a stainless steel tag
2.

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Appendix K

List of Drawings

LIST OF DRAWINGS	
DRAWING NUMBER	**TITLE**
(01) KPSX-EP-16260-DRG-WW-GA-0101-01	PCD 4-PCD 4 INFRASTRUCTURE-GENERAL ARRANGEMENT
(02) KPSX-EP-16260-DRG-WW-LY-0101-01	PCD 4-BULK EARTHWORKS-FINAL EMANKMENT SETTING OUT DETAILS
(03) KPSX-EP-16260-DRG-WW-SE-0110-01	PCD 4-GEOTECHNCIAL FEATURES-SOIL PROFILES
(04) KPSX-EP-16260-DRG-WW-SE-0101-01	PCD 4-POLLUTION CONTROL DAM 4-DAM CROSS SECTIONS
(05) KPSX-EP-16260-DRG-WW-LY-0110-01	PCD 4-BULK EARTHWORKS-BULK EXCAVATION - SETTING OUT DETAILS
(06) KPSX-EP-16260-DRG-WW-LY-0102-01	PCD 4-BULK EARTHWORKS-EMBANKMENT SECTIONS LAYOUT
(07) KPSX-EP-16260-DRG-WW-SE-0102-01	PCD 4-BULK EARTHWORKS-EMBANKMENT SECTIONS LAYOUT
(08) KPSX-EP-16260-DRG-WW-DE-0102-01	POLLUTION CONTROL DAMS-TYPICAL DETAIL-TYPICAL EMBANKMENT DETAIL
(09) KPSX-EP-16260-DRG-WW-DE-0102-02	POLLUTION CONTROL DAMS-TYPICAL DETAIL-TYPICAL EMBANKMENT DETAIL
(10) KPSX-EP-16260-DRG-WW-DE-0103-01	POLLUTION CONTROL DAMS-TYPICAL DETAIL-LINING DETAIL
(11) KPSX-EP-16260-DRG-WW-DE-0104-01	POLLUTION CONTROL DAMS-TYPICAL DETAIL-LINING FIXING DETAIL
(12) KPSX-EP-16260-DRG-WW-GA-0120-01	PCD 4-PUMP STATION INTAKE STRUCTURE-GENERAL ARRANGEMENT
(13) KPSX-EP-16260-DRG-WW-LY-0123-01	PCD 4-PUMP INTAKE STRUCTURE-LAYOUT, SECTIONS AND SETTING OUT DETAILS
(14) KPSX-EP-16260-DRG-WW-DE-0121-01	PCD 4-PUMP STATION INTAKE STRUCTURE-LAYOUTS, SECTIONS AND DETAILS
(15) KPSX-EP-16260-DRG-WW-DE-0121-02	PCD 4-PUMP STATION INTAKE STRUCTURE-LAYOUTS, SECTIONS AND DETAILS
(16) KPSX-EP-16260-DRG-WW-DE-0121-03	PCD 4-PUMP STATION INTAKE STRUCTURE-LAYOUTS, SECTIONS AND DETAILS
(17) KPSX-EP-16260-DRG-WW-DE-0121-04	PCD 4-PUMP STATION INTAKE STRUCTURE-LAYOUTS, SECTIONS AND DETAILS
(18) KPSX-EP-16260-DRG-WW-DE-0122-01	PCD 4-PUMP STATION INTAKE STRUCTURE-MECHANICAL DETAILS
(19) KPSX-EP-16260-DRG-WW-DE-0122-02	PCD 4-PUMP STATION INTAKE STRUCTURE-MECHANICAL DETAILS
(20) KPSX-EP-16260-DRG-WW-DE-0122-03	PCD 4-PUMP STATION INTAKE STRUCTURE-MECHANICAL DETAILS
(21) KPSX-EP-16260-DRG-WW-DE-0123-01	PCD 4-PUMP STATION INTAKE STRUCTURE-ACCESS PLATFORM AND BRIDGE
(22) KPSX-EP-16260-DRG-WW-DE-0124-01	PCD 4-PUMP INTAKE STRUCTURE-LEVEL INSTRUMENTATION PIPE FIXING DETAILS

LIST OF DRAWINGS	
DRAWING NUMBER	**TITLE**
(23) KPSX-EP-16260-DRG-WW-DE-0182-01	PCD 4-PCD ACCESS STAIRCASE-LAYOUT AND DETAILS
(24) KPSX-EP-16260-DRG-WW-DE-0182-02	PCD 4-PCD ACCESS STAIRCASE-LAYOUT AND DETAILS
(25) KPSX-EP-16260-DRG-WW-DE-0182-03	PCD 4-PCD ACCESS STAIRCASE-LAYOUT AND DETAILS
(26) KPSX-EP-16260-DRG-WW-DE-0182-04	PCD 4-PCD ACCESS STAIRCASE-LAYOUT AND DETAILS
(27) KPSX-EP-16260-DRG-WW-DE-0182-05	PCD 4-PCD ACCESS STAIRCASE-LAYOUT AND DETAILS
(28) KPSX-EP-16260-DRG-WW-DE-0114-01	POLLUTION CONTROL DAMS-ACCESS STAIRCASE AND PIPE SUPPORT-CONCRETE DETAILS
(29) KPSX-EP-16260-DRG-WW-DE-0114-02	POLLUTION CONTROL DAMS-ACCESS STAIRCASE AND PIPE SUPPORT-CONCRETE DETAILS
(30) KPSX-EP-16260-DRG-WW-DE-0114-03	POLLUTION CONTROL DAMS-ACCESS STAIRCASE AND PIPE SUPPORT-CONCRETE DETAILS
(31) KPSX-EP-16260-DRG-WW-GA-0140-01	PCD 4-SILT TRAP-GENERAL ARRANGEMENT AND MECHANICAL DETAILS
(32) KPSX-EP-16260-DRG-WW-DE-0141-01	PCD 4-SILT TRAP-LAYOUT, SECTIONS AND DETAILS
(33) KPSX-EP-16260-DRG-WW-DE-0141-02	PCD 4-SILT TRAP-LAYOUT, SECTIONS AND DETAILS
(34) KPSX-EP-16260-DRG-WW-DE-0141-03	PCD 4-SILT TRAP-LAYOUT, SECTIONS AND DETAILS
(35) KPSX-EP-16260-DRG-WW-DE-0142-01	PCD 4-SILT TRAP-SLUICE GATE DETAILS
(36) KPSX-EP-16260-DRG-WW-DE-0161-01	PCD 4-DAM INLET STRUCTURE-LAYOUT AND SECTIONS
(37) KPSX-EP-16260-DRG-WW-LY-0121-01	PCD 4-DAM INLET-LAYOUT, SECTIONS AND SETTING OUT DETAILS
(38) KPSX-EP-16260-DRG-WW-DE-0181-01	PCD 4-EMERGENCY SPILLWAY-LAYOUT AND DETAILS
(39) KPSX-EP-16260-DRG-WW-LY-0122-01	PCD 4-EMERGENCY SPILLWAY AND LEAK DETECTION SUMP-LAYOUT, SECTIONS AND SETTING OUT DETAILS
(40) KPSX-EP-16260-DRG-WW-LY-0104-01	PCD 4-STORMWATER DRAINAGE-SITE DRAINAGE LAYOUT
(41) KPSX-EP-16260-DRG-WW-DE-0111-01	PCD 4-LEAK DETECTION SUMP-PLANS, SECTIONS & ELEVATIONS
(42) KPSX-EP-16260-DRG-WW-DE-0115-01	POLLUTION CONTROL DAMS-SUBSOIL DRAINAGE AND LEAK DETECTION-GANTRY DETAILS
(43) KPSX-EP-16260-DRG-WW-DE-0115-02	POLLUTION CONTROL DAMS-SUBSOIL DRAINAGE AND LEAK DETECTION-GANTRY DETAILS
(44) KPSX-EP-16260-DRG-WW-DE-0116-01	POLLUTION CONTROL DAMS-SUBSOIL DRAINAGE AND LEAK DETECTION-MECHANICAL DETAILS
(45) KPSX-EP-16200-DRG-WW-DE-0113-01	WATER MANAGEMENT-TYPICAL DETAIL-BURGLAR BAR
(46) KPSX-EP-16260-DRG-WW-LY-0103-01	PCD 4-SUBSOIL DRAINAGE AND LEAK DETECTION-SUBSOIL DRAINAGE LAYOUT

LIST OF DRAWINGS	
DRAWING NUMBER	**TITLE**
(47) KPSX-EP-16260-DRG-WW-DE-0101-01	POLLUTION CONTROL DAMS-TYPICAL DETAIL-PCD SUBSOIL DRAINAGE
(48) KPSX-EP-16260-DRG-WW-DE-0105-01	POLLUTION CONTROL DAMS-TYPICAL DETAIL-DAM DETAILS
(49) KPSX-EP-16260-DRG-WW-DE-0106-01	POLLUTION CONTROL DAMS-TYPICAL DETAIL-JOINT DETAILS

LIST OF DRAWINGS – MECHANICAL	
DRAWING NUMBER	**TITLE**
(01) KPSX-EP-16290-DRG-II-PI-0004-01	RAW WATER SYSTEM – PCD 4 – P&ID
(02) KPSX-EP-16290-DRG-II-PI-0004-02	RAW WATER SYSTEM – PCD 4 PUMP STATION – P&ID
(03) KPSX-EP-16290-DRG-II-PI-0004-03	RAW WATER SYSTEM – PCD 4 PUMP STATION – P&ID
(04) KPSX-EP-16260-DRG-WW-DE-0122-01	PCD 4-PUMP STATION INTAKE STRUCTURE-MECHANICAL DETAILS
(05) KPSX-EP-16260-DRG-WW-DE-0122-02	PCD 4-PUMP STATION INTAKE STRUCTURE-MECHANICAL DETAILS
(06) KPSX-EP-16260-DRG-WW-DE-0122-03	PCD 4-PUMP STATION INTAKE STRUCTURE-MECHANICAL DETAILS
(07) KPSX-EP-16290-DRG-WW-GA-0671-01	PIT BD-PCD 4 PUMP STATION-GENERAL ARRANGEMENT
(08) KPSX-EP-16290-DRG-WW-DE-0671-01	PCD 4 PUMP STATION-PUMP SYSTEM TO RAW WATER RESERVOIR-MECHANICAL DETAILS
(09) KPSX-EP-16290-DRG-WW-DE-0671-02	PCD 4 PUMP STATION-PUMP SYSTEM TO RAW WATER RESERVOIR-MECHANICAL DETAILS
(10) KPSX-EP-16290-DRG-WW-DE-0672-01	PCD 4 PUMP STATION-PUMP SYSTEM TO PCD 1-MECHANICAL DETAILS
(11) KPSX-EP-16290-DRG-WW-DE-0672-02	PCD 4 PUMP STATION-PUMP SYSTEM TO PCD 1-MECHANICAL DETAILS
(12) KPSX-EP-16290-DRG-WW-DE-0673-01	PCD 4 PUMP STATION-PUMP SYSTEM TO FILLING POINT-MECHANICAL DETAILS
(13) KPSX-EP-16290-DRG-WW-DE-0681-01	PCD 4 PUMP STATION-VALVE CHAMBER-CHAMBER DETAILS
(14) KPSX-EP-16290-DRG-WW-DE-0084-01	RAW WATER PIPELINE-TIE-IN CHAMBER 2 - PCD 4 SUPPLY TO RAW WATER RESERVOIR-MECHANICAL DETAILS
(15) KPSX-EP-16260-DRG-WW-DE-0111-01	PCD 4-LEAK DETECTION SUMP-PLANS, SECTIONS & ELEVATIONS

Appendix L
Drawings – Civil

THE MASTER HELD AT ZUTARI, GAUTENG DELIVERY CENTRE, RESOURCES & MANUFACTURING UNIT, BEARS THE ORIGINAL SIGNATURE OF APPROVAL

NOTES:

1. THIS PCD IS A CLASS C WASTE FACILITY IN TERMS OF THE WASTE MANAGEMENT ACT, 2014.
2. WHERE THE DOWNSTREAM EMBANKMENT IS LOWER THAN 500 mm THE EMBANKMENT SHOULD BE PROTECTED WITH A 500 mm HIGH EARTH BERM
3. BENCH MARKS OR REFERENCE POINTS ON THE CREST OF THE EMBANKMENT AT THE APPROXIMATE POSITIONS AS SHOWN. 10 ON THE DAM CREST, 1 ON THE PUMP STATION PLATFORM AND ONE ELSEWHERE AS DETERMINED BY THE ENGINEER
4. PERIMETER FENCES TO BE CONSTRUCTED BY OTHERS

LEGEND:

- —X— LOW RISK AREA CHAIN LINK SECURITY FENCE
- PERIMETER ELECTRIC/RAZOR WIRE FENCE
- SECURITY TYPICAL CLEARVU FENCE

LOW RISK AREA CHAIN LINK SECURITY FENCE. REFER TO DRAWING KPSX-EP-15310-DRG-CC-DE-0002 FOR DETAILS

5600 mm WIDE LOW RISK AREA VEHICLE ACCESS GATE. REFER TO FENCE DETAILS

SETTLEMENT BEACONS

WEST BERM REFER TO DRAWING KPSX-EP-16260-DRG-WW-LY-0104

EMERGENCY SPILLWAY TO TIE INTO DOWNSTREAM STORMWATER SYSTEM. REFER TO DRAWING KPSX-EP-16260-DRG-WW-DE-0181-01 FOR DETAILS

SPILLWAY CANAL REFER TO DRAWING KPSX-EP-16260-WW-LY-0104-01

ACCESS ROAD

SOUTH BERM REFER TO DRAWING KPSX-EP-16260-DRG-WW-LY-0104

PCD 4 INFRASTRUCTURE

PUMP STATION INTAKE STRUCTURE REFER TO DRAWING KPSX-EP-16260-DRG-WW-GA-0120-01

22kV OVERHEAD POWERLINES

PCD 4 PUMP STATION REFER TO DRAWING KPSX-EP-16260-DRG-WW-LY-0223-01 FOR DETAILS

PERIMETER ELECTRIC/RAZOR WIRE FENCE COMBINATION DETAILS. REFER TO DRAWING KPSX-EP-15310-DRG-CC-DE-0006-01 FOR DETAILS

SECURITY TYPICAL CLEARVU FENCE. REFER TO DRAWING KPSX-EP-15310-DRG-CC-DE-0004-01 FOR DETAILS

DAM INLET STRUCTURE REFER TO DRAWING KPSX-EP-16260-DRG-WW-DE-0161-01 FOR DETAIL.

G7 MATERIAL OR BETTER TO BE COMPACTED IN 150 mm LAYERS TO 93% MODIFIED AASHTO DENSITY

STORMWATER INFRASTRUCTURE

STORM WATER DROP STRUCTURE

SILT TRAP REFER TO DRAWING KPSX-EP-16260-DRG-WW-DE-0141-01 FOR DETAIL.

WATER METER CHAMBER REFER TO DRAWING KPSX-EP-14110-DRG-WW-DE-0101-01

PIPELINES

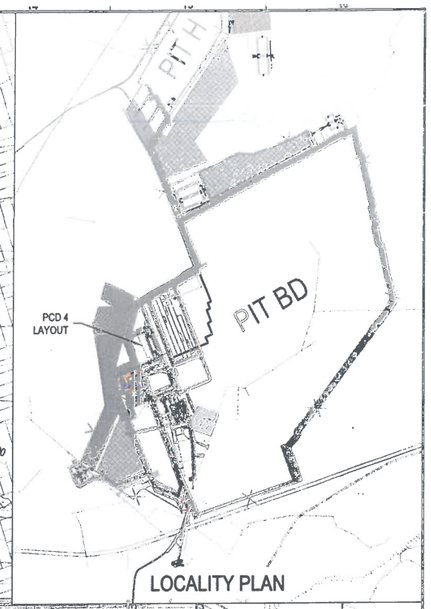
PCD ACCESS STAIR DETAIL REFER TO DRAWING KPSX-EP-16260-DRG-WW-DE-0182-01

SCOUR PIPELINE REFER TO DRAWING KPSX-EP-16260-DRG-WW-LY-0123-01 FOR DETAILS

LEAK DETECTION SUMP REFER TO DWG NO. KPSX-EP-16260-DRG-WW-DE-0111-01

5600 mm WIDE LOW RISK AREA VEHICLE ACCESS GATE. REFER TO FENCE DETAILS

5600 mm WIDE HIGH RISK AREA VEHICLE ACCESS GATE. REFER TO FENCE DETAILS



LOCALITY PLAN

SURFACE	PCD 4
APROX. DAM EARTHWORKS VOLUME	
CUT VOLUME	87 344 CU. M.
FILL VOLUME	26 121 CU. M.
NET VOLUME CUT	61 223 CU. M.
ROCK VOLUME	24 701 CU. M.
AREA	27 357 SQ.M
WATER	
NON OVERSPILL CREST (NOC)	1 550.400
FULL SUPPLY LEVEL (FSL)	1 549.400
TOTAL VOL	62 919 CU. M.

KLIPSPRUIT EXTENSION (KPSX)

NOTES FOR POLLUTION CONTROL DAM (PCD) EMBANKMENTS

ZONE	DESCRIPTION	MAXIMUM PARTICLE SIZE	LAYER THICKNESS	COMPACTION	SANS 1200 SPECIFICATIONS
-	IN-SITU MATERIAL	50 mm	150 mm	93% MOD AASHTO	
1	GENERAL FILL	50 mm	200 mm	95% PROCTOR DENSITY	SANS 1200 DE 1986 SECTION DE: (SMALL EARTH DAMS)
2	GRAVEL CAPPING	50 mm	200 mm	93% MOD AASHTO	
3	TOP SOIL	-	200 mm	-	

NOTE: THE EMBANKMENT FOR THIS PCD IS A HOMOGENOUS EMBANKMENT WITH NO CLAY CORE

NOTES ON EMBANKMENT GEOMETRY	
TOTAL FREEBOARD	1.0 m
CREST WIDTH OF PERIMETER WALLS	4 m (minimum)
UPSTREAM SLOPE	1.0 V: 3.0 H
DOWNSTREAM SLOPE	1.0 V: 2.5 H
CREST WIDTH OF DIVIDING WALL	NOT APPLICABLE
ALL SLOPES (DIVIDING WALL)	NOT APPLICABLE

AS BUILT DRAWINGS
ZUTARI ENGINEERING
For Zutari / For Client
Date

This AS BUILT drawing has been prepared based on information provided by the contractor. The levels and coordinates have not been independently checked or verified by Zutari.

REFERENCE DRAWINGS	
KPSX-EP-16260-DRG-WW-DE-0105-01	PCD TYPICAL DAM DETAILS
KPSX-EP-19440-DRG-CC-DE-0001-01	TYPICAL CROSS SECTION AND LAYERWORK DETAILS
KPSX-EP-16260-DRG-WW-DE-0181-01	PCD 4 SPILLWAY LAYOUT, SECTIONS AND SETTING OUT DETAILS
KPSX-EP-16260-DRG-WW-DE-0111-01	PCD 4 LEAK DETECTION SUMP
KPSX-EP-16260-DRG-WW-GA-0120-01	PCD 4 PUMP INTAKE STRUCTURE LAYOUT AND SECTIONS
KPSX-EP-16260-DRG-WW-SE-0110-01	PCD 4 GEOLOGICAL FEATURES SOIL PROFILES
KPSX-EP-16260-DRG-WW-LY-0110-01	PCD 4 BULK EARTHWORKS BULK EXCAVATION - SETTING OUT DETAILS
DRAWING NO.	TITLE

REFERENCE DRAWINGS	
KPSX-EP-16260-DRG-WW-LY-0102-01	PCD 4 BULK EARTHWORKS EMBANKMENT SECTIONS LAYOUT
KPSX-EP-16260-DRG-WW-LY-0103-01	PCD 4 SUBSOIL DRAINAGE & LEAK DETECTION LAYOUT
KPSX-EP-16260-DRG-WW-DE-0104-01	POLLUTION CONTROL DAMS TYPICAL DETAIL LINNING FIXING DETAIL
KPSX-EP-16260-DRG-WW-DE-0103-01	POLLUTION CONTROL DAMS TYPICAL DETAIL LINING DETAIL
KPSX-EP-16260-DRG-WW-LY-0102-01	BULK EARTHWORKS EMBANKMENT SECTIONS LAYOUT
KPSX-EP-16260-DRG-WW-SE-0101-01	PCD 4 POLLUTION CONTROL DAM CROSS SECTIONS
KPSX-EP-15310-DRG-CC-DE-0002-01	LOW RISK AREA CHAIN LINK SECURITY FENCE
KPSX-EP-15310-DRG-CC-DE-0006-01	PERIMETER ELECTRIC/RAZOR WIRE FENCE COMBINATION DETAILS
KPSX-EP-15310-DRG-CC-DE-0004-01	SECURITY TYPICAL CLEARVU FENCE
DRAWING NO.	TITLE

ZUTARI PROFESSIONAL ENGINEER

NAME	VICTOR WENTZEL	DATE
PROF. REG. No.	20120373	
SIGNATURE		21/05/2021

SOUTH 32 PROFESSIONAL APPROVAL

NAME	SIGN.	DATE
CLIENT PROJECT MANAGER		
CLIENT ENGINEERING MANAGER		
ADDITIONAL SIGNATORY		
ZUTARI PROJECT No.	113452	
CLIENT CONTRACT No.	8500084829	

REV.	I.T.	DESCRIPTION	DRWN.	DES.	CHK.	APR.	DATE
*	F	AS-BUILT DRAWING	E.E.	S.M.	V.W.	A.C.	13/04/2021

I.T. ISSUE TYPE: (A) FOR REVIEW (SQ) (B) INTERNAL PEER REVIEW (C) FOR APPROVAL (CR) (D) FOR CONSTRUCTION (E) FOR INFORMATION (F) AS-BUILT (G) CANCELED

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SOUTH32
ZUTARI IMPACT. ENGINEERED.
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E connects@zutari.com

KLIPSPRUIT EXTENSION (KPSX)

AREA: PCD 4

ELEMENT: PCD 4 INFRASTRUCTURE

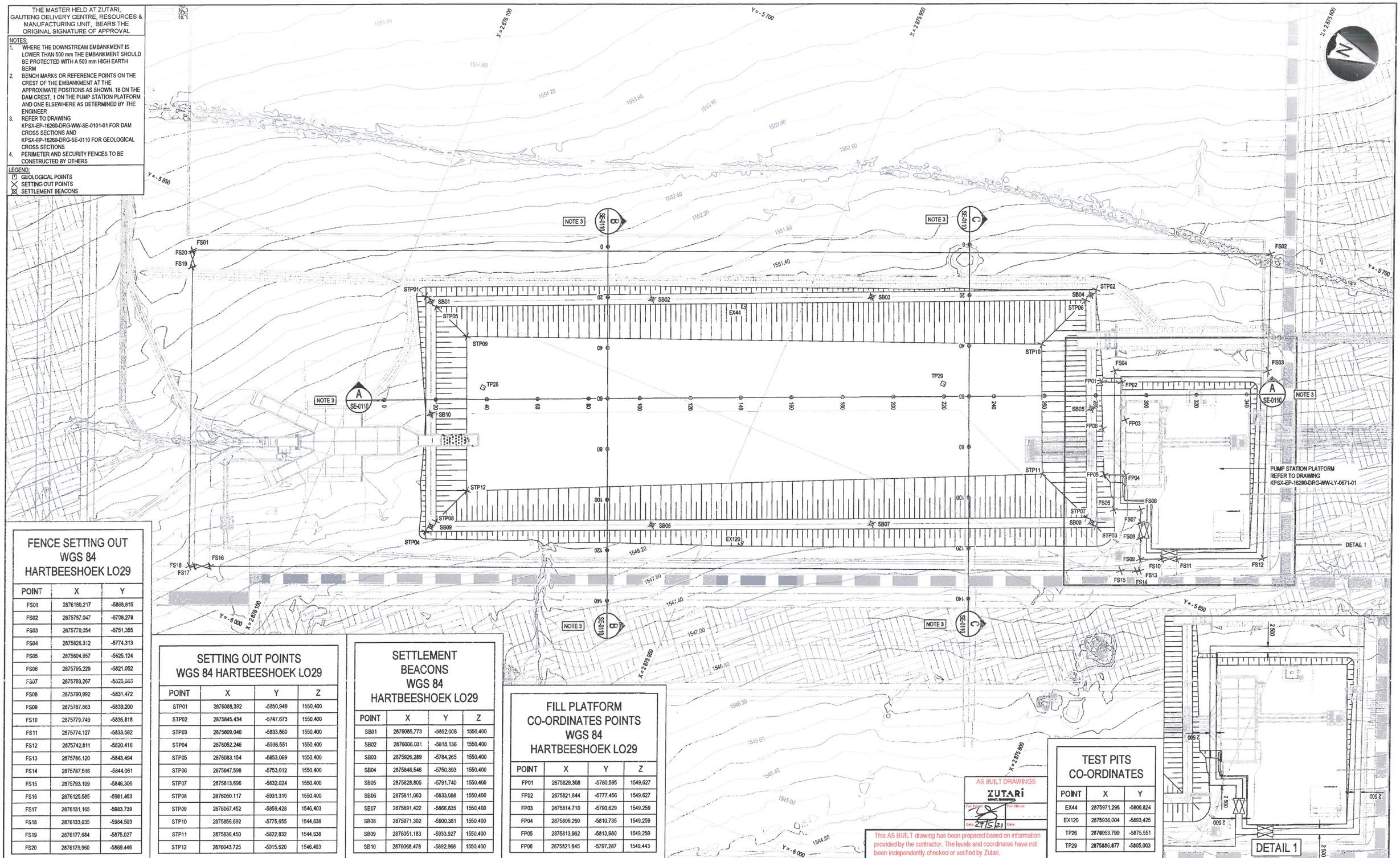
TITLE: GENERAL ARRANGEMENT

SCALE:	SHEET SIZE	DRAWING NUMBER	SHEET No.	REV.
N.T.S.	(A1)	KPSX-EP-16260-DRG-WW-GA-0101-01	1 OF 1	*

THE MASTER HELD AT ZUTARI, GAUTENG DELIVERY CENTRE, RESOURCES & MANUFACTURING UNIT, BEARS THE ORIGINAL SIGNATURE OF APPROVAL

NOTES:
1. WHERE THE DOWNSTREAM EMBANKMENT IS LOWER THAN 500 mm THE EMBANKMENT SHOULD BE PROTECTED WITH A 500 mm HIGH EARTH BERM
2. BENCH MARKS OR REFERENCE POINTS ON THE CREST OF THE EMBANKMENT AT THE APPROXIMATE POSITIONS AS SHOWN. 18 ON THE DAM CREST, 1 ON THE PUMP STATION PLATFORM AND ONE ELSEWHERE AS DETERMINED BY THE ENGINEER
3. REFER TO DRAWING KPSX-EP-16260-DRG-WW-SE-0101-01 FOR DAM CROSS SECTIONS AND KPSX-EP-16260-DRG-SE-0110 FOR GEOLOGICAL CROSS SECTIONS
4. PERIMETER AND SECURITY FENCES TO BE CONSTRUCTED BY OTHERS

LEGEND:
- GEOLOGICAL POINTS
- SETTING OUT POINTS
- SETTLEMENT BEACONS



FENCE SETTING OUT WGS 84 HARTBEESHOEK LO29

POINT	X	Y
FS01	2876180,217	-5868,815
FS02	2875787.047	-5708.278
FS03	2875770.054	-5751.365
FS04	2875826.312	-5774.313
FS05	2875804.957	-5825.124
FS06	2875795.229	-5821.052
FS07	2875793.267	-5825.360
FS08	2875790.992	-5831.472
FS09	2875787.863	-5839.200
FS10	2875779.749	-5835.818
FS11	2875774.127	-5833.582
FS12	2875742.811	-5820.416
FS13	2875786.120	-5843.494
FS14	2875787.516	-5844.061
FS15	2875793.109	-5846.306
FS16	2876125.585	-5981.463
FS17	2876131.165	-5983.739
FS18	2876133.035	-5984.503
FS19	2876177.684	-5875.027
FS20	2876179.960	-5869.446

SETTING OUT POINTS WGS 84 HARTBEESHOEK LO29

POINT	X	Y	Z
STP01	2876088.392	-5850.949	1550.400
STP02	2875845.434	-5747.673	1550.400
STP03	2875809.046	-5833.860	1550.400
STP04	2876052.246	-5936.551	1550.400
STP05	2876083.154	-5853.069	1550.400
STP06	2875847.598	-5753.012	1550.400
STP07	2875813.696	-5832.024	1550.400
STP08	2876050.117	-5931.310	1550.400
STP09	2876067.452	-5859.428	1546.403
STP10	2875856.692	-5775.655	1544.638
STP11	2875836.450	-5822.832	1544.638
STP12	2876043.725	-5915.520	1546.403

SETTLEMENT BEACONS WGS 84 HARTBEESHOEK LO29

POINT	X	Y	Z
SB01	2876085.773	-5852.008	1550.400
SB02	2876006.031	-5818.136	1550.400
SB03	2875926.289	-5784.265	1550.400
SB04	2875846.546	-5750.393	1550.400
SB05	2875828.805	-5791.740	1550.400
SB06	2875811.063	-5833.088	1550.400
SB07	2875891.422	-5866.835	1550.400
SB08	2875971.302	-5900.381	1550.400
SB09	2876051.183	-5933.927	1550.400
SB10	2876068.478	-5892.968	1550.400

FILL PLATFORM CO-ORDINATES POINTS WGS 84 HARTBEESHOEK LO29

POINT	X	Y	Z
FP01	2875829.308	-5780.595	1549.627
FP02	2875821.844	-5777.456	1549.627
FP03	2875814.710	-5790.629	1549.259
FP04	2875806.260	-5810.735	1549.259
FP05	2875813.982	-5813.980	1549.259
FP06	2875821.645	-5797.287	1549.443

TEST PITS CO-ORDINATES

POINT	X	Y
EX44	2875971.296	-5806.824
EX120	2875936.004	-5893.425
TP26	2876053.799	-5875.551
TP29	2875886.877	-5805.003

AS BUILT DRAWINGS
ZUTARI IMPACT. ENGINEERING
For Zutari: Date: 27/5/21
For Client: Date:

This AS BUILT drawing has been prepared based on information provided by the contractor. The levels and coordinates have not been independently checked or verified by Zutari.

REFERENCE DRAWINGS	
DRAWING NO.	TITLE

REFERENCE DRAWINGS	
KPSX-EP-16290-DRG-WW-LY-0671-01	PUMP STATION PLATFORM
KPSX-EP-16260-DRG-WW-LY-0110-01	GEOLOGICAL CROSS SECTIONS
KPSX-EP-16260-DRG-WW-DE-0105-01	DAM DETAILS
KPSX-EP-16260-DRG-WW-DE-0104-01	POLLUTION CONTROL DAMS TYPICAL DETAIL LINER FIXING DETAIL
KPSX-EP-16260-DRG-WW-DE-0103-01	POLLUTION CONTROL DAMS TYPICAL DETAIL LINER DETAIL
KPSX-EP-16260-DRG-WW-DE-0102-01	POLLUTION CONTROL DAMS TYPICAL EMBANKMENT DETAIL
DRAWING NO.	TITLE

ZUTARI PROFESSIONAL ENGINEER

NAME	VICTOR WENTZEL	DATE
PROF. REG. No.	20130173	
SIGNATURE:		27/5/21

SOUTH 32 PROFESSIONAL APPROVAL

NAME	SIGN.	DATE
CLIENT PROJECT MANAGER		
CLIENT ENGINEERING MANAGER		
ADDITIONAL SIGNATORY		
ZUTARI PROJECT No.	113452	
CLIENT CONTRACT No.	8500084829	

*	F	AS-BUILT DRAWING	E.E.	S.M.	V.W.	A.C.	19/03/2018
REV.	I.T.	DESCRIPTION	DRWN.	DES.	CHK.	APR.	DATE
	I.T. ISSUE TYPE	(A) FOR REVIEW (SQ) (B) INTERNAL PEER REVIEW (C) FOR APPROVAL (CR) (D) FOR CONSTRUCTION (E) FOR INFORMATION (F) AS-BUILT (G) CANCELED					

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ZUTARI IMPACT. ENGINEERING
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41 Matroosberg Road
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SOUTH32

KLIPSPRUIT EXTENSION (KPSX)

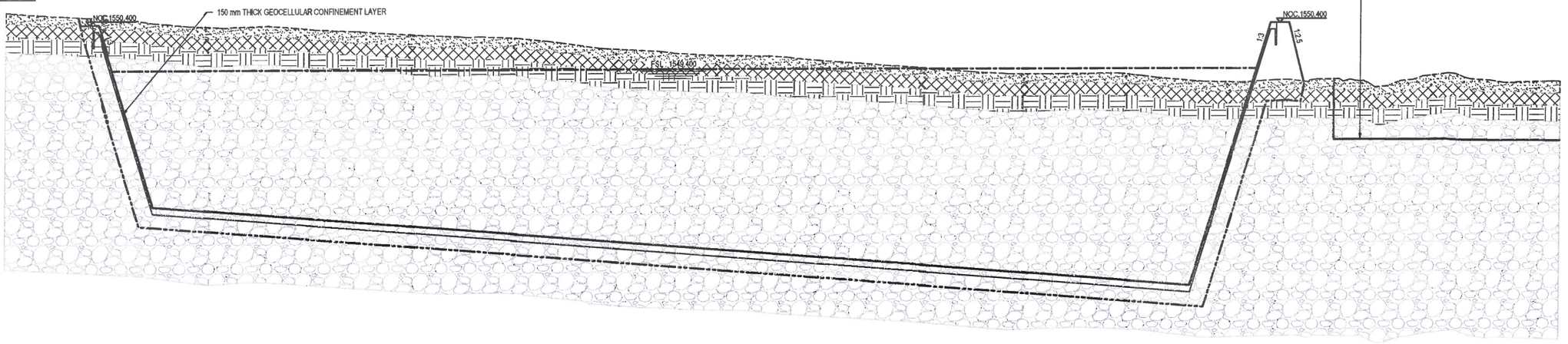
AREA: PCD 4
ELEMENT: BULK EARTHWORKS
TITLE: FINAL EMBANKMENT SETTING OUT DETAILS

SCALE:	SHEET SIZE	DRAWING NUMBER	SHEET No.	REV.
N.T.S.	(A1)	KPSX-EP-16260-DRG-WW-LY-0101-01	1 OF 1	*

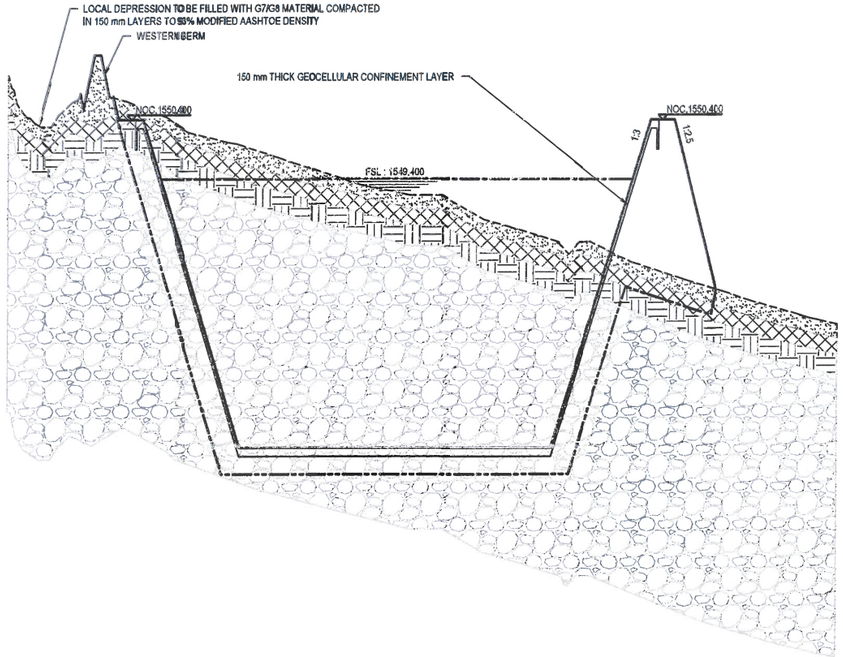
THE MASTER HELD AT ZUTARI, GAUTENG DELIVERY CENTRE, RESOURCES & MANUFACTURING UNIT, BEARS THE ORIGINAL SIGNATURE OF APPROVAL

NOTES:
1. SOIL HORIZONS INDICATED ON THE INTERPRETATION OF THE GEOTECHNICAL INVESTIGATIONS AND SHOULD BE CONFIRMED ON SITE
2. PEDOGENIC MATERIAL TO BE STOCKPILED AND TESTED FOR USE AS THE SECONDARY LINER (SEMI-PERVIOUS). REFER TO THE DRAWING KPSX-EP-16260-DRG-WW-DE-0103-01 AND PROJECT SPECIFICATIONS FOR MATERIAL REQUIREMENTS

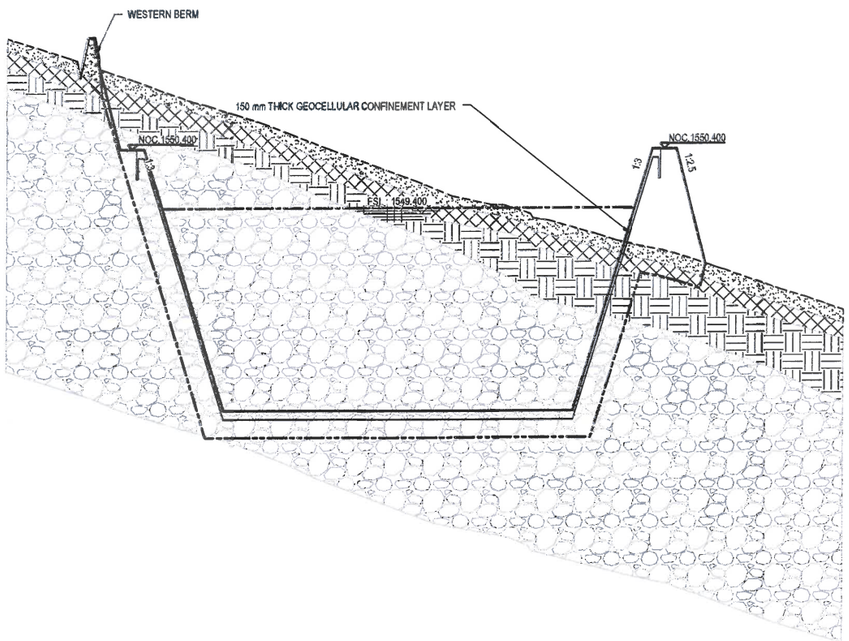
GEOTECHNICAL LAYER LEGEND:
- NGL
- EXCAVATION LINE
- TOP SOIL
- TRANSPORTED
- PEDOGENIC
- ROCK



SECTION A-A
FROM 0.000 TO 340.000
HORIZONTAL SCALE 1:500
VERTICAL SCALE 1:50



SECTION C-C
FROM 0.000 TO 140.000
HORIZONTAL SCALE 1:500
VERTICAL SCALE 1:50



SECTION B-B
FROM 0.000 TO 140.000
HORIZONTAL SCALE 1:500
VERTICAL SCALE 1:50

AS BUILT DRAWINGS
ZUTARI
Initials
Date
21/05/2021

This AS BUILT drawing has been prepared based on information provided by the contractor. The levels and coordinates have not been independently checked or verified by Zutari.

REFERENCE DRAWINGS		REFERENCE DRAWINGS	
DRAWING NO.	TITLE	DRAWING NO.	TITLE
		KPSX-EP-16260-DRG-WW-DE-0104-01	POLLUTION CONTROL DAMS TYPICAL DETAIL LINER FIXING DETAIL
		KPSX-EP-16260-DRG-WW-DE-0103-01	POLLUTION CONTROL DAMS TYPICAL DETAIL LINER DETAIL
		KPSX-EP-16260-DRG-WW-DE-0102-01	POLLUTION CONTROL DAMS TYPICAL EMBANKMENT DETAIL

ZUTARI PROFESSIONAL ENGINEER

NAME	VICTOR WENTZEL	DATE
PROF. REG. No.	20130173	
SIGNATURE		21/05/2021

SOUTH 32 PROFESSIONAL APPROVAL

NAME	SIGN.	DATE
CLIENT PROJECT MANAGER		
CLIENT ENGINEERING MANAGER		
ADDITIONAL SIGNATORY		

ZUTARI PROJECT No.	113452
CLIENT CONTRACT No.	8500084829

REV.	I.T.	DESCRIPTION	DRWN.	DES.	CHK.	APR.	DATE
*	F	AS-BUILT	E.E.	S.M.	V.W.	A.C.	13/04/2021

I.T. ISSUE TYPE: (A) FOR REVIEW (SQ) (B) INTERNAL PEER REVIEW (C) FOR APPROVAL (CR) (D) FOR CONSTRUCTION (E) FOR INFORMATION (F) AS-BUILT (G) CANCELED

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ZUTARI IMPACT. ENGINEERED.
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KLIPSPRUIT EXTENSION (KPSX)

AREA: PCD 4

ELEMENT: GEOTECHNCIAL FEATURES

TITLE: SOIL PROFILES

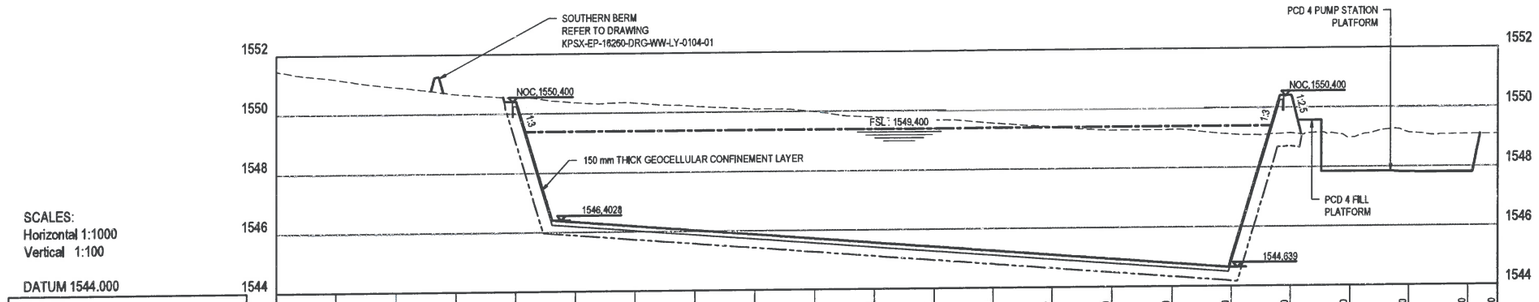
SCALE:	SHEET SIZE	DRAWING NUMBER	SHEET No.	REV.
	(A1)	KPSX-EP-16260-DRG-WW-SE-0110-01	1 OF 1	*

PROJECT FILE: 113452

THE MASTER HELD AT ZUTARI, GAUTENG DELIVERY CENTRE, RESOURCES & MANUFACTURING UNIT, BEARS THE ORIGINAL SIGNATURE OF APPROVAL

NOTES:
1. REFER TO DRAWINGS KPSX-FS-16260-DRG-WW-DE-0102 FOR TYPICAL EMBANKMENT DETAILS
2. THIS IS A HDPE LINED PCD. REFER TO DRAWING KPSX-FS-16260-DRG-WW-DE-0103 FOR LINER DETAILS
3. EMBANKMENT SLOPES
   1:3 UPSTREAM FACE
   1:2,5 DOWNSTREAM FACE
4. DOWNSTREAM EMBANKMENT TO BE TOPSOILED TO A MINIMUM DEPTH OF 150 mm AND HYDROSEEDED IN ACCORDANCE WITH THE PROJECT SPECIFICATIONS
5. FINAL EXCAVATION TO BE INSPECTED BY THE ENGINEER PRIOR TO THE CONSTRUCTION OF THE DAM FLOOR AND EMBANKMENT

LEGEND:
- NGL
- FINAL DAM LEVELS
- EXCAVATION LINE
- WATER LEVEL
- NOC NON OVERSPILL CREST
- FSL FULL SUPPLY LEVEL

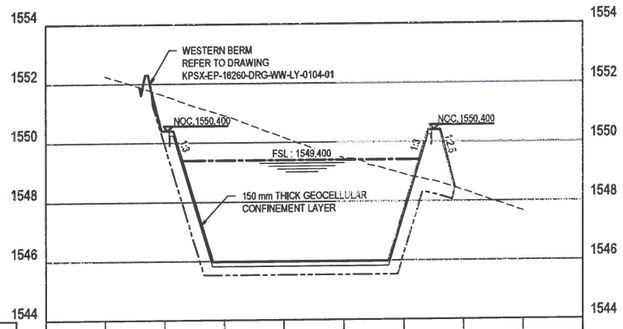


SCALES:
Horizontal 1:1000
Vertical 1:100

DATUM 1544.000

DISTANCE (m)	0.000	20.000	40.000	60.000	80.000	100.000	120.000	140.000	160.000	180.000	200.000	220.000	240.000	260.000	280.000	300.000	320.000	340.000	360.000	380.000	400.000	410.000
GROUND LEVEL	1551.487	1551.200	1550.927	1550.675	1550.553	1550.398	1550.343	1550.214	1550.102	1549.995	1549.798	1549.883	1549.550	1549.469	1549.279	1549.291	1549.119	1549.148	1548.985	1549.144	1549.083	1549.080
FINAL DAM LEVEL					1550.400	1546.341	1546.186	1548.030	1545.875	1545.719	1545.563	1545.408	1545.252	1545.097	1544.941	1544.786	1544.975	1550.400				
EXCAVATION LEVEL					1549.017	1545.891	1545.736	1545.580	1545.425	1545.269	1545.114	1544.958	1544.802	1544.647	1544.491	1544.336	1544.180	1549.698				

SECTION A-A
FROM 0.000 TO 410.000

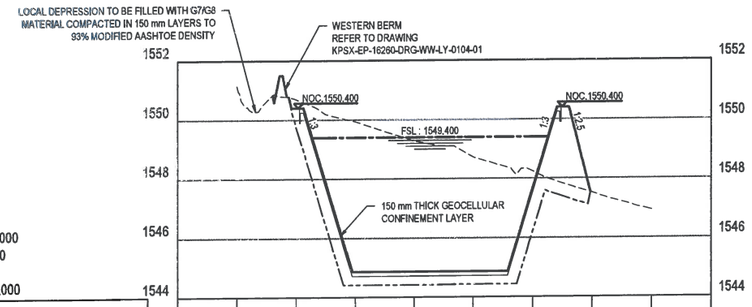


SCALES:
Horizontal 1:1000
Vertical 1:100

DATUM 1544.000

DISTANCE (m)	-20.000	0.000	20.000	40.000	60.000	80.000	100.000	120.000	140.000	160.000
GROUND LEVEL		1552.267	1551.902	1550.919	1550.167	1549.477	1548.912	1548.357	1547.654	
FINAL DAM LEVEL			1550.400	1545.972	1545.973	1545.973	1547.687			
EXCAVATION LEVEL			1549.929	1545.522	1545.523	1545.523	1546.237			

SECTION B-B
FROM 0.000 TO 140.000



SCALES:
Horizontal 1:1000
Vertical 1:100

DATUM 1544.000

DISTANCE (m)	-20.000	0.000	20.000	40.000	60.000	80.000	100.000	120.000	140.000	160.000
GROUND LEVEL		1551.145	1550.895	1549.939	1549.262	1548.723	1548.243	1547.512	1546.934	
FINAL DAM LEVEL			1550.400	1544.862	1544.863	1544.864	1547.674			
EXCAVATION LEVEL			1549.748	1544.412	1544.413	1544.414	1546.224			

SECTION C-C
FROM 0.000 TO 140.000

AS BUILT DRAWINGS
ZUTARI
By Client
Date

This AS BUILT drawing has been prepared based on information provided by the contractor. The levels and coordinates have not been independently checked or verified by Zutari.

REFERENCE DRAWINGS	
DRAWING NO.	TITLE

REFERENCE DRAWINGS	
KPSX-EP-16260-DRG-WW-DE-0105-01	GENERAL PIPEWORK LAYOUTS AND LONGSECTIONS
KPSX-EP-16260-DRG-WW-DE-0104-01	POLLUTION CONTROL DAMS TYPICAL DETAIL LINER FIXING DETAIL
KPSX-EP-16260-DRG-WW-DE-0103-01	POLLUTION CONTROL DAMS TYPICAL DETAIL LINER DETAIL
KPSX-EP-16260-DRG-WW-DE-0102-01	POLLUTION CONTROL DAMS TYPICAL EMBANKMENT DETAIL
DRAWING NO.	TITLE

ZUTARI PROFESSIONAL ENGINEER

NAME	VICTOR WENTZEL	DATE
PROF. REG. No.	20130173	
SIGNATURE		

SOUTH 32 PROFESSIONAL APPROVAL

NAME	SIGN.	DATE
CLIENT PROJECT MANAGER		
CLIENT ENGINEERING MANAGER		
ADDITIONAL SIGNATORY		
ZUTARI PROJECT No.	113452	
CLIENT CONTRACT No.		

REV.	I.T.	DESCRIPTION	DRWN.	DES.	CHK.	APR.	DATE
*	F	AS-BUILT	E.E.	S.M.	V.W.	A.C.	13/04/2021

I.T. ISSUE TYPE: (A) FOR REVIEW (SQ) (B) INTERNAL PEER REVIEW (C) FOR APPROVAL (CR) (D) FOR CONSTRUCTION (E) FOR INFORMATION (F) AS-BUILT (G) CANCELED

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KLIPSPRUIT EXTENSION (KPSX)

AREA:
ELEMENT: PCD 4
TITLE: POLLUTION CONTROL DAM 4
DAM CROSS SECTIONS

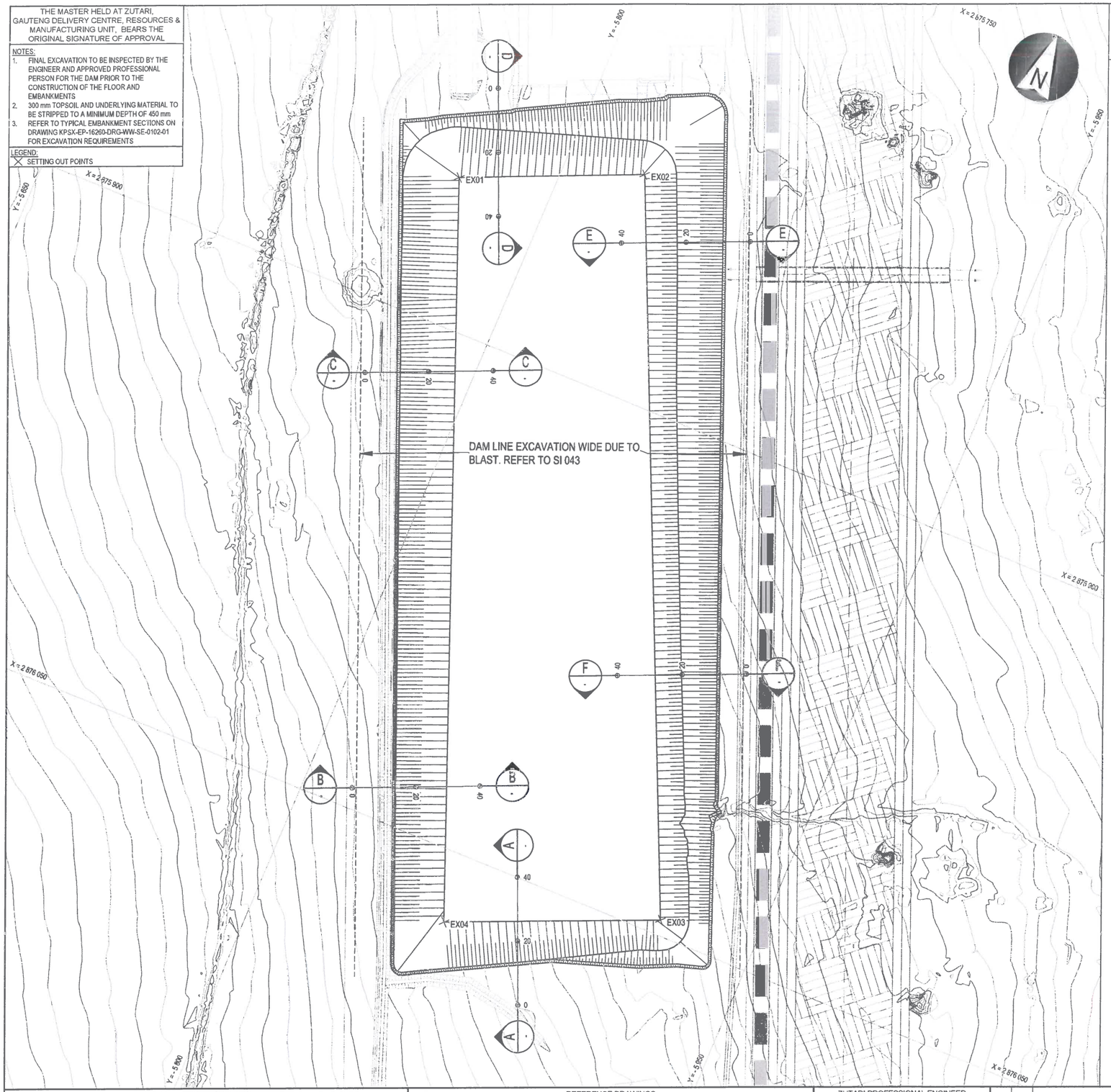
SCALE:	SHEET SIZE	DRAWING NUMBER	SHEET No.	REV.
	(A1)	KPSX-EP-16260-DRG-WW-SE-0101-01	1 OF 1	*

PROJECT FILE: 113452

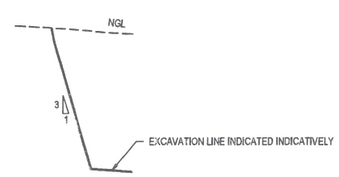
THE MASTER HELD AT ZUTARI, GAUTENG DELIVERY CENTRE, RESOURCES & MANUFACTURING UNIT, BEARS THE ORIGINAL SIGNATURE OF APPROVAL

NOTES:
1. FINAL EXCAVATION TO BE INSPECTED BY THE ENGINEER AND APPROVED PROFESSIONAL PERSON FOR THE DAM PRIOR TO THE CONSTRUCTION OF THE FLOOR AND EMBANKMENTS
2. 300 mm TOPSOIL AND UNDERLYING MATERIAL TO BE STRIPPED TO A MINIMUM DEPTH OF 450 mm
3. REFER TO TYPICAL EMBANKMENT SECTIONS ON DRAWING KPSX-EP-16260-DRG-WW-SE-0102-01 FOR EXCAVATION REQUIREMENTS

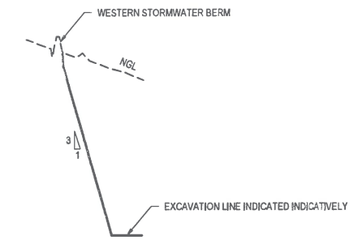
LEGEND:
- SETTING OUT POINTS



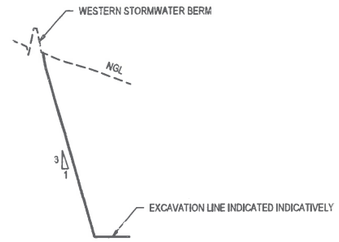
LEGEND:
- NGL
- EXCAVATION LINE



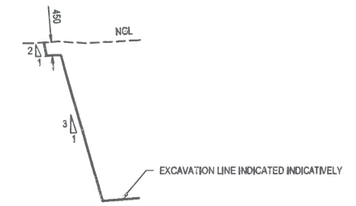
SECTION A-A
FROM 0.000 TO 40.000
HORIZONTAL SCALE 1:1000
VERTICAL SCALE 1:100



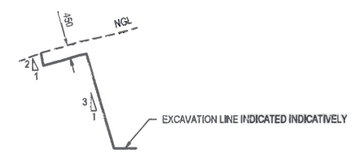
SECTION B-B
FROM 0.000 TO 40.000
HORIZONTAL SCALE 1:1000
VERTICAL SCALE 1:100



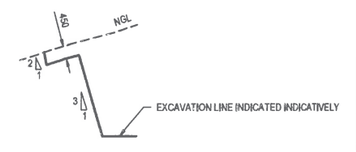
SECTION C-C
FROM 0.000 TO 40.000
HORIZONTAL SCALE 1:1000
VERTICAL SCALE 1:100



SECTION D-D
FROM 0.000 TO 40.000
HORIZONTAL SCALE 1:1000
VERTICAL SCALE 1:100



SECTION E-E
FROM 0.000 TO 40.000
HORIZONTAL SCALE 1:1000
VERTICAL SCALE 1:100



SECTION F-F
FROM 0.000 TO 40.000
HORIZONTAL SCALE 1:1000
VERTICAL SCALE 1:100

EXCAVATION SETTING OUT CO-ORDINATES
WGS 84 HARTBEESHOEK LO29

POINT	X	Y	Z
EX01	2875855,086	-5771,789	1544,165
EX02	2875832,528	-5824,363	1544,165
EX03	2876045,297	-5919,610	1545,976
EX04	2876071,406	-5857,772	1545,976

AS BUILT DRAWINGS
ZUTARI IMPACT. ENGINEERED.
For Contr. For Client
Date 27/5/21 Date

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REFERENCE DRAWINGS		REFERENCE DRAWINGS	
		KPSX-EP-16260-DRG-WW-SE-0102-01	EMBANKMENT SECTIONS LAYOUT
DRAWING NO.	TITLE	DRAWING NO.	TITLE

ZUTARI PROFESSIONAL ENGINEER		
NAME	VICTOR WENTZEL	DATE
PROF. REG. No.	20130173	
SIGNATURE		27/5/21
SOUTH 32 PROFESSIONAL APPROVAL		
NAME	SIGN.	DATE
CLIENT PROJECT MANAGER		
CLIENT ENGINEERING MANAGER		
ADDITIONAL SIGNATORY		
ZUTARI PROJECT No.	113452	
CLIENT CONTRACT No.	8500084829	

REV.	I.T.	DESCRIPTION	DRWN.	DES.	CHK.	APR.	DATE
*	F	AS-BUILT DRAWING	E.E.	S.M.	V.W.	A.C.	26/02/2016

I.T. ISSUE TYPE: (A) FOR REVIEW (SO) (B) INTERNAL PEER REVIEW (C) FOR APPROVAL (CR) (D) FOR CONSTRUCTION (E) FOR INFORMATION (F) AS-BUILT (G) CANCELED

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SOUTH32

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E connect@zutari.com

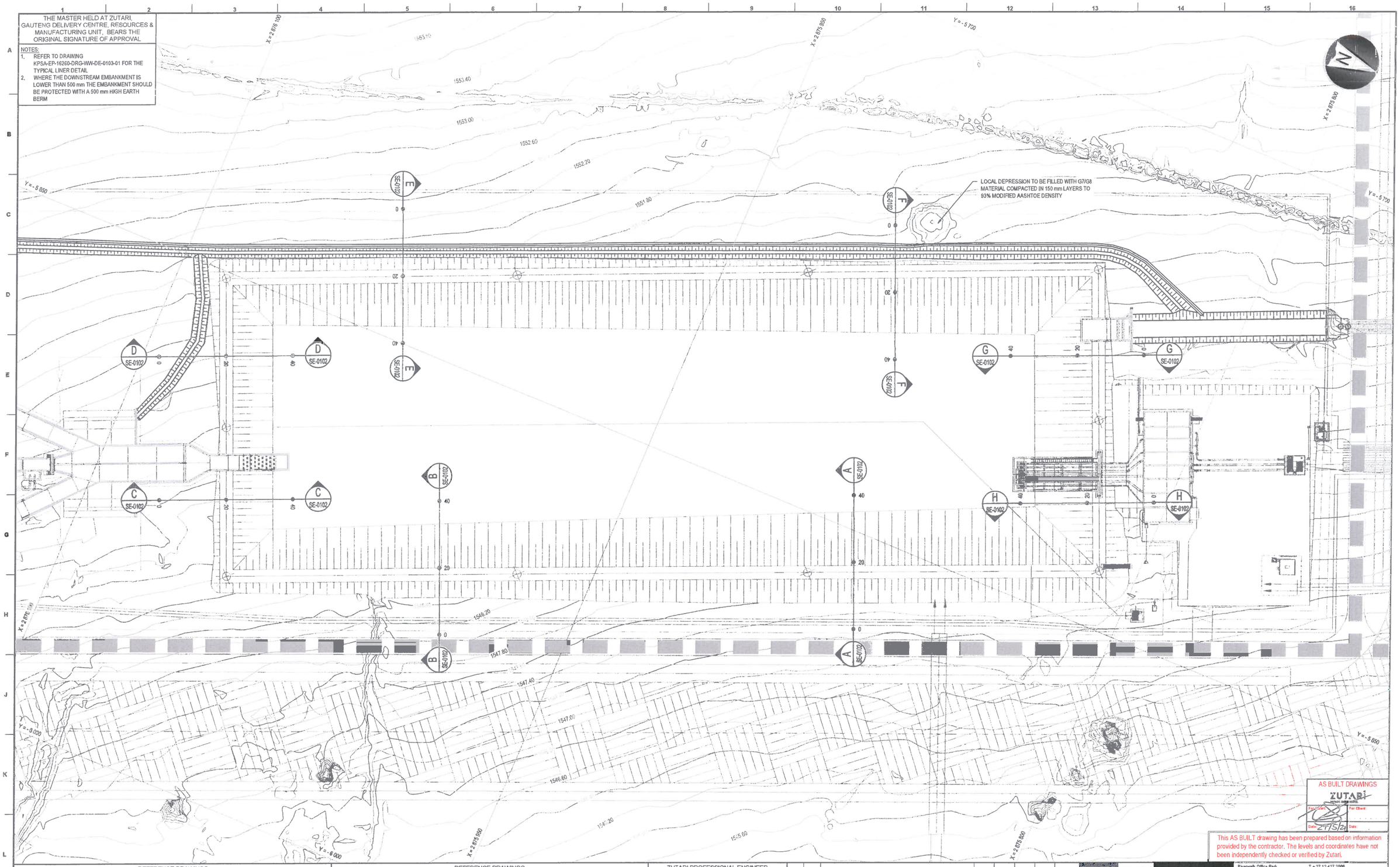
KLIPSPRUIT EXTENSION (KPSX)

AREA: PCD 4
ELEMENT: BULK EARTHWORKS
TITLE: BULK EXCAVATION - SETTING OUT DETAILS

SCALE:	SHEET SIZE	DRAWING NUMBER	SHEET No.	REV.
N.T.S.	(A1)	KPSX-EP-16260-DRG-WW-LY-0110-01	1 OF 1	*

THE MASTER HELD AT ZUTARI, GAUTENG DELIVERY CENTRE, RESOURCES & MANUFACTURING UNIT, BEARS THE ORIGINAL SIGNATURE OF APPROVAL.

NOTES:
1. REFER TO DRAWING KPSA-EP-16269-DRG-WW-DE-0103-01 FOR THE TYPICAL LINER DETAIL
2. WHERE THE DOWNSTREAM EMBANKMENT IS LOWER THAN 500 mm THE EMBANKMENT SHOULD BE PROTECTED WITH A 500 mm HIGH EARTH BERM



AS BUILT DRAWINGS
ZUTARI
For Client:
Date: 27/5/21

This AS BUILT drawing has been prepared based on information provided by the contractor. The levels and coordinates have not been independently checked or verified by Zutari.

REFERENCE DRAWINGS		REFERENCE DRAWINGS	
		KPSX-EP-16260-DRG-WW-LY-0110-01	GEOLOGICAL CROSS SECTIONS
		KPSX-EP-16260-DRG-WW-DE-0105-01	DAM DETAILS
		KPSX-EP-16260-DRG-WW-DE-0104-01	POLLUTION CONTROL DAMS TYPICAL DETAIL LINER FIXING DETAIL
		KPSX-EP-16260-DRG-WW-DE-0103-01	POLLUTION CONTROL DAMS TYPICAL DETAIL LINER DETAIL
		KPSX-EP-16260-DRG-WW-DE-0102-01	POLLUTION CONTROL DAMS TYPICAL EMBANKMENT DETAIL
DRAWING NO.	TITLE	DRAWING NO.	TITLE

ZUTARI PROFESSIONAL ENGINEER		
NAME	VICTOR WENTZEL	DATE
PROF. REG. No.	20130177	
SIGNATURE		27/5/21

SOUTH 32 PROFESSIONAL APPROVAL		
NAME	SIGN.	DATE
CLIENT PROJECT MANAGER		
CLIENT ENGINEERING MANAGER		
ADDITIONAL SIGNATORY		
ZUTARI PROJECT No.	113452	
CLIENT CONTRACT No.	8500088746	

REV.	I.T.	DESCRIPTION	DRWN.	DES.	CHK.	APR.	DATE
*	F	AS-BUILT DRAWING	E.E.	S.M.	V.W.	A.C.	26/02/2021

I.T. ISSUE TYPE: (A) FOR REVIEW (SQ) (B) INTERNAL PEER REVIEW (C) FOR APPROVAL (CR) (D) FOR CONSTRUCTION (E) FOR INFORMATION (F) AS-BUILT (G) CANCELED

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ZUTARI IMPACT. ENGINEERED.
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E connect@zutari.com

SOUTH 32

KLIPSPRUIT EXTENSION (KPSX)

AREA: PCD 4
ELEMENT: BULK EARTHWORKS
TITLE: EMBANKMENT SECTIONS LAYOUT

SCALE:	SHEET SIZE	DRAWING NUMBER	SHEET No.	REV.
1:500	(A1)	KPSX-EP-16260-DRG-WW-LY-0102-01	1 OF 1	*

PROJECT FILE: 113452

THE MASTER HELD AT ZUTARI, GAUTENG DELIVERY CENTRE, RESOURCES & MANUFACTURING UNIT, BEARS THE ORIGINAL SIGNATURE OF APPROVAL

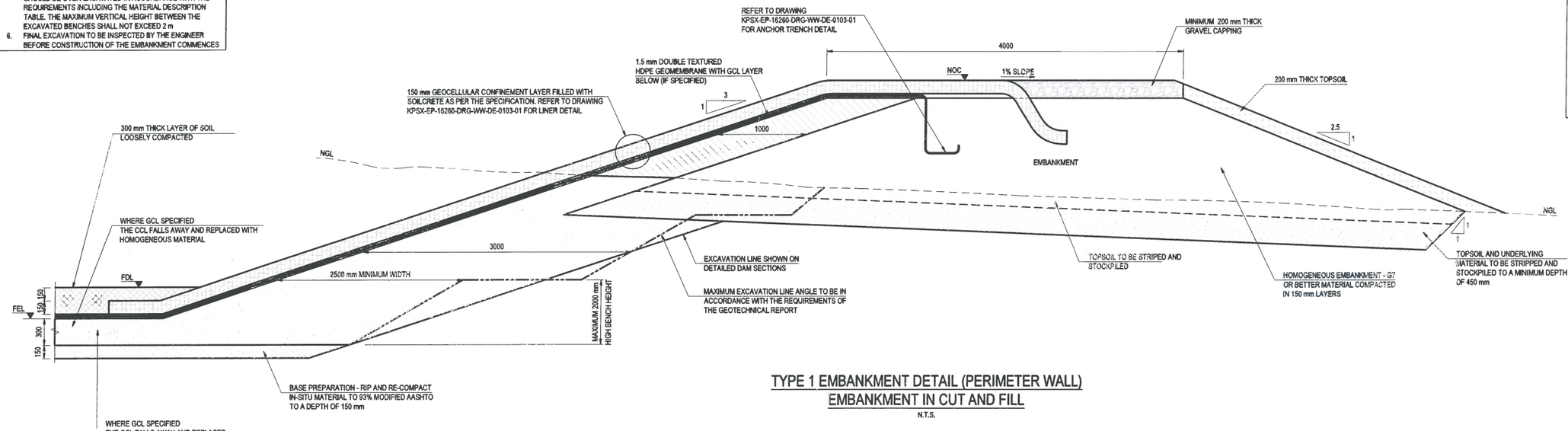
NOTES:

1. REFER TO DWG KPSX-FS-16260-DRG-WW-DE-0103-01 FOR TYPICAL ANCHOR TRENCH DETAILS
2. DOWNSTREAM EMBANKMENT TO BE TOPSOILED TO A MINIMUM THICKNESS OF 200 mm AND HYDROSEEDED IN ACCORDANCE WITH ENGINEERING SPECIFICATIONS
3. SEMI-PERVIOUS MATERIAL TO BE SCARIFIED AFTER EACH COMPACTED LAYER PRIOR TO PLACING AND COMPACTION OF THE NEXT LAYER
4. MATERIAL FOR THE SECONDARY LAYER TO BE SELECTED TO CONTAIN NO PARTICALS GREATER THAN 9 mm. FINAL SURFACE TO BE PREPARED IN ACCORDANCE WITH THE PROJECT SPECIFICATION
5. WHERE THE EMBANKMENT IS CONSTRUCTED BELOW NGL IT SHOULD BE OVER EXCAVATED IN ACCORDANCE WITH THE REQUIREMENTS INCLUDING THE MATERIAL DESCRIPTION TABLE. THE MAXIMUM VERTICAL HEIGHT BETWEEN THE EXCAVATED BENCHES SHALL NOT EXCEED 2 m
6. FINAL EXCAVATION TO BE INSPECTED BY THE ENGINEER BEFORE CONSTRUCTION OF THE EMBANKMENT COMMENCES

LEGEND:

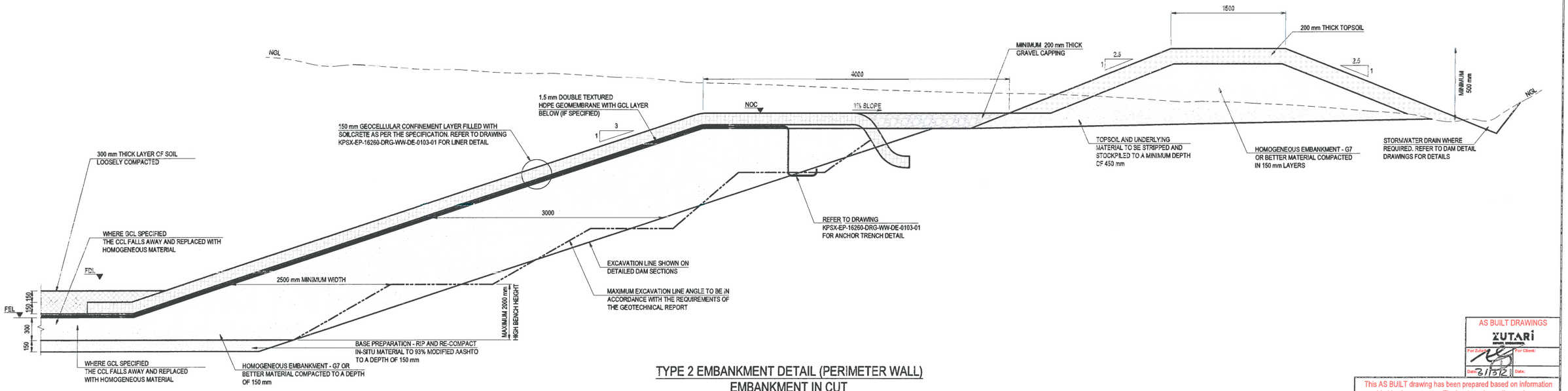
- NOC - NON OVERSPILL CREST
- FDL - FINAL DAM LEVEL
- FEL - FINAL EARTWORKS LEVEL
- NGL - NGL - NATURAL GROUND LEVEL
- EXCAVATION LINE
- BASE PREPARATION
- MINIMUM 200 mm THICK GRAVEL CAPPING
- HOMOGENEOUS EMBANKMENT - EMBANKMENT TO BE CONSTRUCTED USING G7 OR BETTER MATERIAL COMPACTED IN 150 mm LAYERS TO 95% PROCTOR DENSITY @ -1% TO +2% OMC. EMBANKMENT CAN ALTERNATIVELY BE CONSTRUCTED USING THE SELECTED MATERIAL REQUIRED FOR SECONDARY LINER
- 150 mm GEOCELLULAR CONFINEMENT LAYER FILLED WITH SOILCRETE AS PER SPECIFICATION
- 200 mm THICK TOPSOIL
- 300 mm SOIL LOOSELY COMPACTED

ZUTARI
IMPACT. ENGINEERED.
APPROVED PROFESSIONAL PERSON DAM ENGINEER
A.G. CHEMALY
870130
Signature
Date: 2021-03-31



TYPE 1 EMBANKMENT DETAIL (PERIMETER WALL)
EMBANKMENT IN CUT AND FILL

N.T.S.



TYPE 2 EMBANKMENT DETAIL (PERIMETER WALL)
EMBANKMENT IN CUT

N.T.S.

AS BUILT DRAWINGS
ZUTARI
For Zutari: For Client:
Date: 2/3/21 Date:

This AS BUILT drawing has been prepared based on information provided by the contractor. The levels and coordinates have not been independently checked or verified by Zutari.

REFERENCE DRAWINGS		REFERENCE DRAWINGS	
DRAWING NO.	TITLE	DRAWING NO.	TITLE
KPSX-EP-16260-DRG-WW-DE-0104-01	LINING FIXING DETAIL		
KPSX-EP-16260-DRG-WW-DE-0103-01	LINING DETAIL		

ZUTARI PROFESSIONAL ENGINEER

NAME	VICTOR WENTZEL	DATE
PROF. REG. No.	20130173	
SIGNATURE		3/3/21

SOUTH 32 PROFESSIONAL APPROVAL

NAME	SIGN.	DATE
CLIENT PROJECT MANAGER		
CLIENT ENGINEERING MANAGER		
ADDITIONAL SIGNATORY		
ZUTARI PROJECT No.	113452	
CLIENT CONTRACT No.	8500088746	

REV.	I.T.	DESCRIPTION	DRWN.	DES.	CHK.	APR.	DATE
*	F	AS-BUILT DRAWING	R.S.	I.B.	A.C.	V.W.	26/02/2021

I.T. ISSUE TYPE: (A) FOR REVIEW (SQ) (B) INTERNAL PEER REVIEW (C) FOR APPROVAL (CR) (D) FOR CONSTRUCTION (E) FOR INFORMATION (F) AS-BUILT (G) CANCELED

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ZUTARI IMPACT. ENGINEERED.
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Pretoria
0081
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SOUTH32

KLIPSPRUIT EXTENSION (KPSX)

AREA: POLLUTION CONTROL DAM
ELEMENT: TYPICAL DETAIL
TITLE: TYPICAL EMBANKMENT DETAIL

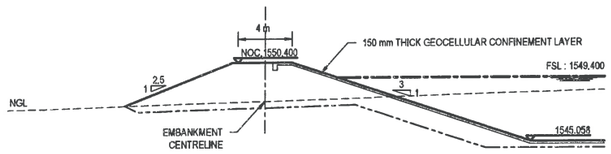
SCALE:	SHEET SIZE	DRAWING NUMBER	SHEET No.	REV.
	(A1)	KPSX-EP-16260-DRG-WW-DE-0102-01	1 OF 2	*

PROJECT FILE 113452

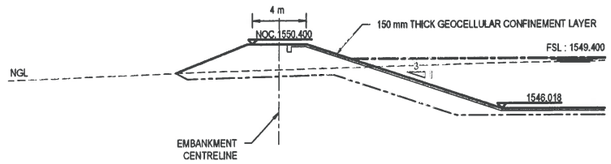
THE MASTER HELD AT ZUTARI, GAUTENG DELIVERY CENTRE, RESOURCES & MANUFACTURING UNIT, BEARS THE ORIGINAL SIGNATURE OF APPROVAL

NOTES:
1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS STATED OTHERWISE
2. ALL LEVELS ARE IN METRES ABOVE SEA LEVEL
3. EMBANKMENT TO BE CONSTRUCTED TO 2% HIGHER THAN HEIGHT ABOVE ORIGINAL GROUND LEVEL TO THEORETICAL NON OVERSPILL CREST IN ORDER TO ALLOW FOR LONG TERM SETTLEMENT
4. SELECTED SEMI-PERVIOUS EMBANKMENT MATERIAL TO BE PLACED WITHIN -1% TO +2% OF OPTIMUM MOISTURE CONTENT
5. REFER TO DRAWING KPSA-EP-16260-DRG-WW-DE-0103-01 FOR THE TYPICAL LINER DETAIL
6. WHERE THE DOWNSTREAM EMBANKMENT IS LOWER THAN 500 mm THE EMBANKMENT SHOULD BE PROTECTED WITH A 500 mm HIGH EARTH BERM
7. BENCH MARKS OR REFERENCE POINTS ON THE CREST OF THE EMBANKMENT AT THE APPROXIMATE POSITIONS AS SHOWN. 18 ON THE DAM CREST, 1 ON THE PUMP STATION PLATFORM AND ONE ELSEWHERE AS DETERMINED BY THE ENGINEER
8. FINAL EXCAVATION TO BE INSPECTED BY THE ENGINEER PRIOR TO THE CONSTRUCTION OF THE FLOOR AND EMBANKMENTS
9. SECTIONS ONLY INDICATE EMBANKMENTS. STORMWATER CHANNELS, BERMS AND STRUCTURES ARE DETAILED ELSEWHERE.

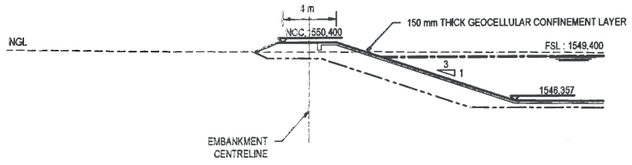
LEGEND:
- NGL
- FINAL DAM LEVELS
- EXCAVATION LINE
- WATER LEVEL
- NOC NON OVERSPILL CREST
- FSL FULL SUPPLY LEVEL



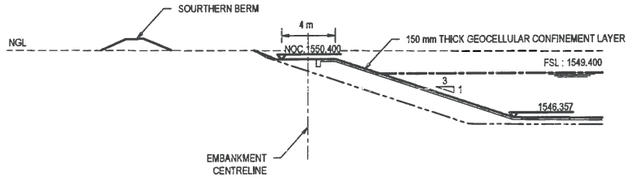
SECTION A-A
FROM 0.000 TO 40.000
SCALE 1:500



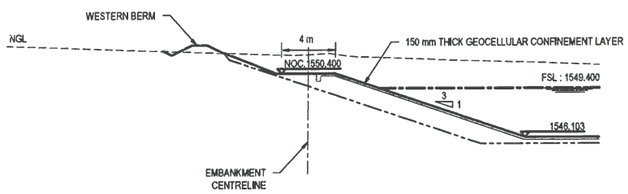
SECTION B-B
FROM 0.000 TO 40.000
SCALE 1:500



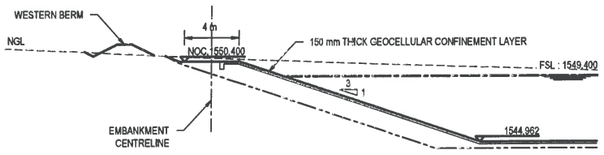
SECTION C-C
FROM 0.000 TO 40.000
SCALE 1:500



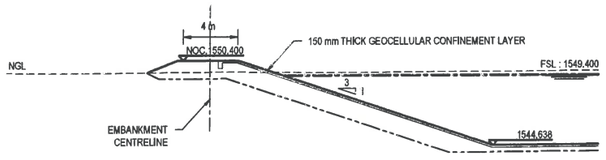
SECTION D-D
FROM 0.000 TO 40.000
SCALE 1:500



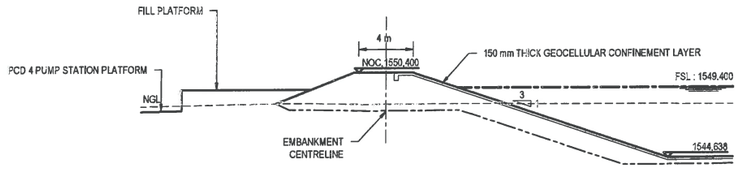
SECTION E-E
FROM 0.000 TO 40.000
SCALE 1:500



SECTION F-F
FROM 0.000 TO 40.000
SCALE 1:500



SECTION G-G
FROM 0.000 TO 40.000
SCALE 1:500



SECTION H-H
FROM 0.000 TO 40.000
SCALE 1:500

AS BUILT DRAWINGS
ZUTARI IMPACT. ENGINEERED.
Approved for Client:
Date: 15/05/2024

This AS BUILT drawing has been prepared based on information provided by the contractor. The levels and coordinates have not been independently checked or verified by Zutari.

REFERENCE DRAWINGS		REFERENCE DRAWINGS	
		KPSX-EP-16260-DRG-WW-DE-0104-01	POLLUTION CONTROL DAMS TYPICAL DETAIL LINER FIXING DETAIL
		KPSX-EP-16260-DRG-WW-DE-0103-01	POLLUTION CONTROL DAMS TYPICAL DETAIL LINER DETAIL
		KPSX-EP-16260-DRG-WW-DE-0102-01	POLLUTION CONTROL DAMS TYPICAL DETAIL EMBANKMENT DETAIL
DRAWING NO.	TITLE	DRAWING NO.	TITLE

ZUTARI PROFESSIONAL ENGINEER		
NAME	VICTOR WENTZEL	DATE
PROF. REG. No.	20130133	
SIGNATURE		24/05/2024

SOUTH 32 PROFESSIONAL APPROVAL		
NAME	SIGN.	DATE
CLIENT PROJECT MANAGER		
CLIENT ENGINEERING MANAGER		
ADDITIONAL SIGNATORY		
ZUTARI PROJECT No.	113452	
CLIENT CONTRACT No.	8500088746	

REV.	I.T.	DESCRIPTION	DRWN.	DES.	CHK.	APR.	DATE
*	F	AS-BUILT DRAWING	E.E.	S.M.	V.W.	A.C.	26/02/2021

I.T. ISSUE TYPE: (A) FOR REVIEW (SQ) (B) INTERNAL PEER REVIEW (C) FOR APPROVAL (CR) (D) FOR CONSTRUCTION (E) FOR INFORMATION (F) AS-BUILT (G) CANCELED

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SOUTH32

KLIPSPRUIT EXTENSION (KPSX)

AREA: PCD 4

ELEMENT: BULK EARTHWORKS

TITLE: EMBANKMENT SECTIONS LAYOUT

SCALE:	SHEET SIZE	DRAWING NUMBER	SHEET No.	REV.
	(A1)	KPSX-EP-16260-DRG-WW-SE-0102-01	1 OF 1	*

PROJECT FILE: 113452

THE MASTER HELD AT ZUTARI, GAUTENG DELIVERY CENTRE, RESOURCES & MANUFACTURING UNIT, BEARS THE ORIGINAL SIGNATURE OF APPROVAL

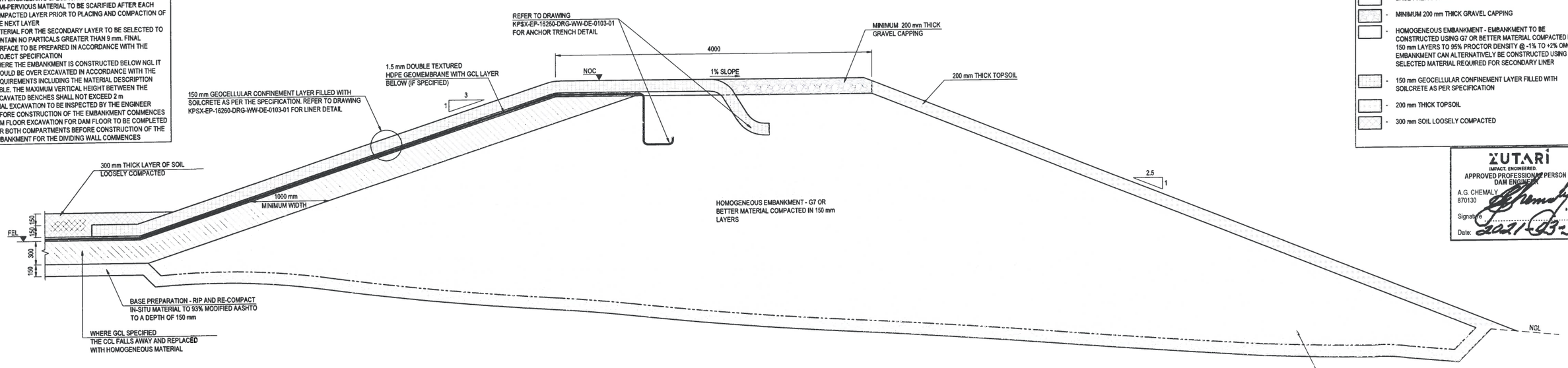
NOTES:

1. REFER TO DWG KPSX-FS-16260-DRG-WW-DE-0103-01 FOR TYPICAL ANCHOR TRENCH DETAILS
2. DOWNSTREAM EMBANKMENT TO BE TOPSOILED TO A MINIMUM THICKNESS OF 200 mm AND HYDROSEEDED IN ACCORDANCE WITH ENGINEERING SPECIFICATIONS
3. SEMI-PERVIOUS MATERIAL TO BE SCARIFIED AFTER EACH COMPACTED LAYER PRIOR TO PLACING AND COMPACTION OF THE NEXT LAYER
4. MATERIAL FOR THE SECONDARY LAYER TO BE SELECTED TO CONTAIN NO PARTICALS GREATER THAN 9 mm. FINAL SURFACE TO BE PREPARED IN ACCORDANCE WITH THE PROJECT SPECIFICATION
5. WHERE THE EMBANKMENT IS CONSTRUCTED BELOW NGL IT SHOULD BE OVER EXCAVATED IN ACCORDANCE WITH THE REQUIREMENTS INCLUDING THE MATERIAL DESCRIPTION TABLE. THE MAXIMUM VERTICAL HEIGHT BETWEEN THE EXCAVATED BENCHES SHALL NOT EXCEED 2 m
6. FINAL EXCAVATION TO BE INSPECTED BY THE ENGINEER BEFORE CONSTRUCTION OF THE EMBANKMENT COMMENCES
7. DAM FLOOR EXCAVATION FOR DAM FLOOR TO BE COMPLETED FOR BOTH COMPARTMENTS BEFORE CONSTRUCTION OF THE EMBANKMENT FOR THE DIVIDING WALL COMMENCES

LEGEND:

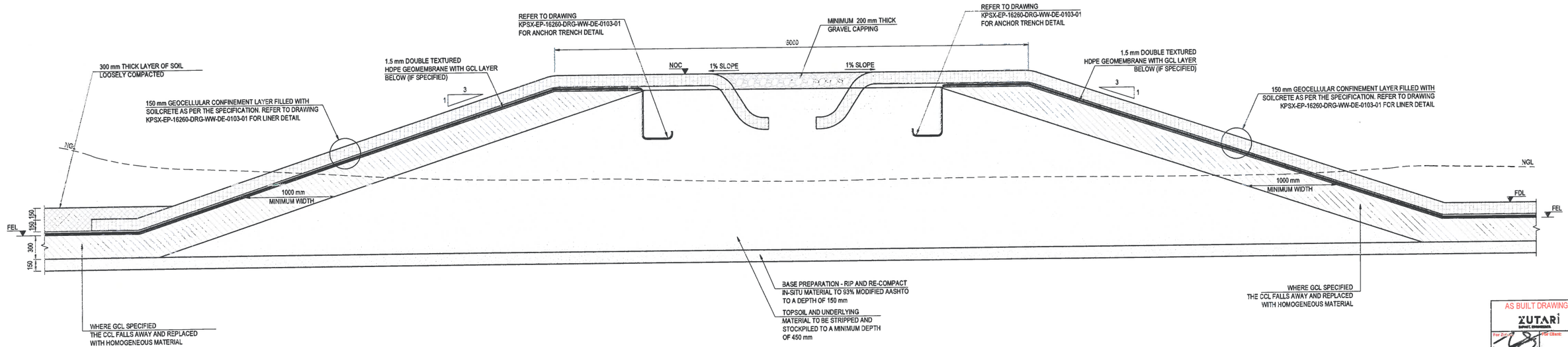
- NOC - NON OVERSPILL CREST
- FDL - FINAL DAM LEVEL
- FEL - FINAL EARTWORKS LEVEL
- NGL - NGL - NATURAL GROUND LEVEL
- EXCAVATION LINE
- BASE PREPARATION
- MINIMUM 200 mm THICK GRAVEL CAPPING
- HOMOGENEOUS EMBANKMENT - EMBANKMENT TO BE CONSTRUCTED USING G7 OR BETTER MATERIAL COMPACTED IN 150 mm LAYERS TO 95% PROCTOR DENSITY @ -1% TO +2% OMC. EMBANKMENT CAN ALTERNATIVELY BE CONSTRUCTED USING THE SELECTED MATERIAL REQUIRED FOR SECONDARY LINER
- 150 mm GEOCELLULAR CONFINEMENT LAYER FILLED WITH SOILCRETE AS PER SPECIFICATION
- 200 mm THICK TOPSOIL
- 300 mm SOIL LOOSELY COMPACTED

ZUTARI
IMPACT. ENGINEERED.
APPROVED PROFESSIONAL PERSON DAM ENGINEER
A.G. CHEMALY
870130
Signature:
Date: 2021-03-31



TYPE 3 EMBANKMENT DETAIL (PERIMETER WALL) EMBANKMENT IN FILL

N.T.S.



TYPE 4 EMBANKMENT DETAIL (DIVIDING WALL) EMBANKMENT IN CUT AND FILL

N.T.S.

AS BUILT DRAWINGS
ZUTARI IMPACT. ENGINEERED.
For Zutari: Date: 31/3/21
For Client: Date:

This AS BUILT drawing has been prepared based on information provided by the contractor. The levels and coordinates have not been independently checked or verified by Zutari.

REFERENCE DRAWINGS		REFERENCE DRAWINGS	
DRAWING NO.	TITLE	DRAWING NO.	TITLE
		KPSX-EP-16260-DRG-WW-DE-0104-01	LINING FIXING DETAIL
		KPSX-EP-16260-DRG-WW-DE-0103-01	LINING DETAIL

ZUTARI PROFESSIONAL ENGINEER		
NAME	VICTOR WENTZEL	DATE
PROF. REG. No.	20130173	
SIGNATURE		31/3/21

SOUTH 32 PROFESSIONAL APPROVAL		
NAME	SIGN.	DATE
CLIENT PROJECT MANAGER		
CLIENT ENGINEERING MANAGER		
ADDITIONAL SIGNATORY		
ZUTARI PROJECT No.	113452	
CLIENT CONTRACT No.	8500088746	

REV.	I.T.	DESCRIPTION	DRWN.	DES.	CHK.	APR.	DATE
*	F	AS-BUILT DRAWING	R.S.	I.B.	A.C.	V.W.	17/03/2021

I.T. ISSUE TYPE: (A) FOR REVIEW (SQ) (B) INTERNAL PEER REVIEW (C) FOR APPROVAL (CR) (D) FOR CONSTRUCTION (E) FOR INFORMATION (F) AS-BUILT (G) CANCELED

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KLIPSPRUIT EXTENSION (KPSX)

AREA: POLLUTION CONTROL DAM
ELEMENT: TYPICAL DETAIL
TITLE: TYPICAL EMBANKMENT DETAIL

SCALE:	SHEET SIZE	DRAWING NUMBER	SHEET No.	REV.
	(A1)	KPSX-EP-16260-DRG-WW-DE-0102-02	2 OF 2	*

PROJECT FILE: 113452

THE MASTER HELD AT ZUTARI, GAUTENG DELIVERY CENTRE, RESOURCES & MANUFACTURING UNIT, BEARS THE ORIGINAL SIGNATURE OF APPROVAL

NOTES:

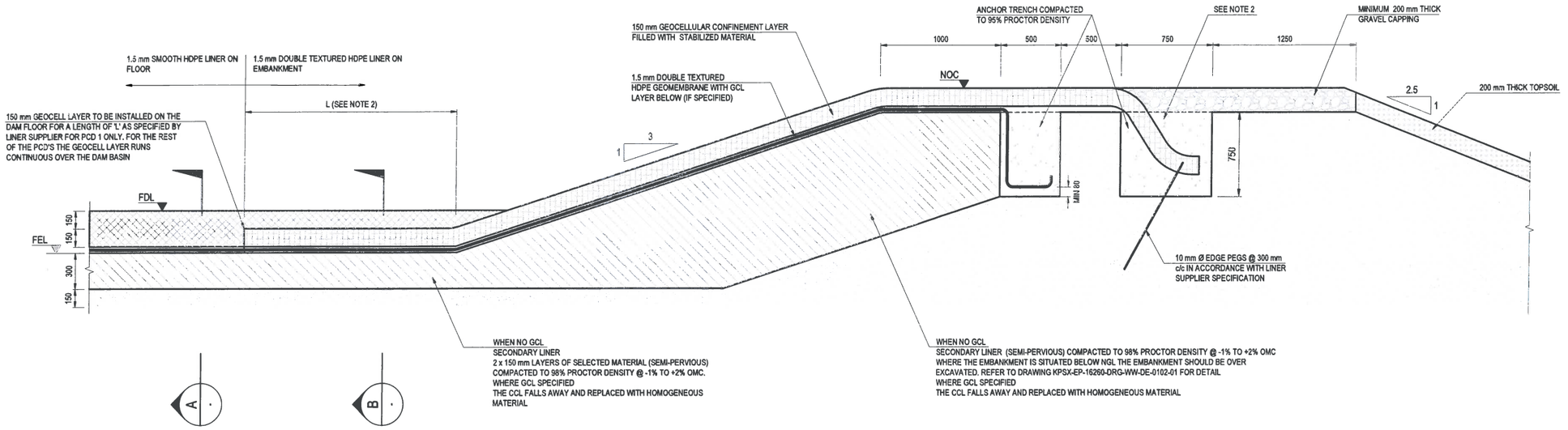
1. DOWNSTREAM EMBANKMENT TO BE TOPSOILED TO A MINIMUM THICKNESS OF 200 mm AND HYDROSEEDED IN ACCORDANCE WITH ENGINEERING SPECIFICATIONS.
2. "DEADMAN'S" ANCHOR IS PROPOSED FOR THE ANCHORING OF THE GEOCELL INTO THE ANCHOR TRENCH. FINAL ANCHORING DETAILS TO BE SPECIFIED BY THE INSTALLATION CONTRACTOR BASED ON THE EMBANKMENT HEIGHT AND SLOPE OF THE INDIVIDUAL PCD'S, (L) TO BE SUPPLIED BY LINER SUPPLIER. ALL CALCULATIONS AND ANALYSIS TO BE SUBMITTED TO ENGINEER FOR APPROVAL.
3. GEOCELLULAR CONFINEMENT LAYER (GEOCELL) TO BE FILLED WITH SOILCRETE IN ACCORDANCE WITH THE PROJECT SPECIFICATIONS. (SPECIFICATION 112423-16200-SPE-WW-0002 PART PAE)
4. WHERE A GCL IS REQUIRED ENVIROFIX X800 OR SIMILAR APPROVED IS TO BE USED ON THE FLOOR OF THE PCD AND ENVIROFIX X1000 OR SIMILAR APPROVED TO BE USED ON THE SLOPES OF THE PCD'S / EMBANKMENTS

LEGEND:

NOC - NON OVERSPILL CREST

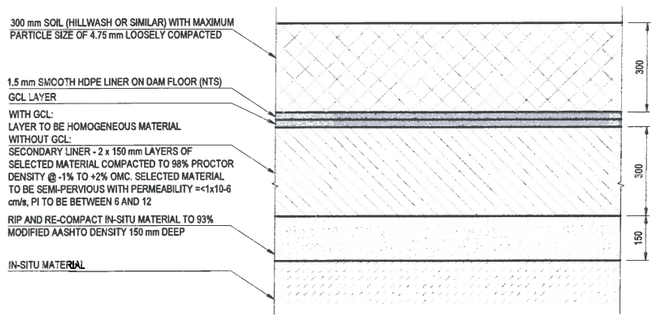
FDL - FINAL DAM LEVEL

FEL - FINAL EARTHWORKS LEVEL



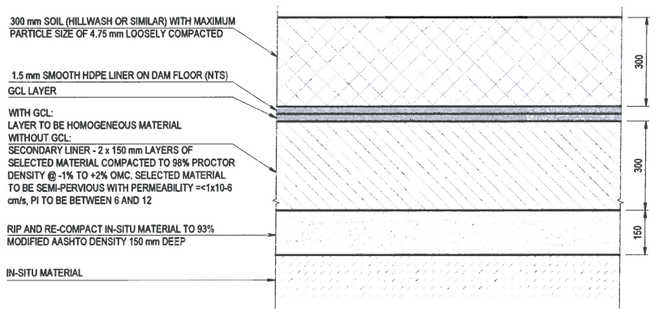
TYPICAL EMBANKMENT SECTION

N.T.S.



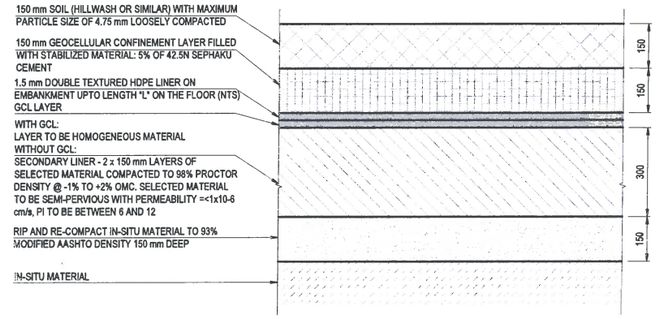
SECTION A-A
PCD 3 & PCD 4

SCALE 1:10



SECTION A-A
PCD 1

SCALE 1:10



SECTION B-B
PCD 3 & PCD 4

SCALE 1:10

ZUTARI
IMPACT. ENGINEERED.
APPROVED PROFESSIONAL PERSON DAM ENGINEER
A.G. CHEMALY
870130
Signature:
Date: 2021-03-31

AS BUILT DRAWINGS
ZUTARI
For Zutari: For Client:
Date: 31/3/21 Date:

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REFERENCE DRAWINGS		REFERENCE DRAWINGS	
		KPSX-EP-16260-DRG-WW-DE-0104-01	LINING FIXING DETAIL
		KPSX-EP-16260-DRG-WW-DE-0102-02	TYPICAL EMBANKMENT DETAIL
		KPSX-EP-16260-DRG-WW-DE-0102-01	TYPICAL EMBANKMENT DETAIL
DRAWING NO.	TITLE	DRAWING NO.	TITLE

ZUTARI PROFESSIONAL ENGINEER		
NAME	VICTOR WENTZEL	DATE
PROF. REG. No.	20130173	
SIGNATURE		31/3/21

SOUTH 32 PROFESSIONAL APPROVAL		
NAME	SIGN.	DATE
CLIENT PROJECT MANAGER		
CLIENT ENGINEERING MANAGER		
ADDITIONAL SIGNATORY		
ZUTARI PROJECT No.	113452	
CLIENT CONTRACT No.	8500088746	

REV.	I.T.	DESCRIPTION	DRWN.	DES.	CHK.	APR.	DATE
*	F	AS-BUILT DRAWING	R.S.	I.B.	A.C.	V.W.	26/02/2021

I.T. ISSUE TYPE: (A) FOR REVIEW (SQ) (B) INTERNAL PEER REVIEW (C) FOR APPROVAL (CR) (D) FOR CONSTRUCTION (E) FOR INFORMATION (F) AS-BUILT (G) CANCELED

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SOUTH32

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Pretoria
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T + 27 12 427 2000
E connect@zutari.com

KLIPSPRUIT EXTENSION (KPSX)

AREA: POLLUTION CONTROL DAM

ELEMENT: TYPICAL DETAIL

TITLE: LINING DETAIL

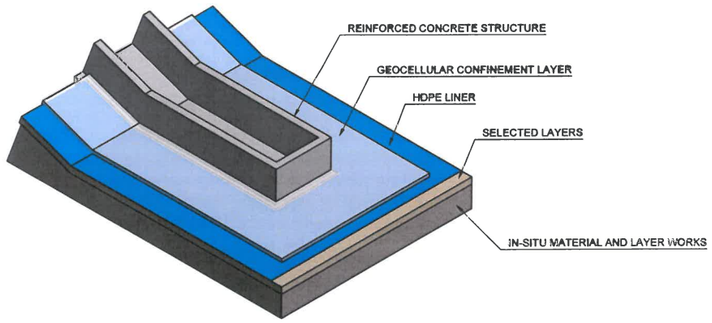
SCALE:	SHEET SIZE	DRAWING NUMBER	SHEET No.	REV.
AS-SHOWN	(A1)	KPSX-EP-16260-DRG-WW-DE-0103-01	1 OF 1	*

PROJECT FILE: 113452

THE MASTER HELD AT ZUTARI, GAUTENG DELIVERY CENTER, RESOURCES & MANUFACTURING UNIT, BEARS THE ORIGINAL SIGNATURE OF APPROVAL

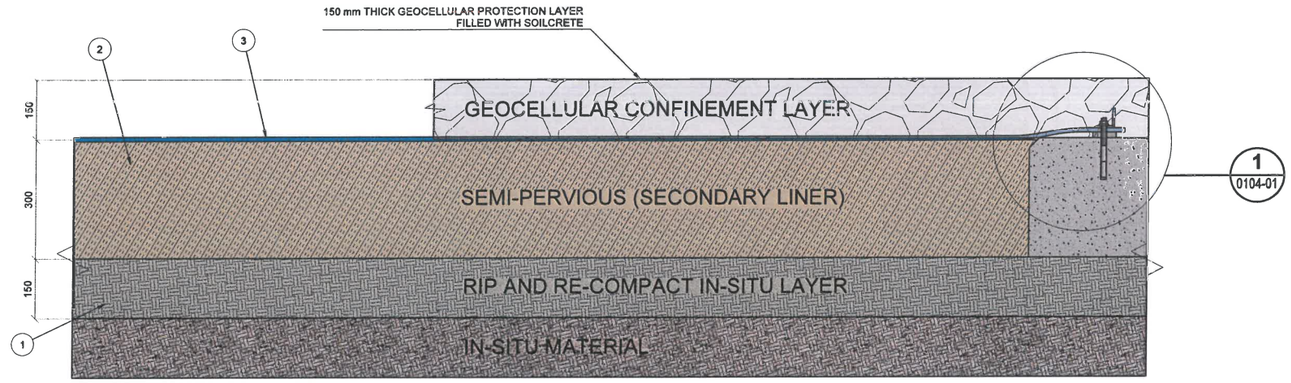
NOTES:

1. GEOCELLULAR CONFINEMENT LAYER (GEOCELL) TO BE FILLED WITH SOILCRETE IN ACCORDANCE WITH THE PROJECT SPECIFICATION (SPECIFICATION 112423-16200-SPE-WW-0002 PART PAE)



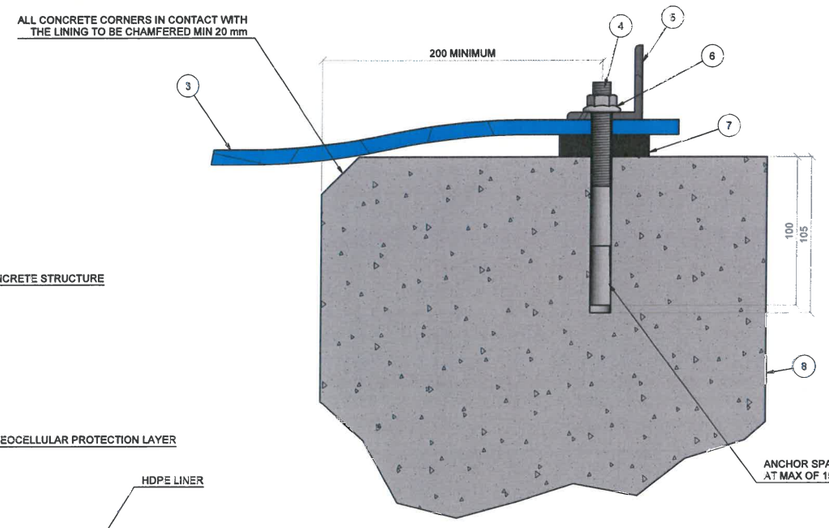
ISOMETRIC VIEW: TYPICAL DETAIL OF LINER FIXING TO CONCRETE STRUCTURE

SCALE 1 : 100



TYPICAL CROSS SECTION: LINER TO CONCRETE JOINT

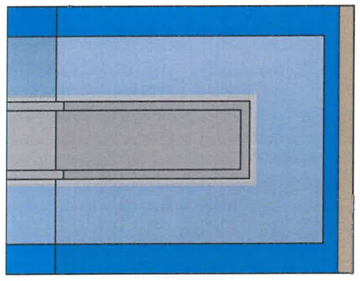
N.T.S.



DETAIL 1 (0104-01)

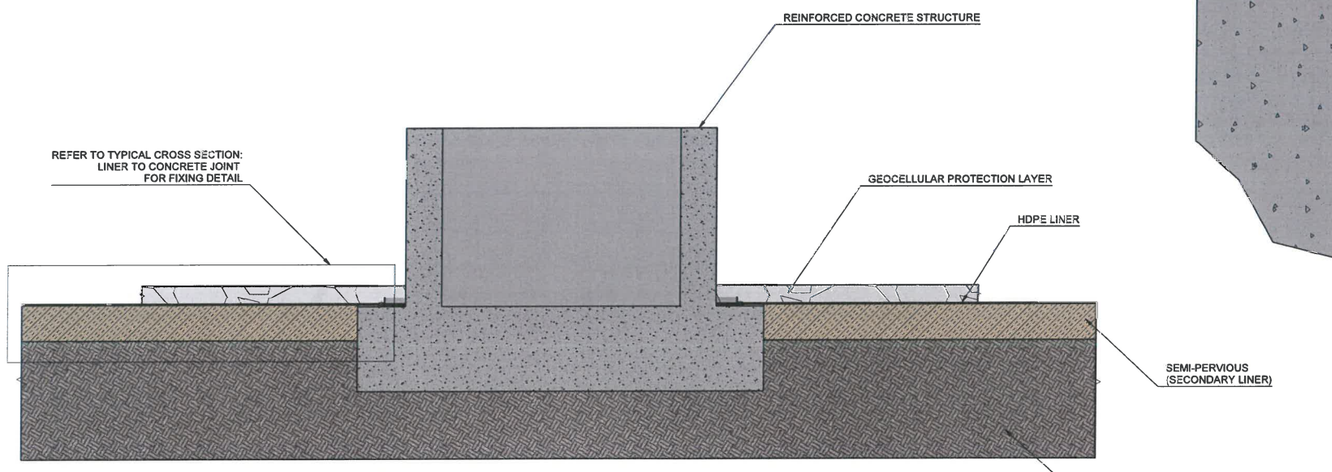
1:2

A (0104-01)



PLAN VIEW:

SCALE 1 : 100



SECTION A (0104-01)

1:25

PARTS LIST		
ITEM	QTY	DESCRIPTION
1	1	RIP AND RE-COMPACT IN-SITU MATERIAL TO 93% MODIFIED AASHTO DENSITY 150 mm DEEP
2	1	WITH GCL: LAYER TO BE HOMOGENEOUS EMBANKMENT WITHOUT GCL: SECONDARY LINER - 2 x 150 mm LAYERS OF SELECTED MATERIAL COMPACTED TO 98% PROCTOR DENSITY @ -1% TO +2% OMC. SELECTED MATERIAL TO BE SEMI-PERVIOUS WITH PERMEABILITY =<1x10-6 cm/s, PI TO BE BETWEEN 6 AND 12
3	1	1.5 mm DOUBLE TEXTURED HDPE LINER (PRIMARY LINER) WITH GCL LAYER BELOW (IF SPECIFIED)
4	1	304 S/S WEDGE ANCHORS
5	1	50 x 50 x 5 mm 304L STAINLESS STEEL ANGLE IRON
6	1	HEXAGON NUT WITH WASHER STAINLESS STEEL
7	1	60 x 5 mm RUBBER GASKET
8	1	REINFORCED CONCRETE STRUCTURE

REFERENCE DRAWINGS			
DRAWING NO.	TITLE	DRAWING NO.	TITLE

ZUTARI PROFESSIONAL ENGINEER		
NAME	VICTOR WENTZEL	DATE
PROF. REG. No.	20130173	
SIGNATURE		31/3/21

SOUTH 32 PROFESSIONAL APPROVAL		
NAME	SIGN.	DATE
CLIENT PROJECT MANAGER		
CLIENT ENGINEERING MANAGER		
ADDITIONAL SIGNATORY		
ZUTARI PROJECT No.	113452	
CLIENT CONTRACT No.	8500084829	

REV.	I.T.	DESCRIPTION	DRWN.	DES.	CHK.	APR.	DATE
-	F	AS BUILT DRAWING	J.A.V.V.	C.N.	C.N.	V.W.	23.02.21

I.T. ISSUE TYPE: (A) FOR REVIEW (SQ) (B) INTERNAL PEER REVIEW (C) FOR APPROVAL (CR) (D) FOR CONSTRUCTION (E) FOR INFORMATION (F) AS-BUILT (G) CANCELLED

ZUTARI IMPACT. ENGINEERED.
APPROVED PROFESSIONAL PERSON
DAM ENGINEER
A.G. CHEMALY
870130
Signature
Date: 2021-03-31

AS BUILT DRAWINGS
ZUTARI IMPACT. ENGINEERS.
For Zutari / For Client
Date 31/3/21 Date

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SOUTH32

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Tel: +27 12 427 2000
E connect@zutari.com

KLIPSPRUIT EXTENSION (KPSX)

AREA:
ELEMENT: POLLUTION CONTROL DAMS
TITLE: TYPICAL DETAIL LINER FIXING DETAIL

SCALE:	SHEET SIZE	Drawing Number	SHEET No.	REV.
AS SHOWN	(A1)	KPSX-EP-16260-DRG-WW-DE-0104-01	1 OF 1	*

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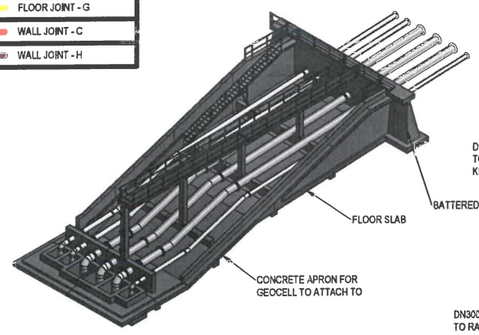
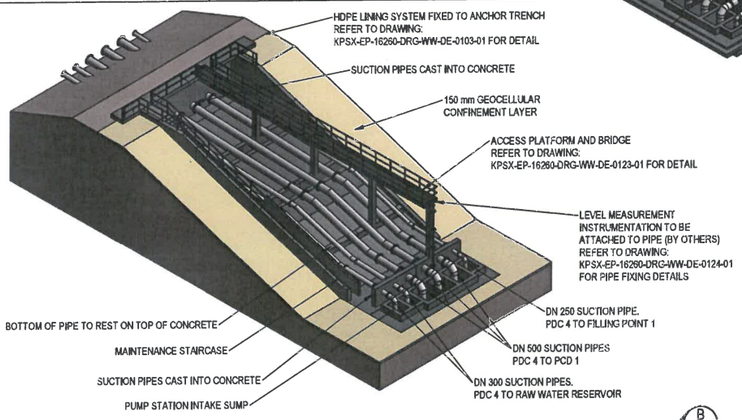
STRUCTURAL REQUIREMENTS	
STRUCTURE TYPE:	WATER RETAINING STRUCTURE
CONCRETE GRADE:	35 MPa/19 mm TO ALL STRUCTURAL CONCRETE
	15 MPa/19 mm TO BLINDING
BLINDING LAYER	50 mm BELOW ALL STRUCTURES
EXTENDERS:	MAXIMUM FLY ASH TO SPECIFICATION
AGGREGATE:	STANDARD
FORMED SURFACE FINISH:	SMOOTH
	ALL EXPOSED EXTERNAL EDGES IN CONCRETE WORK SHALL HAVE 20 mm X 20 mm CHAMFERS
UNFORMED SURFACE FINISH:	STEEL FLOAT FINISH TO TOP OF WALLS AND FLOORS
CONCRETE COVER TO REBAR:	75 mm IF CAST AGAINST SOIL
	40 mm FOR WATER CONTACT AREAS
	50 mm FOR SOIL CONTACT AREAS OR CAST AGAINST BLINDING
	30 mm FOR AIR CONTACT AREAS

JOINT TYPE

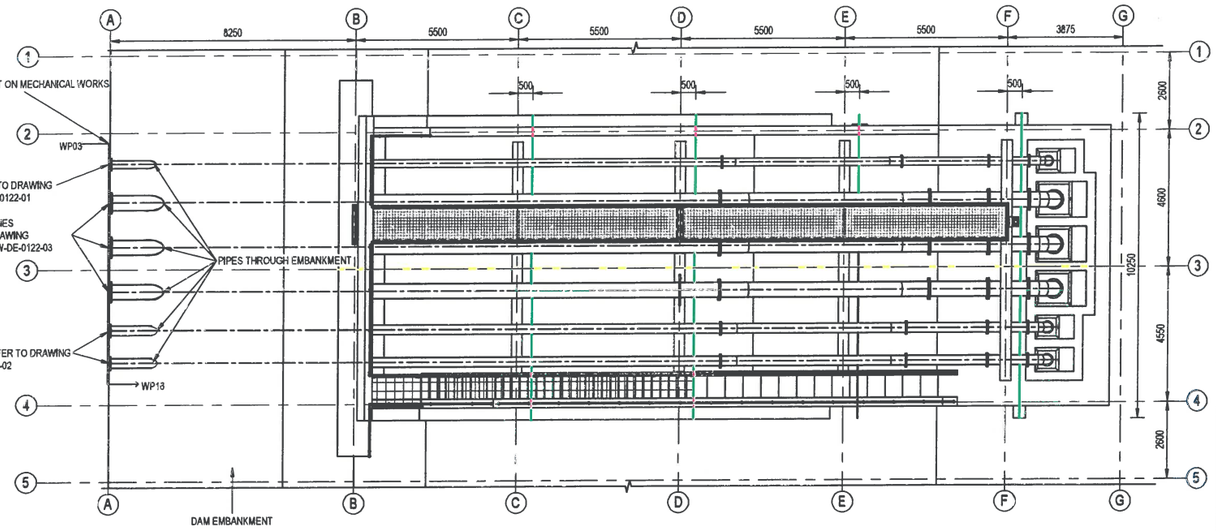
- FLOOR JOINT - A1
- FLOOR JOINT - G
- WALL JOINT - C
- WALL JOINT - H



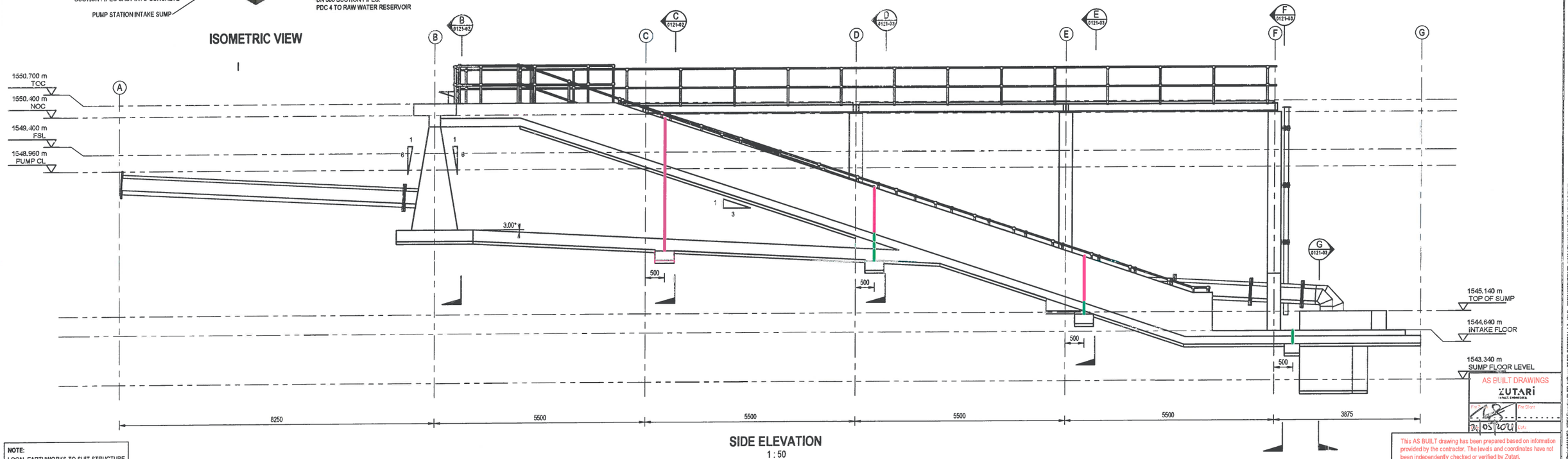
ISOMETRIC VIEW (NO EMBANKMENT)



ISOMETRIC VIEW



PLAN VIEW
1 : 100



SIDE ELEVATION
1 : 50

NOTE:
LOCAL EARTHWORKS TO SUIT STRUCTURE

REFERENCE DRAWINGS	
KPSX-EP-16260-DRG-WW-DE-0124	PUMP STATION INTAKE STRUCTURE - LEVEL INSTRUMENTATION PIPE FIXING DETAILS
KPSX-EP-16260-DRG-WW-DE-0123	PUMP STATION INTAKE STRUCTURE - ACCESS PLATFORM AND BRIDGE
KPSX-EP-16260-DRG-WW-DE-0122	PUMP STATION INTAKE STRUCTURE - MECHANICAL DETAILS
KPSX-EP-16260-DRG-WW-DE-0121	PUMP STATION INTAKE STRUCTURE - LAYOUTS, SECTIONS AND DETAILS
KPSX-EP-16260-DRG-WW-DE-0106	TYPICAL DETAILS - JOINT DETAILS
DRAWING No.	TITLE

REFERENCE DRAWINGS	
KPSX-EP-16260-DRG-WW-DE-0104	TYPICAL DETAILS - LINING FIXING DETAIL
KPSX-EP-16260-DRG-WW-DE-0103	TYPICAL DETAILS - LINING DETAIL
KPSX-EP-16260-DRG-WW-DE-0102	TYPICAL DETAILS - TYPICAL EMBANKMENT DETAIL
KPSX-EP-11000-DRG-SS-GE-0013	FLOOR GRATING - TYPICAL DETAILS
KPSX-EP-11000-DRG-SS-GE-0012	STRUCTURAL STEELWORK - HANDRAILS
KPSX-EP-11000-DRG-SS-GE-0006	STRUCTURAL STEELWORK - STAIRCASE AND TYPICAL DETAILS
KPSX-EP-11000-DRG-SS-GE-0001	STRUCTURAL STEELWORK - STANDARD STEELWORK NOTES
KPSX-EP-11000-DRG-SC-GE-0002	STRUCTURAL CONCRETE - TYPICAL CIVIL DETAILS
KPSX-EP-11000-DRG-SC-GE-0001	STRUCTURAL CONCRETE - STANDARD CONCRETE NOTES
DRAWING No.	TITLE

ZUTARI PROFESSIONAL ENGINEER		
NAME	VICTOR WENTZEL	DATE
PROF. REG. No.	20130173	
SIGNATURE		21/05/2021

SOUTH 32 PROFESSIONAL APPROVAL		
NAME	SIGN	DATE
CLIENT PROJECT MANAGER		
CLIENT ENGINEERING MANAGER		
ADDITIONAL SIGNATORY		
ZUTARI PROJECT No.	113452	
CLIENT CONTRACT No.	8500084829	

REV.	I.T.	DESCRIPTION	DRWN.	DES.	CHK.	APR.	DATE
*	F	AS-BUILT DRAWING	G.W.	G.W.	V.W.	J.L.	23/04/2021

I.T. ISSUE TYPE: (A) FOR REVIEW (B) FOR APPROVAL (C) FOR TENDER (D) FOR CONSTRUCTION (E) FOR INFORMATION (F) AS-BUILT (G) CANCELLED

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ZUTARI IMPACT ENGINEERED.
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T + 27 12 427 2000
E connect@zutari.com

AS BUILT DRAWINGS
ZUTARI IMPACT ENGINEERS
Per Client
21/05/2021 Date

This AS BUILT drawing has been prepared based on information provided by the contractor. The levels and coordinates have not been independently checked or verified by Zutari.

KLIPSPRUIT EXTENSION (KPSX)

AREA:	PCD 4
ELEMENT:	PUMP STATION INTAKE STRUCTURE
TITLE:	GENERAL ARRANGEMENT

SCALE:	SHEET SIZE	DRAWING NUMBER	SHEET NO.	REV.
AS SHOWN	(A1)	KPSX-EP-16260 - DRG - WW-GA - 0120-01	1 OF 1	*

Filename: P:\Projects\113452 KPSX Execution Ph1\ELAN\Drawings\06. DESIGN\Mech&Agch\ RevModel\16260KPSXEPH-1-2004ADAMW-0231PCD 4 PUMP INTAKE.rvt
Plot Date: 4/27/2021 4:09:38 PM
Office:

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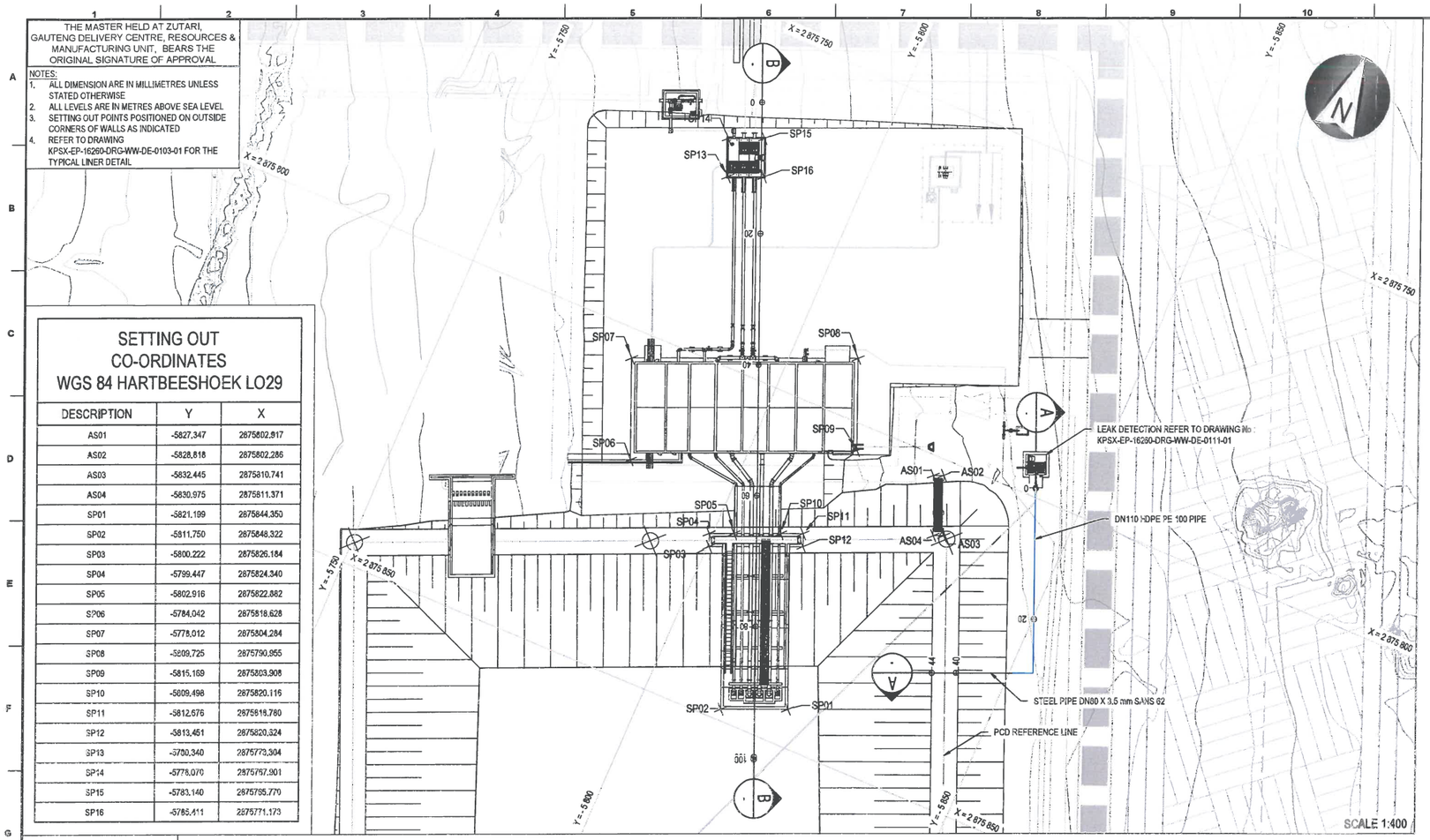
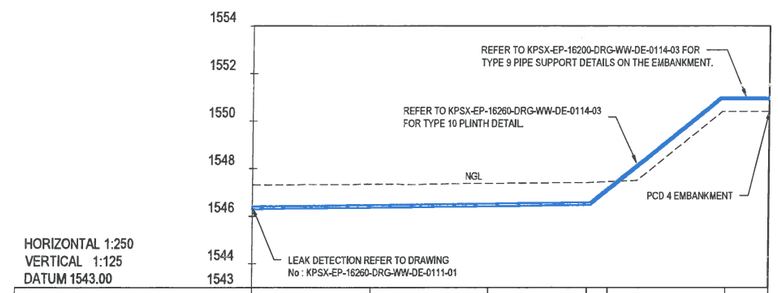
NOTES:
1. ALL DIMENSION ARE IN MILLIMETRES UNLESS STATED OTHERWISE
2. ALL LEVELS ARE IN METRES ABOVE SEA LEVEL
3. SETTING OUT POINTS POSITIONED ON OUTSIDE CORNERS OF WALLS AS INDICATED
4. REFER TO DRAWING KPSX-EP-16260-DRG-WW-DE-0103-01 FOR THE TYPICAL LINER DETAIL

SETTING OUT CO-ORDINATES WGS 84 HARTBEESHOEK LO29

DESCRIPTION	Y	X
AS01	-5827.347	2875802.817
AS02	-5828.818	2875802.286
AS03	-5832.445	2875810.741
AS04	-5830.975	2875811.371
SP01	-5821.199	2875844.350
SP02	-5811.750	2875848.322
SP03	-5800.222	2875826.184
SP04	-5799.447	2875824.340
SP05	-5802.916	2875822.882
SP06	-5784.042	2875818.628
SP07	-5778.012	2875804.284
SP08	-5809.725	2875790.955
SP09	-5815.169	2875803.908
SP10	-5809.498	2875820.116
SP11	-5812.676	2875818.780
SP12	-5813.451	2875820.324
SP13	-5780.340	2875773.304
SP14	-5778.070	2875757.901
SP15	-5783.140	2875755.770
SP16	-5785.411	2875771.173



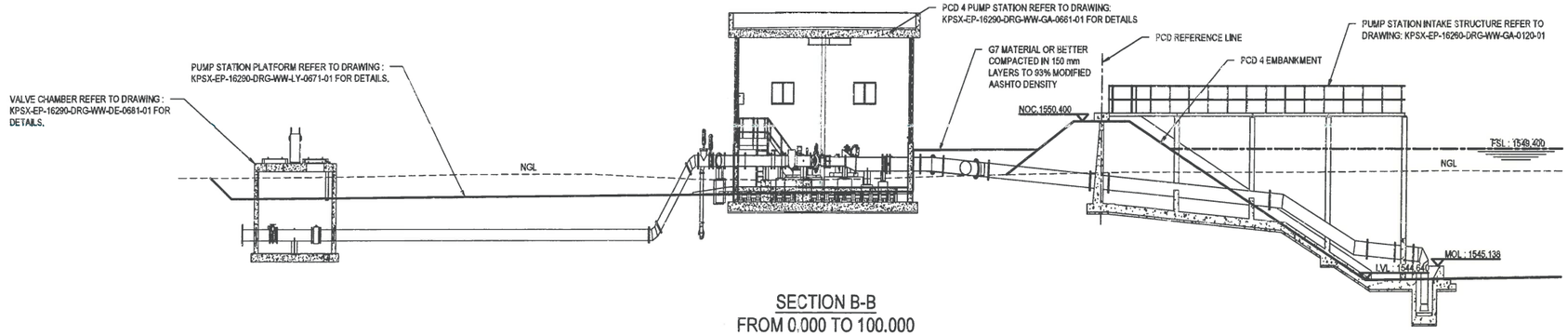


HORIZONTAL 1:250
VERTICAL 1:125
DATUM 1543.00

CHAINAGE (m)	0.00	10.00	20.00	28.26	30.00	40.00	43.86		
GROUND LEVEL (mamsl)	1547.31	1547.34	1547.38	1547.45	1550.40	1550.40			
PIPE INVERT LEVEL (mamsl)	1546.31	1546.37	1546.43	1547.07	1550.90	1550.90			
GROUND COVER	0.80	0.87	0.85	0.25	-0.80	-0.80			
CHANGE IN DIRECTION HOR					90.00°				
CHANGE IN DIRECTION VER				21.45°		21.81°			
PIPE DESCRIPTION	DN110 HDPE PE 100 PIPE				STEEL PIPE DN80 X 3.5 mm SANS 62 INSTALLED ON PLINTHS				

SECTION A-A
FROM 0.000 TO 50.000

LEGEND:
- NGL
- FINAL DAM LEVELS
- WATER LEVEL
- NOC NON OVERSPILL CREST
- FSL FULL SUPPLY LEVEL



SECTION B-B
FROM 0.000 TO 100.000
HORIZONTAL SCALE 1:100
VERTICAL SCALE 1:50

AS BUILT DRAWINGS
ZUTARI IMPACT. ENGINEERED.
For Zutari: Date: 27/5/21
For Client: Date:

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REFERENCE DRAWINGS		REFERENCE DRAWINGS	
		KPSX-EP-16260-DRG-WW-DE-0104-01	STEEL PIPE FITTINGS
		KPSX-EP-16260-DRG-WW-DE-0121-01	PUMP STATION INTAKE STRUCTURE LAYOUT AND SECTIONS
		KPSX-EP-16260-DRG-WW-DE-0104-01	POLLUTION CONTROL DAMS TYPICAL DETAIL LINER FIXING DETAIL
		KPSX-EP-16260-DRG-WW-DE-0103-01	POLLUTION CONTROL DAMS TYPICAL DETAIL LINER DETAIL
DRAWING NO.	TITLE	DRAWING NO.	TITLE

ZUTARI PROFESSIONAL ENGINEER
NAME VICTOR WENTZEL DATE
PROF. REG. No. 20150173
SIGNATURE 27/5/21
SOUTH 32 PROFESSIONAL APPROVAL

	NAME	SIGN.	DATE
CLIENT PROJECT MANAGER			
CLIENT ENGINEERING MANAGER			
ADDITIONAL SIGNATORY			
ZUTARI PROJECT No.	113452		
CLIENT CONTRACT No.	8500084829		

REV.	I.T.	DESCRIPTION	DRWN.	DES.	CHK.	APR.	DATE
*	F	AS-BUILT	E.E.	S.M.	V.W.	A.C.	19/03/2021

I.T. ISSUE TYPE: (A) FOR REVIEW (SQ) (B) INTERNAL PEER REVIEW (C) FOR APPROVAL (CR) (D) FOR CONSTRUCTION (E) FOR INFORMATION (F) AS-BUILT (G) CANCELED

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SOUTH32

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KLIPSPRUIT EXTENSION (KPSX)

AREA: PCD 4
ELEMENT: PUMP INTAKE STRUCTURE
TITLE: LAYOUT, SECTIONS AND SETTING OUT DETAILS

SCALE:	SHEET SIZE	DRAWING NUMBER	SHEET No.	REV.
1:400	(A1)	KPSX-EP-16260-DRG-WW-LY-0123-01	1 OF 1	*

PROJECT FILE: 113452

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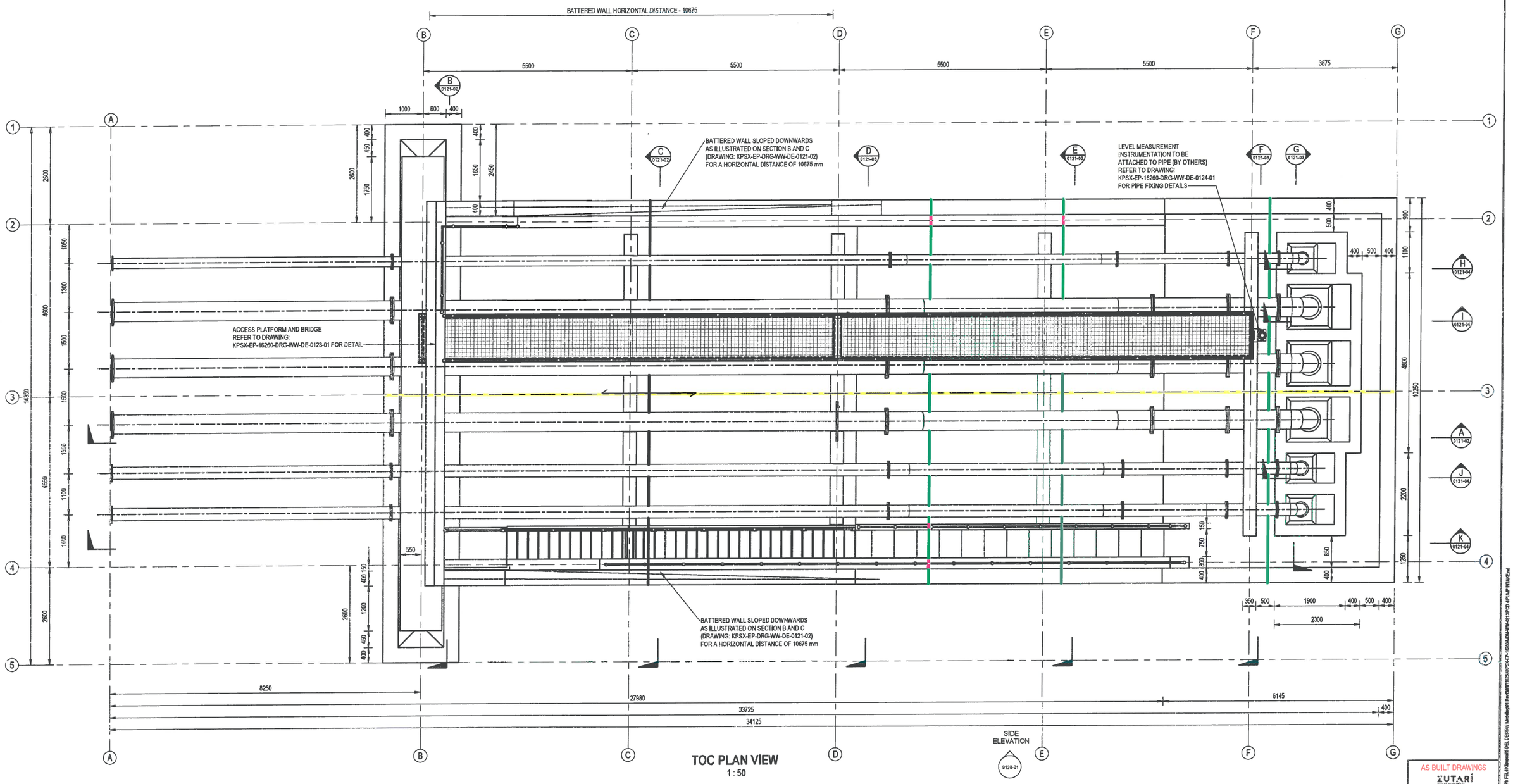
JOINT TYPE
- FLOOR JOINT - A1
- FLOOR JOINT - G
- WALL JOINT - C
- WALL JOINT - H



TOC PLAN VIEW
1 : 50

SIDE ELEVATION

AS BUILT DRAWINGS
ZUTARI IMPACT. ENGINEERED.
for Client
24/05/2021 Date

This AS BUILT drawing has been prepared based on information provided by the contractor. The levels and coordinates have not been independently checked or verified by Zutari.

REFERENCE DRAWINGS		REFERENCE DRAWINGS	
		KPSX-EP-16260-DRG-WW-DE-0124	PUMP STATION INTAKE STRUCTURE - LEVEL INSTRUMENTATION PIPE FIXING DETAILS
		KPSX-EP-16260-DRG-WW-DE-0123	PUMP STATION INTAKE STRUCTURE - ACCESS PLATFORM AND BRIDGE
		KPSX-EP-16260-DRG-WW-DE-0122	PUMP STATION INTAKE STRUCTURE - MECHANICAL DETAILS
DRAWING No.	TITLE	DRAWING No.	TITLE

ZUTARI PROFESSIONAL ENGINEER		
NAME	VICTOR WENTZEL	DATE
PROF. REG. No.	20130173	
SIGNATURE		24/05/2021

SOUTH 32 PROFESSIONAL APPROVAL		
NAME	SIGN	DATE
CLIENT PROJECT MANAGER		
CLIENT ENGINEERING MANAGER		
ADDITIONAL SIGNATORY		
ZUTARI PROJECT No.	113452	
CLIENT CONTRACT No.	8500084829	

REV.	I.T.	DESCRIPTION	DRWN.	DES.	CHK.	APR.	DATE
*	F	AS-BUILT DRAWING	G.W.	G.W.	V.W.	J.L.	23/04/2021

I.T. ISSUE TYPE: (A) FOR REVIEW (B) FOR APPROVAL (C) FOR TENDER (D) FOR CONSTRUCTION (E) FOR INFORMATION (F) AS-BUILT (G) CANCELLED

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E connect@zutari.com

SOUTH32

KLIPSPRUIT EXTENSION (KPSX)

AREA: PCD 4
ELEMENT: PUMP STATION INTAKE STRUCTURE
TITLE: LAYOUTS, SECTIONS AND DETAILS

SCALE:	SHEET SIZE	DRAWING NUMBER	SHEET NO.	REV.
AS SHOWN	(A1)	KPSX-EP-16260 - DRG - WW-DE - 0121-01	1 OF 4	*

File Name: P:\Projects\113452 KPSX Execution Ph FEL4\Deposit\5 DEL DESIGN\3 Models\01 Revit\WW\16260\KPSX-EP-16260-MDAWW-0121.PCD 4 PUMP INTAKE.rvt
File Date: 4/23/2021 4:12:38 PM

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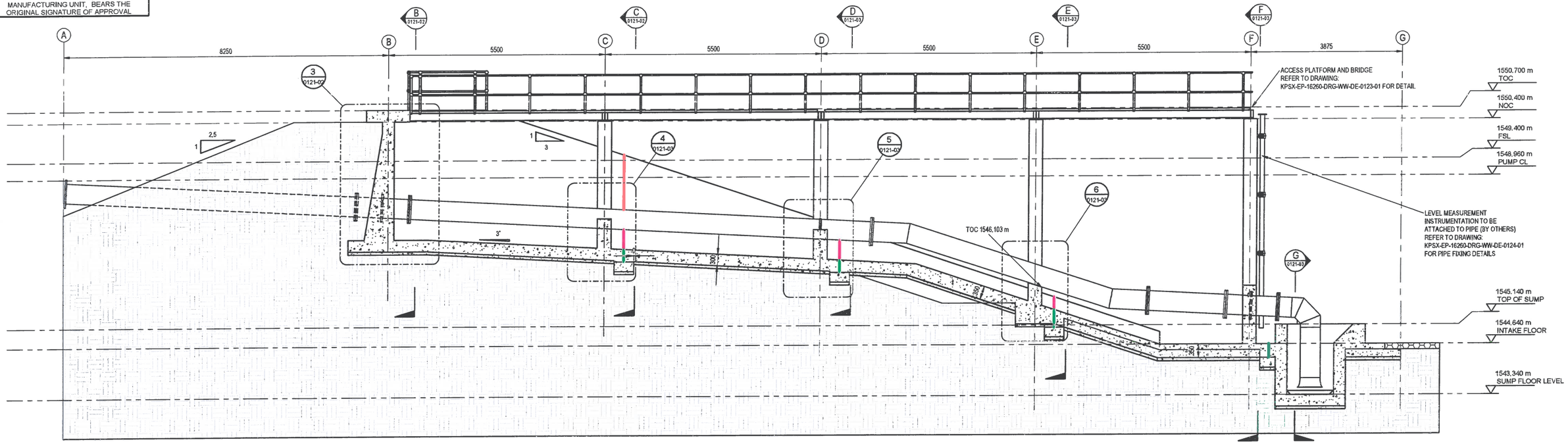
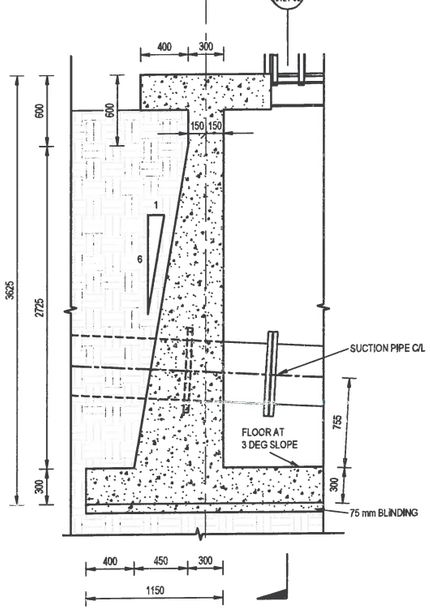
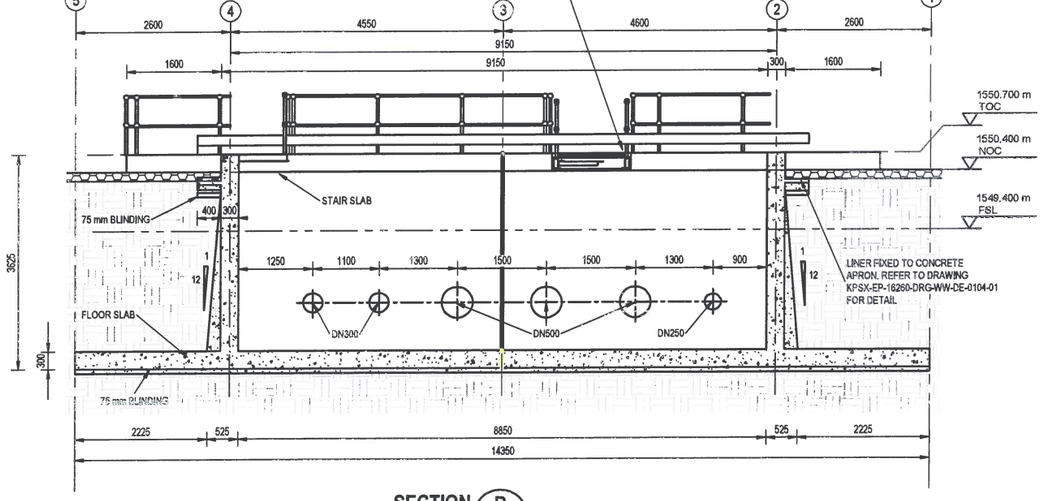


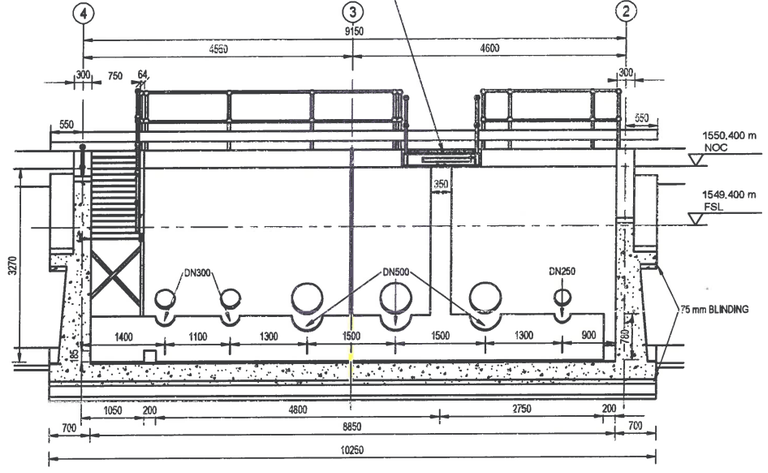
SECTION A 1 : 50 (0121-01)



DETAIL 3 1 : 25 (0121-02)



SECTION B 1 : 50 (0120-01)



SECTION C 1 : 50 (0120-01)

AS BUILT DRAWINGS
ZUTARI IMPACT. ENGINEERED.
For Client
Date

JOINT TYPE
- FLOOR JOINT - A1
- FLOOR JOINT - G
- WALL JOINT - C
- WALL JOINT - H

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REFERENCE DRAWINGS		REFERENCE DRAWINGS	
DRAWING No.	TITLE	DRAWING No.	TITLE
		KPSX-EP-16260-DRG-WW-DE-0124	PUMP STATION INTAKE STRUCTURE - LEVEL INSTRUMENTATION PIPE FIXING DETAILS
		KPSX-EP-16260-DRG-WW-DE-0123	PUMP STATION INTAKE STRUCTURE - ACCESS PLATFORM AND BRIDGE
		KPSX-EP-16260-DRG-WW-DE-0122	PUMP STATION INTAKE STRUCTURE - MECHANICAL DETAILS

ZUTARI PROFESSIONAL ENGINEER		
NAME	VICTOR WENTZEL	DATE
PROF. REG. No.	20139173	
SIGNATURE		21/05/2021

SOUTH 32 PROFESSIONAL APPROVAL		
NAME	SIGN	DATE
CLIENT PROJECT MANAGER		
CLIENT ENGINEERING MANAGER		
ADDITIONAL SIGNATORY		
ZUTARI PROJECT No.	113452	
CLIENT CONTRACT No.	8500084829	

REV.	I.T.	DESCRIPTION	DRWN.	DES.	CHK.	APR.	DATE
*	F	AS-BUILT DRAWING	G.W.	G.W.	V.W.	J.L.	23/04/2021

I.T. ISSUE TYPE: (A) FOR REVIEW (B) FOR APPROVAL (C) FOR TENDER (D) FOR CONSTRUCTION (E) FOR INFORMATION (F) AS-BUILT (G) CANCELLED

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Riverwalk Office Park
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KLIPSPRUIT EXTENSION (KPSX)

AREA: PCD 4

ELEMENT: PUMP STATION INTAKE STRUCTURE

TITLE: LAYOUTS, SECTIONS AND DETAILS

SCALE:	SHEET SIZE	DRAWING NUMBER	SHEET No.	REV.
AS SHOWN	(A1)	KPSX-EP-16260 - DRG - WW-DE - 0121-02	2 OF 4	*

Plot Date: 4/2/2021 4:13:29 PM
Filename: P:\Projects\113452 - KPSX Execution Ph ITEL 4\3\drgs\pdf\DEL DES\02 Model\gdn1 Rev\MWW\113452WW2021KPSX-150004ADM-WW-0213 PCD 4 PUMP INTAKE.rvt

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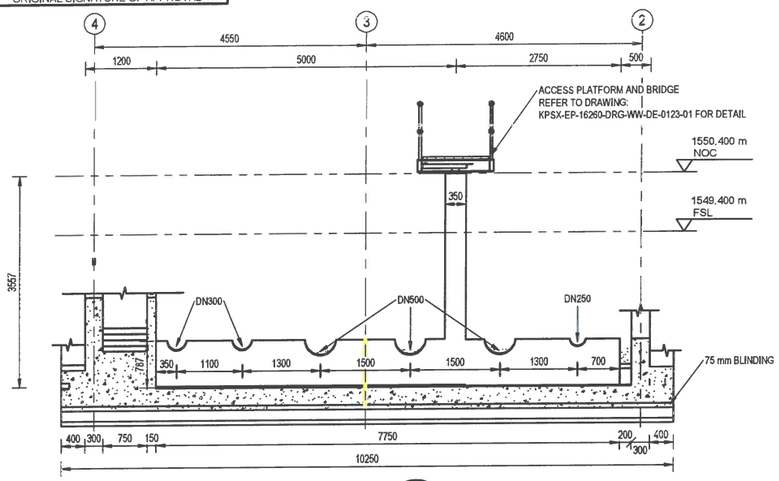

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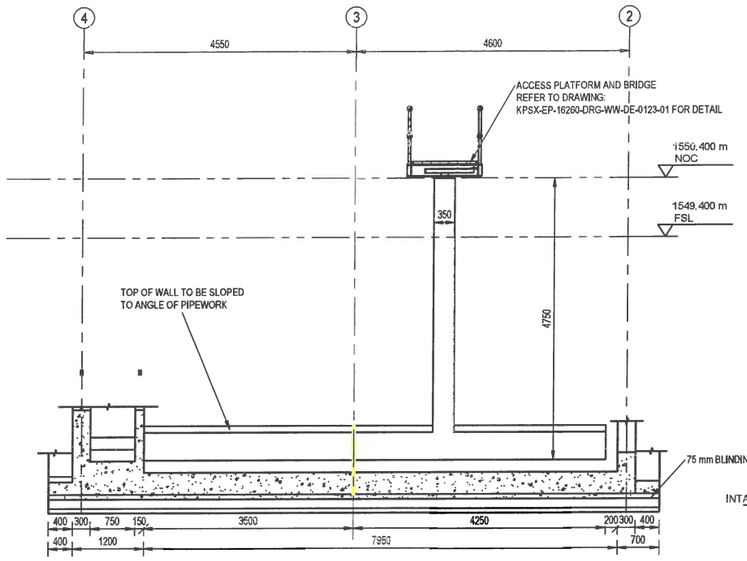
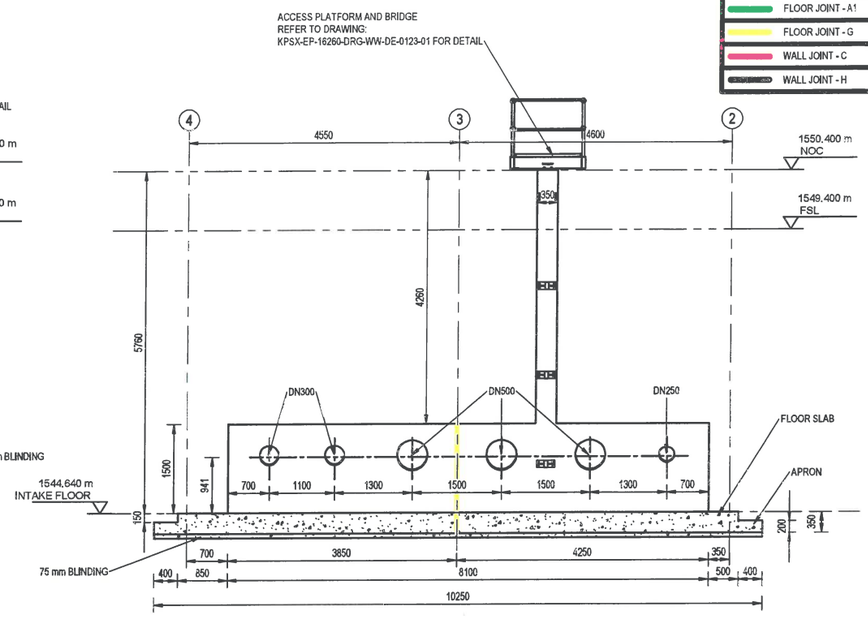
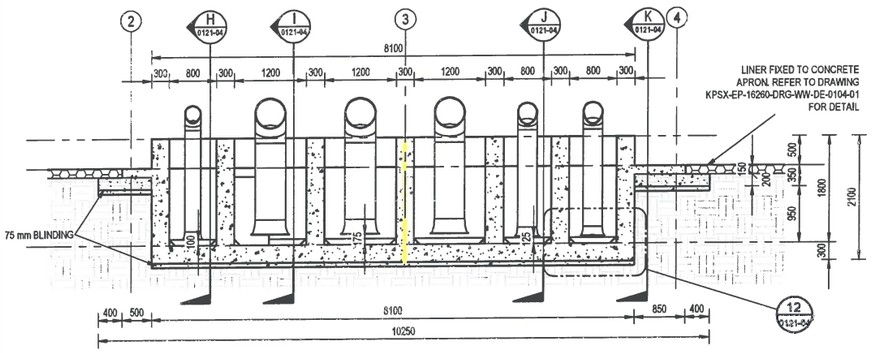


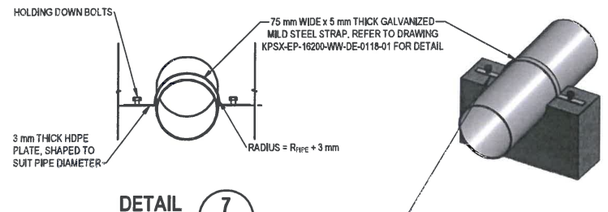
SECTION E 1 : 50 (0120-01)



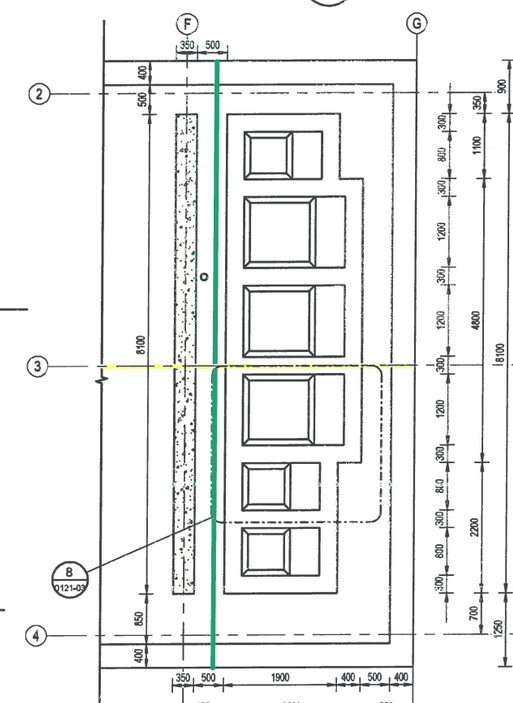
SECTION F 1 : 50 (0120-01)

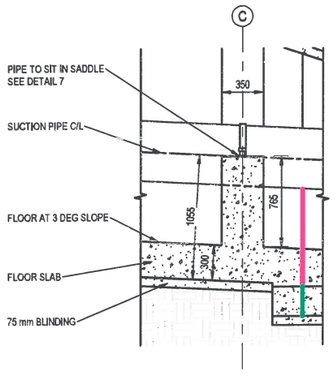


SECTION G 1 : 50 (0120-01)

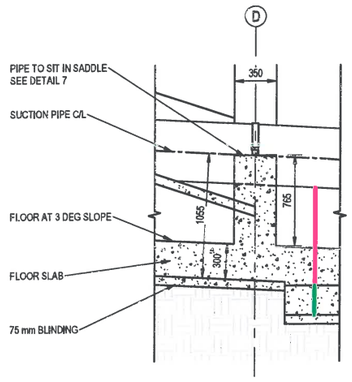


DETAIL 7 1 : 25 (0121-03)

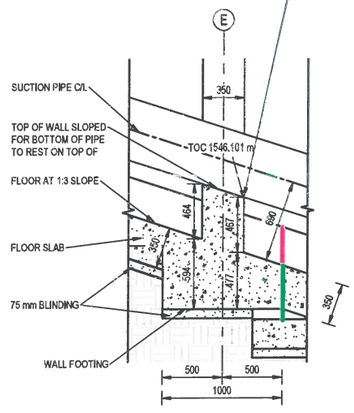




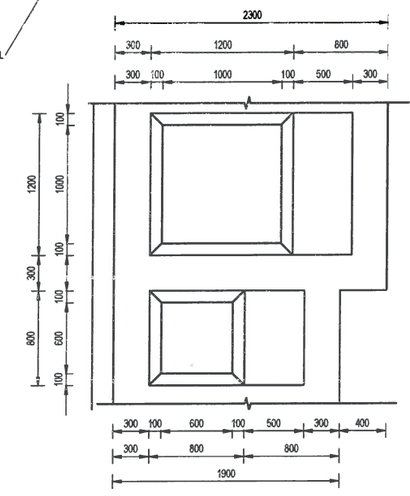
DETAIL 4 1 : 25 (0121-02)



DETAIL 5 1 : 25 (0121-02)



DETAIL 6 1 : 25 (0121-02)



DETAIL 8 1 : 25 (0121-03)

REFERENCE DRAWINGS		REFERENCE DRAWINGS	
DRAWING No.	TITLE	DRAWING No.	TITLE
		KPSX-EP-16260-DRG-WW-DE-0123	PUMP STATION INTAKE STRUCTURE - -ACCESS PLATFORM AND BRIDGE
		KPSX-EP-16260-DRG-WW-DE-0122	PUMP STATION INTAKE STRUCTURE - MECHANICAL DETAILS

ZUTARI PROFESSIONAL ENGINEER		
NAME	VICTOR WENTZEL	DATE
PROF. REG. No.	20130173	
SIGNATURE		21/04/21
SOUTH 32 PROFESSIONAL APPROVAL		
NAME	SIGN	DATE
CLIENT PROJECT MANAGER		
CLIENT ENGINEERING MANAGER		
ADDITIONAL SIGNATORY		
ZUTARI PROJECT No.	113452	
CLIENT CONTRACT No.	8500084829	

REV.	I.T.	DESCRIPTION	DRWN.	DES.	CHK.	APR.	DATE
*	F	AS-BUILT DRAWING	G.W.	G.W.	V.W.	J.L.	23/04/2021

I.T. ISSUE TYPE: (A) FOR REVIEW (B) FOR APPROVAL (C) FOR TENDER (D) FOR CONSTRUCTION (E) FOR INFORMATION (F) AS-BUILT (G) CANCELLED

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ZUTARI (PROJECT. ENGINEERED.)
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KLIPSPRUIT EXTENSION (KPSX)

AREA: PCD 4
ELEMENT: PUMP STATION INTAKE STRUCTURE
TITLE: LAYOUTS, SECTIONS AND DETAILS

SCALE:	SHEET SIZE	DRAWING NUMBER	SHEET NO.	REV.
AS SHOWN	(A1)	KPSX-EP-16260 - DRG - WW-DE - 0121-03	3 OF 4	*

AS BUILT DRAWINGS
ZUTARI (PROJECT. ENGINEERED.)
Part 2 Part 3
24/05/2021 Date

This AS BUILT drawing has been prepared based on information provided by the contractor. The levels and coordinates have not been independently checked or verified by Zutari.

File Name: P:\Projects\113452 - KPSX Expansion Ph 1\EA\4 Drgs\ed\B1 DEL\DES\02 Modelling\01 Revit\WW\02 Working\KPSX-EP-16260-DRG-WW-DE-0121-PCD 4 PUMP INTAKE.rvt
File Date: 4/21/2021 4:14:09 PM
Office:

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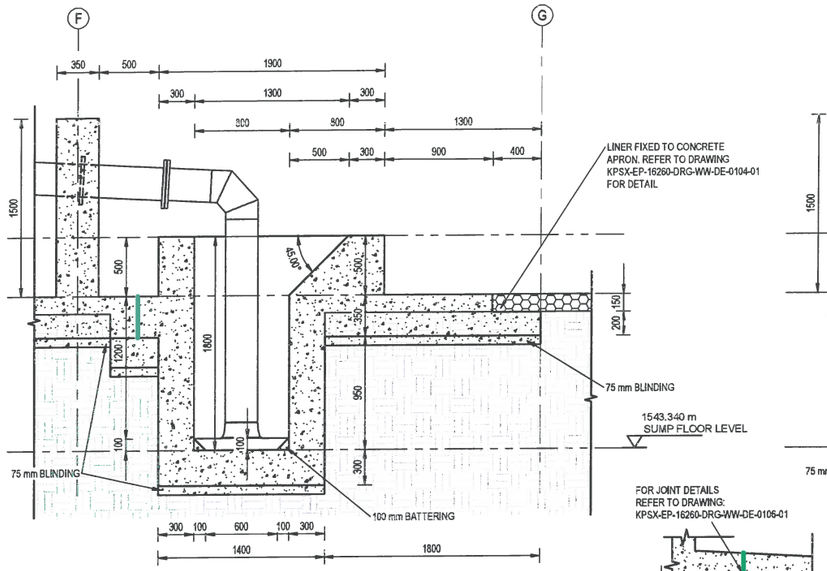
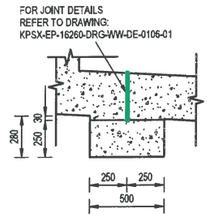
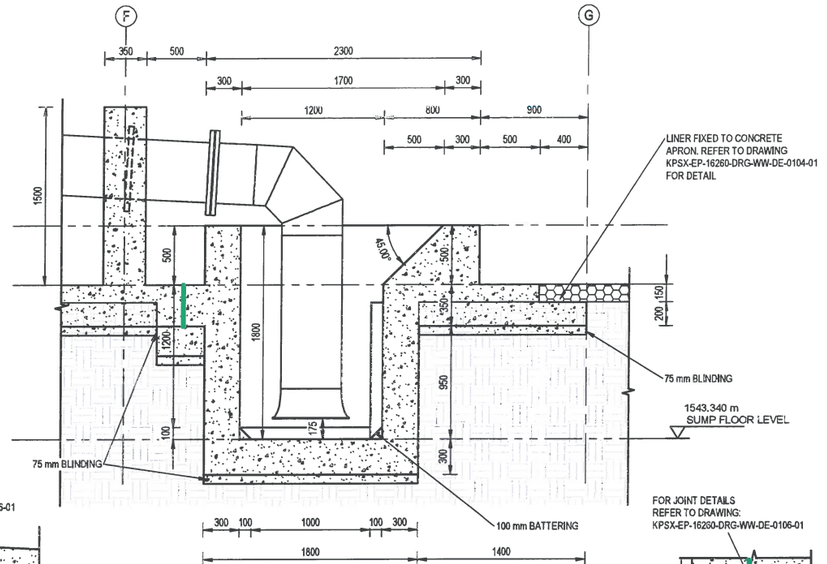
JOINT TYPE
- FLOOR JOINT - A1
- FLOOR JOINT - G
- WALL JOINT - C
- WALL JOINT - H



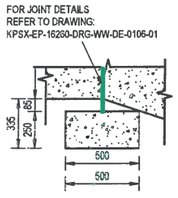
SECTION H 1 : 25 (0121-01)



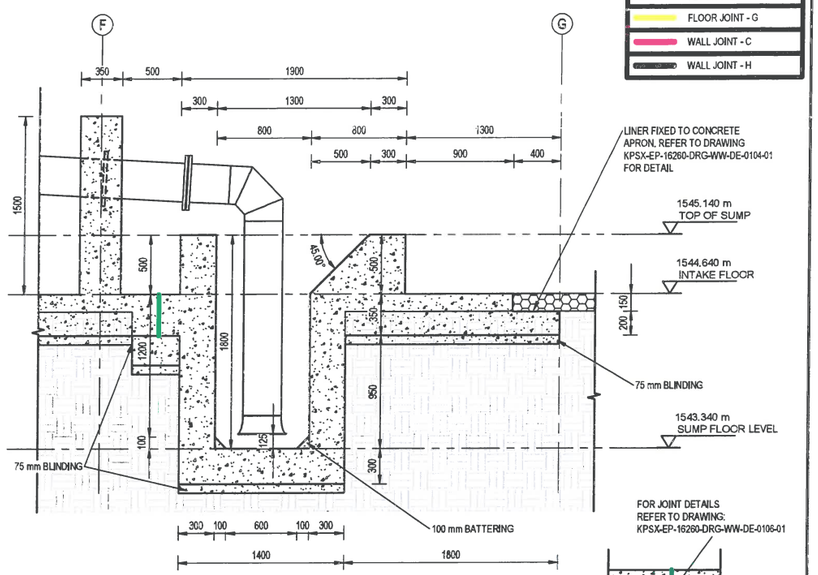
DETAIL 9 1 : 20 (0121-04)



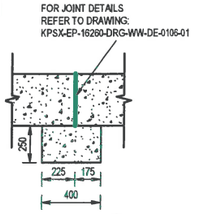
SECTION I 1 : 25 (0121-01)



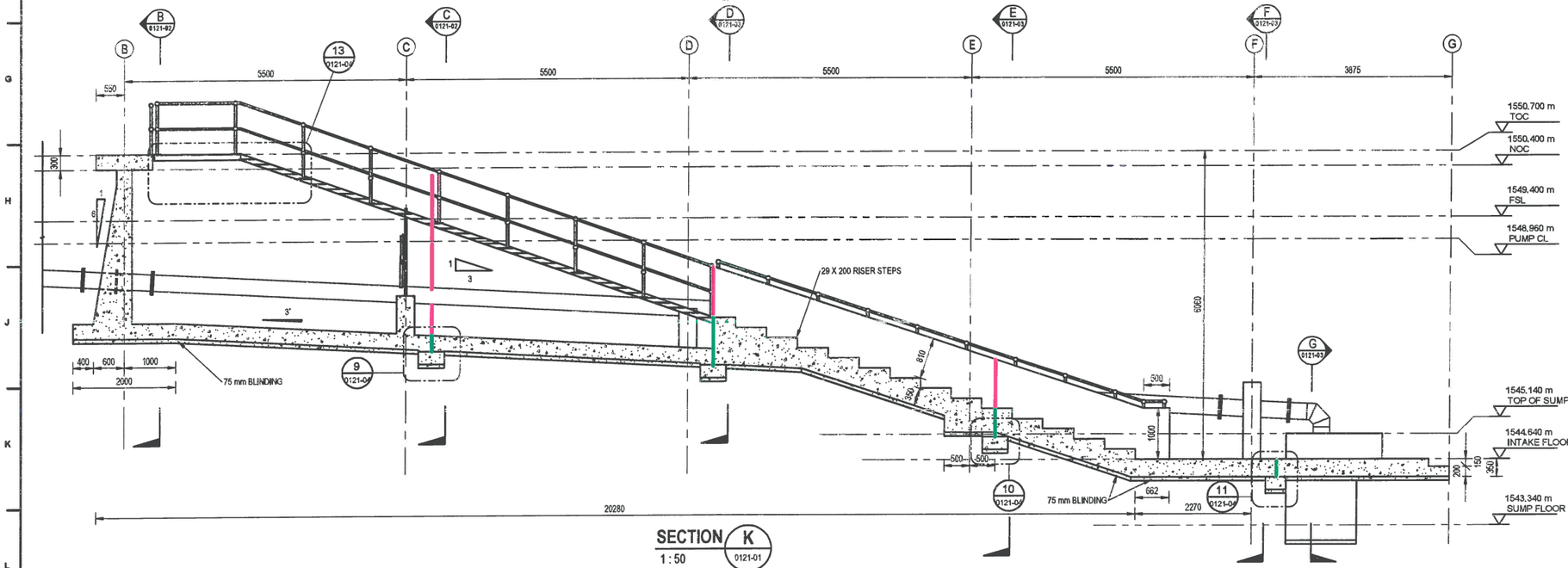
DETAIL 10 1 : 20 (0121-04)



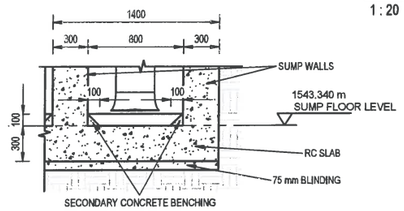
SECTION J 1 : 25 (0121-01)



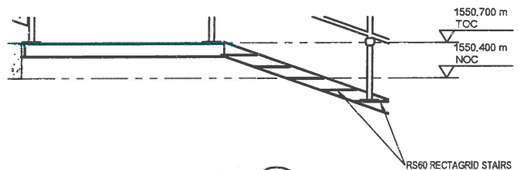
DETAIL 11 1 : 20 (0121-04)



SECTION K 1 : 50 (0121-01)



DETAIL 12 1 : 25 (0121-03)



DETAIL 13 1 : 25 (0121-04)

AS BUILT DRAWINGS ZUTARI

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REFERENCE DRAWINGS	
DRAWING No.	TITLE

REFERENCE DRAWINGS	
KPSX-EP-16260-DRG-WW-DE-0123	PUMP STATION INTAKE STRUCTURE - ACCESS PLATFORM AND BRIDGE
KPSX-EP-16260-DRG-WW-DE-0122	PUMP STATION INTAKE STRUCTURE - MECHANICAL DETAILS
DRAWING No.	TITLE

ZUTARI PROFESSIONAL ENGINEER		
NAME	VICTOR WENTZEL	DATE
PROF. REG. No.	20130173	
SIGNATURE		21/05/2021
SOUTH 32 PROFESSIONAL APPROVAL		
NAME	SIGN	DATE
CLIENT PROJECT MANAGER		
CLIENT ENGINEERING MANAGER		
ADDITIONAL SIGNATORY		
ZUTARI PROJECT No.	113452	
CLIENT CONTRACT No.	8500084829	

REV.	I.T.	DESCRIPTION	DRWN.	DES.	CHK.	APR.	DATE
*	F	AS-BUILT DRAWING	G.W.	G.W.	V.W.	J.L.	23/04/2021

I.T. ISSUE TYPE: (A) FOR REVIEW (B) FOR APPROVAL (C) FOR TENDER (D) FOR CONSTRUCTION (E) FOR INFORMATION (F) AS-BUILT (G) CANCELLED

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ZUTARI IMPACT. ENGINEERED.
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SOUTH32

KLIPSPRUIT EXTENSION (KPSX)

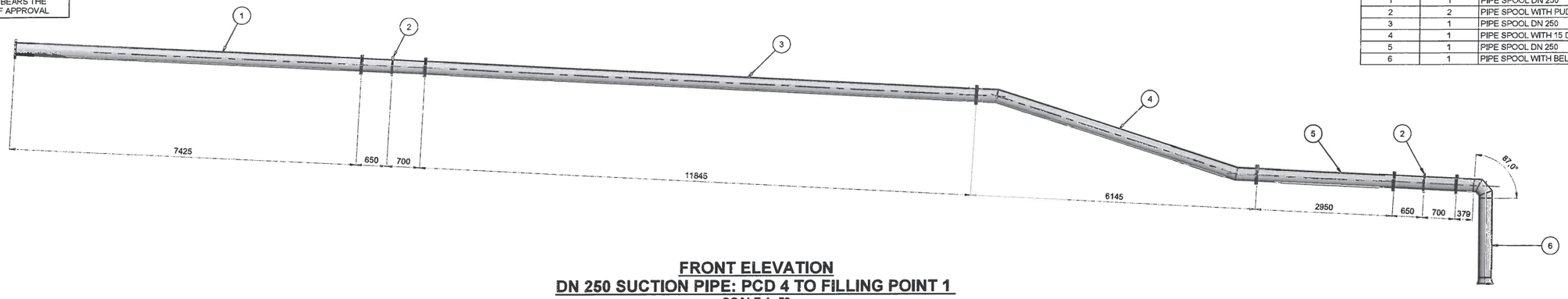
AREA: PCD 4
ELEMENT: PUMP STATION INTAKE STRUCTURE
TITLE: LAYOUTS, SECTIONS AND DETAILS

SCALE:	SHEET SIZE	DRAWING NUMBER	SHEET NO.	REV.
AS SHOWN	(A1)	KPSX-EP-16260 - DRG - WW-DE - 0121-04	4 OF 4	*

Filename: P:\Projects\113452 KPSX Execution Ph1\ELH\Drg\publish DEL DES\SU\Model\gph Pwe\WW\WW260\KPSX-EP-16260-ADM-WW-DE-0121.PCD 4 PUMP INTAKE.rvt
Plot Date: 4/21/2021 4:14:49 PM

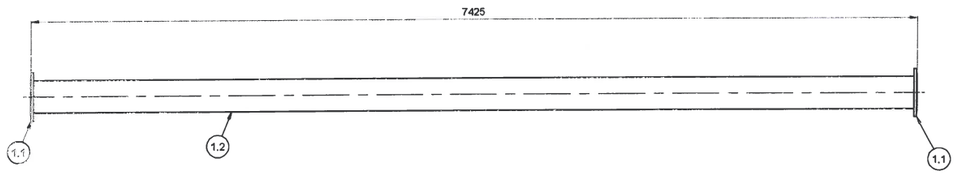
THE MASTER HELD AT ZUTARI, GAUTENG DELIVERY CENTER, RESOURCES & MANUFACTURING UNIT, BEARS THE ORIGINAL SIGNATURE OF APPROVAL

PARTS LIST		
ITEM	QTY	DESCRIPTION
1	1	PIPE SPOOL DN 250
2	2	PIPE SPOOL WITH PUDDLE FLANGE DN 250
3	1	PIPE SPOOL DN 250
4	1	PIPE SPOOL WITH 15 DEG BENDS DN 250
5	1	PIPE SPOOL DN 250
6	1	PIPE SPOOL WITH BELLMOUTH AND 87 DEGREE SHORT RADIUS BEND DN 250



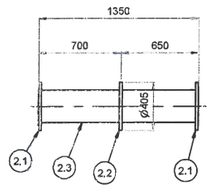
FRONT ELEVATION
DN 250 SUCTION PIPE: PCD 4 TO FILLING POINT 1
SCALE 1 :50

PARTS LIST		
ITEM	QTY	DESCRIPTION
1.1	2	FLANGE DN 250 SANS 1123 TABLE 1600/3 (RF)
1.2	7425.000 mm	STEEL PIPE DN 250 X 6 mm SANS 719 GRADE C



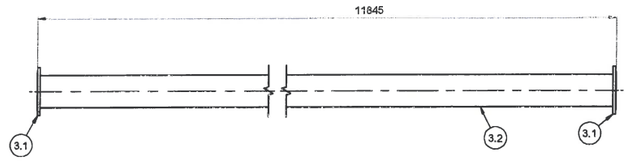
PLAN VIEW
ITEM 1
SCALE 1 : 25

PARTS LIST		
ITEM	QTY	DESCRIPTION
2.1	2	FLANGE DN 250 SANS 1123 TABLE 1600/3 (RF)
2.2	1	PUDDLE FLANGE DN 250, OD 405mm, THICKNESS 25mm
2.3	1350.000 mm	STEEL PIPE DN 250 X 6 mm SANS 719 GRADE C



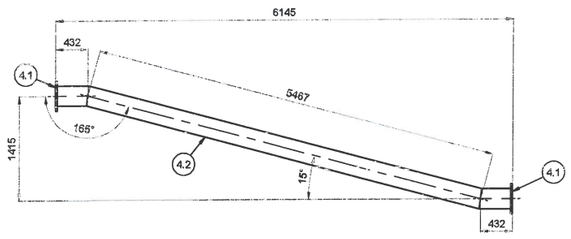
PLAN VIEW
ITEM 2
SCALE 1 :25

PARTS LIST		
ITEM	QTY	DESCRIPTION
3.1	2	FLANGE DN 250 SANS 1123 TABLE 1600/3 (RF)
3.2	11845.000 mm	STEEL PIPE DN 250 X 6 mm SANS 719 GRADE C



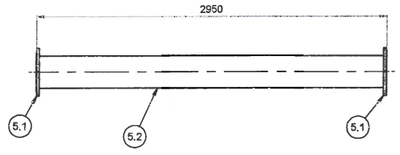
PLAN VIEW
ITEM 3
SCALE 1 :25

PARTS LIST		
ITEM	QTY	DESCRIPTION
4.1	2	FLANGE DN 250 SANS 1123 TABLE 1600/3 (RF)
4.2	6331.533 mm	STEEL PIPE DN 250 X 6 mm SANS 719 GRADE C



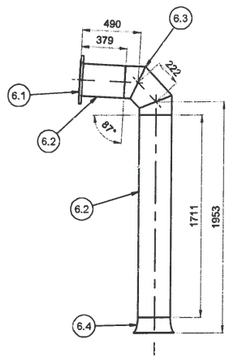
PLAN VIEW
ITEM 4
SCALE 1 :40

PARTS LIST		
ITEM	QTY	DESCRIPTION
5.1	2	FLANGE DN 250 SANS 1123 TABLE 1600/3 (RF)
5.2	2950.000 mm	STEEL PIPE DN 250 X 6 mm SANS 719 GRADE C



PLAN VIEW
ITEM 5
SCALE 1 :25

PARTS LIST		
ITEM	QTY	DESCRIPTION
6.1	1	FLANGE DN 250 SANS 1123 TABLE 1600/3 (RF)
6.2	2090.794 mm	STEEL PIPE DN 250 X 6 mm SANS 719 GRADE C
6.3	1	SHORT RADIUS BEND (1 D) ; 87 DEGREE DN 250 X 6 MM SANS 719 GRADE C
6.4	1	USBR BELLMOUTH



PLAN VIEW
ITEM 6
SCALE 1 :25

AS BUILT DRAWINGS
ZUTARI
21/05/2024

This AS BUILT drawing has been prepared based on information provided by the contractor. The levels and coordinates have not been independently checked or verified by Zutari.

REFERENCE DRAWINGS		
DRAWING NO.	TITLE	

REFERENCE DRAWINGS		
DRAWING NO.	TITLE	

ZUTARI PROFESSIONAL ENGINEER		
NAME	VICTOR WENTZEL	DATE
PROF. REG. No.	20130173	
SIGNATURE		21/05/2024
SOUTH 32 PROFESSIONAL APPROVAL		
NAME	SIGN.	DATE
CLIENT PROJECT MANAGER		
CLIENT ENGINEERING MANAGER		
ADDITIONAL SIGNATORY		
ZUTARI PROJECT No.	113452	
CLIENT CONTRACT No.	8500084829	

REV.	I.T.	DESCRIPTION	DRWN.	DES.	CHK.	APR.	DATE
*	F	AS-BUILT DRAWING	C.R.	C.R.	C.N.	V.W.	23/04/2021

I.T. ISSUE TYPE: (A) FOR REVIEW (SQ) (B) INTERNAL PEER REVIEW (C) FOR APPROVAL (CR) (D) FOR CONSTRUCTION (E) FOR INFORMATION (F) AS-BUILT (G) CANCELLED

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SOUTH32

ZUTARI IMPACT. ENGINEERED

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Pretoria
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Tel: +27 12 427 2000
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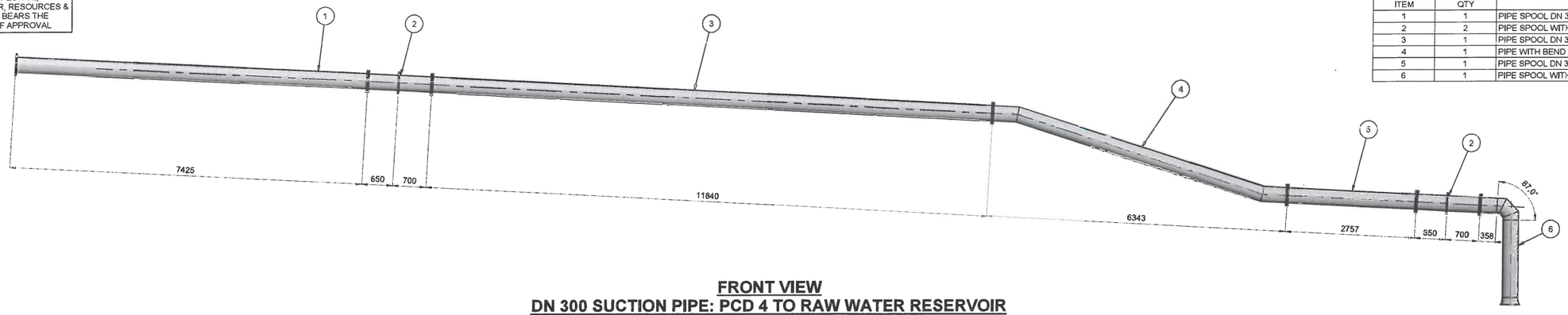
KLIPSPRUIT EXTENSION (KPSX)

AREA: PCD 4
ELEMENT: PUMP STATION INTAKE STRUCTURE
TITLE: MECHANICAL DETAILS

SCALE:	SHEET SIZE	Drawing Number	SHEET No.	REV.
AS SHOWN	(A1)	KPSX-EP-16260-DRG-WW-DE-0122-01	1 OF 3	*

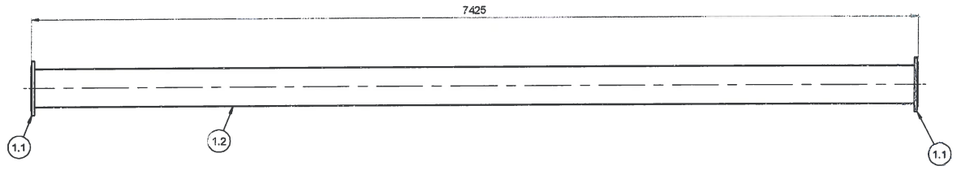
THE MASTER HELD AT ZUTARI, GAUTENG DELIVERY CENTER, RESOURCES & MANUFACTURING UNIT, BEARS THE ORIGINAL SIGNATURE OF APPROVAL

PARTS LIST		
ITEM	QTY	DESCRIPTION
1	1	PIPE SPOOL DN 300
2	2	PIPE SPOOL WITH PUDDLE FLANGE DN 300
3	1	PIPE SPOOL DN 300
4	1	PIPE WITH BEND 15 DEG DN 300
5	1	PIPE SPOOL DN 300
6	1	PIPE SPOOL WITH BELLMOUTH AND 87 DEGREE SHORT RADIUS BEND DN 300



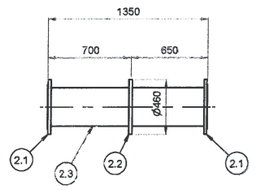
FRONT VIEW
DN 300 SUCTION PIPE: PCD 4 TO RAW WATER RESERVOIR
SCALE 1 :50

PARTS LIST		
ITEM	QTY	DESCRIPTION
1.1	2	FLANGE DN 300 SANS 1123 TABLE 1600/3 (RF)
1.2	7425.000 mm	STEEL PIPE DN 300 X 3 mm SANS 719 GRADE C



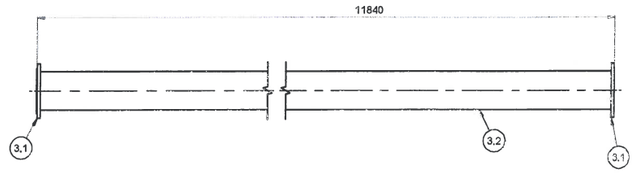
PLAN VIEW
ITEM 1
SCALE 1 : 25

PARTS LIST		
ITEM	QTY	DESCRIPTION
2.1	2	FLANGE DN 300 SANS 1123 TABLE 1600/3 (RF)
2.2	1	PUDDLE FLANGE DN 300, OD 460mm, THICKNESS 28mm
2.3	1350.000 mm	STEEL PIPE DN 300 X 6 mm SANS 719 GRADE C



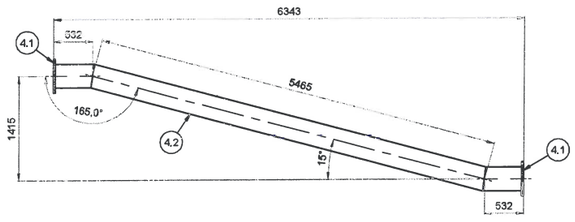
PLAN VIEW
ITEM 2
SCALE 1 :25

PARTS LIST		
ITEM	QTY	DESCRIPTION
3.1	2	FLANGE DN 300 SANS 1123 TABLE 1600/3 (RF)
3.2	11840.000 mm	STEEL PIPE DN 300 X 6 mm SANS 719 GRADE C



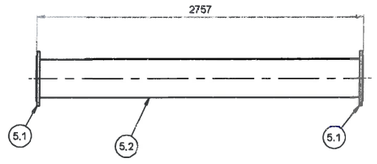
PLAN VIEW
ITEM 3
SCALE 1 :25

PARTS LIST		
ITEM	QTY	DESCRIPTION
4.1	2	FLANGE DN 300 SANS 1123 TABLE 1600/3 (RF)
4.2	6529.536 mm	STEEL PIPE DN 300 X 6 mm SANS 719 GRADE C



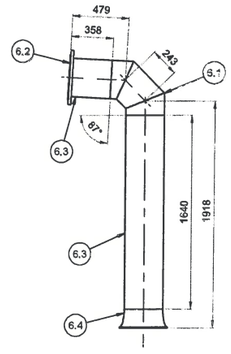
PLAN VIEW
ITEM 4
SCALE 1 :40

PARTS LIST		
ITEM	QTY	DESCRIPTION
5.1	2	FLANGE DN 300 SANS 1123 TABLE 1600/3 (RF)
5.2	2757.000 mm	STEEL PIPE DN 300 X 6 mm SANS 719 GRADE C



PLAN VIEW
ITEM 5
SCALE 1 :25

PARTS LIST		
ITEM	QTY	DESCRIPTION
6.1	1	SHORT RADIUS BEND (1 D) ; 87 DEGREE DN 300 X 6 MM SANS 719 GRADE C
6.2	1	FLANGE DN 300 SANS 1123 TABLE 1600/3 (RF)
6.3	1997.928 mm	STEEL PIPE DN 300 X 6 mm SANS 719 GRADE C
6.4	1	USBR BELLMOUTH



PLAN VIEW
ITEM 6
SCALE 1 :25

AS BUILT DRAWINGS
ZUTARI
Date: 21/05/2021

This AS BUILT drawing has been prepared based on information provided by the contractor. The levels and coordinates have not been independently checked or verified by Zutari.

REFERENCE DRAWINGS		
DRAWING NO.	TITLE	

REFERENCE DRAWINGS		
DRAWING NO.	TITLE	

ZUTARI PROFESSIONAL ENGINEER		
NAME	VICTOR WENTZEL	DATE
PROF. REG. No.	20130173	
SIGNATURE		21/05/2021
SOUTH 32 PROFESSIONAL APPROVAL		
NAME	SIGN.	DATE
CLIENT PROJECT MANAGER		
CLIENT ENGINEERING MANAGER		
ADDITIONAL SIGNATORY		
ZUTARI PROJECT No.	113452	
CLIENT CONTRACT No.	8500084829	

REV.	I.T.	DESCRIPTION	DRWN.	DES.	CHK.	APR.	DATE
*	F	AS-BUILT DRAWING	C.R.	C.R.	C.N.	V.W.	23/04/2021

I.T. ISSUE TYPE: (A) FOR REVIEW (SQ) (B) INTERNAL PEER REVIEW (C) FOR APPROVAL (CR) (D) FOR CONSTRUCTION (E) FOR INFORMATION (F) AS-BUILT (G) CANCELLED

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ZUTARI IMPACT. ENGINEERED.
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SOUTH32

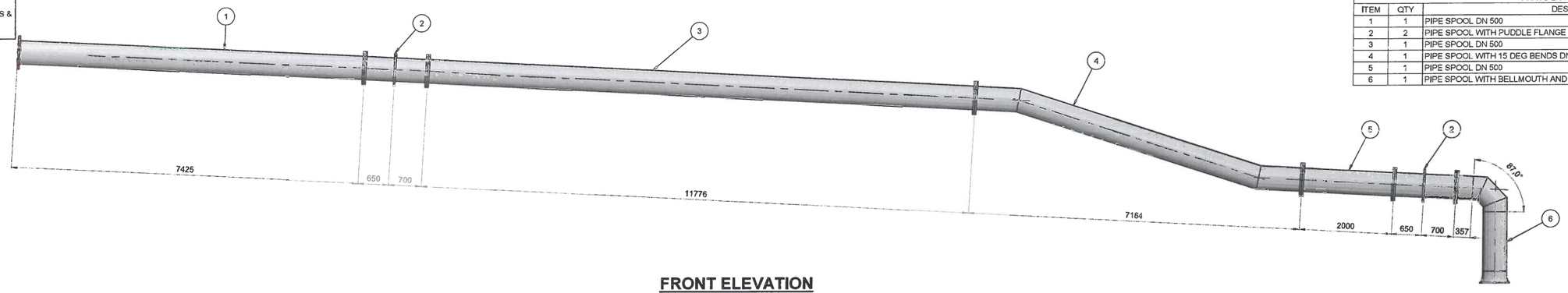
KLIPSPRUIT EXTENSION (KPSX)

AREA: PCD 4
ELEMENT: PUMP STATION INTAKE STRUCTURE
TITLE: MECHANICAL DETAILS

SCALE:	SHEET SIZE	Drawing Number	SHEET No.	REV.
AS SHOWN	(A1)	KPSX-EP-16260-DRG-WW-DE-0122-02	2 OF 3	*

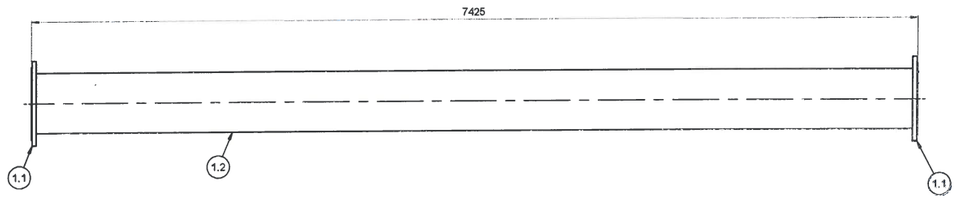
THE MASTER HELD AT ZUTARI, GAUTENG DELIVERY CENTER, RESOURCES & MANUFACTURING UNIT, BEARS THE ORIGINAL SIGNATURE OF APPROVAL

PARTS LIST		
ITEM	QTY	DESCRIPTION
1	1	PIPE SPOOL DN 500
2	2	PIPE SPOOL WITH PUDDLE FLANGE DN 500
3	1	PIPE SPOOL DN 500
4	1	PIPE SPOOL WITH 15 DEG BENDS DN 500
5	1	PIPE SPOOL DN 500
6	1	PIPE SPOOL WITH BELLMOUTH AND 87 DEGREE SHORT RADIUS BEND DN 500



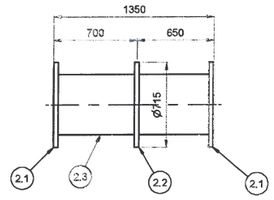
FRONT ELEVATION
DN 500 SUCTION PIPE: PCD 4 TO PCD 1
SCALE 1 :50

PARTS LIST		
ITEM	QTY	DESCRIPTION
1.1	2	FLANGE DN 500 SANS 1123 TABLE 1600/3 (RF)
1.2	7425.000 mm	STEEL PIPE DN 500 X 6 mm SANS 719 GRADE C



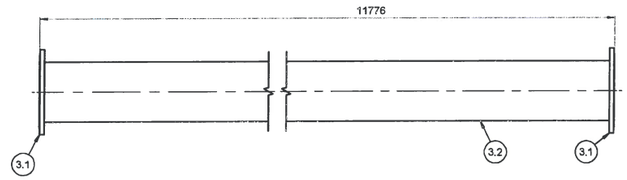
PLAN VIEW
ITEM 1
SCALE 1 : 25

PARTS LIST		
ITEM	QTY	DESCRIPTION
2.1	2	FLANGE DN 500 SANS 1123 TABLE 1600/3 (RF)
2.2	1	PUDDLE FLANGE DN 500, OD 715 mm x 40 mm THK
2.3	1350.000 mm	STEEL PIPE DN 500 X 6 mm SANS 719 GRADE C



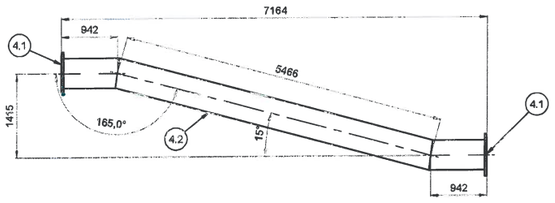
PLAN VIEW VIEW5
ITEM 2
SCALE 1 :25

PARTS LIST		
ITEM	QTY	DESCRIPTION
3.1	2	FLANGE DN 500 SANS 1123 TABLE 1600/3 (RF)
3.2	11776.000 mm	STEEL PIPE DN 500 X 6 mm SANS 719 GRADE C



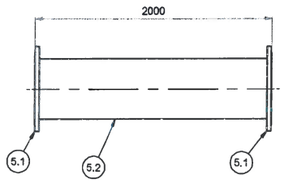
PLAN VIEW
ITEM 3
SCALE 1 :25

PARTS LIST		
ITEM	QTY	DESCRIPTION
4.1	2	FLANGE DN 500 SANS 1123 TABLE 1600/3 (RF)
4.2	7350.544 mm	STEEL PIPE DN 500 X 6 mm SANS 719 GRADE C



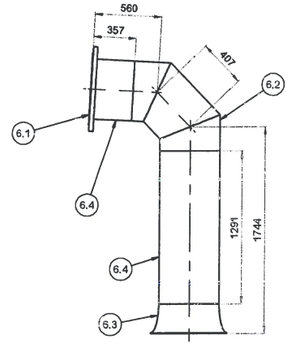
PLAN VIEW
ITEM 4
SCALE 1 :50

PARTS LIST		
ITEM	QTY	DESCRIPTION
5.1	2	FLANGE DN 500 SANS 1123 TABLE 1600/3 (RF)
5.2	2000.000 mm	STEEL PIPE DN 500 X 6 mm SANS 719 GRADE C



PLAN VIEW
ITEM 5
SCALE 1 :25

PARTS LIST		
ITEM	QTY	DESCRIPTION
6.1	1	FLANGE DN 500 SANS 1123 TABLE 1600/3 (RF)
6.2	1	SPECIAL SHORT RADIUS BEND (1 D); 87 DEGREE DN 500 X 6 MM SANS 719 GRADE C
6.3	1	USBR BELLMOUTH
6.4	1647.800 mm	STEEL PIPE DN 500 X 6 mm SANS 719 GRADE C



PLAN VIEW
ITEM 6
SCALE 1 :25

AS BUILT DRAWINGS
ZUTARI
Prepared by: Verified by:
21/05/2021
Date

This AS BUILT drawing has been prepared based on information provided by the contractor. The levels and coordinates have not been independently checked or verified by Zutari.

REFERENCE DRAWINGS	
DRAWING NO.	TITLE

REFERENCE DRAWINGS	
DRAWING NO.	TITLE

ZUTARI PROFESSIONAL ENGINEER		
NAME	VICTOR WENTZEL	DATE
PROF. REG. No.	20130173	
SIGNATURE		21/05/2021
SOUTH 32 PROFESSIONAL APPROVAL		
NAME	SIGN.	DATE
CLIENT PROJECT MANAGER		
CLIENT ENGINEERING MANAGER		
ADDITIONAL SIGNATORY		
ZUTARI PROJECT No.	113452	
CLIENT CONTRACT No.	8500084829	

REV.	I.T.	DESCRIPTION	DRWN.	DES.	CHK.	APR.	DATE
*	F	AS-BUILT DRAWING	C.R.	C.R.	C.N.	V.W.	23/04/2021

I.T. ISSUE TYPE: (A) FOR REVIEW (SQ) (B) INTERNAL PEER REVIEW (C) FOR APPROVAL (CR) (D) FOR CONSTRUCTION (E) FOR INFORMATION (F) AS-BUILT (G) CANCELLED

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KLIPSPRUIT EXTENSION (KPSX)

AREA: PCD 4
ELEMENT: PUMP STATION INTAKE STRUCTURE
TITLE: MECHANICAL DETAILS

SCALE:	SHEET SIZE	Drawing Number	SHEET No.	REV.
AS SHOWN	(A1)	KPSX-EP-16260-DRG-WW-DE-0122-03	3 OF 3	*

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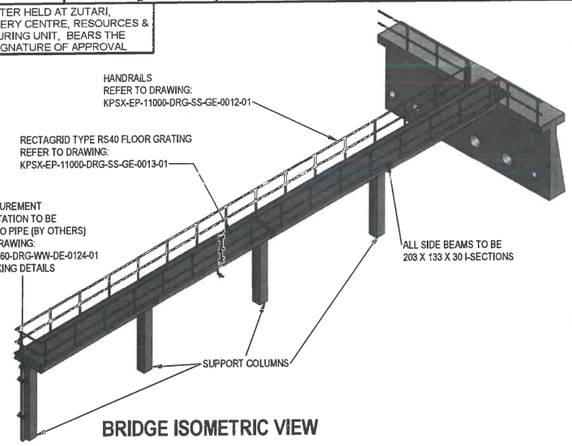
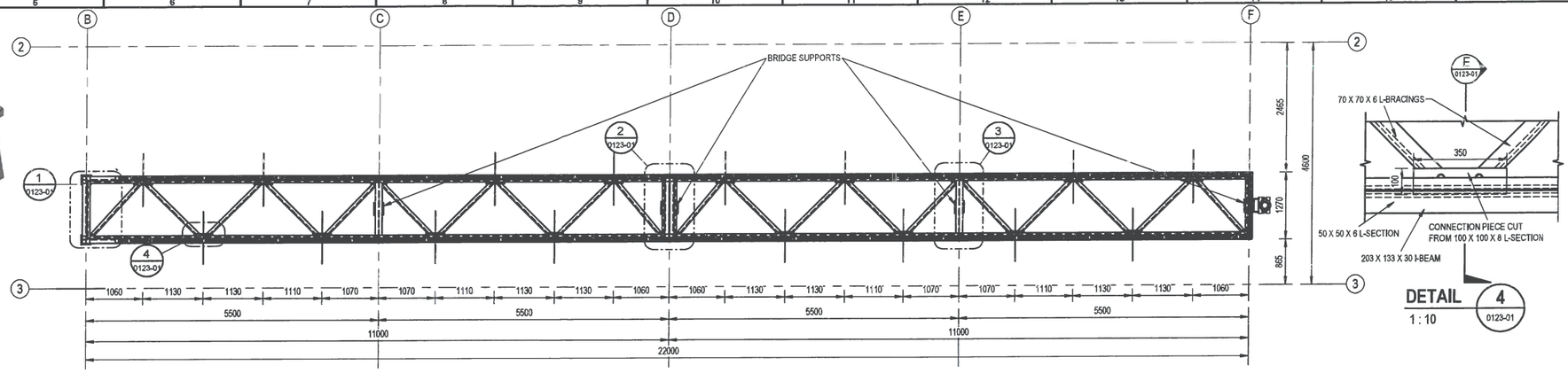
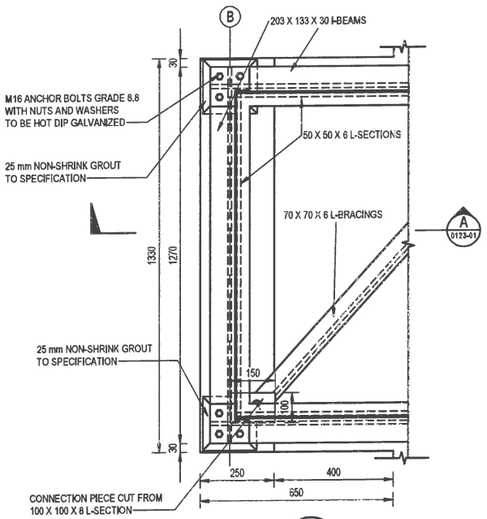


BRIDGE ISOMETRIC VIEW

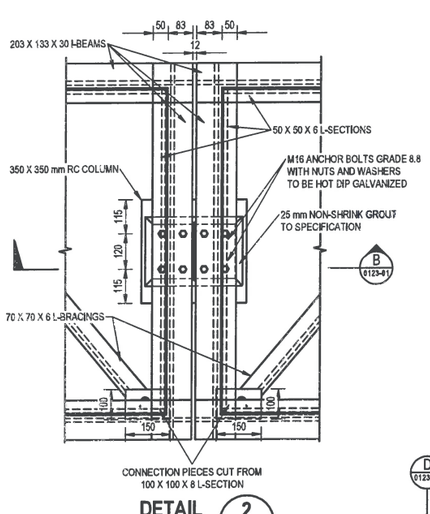


DETAIL 4 (0123-01) 1 : 10

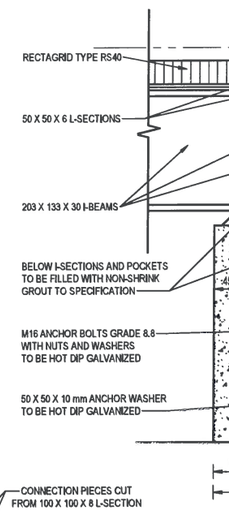
BRIDGE PLAN VIEW
1 : 50



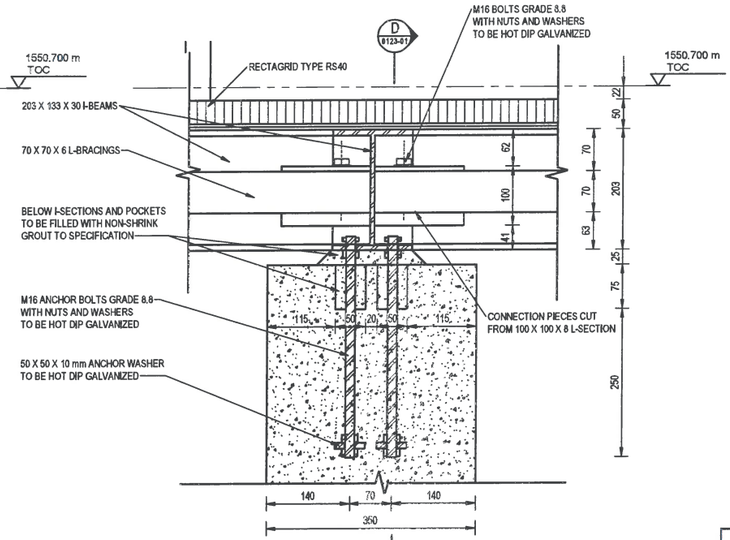
DETAIL 1 (0123-01) 1 : 10



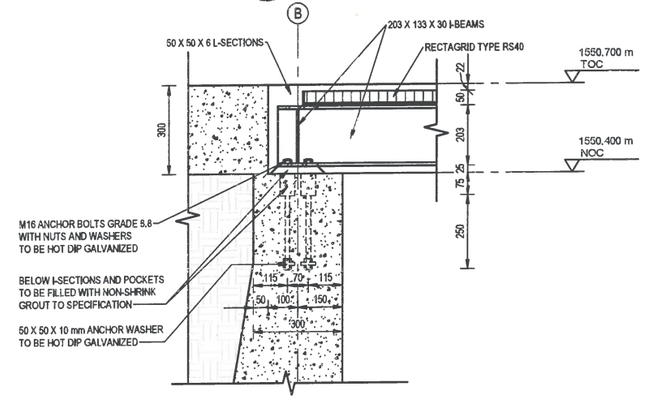
DETAIL 2 (0123-01) 1 : 10



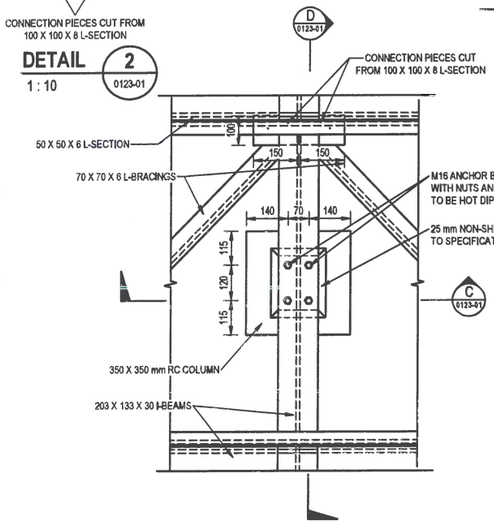
SECTION B (0123-01) 1 : 5



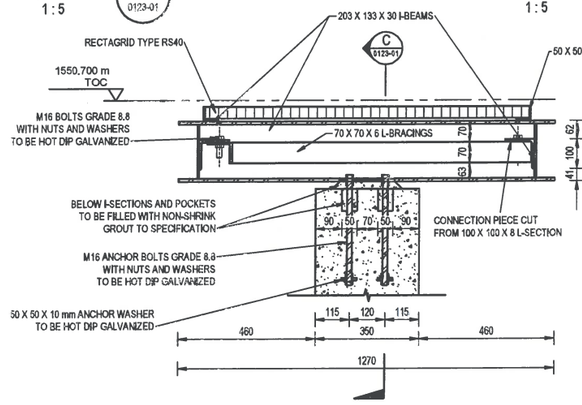
SECTION C (0123-01) 1 : 5



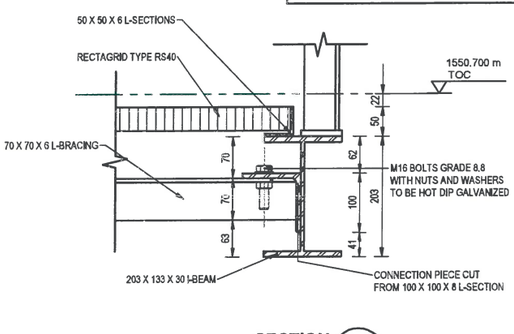
SECTION A (0123-01) 1 : 10



DETAIL 3 (0123-01) 1 : 10



SECTION D (0123-01) 1 : 10



SECTION E (0123-01) 1 : 5

AS BUILT DRAWINGS
ZUTARI
For Client
24/05/2021 Date

This AS BUILT drawing has been prepared based on information provided by the contractor. The levels and coordinates have not been independently checked or verified by Zutari.

REFERENCE DRAWINGS	
DRAWING No.	TITLE

REFERENCE DRAWINGS	
KPSX-EP-11000-DRG-SS-GE-0013	FLOOR GRATING - TYPICAL DETAILS
KPSX-EP-11000-DRG-SS-GE-0012	STRUCTURAL STEELWORK - HANDRAILS
KPSX-EP-11000-DRG-SS-GE-0001	STRUCTURAL STEELWORK - STANDARD STEELWORK NOTES
DRAWING No.	TITLE

ZUTARI PROFESSIONAL ENGINEER		
NAME	VICTOR WENTZEL	DATE
PROF. REG. No.	20130173	
SIGNATURE		24/05/21

SOUTH 32 PROFESSIONAL APPROVAL		
NAME	SIGN	DATE
CLIENT PROJECT MANAGER		
CLIENT ENGINEERING MANAGER		
ADDITIONAL SIGNATORY		
ZUTARI PROJECT No.	113452	
CLIENT CONTRACT No.	8500084829	

REV.	I.T.	DESCRIPTION	DRWN.	DES.	CHK.	APR.	DATE
*	F	AS-BUILT DRAWING	J.A.V.V.	J.A.V.V.	V.W.	J.L.	23/06/2021

I.T. ISSUE TYPE: (A) FOR REVIEW (B) FOR APPROVAL (C) FOR TENDER (D) FOR CONSTRUCTION (E) FOR INFORMATION (F) AS-BUILT (G) CANCELLED

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ZUTARI IMPACT: ENGINEERED.
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KLIPSPRUIT EXTENSION (KPSX)

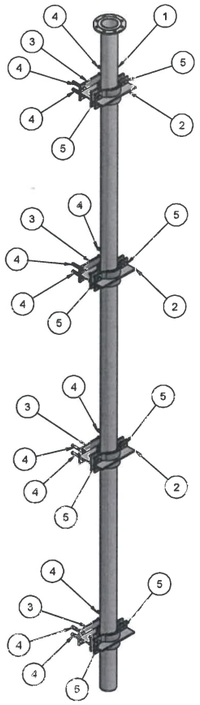
AREA: PCD 4
ELEMENT: PUMP STATION INTAKE STRUCTURE
TITLE: ACCESS PLATFORM AND BRIDGE

SCALE:	SHEET SIZE	DRAWING NUMBER	SHEET NO.	REV.
AS SHOWN	(A1)	KPSX-EP-16260 - DRG - WW-DE - 0123-01	1 OF 1	*

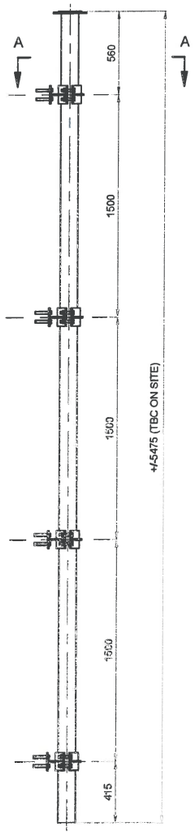
File Name: P:\Projects\113452 - KPSX Extension Ph1\ELA\Signed\0 DEL DES\0023 Mar\Mar\pH Rev\0\WW\16260KPSXDP-1600AADAAWW-0231PC0 2-PUMP INTAKE.rvt
Plot Date: 4/26/2021 3:06:17 PM
Plot Size: A1
Plot Scale: 1:1

THE MASTER HELD AT ZUTARI, GAUTENG DELIVERY CENTER, RESOURCES & MANUFACTURING UNIT, BEARS THE ORIGINAL SIGNATURE OF APPROVAL

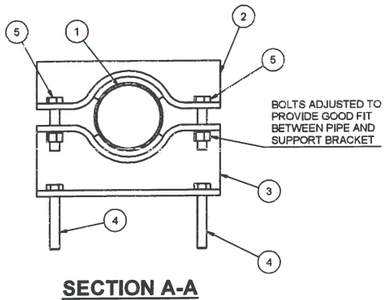
NOTES:
1. ALL STEELWORK, BOLTS, NUTS AND WASHERS TO BE HOT DIPPED GALVANIZED AND COATED IN ACCORDANCE WITH THE PROJECT SPECIFICATION.



ISOMETRIC VIEW
SCALE 1:20

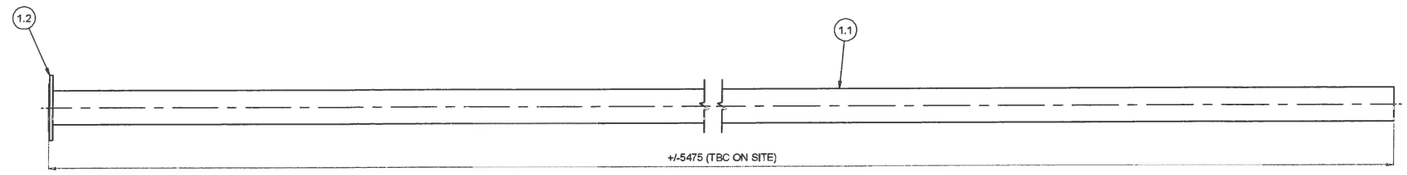


SIDE VIEW
SCALE 1:20



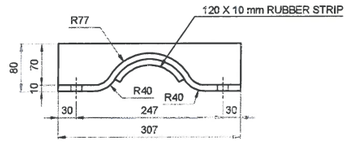
SECTION A-A
SCALE 1:5

PARTS LIST		
ITEM	QTY	DESCRIPTION
1	1	SPOOL PIECE DN 100 X 3,9 mm SANS 62; FLANGED ONE END SANS 1123 TABLE 1600/3 (RF)
2	4	TOP CRADLE ASSEMBLY
3	4	BOTTOM CRADLE ASSEMBLY
4	16	M16 CHEMICAL ANCHOR
5	16	M16 HSFG CLASS 8.8S BOLT AND NUT

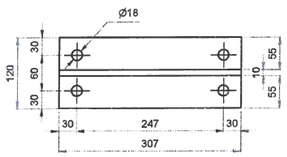


ITEM 1
SCALE 1:10

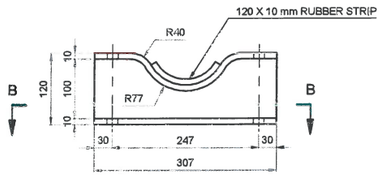
PARTS LIST		
ITEM	QTY	DESCRIPTION
1.1	5.475 m	STEEL PIPE DN 100 x 3,9 mm SANS 62
1.2	1	FLANGE DN 100 SANS 1123 TABLE 1600/3 (RF)



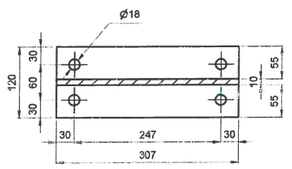
ITEM 2:
SIDE VIEW
SCALE 1:5



ITEM 2:
TOP VIEW
SCALE 1:5



ITEM 3:
SIDE VIEW
SCALE 1:5



ITEM 3:
SECTION B-B
SCALE 1:5

AS BUILT DRAWINGS
ZUTARI
21/05/2021

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REFERENCE DRAWINGS		REFERENCE DRAWINGS	
DRAWING NO.	TITLE	DRAWING NO.	TITLE

ZUTARI PROFESSIONAL ENGINEER		
NAME	VICTOR WENZEL	DATE
PROF. REG. No.	20130173	
SIGNATURE		21/05/2021
SOUTH 32 PROFESSIONAL APPROVAL		
NAME	SIGN.	DATE
CLIENT PROJECT MANAGER		
CLIENT ENGINEERING MANAGER		
ADDITIONAL SIGNATORY		
ZUTARI PROJECT No.	113452	
CLIENT CONTRACT No.	8500084829	

REV.	I.T.	DESCRIPTION	DRWN.	DES.	CHK.	APR.	DATE
*	F	AS-BUILT DRAWING	J.A.V.V.	J.A.V.V.	C.N.	V.W.	23/04/2021

I.T. ISSUE TYPE: (A) FOR REVIEW (SQ) (B) INTERNAL PEER REVIEW (C) FOR APPROVAL (CR) (D) FOR CONSTRUCTION (E) FOR INFORMATION (F) AS-BUILT (G) CANCELLED

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SOUTH32
ZUTARI IMPACT. ENGINEERED.
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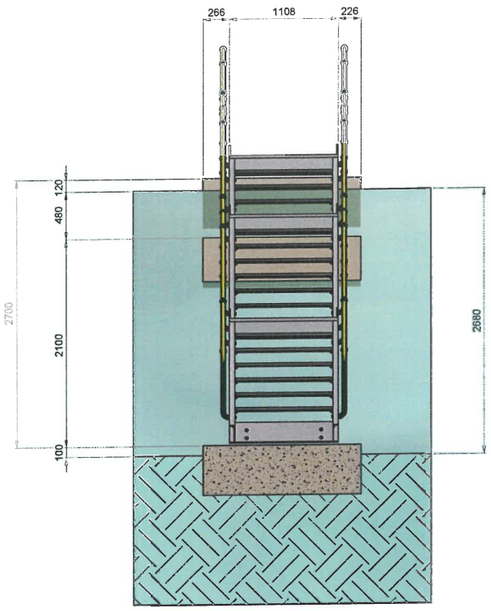
Tel: +27 12 427 2000
E connect@zutari.com

KLIPSPRUIT EXTENSION (KPSX)

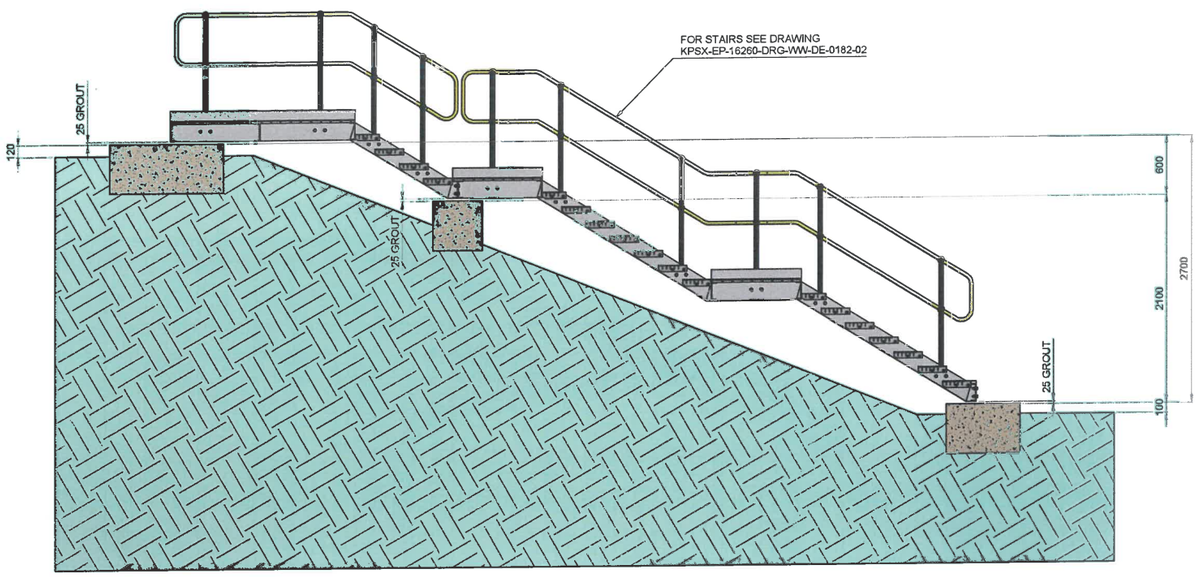
AREA: PCD 4
ELEMENT: PUMP INTAKE STRUCTURE
TITLE: LEVEL INSTRUMENTATION PIPE FIXING DETAILS

SCALE:	SHEET SIZE	Drawing Number	SHEET No.	REV.
AS SHOWN	(A1)	KPSX-EP-16260-DRG-WW-DE-0124-01	1 OF 1	*

THE MASTER HELD AT ZUTARI, GAUTENG DELIVERY CENTER, RESOURCES & MANUFACTURING UNIT, BEARS THE ORIGINAL SIGNATURE OF APPROVAL



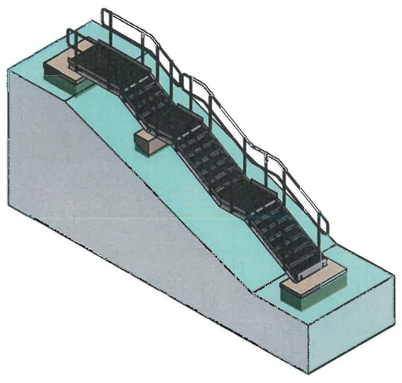
SECTION B-B
SCALE 1 : 30



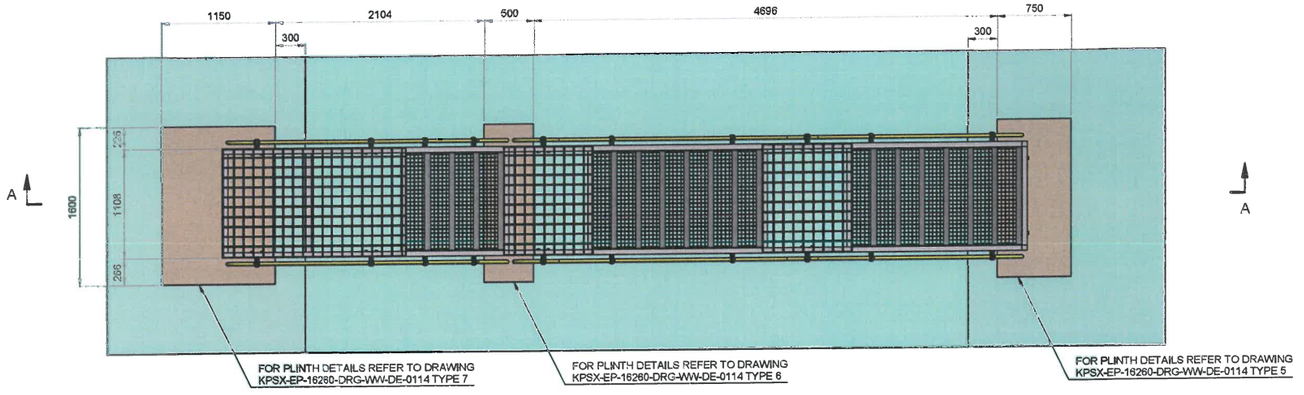
SECTION A-A
SCALE 1 : 30

NOTES:

1. STAIRS TO BE MANUFACTURED AND INSTALLED IN ACCORDANCE WITH DRAWING: KPSX-EP-11000 DRG-SS-GE-0006.
2. HANDRAILINGS TO BE MANUFACTURED AND INSTALLED IN ACCORDANCE WITH DRAWING: KPSX-EP-11000-DRG-SS-GE-0012.
3. NATURAL GROUND AND NON OVERSPILL CREST LEVELS TO BE CONFIRMED BY CONTRACTOR ON SITE, PRIOR TO CONSTRUCTION OF STAIRCASE.



ISOMETRIC VIEW
SCALE 1 : 75



PLAN VIEW
SCALE 1 : 30

AS BUILT DRAWINGS
ZUTARI
21/05/21

This AS BUILT drawing has been prepared based on information provided by the contractor. The levels and coordinates have not been independently checked or verified by Zutari.

REFERENCE DRAWINGS	
DRAWING NO.	TITLE

REFERENCE DRAWINGS	
KPSX-EP-16260-DRG-WW-DE-0114	CONCRETE PLINTH AND FOUNDATION DETAILS
KPSX-EP-11000-DRG-SC-GE-0001	STRUCTURAL CONCRETE - STANDARD CONCRETE NOTES
KPSX-EP-11000-DRG-SC-GE-0002	STRUCTURAL CONCRETE - TYPICAL CIVIL DETAILS
KPSX-EP-11000-DRG-SS-GE-0006	STRUCTURAL STEELWORK - STAIRCASE AND TYPICAL DETAILS
KPSX-EP-11000-DRG-SS-GE-0012	STRUCTURAL STEELWORK - HANDRAILS
KPSX-EP-11000-DRG-SS-GE-0013	FLOOR GRATING TYPICAL DETAIL
DRAWING NO.	TITLE

ZUTARI PROFESSIONAL ENGINEER		
NAME	VICTOR WENZEL	DATE
PROF. REG. No.	20130173	
SIGNATURE		4/05/21

SOUTH 32 PROFESSIONAL APPROVAL		
NAME	SIGN.	DATE
CLIENT PROJECT MANAGER		
CLIENT ENGINEERING MANAGER		
ADDITIONAL SIGNATORY		
ZUTARI PROJECT No.	113452	
CLIENT CONTRACT No.	8500084829	

REV.	LT.	DESCRIPTION	DRWN.	DES.	CHK.	APR.	DATE
*	F	AS-BUILT DRAWING	C.R.	C.R.	C.N.	V.W.	14/04/2021

LT. ISSUE TYPE: (A) FOR REVIEW (BQ) (B) INTERNAL PEER REVIEW (C) FOR APPROVAL (CR) (D) FOR CONSTRUCTION (E) FOR INFORMATION (F) AS-BUILT (G) CANCELLED

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SOUTH32

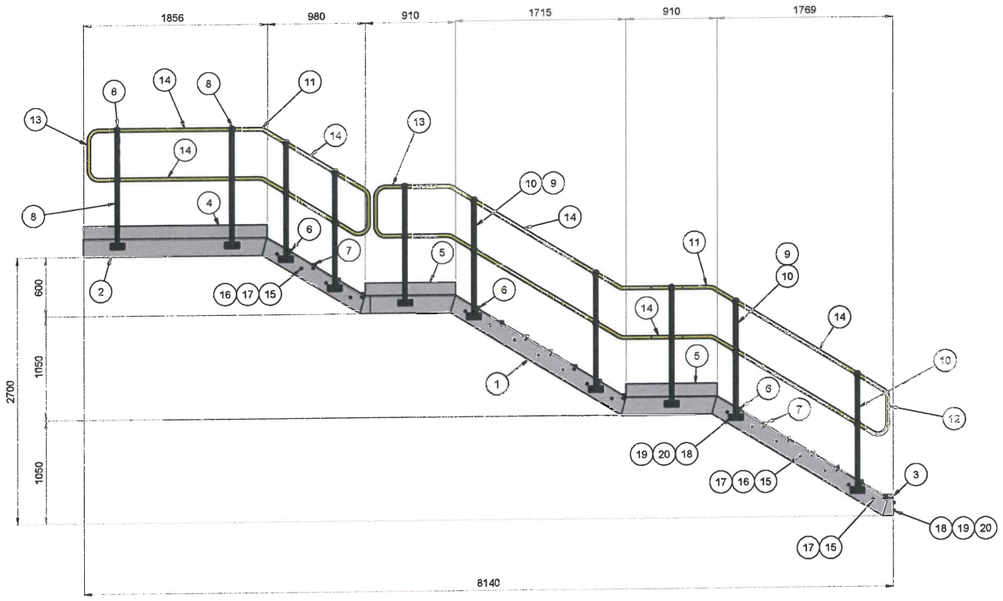
KLIPSPRUIT EXTENSION (KPSX)

AREA: PCD 4
ELEMENT: PCD ACCESS STAIRCASE
TITLE: LAYOUT AND DETAILS

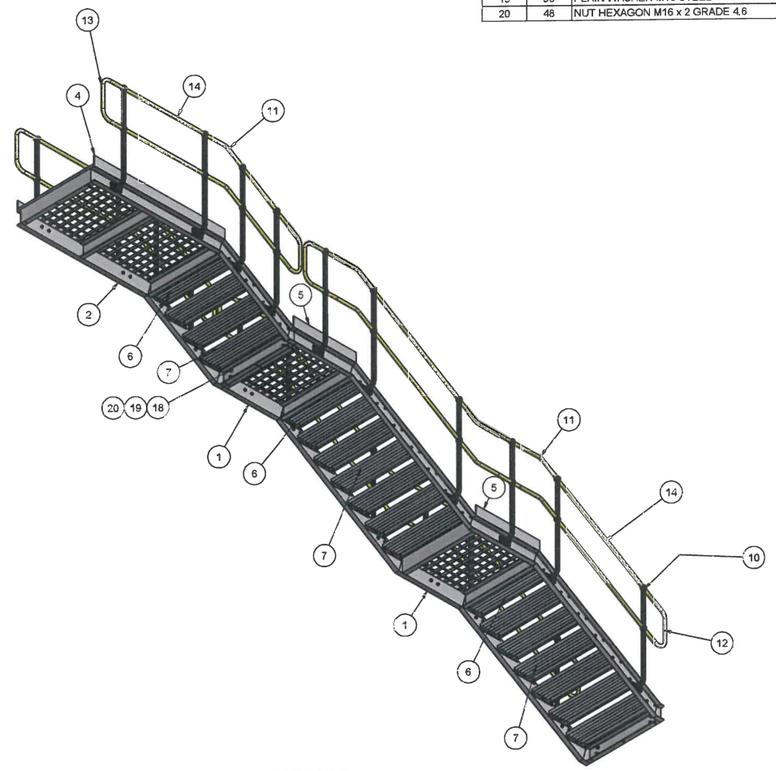
SCALE:	SHEET SIZE	Drawing Number	SHEET No.	REV.
AS SHOWN	(A1)	KPSX-EP-16260-DRG-WW-DE-0182-01	1 OF 5	*

THE MASTER HELD AT ZUTARI, GAUTENG DELIVERY CENTER, RESOURCES & MANUFACTURING UNIT, BEARS THE ORIGINAL SIGNATURE OF APPROVAL

PARTS LIST		
ITEM	QTY	DESCRIPTION
1	1	STAIR FRAME
2	1	STAIRS WITH LANDING
3	1	COVER PLATE
4	1	GRATING 1108 x 1865 x 30, BEARER BAR 30 x 4.5 WITH KICK PLATE 130 WELDED TO GRATING
5	2	GRATING 1108 x 910 x 30, BEARER BAR 30 x 4.5 WITH KICK PLATE 130 WELDED TO GRATING
6	3	STAIRTREADS STEEL 1000 x 245, BEARER BAR 40 x 4.5, HOLE CENTERS 115 (VITAGRID)
7	15	STAIRTREADS STEEL 1000 x 290, BEARER BAR 40 x 4.5, HOLE CENTERS 115 (VITAGRID)
8	8	STANCHION OFFSET 110 mm DIAMETER 43 mm SIDE MOUNTED 90 DEG
9	6	STANCHION OFFSET 110 mm RH DIAMETER 43 mm SIDE MOUNTED 31.5 DEG
10	3	STANCHION OFFSET 110 mm LH DIAMETER 43 mm SIDE MOUNTED 31.5 DEG
11	16	STANDARD RAMP BEND 31.5 DEG
12	4	STANDARD ANGLE CLOSURE 31.5 DEG
13	4	STANDARD CLOSURE 90 DEG
14	24	*Varies*
15	72	BOLT HEX HD M12 x 1.75 x 35 LONG GR 4.6 (SCREW TYPE)
16	144	PLAIN WASHER M12 STEEL
17	72	NUT HEXAGON M12 x 1.75 GRADE 4.6
18	48	BOLT HEX HD M16 x 2 x 45 LONG GR 4.6 (SCREW TYPE)
19	96	PLAIN WASHER M16 STEEL
20	48	NUT HEXAGON M16 x 2 GRADE 4.6



SIDE ELEVATION
SCALE 1 : 30



ISOMETRIC VIEW LOOKING FROM UNDER
SCALE 1 : 30

NOTES:

1. STAIRS TO BE MANUFACTURED AND INSTALLED IN ACCORDANCE WITH DRAWING: KPSX-EP-11000 DRG-SS-GE-0006.
2. HANDRAILINGS TO BE MANUFACTURED AND INSTALLED IN ACCORDANCE WITH DRAWING: KPSX-EP-11000-DRG-SS-GE-0012.
3. NATURAL GROUND AND NON OVERSPILL CREST LEVELS TO BE CONFIRMED BY CONTRACTOR ON SITE, PRIOR TO CONSTRUCTION OF STAIRCASE.

AS BUILT DRAWINGS
ZUTARI IMPACT ENGINEERED
For Client
05 May 21
Date

This AS BUILT drawing has been prepared based on information provided by the contractor. The levels and coordinates have not been independently checked or verified by Zutari.

REFERENCE DRAWINGS	
DRAWING NO.	TITLE

REFERENCE DRAWINGS	
KPSX-EP-16260-DRG-WW-DE-0114	ACCESS STAIRCASE AND PIPE SUPPORT - CONCRETE DETAILS
KPSX-EP-11000-DRG-SC-GE-0001	STRUCTURAL CONCRETE - STANDARD CONCRETE NOTES
KPSX-EP-11000-DRG-SC-GE-0002	STRUCTURAL CONCRETE - TYPICAL CIVIL DETAILS
KPSX-EP-11000-DRG-SS-GE-0006	STRUCTURAL STEELWORK - STAIRCASE AND TYPICAL DETAILS
KPSX-EP-11000-DRG-SS-GE-0012	STRUCTURAL STEELWORK - HANDRAILS
KPSX-EP-11000-DRG-SS-GE-0013	FLOOR GRATING TYPICAL DETAIL
DRAWING NO.	TITLE

ZUTARI PROFESSIONAL ENGINEER		
NAME	VICTOR WENTZEL	DATE
PROF. REG. No.	20130173	
SIGNATURE		05 May 21

SOUTH 32 PROFESSIONAL APPROVAL		
NAME	SIGN.	DATE
CLIENT PROJECT MANAGER		
CLIENT ENGINEERING MANAGER		
ADDITIONAL SIGNATORY		
ZUTARI PROJECT No.	113452	
CLIENT CONTRACT No.	8500084829	

REV.	LT.	DESCRIPTION	DRWN.	DES.	CHK.	APR.	DATE
*	F	AS-BUILT DRAWING	C.R.	C.R.	C.N.	V.W.	14/05/2021

LT. ISSUE TYPE: (A) FOR REVIEW (SQ) (B) INTERNAL PEER REVIEW (C) FOR APPROVAL (CR) (D) FOR CONSTRUCTION (E) FOR INFORMATION (F) AS-BUILT (G) CANCELLED

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SOUTH 32

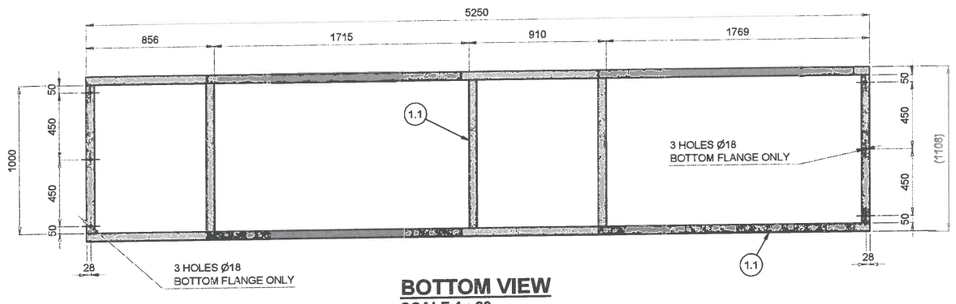
KLIPSPRUIT EXTENSION (KPSX)

AREA: PCD 4
ELEMENT: PCD ACCESS STAIRCASE
TITLE: LAYOUT AND DETAILS

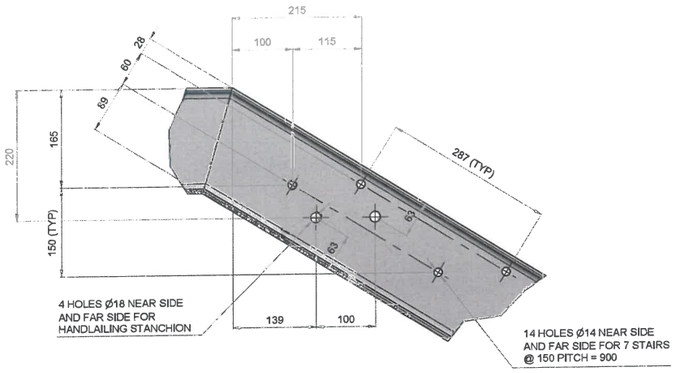
SCALE:	SHEET SIZE	Drawing Number	SHEET No.	REV.
AS SHOWN	(A1)	KPSX-EP-16260-DRG-WW-DE-0182-02	2 OF 5	*

THE MASTER HELD AT ZUTARI, GAUTENG DELIVERY CENTER, RESOURCES & MANUFACTURING UNIT, BEARS THE ORIGINAL SIGNATURE OF APPROVAL

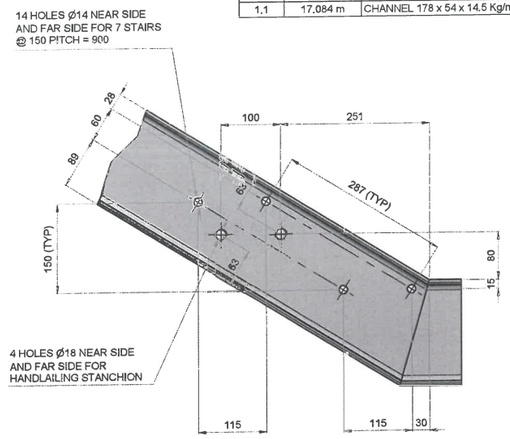
PARTS LIST		
ITEM	QTY	DESCRIPTION
1.1	17.084 m	CHANNEL 178 x 54 x 14.5 Kg/m



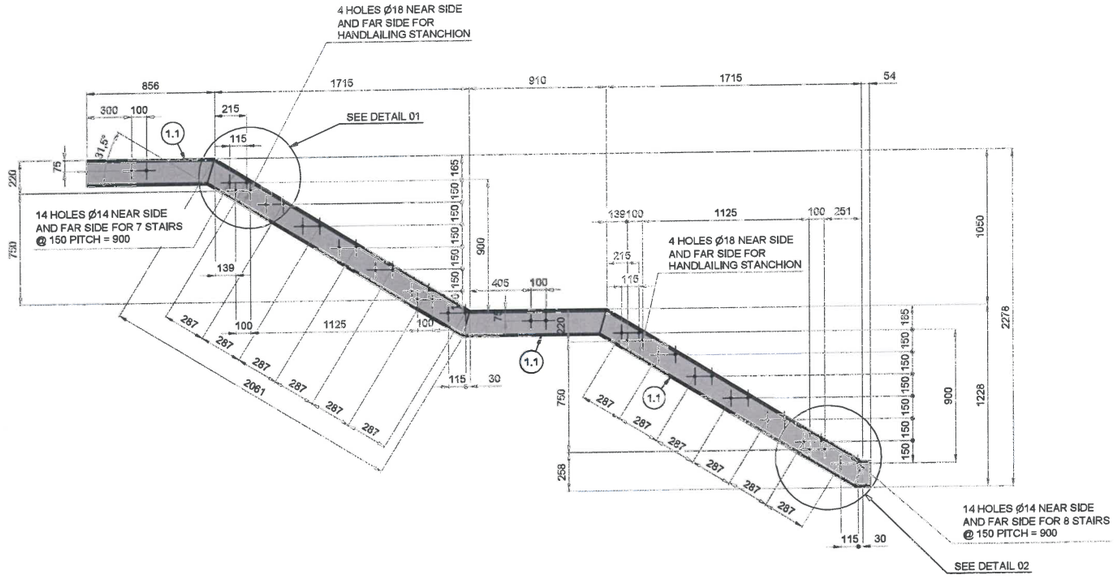
BOTTOM VIEW
SCALE 1 : 20



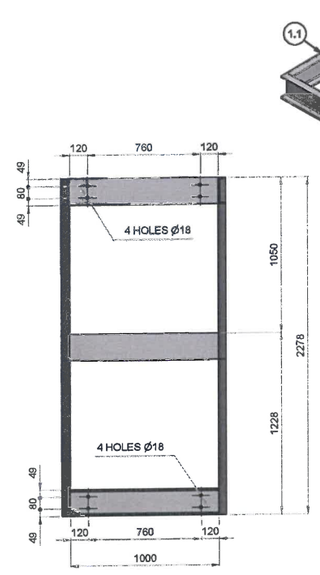
DETAIL 01
SCALE 1 : 5



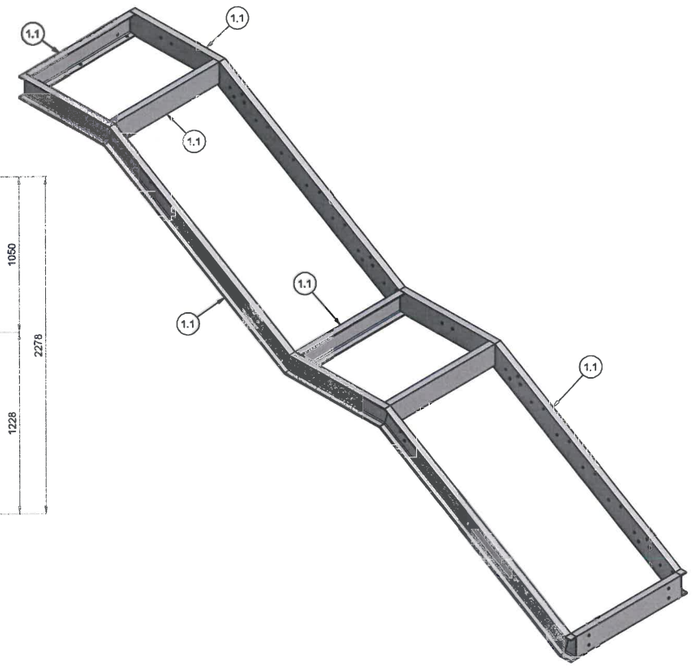
DETAIL 02
SCALE 1 : 5



FRONT ELEVATION
ITEM 1
SCALE 1 : 20



SIDE ELEVATION
SCALE 1 : 20



ISOMETRIC VIEW STAIR FRAME
SCALE 1 : 20

NOTES:

1. ALL WELDS TO BE 8 OR 8
2. REMOVE ALL SHARP EDGES AND BURS.
3. HOT DIP GALVANIZE AFTER MANUFACTURING.

AS BUILT DRAWINGS
ZUTARI
For Client
Date

This AS BUILT drawing has been prepared based on information provided by the contractor. The levels and coordinates have not been independently checked or verified by Zutari.

REFERENCE DRAWINGS	
DRAWING NO.	TITLE

REFERENCE DRAWINGS	
DRAWING NO.	TITLE

ZUTARI PROFESSIONAL ENGINEER		
NAME	VICTOR WENTZEL	DATE
PROF. REG. No.	20130173	
SIGNATURE		21/05/2021

SOUTH 32 PROFESSIONAL APPROVAL		
NAME	SIGN.	DATE
CLIENT PROJECT MANAGER		
CLIENT ENGINEERING MANAGER		
ADDITIONAL SIGNATORY		
ZUTARI PROJECT No.	113452	
CLIENT CONTRACT No.	8500084829	

REV.	I.T.	DESCRIPTION	DRWN.	DES.	CHK.	APR.	DATE
*	F	AS-BUILT DRAWING	C.R.	C.R.	C.N.	J.L.	14/05/2021

I.T. ISSUE TYPE: (A) FOR REVIEW (SQ) (B) INTERNAL PEER REVIEW (C) FOR APPROVAL (CR) (D) FOR CONSTRUCTION (E) FOR INFORMATION (F) AS-BUILT (G) CANCELLED

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SOUTH32

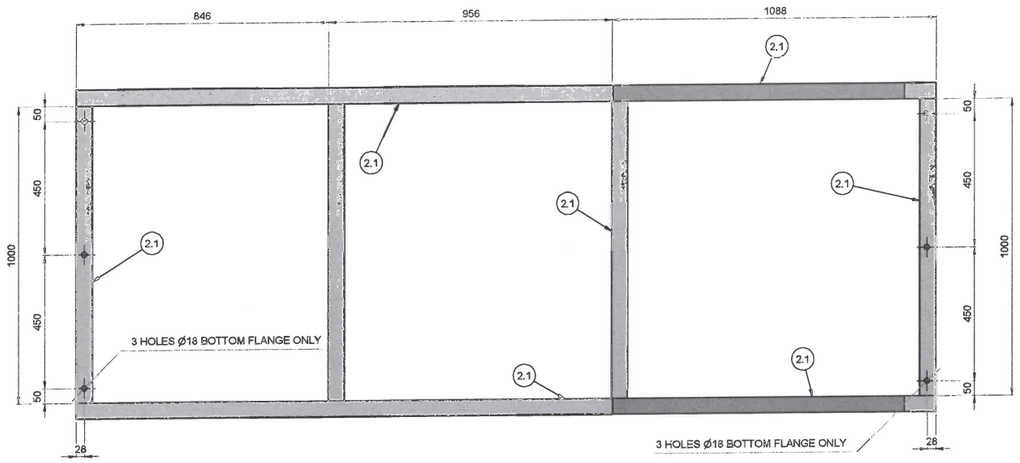
KLIPSPRUIT EXTENSION (KPSX)

AREA: PCD 4
ELEMENT: PCD ACCESS STAIRCASE
TITLE: LAYOUT AND DETAILS

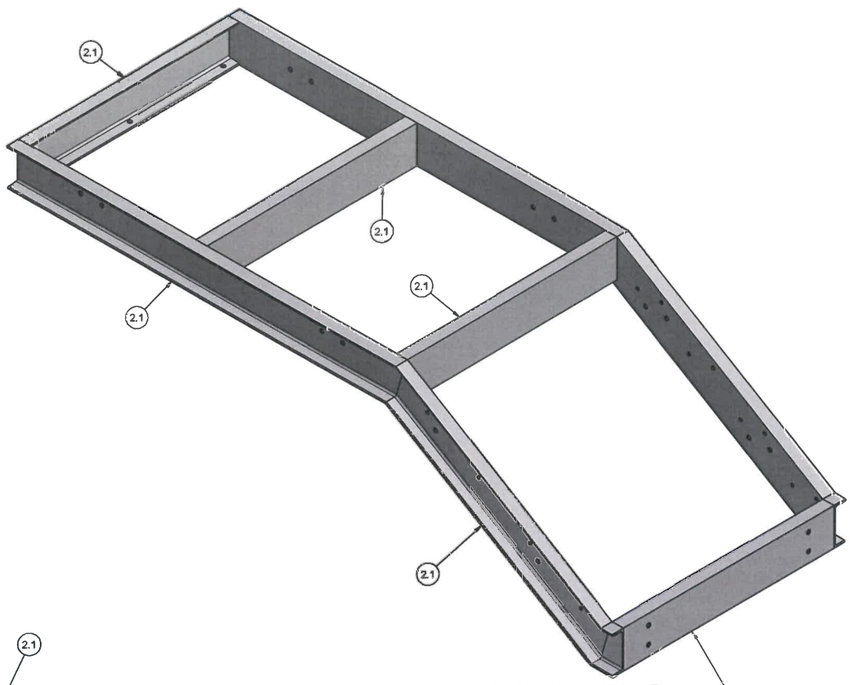
SCALE:	SHEET SIZE	Drawing Number	SHEET No.	REV.
AS SHOWN	(A1)	KPSX-EP-16260-DRG-WW-DE-0182-03	3 OF 5	*

THE MASTER HELD AT ZUTARI, GAUTENG DELIVERY CENTER, RESOURCES & MANUFACTURING UNIT, BEARS THE ORIGINAL SIGNATURE OF APPROVAL

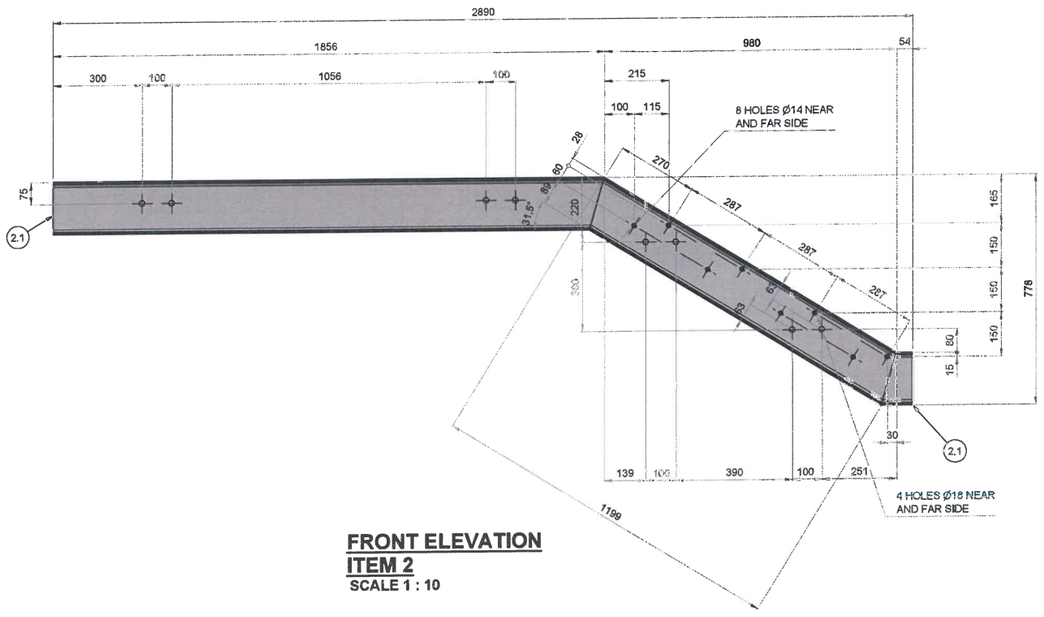
PARTS LIST		
ITEM	QTY	DESCRIPTION
2.1	10,319 m	CHANNEL 178 x 54 x 14.5 Kg/m



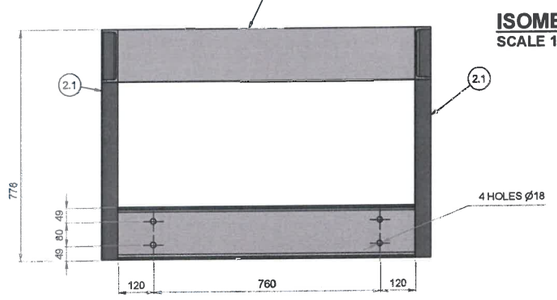
BOTTOM VIEW
SCALE 1 : 10



ISOMETRIC VIEW STAIRS WITH LANDING
SCALE 1 : 10



FRONT ELEVATION
ITEM 2
SCALE 1 : 10



SIDE ELEVATION
SCALE 1 : 10

NOTES:

1. ALL WELDS TO BE 8 OR 8
2. REMOVE ALL SHARP EDGES AND BURS.
3. HOT DIP GALVANIZE AFTER MANUFACTURING.

AS BUILT DRAWINGS
ZUTARI
21/05/2021

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REFERENCE DRAWINGS		REFERENCE DRAWINGS	
DRAWING NO.	TITLE	DRAWING NO.	TITLE

ZUTARI PROFESSIONAL ENGINEER		
NAME	VICTOR WENTZEL	DATE
PROF. REG. No.	20130173	
SIGNATURE		21/05/2021

SOUTH 32 PROFESSIONAL APPROVAL		
NAME	SIGN.	DATE
CLIENT PROJECT MANAGER		
CLIENT ENGINEERING MANAGER		
ADDITIONAL SIGNATORY		
ZUTARI PROJECT No.	113452	
CLIENT CONTRACT No.	8500084829	

REV.	I.T.	DESCRIPTION	DRWN.	DES.	CHK.	APR.	DATE
-	F	AS-BUILT DRAWING	C.R.	C.R.	C.N.	J.L.	14/04/2021

LT. ISSUE TYPE: (A) FOR REVIEW (BQ) (B) INTERNAL PEER REVIEW (C) FOR APPROVAL (CR) (D) FOR CONSTRUCTION (E) FOR INFORMATION (F) AS-BUILT (G) CANCELLED

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SOUTH32

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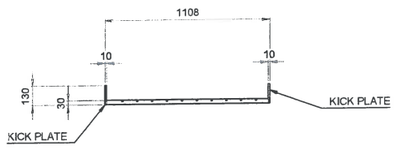
Tel: +27 12 427 2000
E connect@zutari.com

KLIPSPRUIT EXTENSION (KPSX)

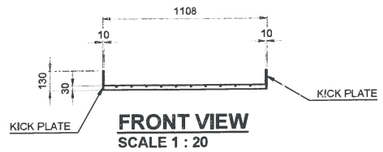
AREA: PCD 4
ELEMENT: PCD ACCESS STAIRCASE
TITLE: LAYOUT AND DETAILS

SCALE:	SHEET SIZE	Drawing Number	SHEET No.	REV.
AS SHOWN	(A1)	KPSX-EP-16260-DRG-WW-DE-0182-04	4 OF 5	*

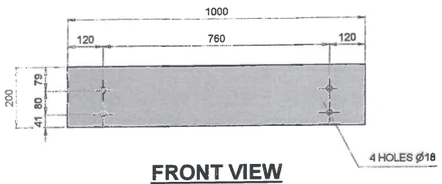
THE MASTER HELD AT ZUTARI, GAUTENG DELIVERY CENTER, RESOURCES & MANUFACTURING UNIT, BEARS THE ORIGINAL SIGNATURE OF APPROVAL



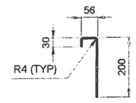
FRONT VIEW
SCALE 1 : 20 FRONT VIEW



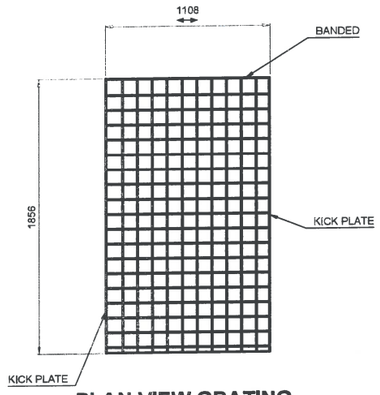
FRONT VIEW
SCALE 1 : 20



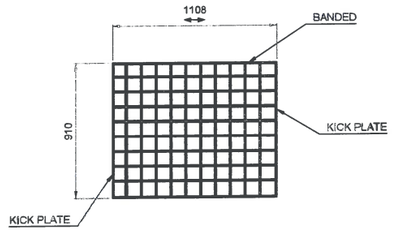
FRONT VIEW
ITEM 3
SCALE 1 : 10



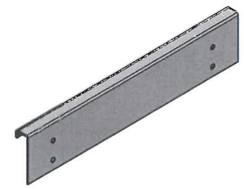
SIDE VIEW
SCALE 1 : 10



PLAN VIEW GRATING
ITEM 4
SCALE 1 : 20

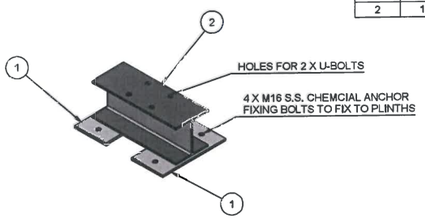


PLAN VIEW GRATING
ITEM 5
SCALE 1 : 20

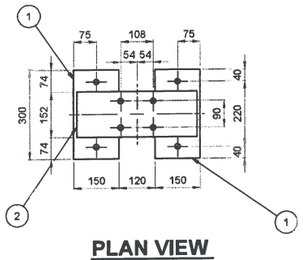


ISOMETRIC VIEW
SCALE 1 : 10

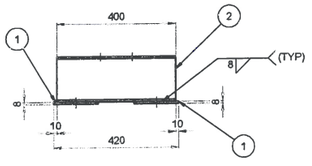
PARTS LIST		
ITEM	QTY	DESCRIPTION
1	2	FLAT BAR 150 x 300 x 8 mm
2	1	H-BEAM 203 x 203 x 46.1 kg/m



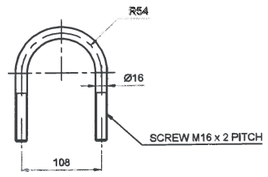
ISOMETRIC VIEW PIPE SUPPORT BEAM
SCALE 1 : 10



PLAN VIEW
SCALE 1 : 10



FRONT ELEVATION
SCALE 1 : 10



PLAN VIEW
U-BOLT FOR DN 80 PIPE
SCALE 1 : 4

NOTE: REFER TO DRAWING KPSX-EP-16260-DRG-WW-LY-0123 WHERE PIPE SUPPORT BEAM IS REQUIRED

NOTES:

1. ALL WELDS TO BE 8 OR 8
2. REMOVE ALL SHARP EDGES AND BURS.
3. HOT DIP GALVANIZE AFTER MANUFACTURING.

AS BUILT DRAWINGS
ZUTARI
24/05/2021

This AS BUILT drawing has been prepared based on information provided by the contractor. The levels and coordinates have not been independently checked or verified by Zutari.

REFERENCE DRAWINGS		REFERENCE DRAWINGS	
DRAWING NO.	TITLE	DRAWING NO.	TITLE

ZUTARI PROFESSIONAL ENGINEER		
NAME	VICTOR WENTZEL	DATE
PROF. REG. No.	20130173	
SIGNATURE		24/05/2021
SOUTH 32 PROFESSIONAL APPROVAL		
NAME	SIGN.	DATE
CLIENT PROJECT MANAGER		
CLIENT ENGINEERING MANAGER		
ADDITIONAL SIGNATORY		
ZUTARI PROJECT No.	113452	
CLIENT CONTRACT No.	8500084829	

REV.	I.T.	DESCRIPTION	DRWN.	DES.	CHK.	APR.	DATE
*	F	AS-BUILT DRAWING	C.R.	C.R.	C.N.	J.L.	14/05/2021

I.T. ISSUE TYPE: (A) FOR REVIEW (SQ) (B) INTERNAL PEER REVIEW (C) FOR APPROVAL (CR) (D) FOR CONSTRUCTION (E) FOR INFORMATION (F) AS-BUILT (G) CANCELLED

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ZUTARI IMPACT. ENGINEERED.
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41 Matroosberg Road
Ashlea Gardens, Extension 6
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0081
Tel: +27 12 427 2000
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KLIPSPRUIT EXTENSION (KPSX)

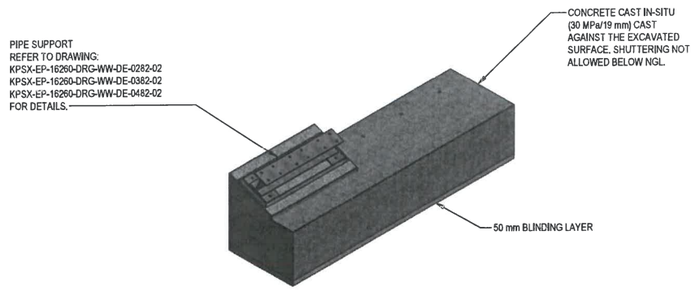
AREA: PCD 4
ELEMENT: PCD ACCESS STAIRCASE
TITLE: LAYOUT AND DETAILS

SCALE:	SHEET SIZE	Drawing Number	SHEET No.	REV.
AS SHOWN	(A1)	KPSX-EP-16260-DRG-WW-DE-0182-05	5 OF 5	*

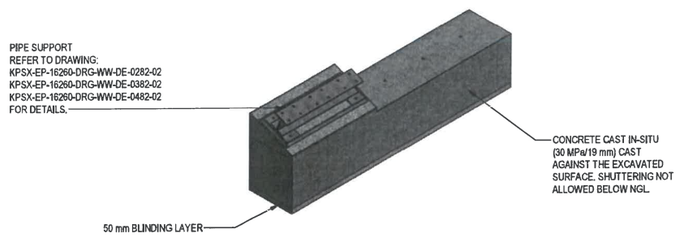
THE MASTER HELD AT ZUTARI GAUTENG DELIVERY CENTRE, RESOURCES & MANUFACTURING UNIT, BEARS THE ORIGINAL SIGNATURE OF APPROVAL

NOTES
1. IN-SITU MATERIAL TO BE COMPACTED TO AT LEAST 90 % MOD AASHTO DENSITY.
2. HOLDING DOWN BOLTS DIMENSIONS TO BE CONFIRMED WITH SHOP DRAWINGS.

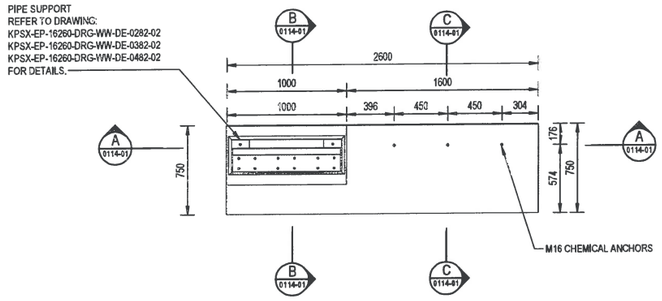
STRUCTURAL REQUIREMENTS	
STRUCTURE TYPE:	BUILDING STRUCTURE
CONCRETE GRADE:	30 MPa/19 mm TO ALL STRUCTURAL CONCRETE
	15 MPa/19 mm TO BLINDING
BLINDING LAYER:	50 mm BELOW ALL STRUCTURES
EXTENDERS:	MAXIMUM FLY ASH TO SPECIFICATION
FORMED SURFACE FINISH:	SMOOTH
	ALL EXPOSED EXTERNAL EDGES IN CONCRETE WORK SHALL HAVE 20 mm X 20 mm CHAMFERS
	POWER FLOAT FINISH TO SLABS
UNFORMED SURFACE FINISH:	STEEL FLOAT FINISH TO TOP OF WALLS
CONCRETE COVER TO REBAR:	75 mm IF CAST AGAINST SOIL OR CAST AGAINST BLINDING
	40 mm FOR WATER CONTACT AREAS
	60 mm FOR SEWAGE CONTACT AREAS
	50 mm FOR SOIL OR BLINDING CONTACT AREAS
	30 mm FOR AIR CONTACT AREAS



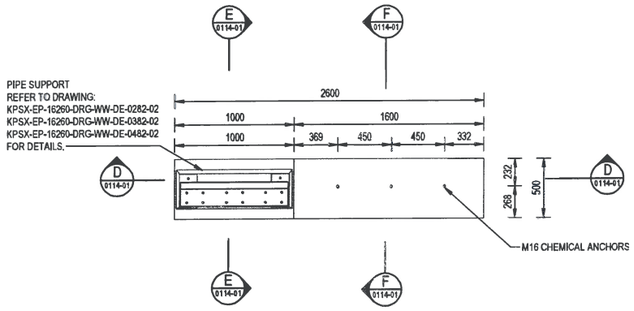
ISOMETRIC VIEW - PIPE AND STAIRS SUPPORT TYPE 1



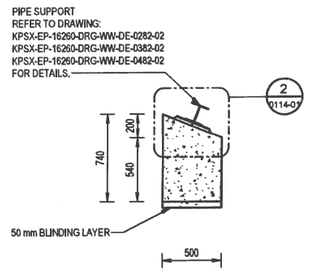
ISOMETRIC VIEW - PIPE AND STAIRS SUPPORT TYPE 2



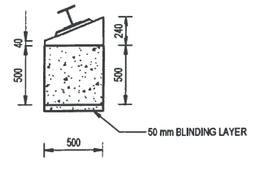
PLAN VIEW - PIPE AND STAIRS SUPPORT TYPE 1
1 : 25



PLAN VIEW - PIPE AND STAIRS SUPPORT TYPE 2
1 : 25



SECTION E
1 : 25 — 0114-01



SECTION F
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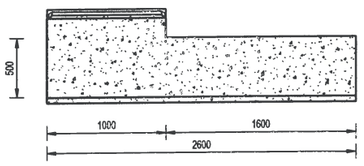

SECTION A
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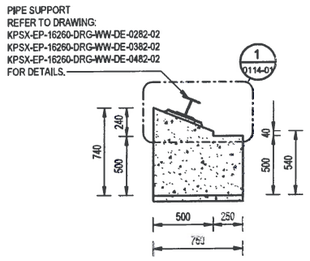

SECTION B
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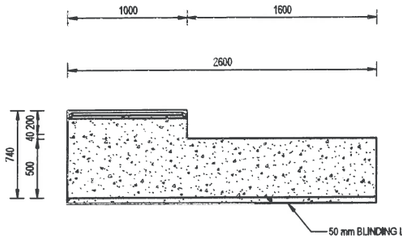
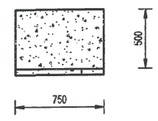
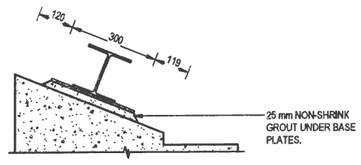


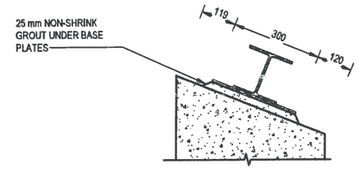
SECTION D
1 : 25 — 0114-01



SECTION C
1 : 25 — 0114-01



DETAIL 1
1 : 10 — 0114-01



DETAIL 2
1 : 10 — 0114-01

AS BUILT DRAWINGS
ZUTARI
PROJECT DIRECTOR
21/05/2021

This AS BUILT drawing has been prepared based on information provided by the contractor. The levels and coordinates have not been independently checked or verified by Zutari.

REFERENCE DRAWINGS	
DRAWING No.	TITLE

REFERENCE DRAWINGS	
KPSX-EP-16260-DRG-WW-DE-0282	PCD 1 ACCESS STAIRCASE - LAYOUT AND DETAILS
KPSX-EP-16260-DRG-WW-DE-0382	PCD 2 ACCESS STAIRCASE - LAYOUT AND DETAILS
KPSX-EP-16260-DRG-WW-DE-0482	PCD 3 ACCESS STAIRCASE - LAYOUT AND DETAILS
KPSX-EP-11000-DRG-SC-GE-0001-01	STRUCTURAL CONCRETE - STANDARD CONCRETE NOTES
DRAWING No.	TITLE

ZUTARI PROFESSIONAL ENGINEER		
NAME	VICTOR WENTZEL	DATE
PROF. REG. No.	20130373	
SIGNATURE		21/05/2021

SOUTH 32 PROFESSIONAL APPROVAL		
NAME	SIGN	DATE
CLIENT PROJECT MANAGER		
CLIENT ENGINEERING MANAGER		
ADDITIONAL SIGNATORY		
ZUTARI PROJECT No.	113452	
CLIENT CONTRACT No.	8500084829	

REV.	I.T.	DESCRIPTION	DRWN.	DES.	CHK.	APR.	DATE
*	F	AS-BUILT DRAWING	S.N.	S.N.	J.L	V.W.	23/03/2021

I.T. ISSUE TYPE: (A) FOR REVIEW (B) FOR APPROVAL (C) FOR TENDER (D) FOR CONSTRUCTION (E) FOR INFORMATION (F) AS-BUILT (G) CANCELLED

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ZUTARI IMPACT. ENGINEERED.
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T + 27 12 427 2000
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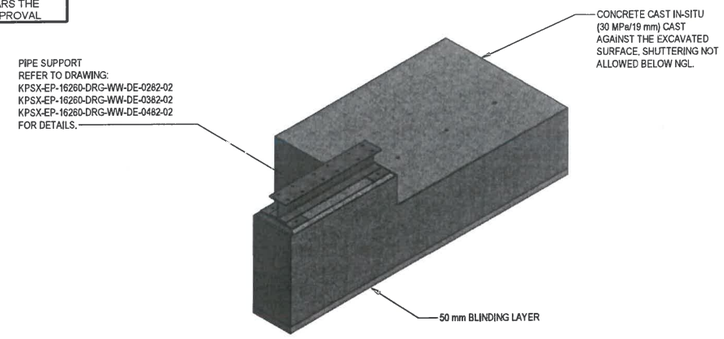
KLIPSPRUIT EXTENSION (KPSX)

AREA: POLLUTION CONTROL DAMS
ELEMENT: ACCESS STAIRCASE AND PIPE SUPPORT
TITLE: CONCRETE DETAILS

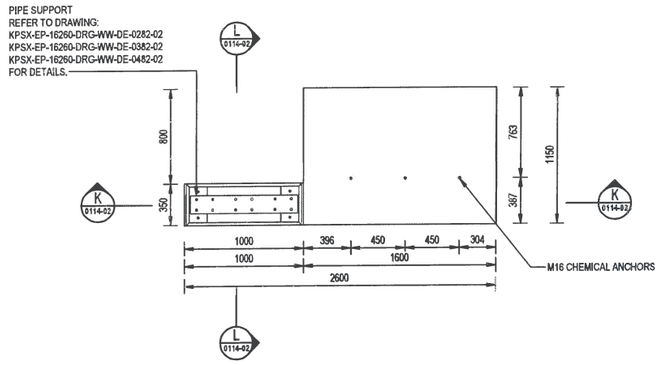
SCALE:	SHEET SIZE	DRAWING NUMBER	SHEET NO.	REV.
AS SHOWN	(A1)	KPSX - EP - 16260 - DRG - WW - DE - 0114-01	1 OF 3	*

File Name: P:\Projects\113452 KPSX Execution (Rv FEL4)\Drawings\05 DEL DES\02 Model\gb\1 Revit\WW\105290PSX-EP-16260-DRG-WW-DE-0114-01 ACCESS STAIRS AND PIPE SUPPORT - CONCRETE DETAILS.rvt
Plot Date: 21 Mar 2021 11:03:39

THE MASTER HELD AT ZUTARI, GAUTENG DELIVERY CENTRE, RESOURCES & MANUFACTURING UNIT, BEARS THE ORIGINAL SIGNATURE OF APPROVAL

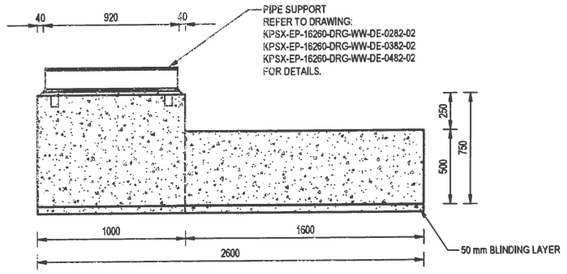


ISOMETRIC VIEW - STAIRS AND PIPE SUPPORT TYPE 3



PLAN VIEW -STAIRS AND PIPE SUPPORT TYPE 3

1 : 25



SECTION K 0114-02

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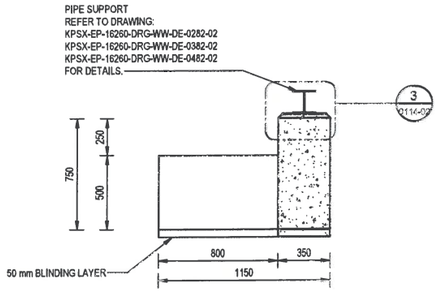

SECTION L 0114-02

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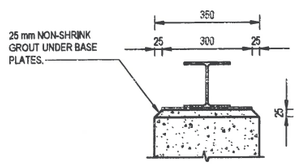
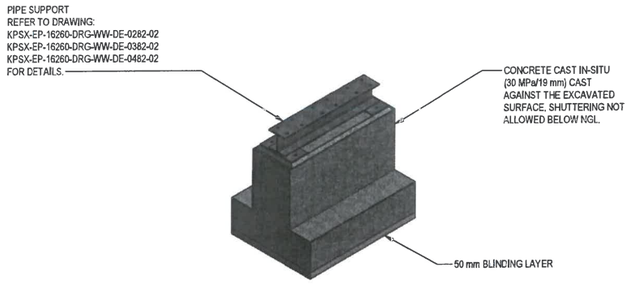


DETAIL 3 0114-02

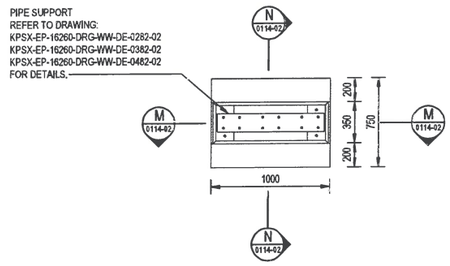
1 : 10

NOTES
1. IN-SITU MATERIAL TO BE COMPACTED TO AT LEAST 90 % MOD AASHTO DENSITY.
2. HOLDING DOWN BOLTS DIMENSIONS TO BE CONFIRMED WITH SHOP DRAWINGS.



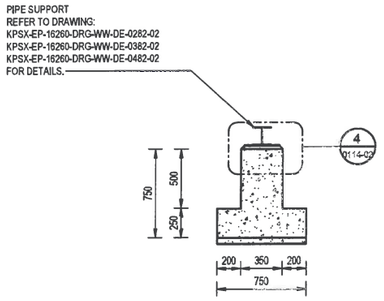
ISOMETRIC VIEW - PIPE SUPPORT TYPE 4

STRUCTURAL REQUIREMENTS	
STRUCTURE TYPE:	BUILDING STRUCTURE
CONCRETE GRADE:	30 MPa/19 mm TO ALL STRUCTURAL CONCRETE
	15 MPa/19 mm TO BLINDING
BLINDING LAYER:	50 mm BELOW ALL STRUCTURES
EXTENDERS:	MAXIMUM FLY ASH TO SPECIFICATION
FORMED SURFACE FINISH:	SMOOTH
	ALL EXPOSED EXTERNAL EDGES IN CONCRETE WORK SHALL HAVE 20 mm X 20 mm CHAMFERS
	POWER FLOAT FINISH TO SLABS
UNFORMED SURFACE FINISH:	STEEL FLOAT FINISH TO TOP OF WALLS
CONCRETE COVER TO REBAR:	75 mm IF CAST AGAINST SOIL OR CAST AGAINST BLINDING
	40 mm FOR WATER CONTACT AREAS
	60 mm FOR SEWAGE CONTACT AREAS
	50 mm FOR SOIL OR BLINDING CONTACT AREAS
	30 mm FOR AIR CONTACT AREAS



PLAN VIEW - PIPE SUPPORT TYPE 4

1 : 25



SECTION N 0114-02

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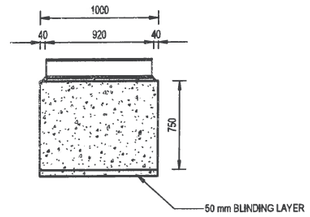

SECTION M 0114-02

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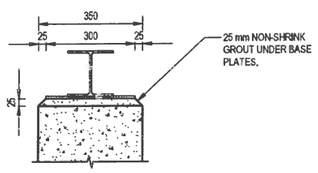

DETAIL 4 0114-02

1 : 10

AS BUILT DRAWINGS
ZUTARI IMPACT. THROUGHOUT.
21/05/2021 Date

This AS BUILT drawing has been prepared based on information provided by the contractor. The levels and coordinates have not been independently checked or verified by Zutari.

REFERENCE DRAWINGS	
DRAWING No.	TITLE

REFERENCE DRAWINGS	
KPSX-EP-16260-DRG-WW-DE-0182	PCD 4 ACCESS STAIRCASE - LAYOUT AND DETAILS
KPSX-EP-16260-DRG-WW-DE-0282	PCD 1 ACCESS STAIRCASE - LAYOUT AND DETAILS
KPSX-EP-16260-DRG-WW-DE-0382	PCD 2 ACCESS STAIRCASE - LAYOUT AND DETAILS
KPSX-EP-16260-DRG-WW-DE-0482	PCD 3 ACCESS STAIRCASE - LAYOUT AND DETAILS
KPSX-EP-11000-DRG-SC-GE-0001-01	STRUCTURAL CONCRETE - STANDARD CONCRETE DETAILS
DRAWING No.	TITLE

ZUTARI PROFESSIONAL ENGINEER		
NAME	VICTOR WENTZEL	DATE
PROF. REG. No.	20120273	
SIGNATURE		21/05/2021

SOUTH 32 PROFESSIONAL APPROVAL		
NAME	SIGN	DATE
CLIENT PROJECT MANAGER		
CLIENT ENGINEERING MANAGER		
ADDITIONAL SIGNATORY		
ZUTARI PROJECT No.	113452	
CLIENT CONTRACT No.	8500084829	

REV.	I.T.		S.N	S.N	J.L	V.W.	23.02.21
°	F	AS BUILT DRAWING					
REV.	I.T.	DESCRIPTION	DRWN.	DES.	CHK.	APR.	DATE

I.T. ISSUE TYPE: (A) FOR REVIEW (B) FOR APPROVAL (C) FOR TENDER (D) FOR CONSTRUCTION (E) FOR INFORMATION (F) AS-BUILT (G) CANCELLED

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SOUTH32

ZUTARI IMPACT. ENGINEERED.
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Pretoria
0081
T + 27 12 427 2000
E connect@zutari.com

KLIPSPRUIT EXTENSION (KPSX)

AREA: POLLUTION CONTROL DAMS

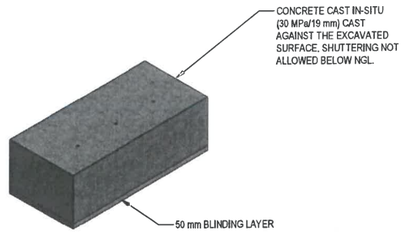
ELEMENT: ACCESS STAIRCASE AND PIPE SUPPORT

TITLE: CONCRETE DETAILS

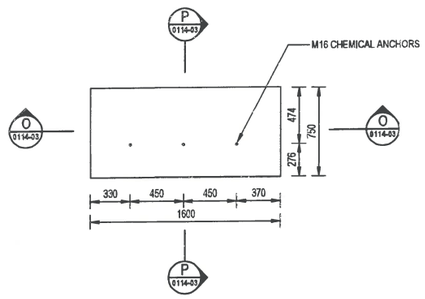
SCALE:	SHEET SIZE	DRAWING NUMBER	SHEET NO.	REV.
AS SHOWN	(A1)	KPSX - EP - 16260 - DRG - WW - DE - 0114-02	2 OF 3	*

File name: P:\Projects\113452 - KPSX Escalation Pt 2\FEL4\Engineering\DEL DESIGN\2 Modelling\01 Revit\Models\KPSX_EP-16260-DRG-WW-DE-0114-02 ACCESS STAIRS AND PIPE SUPPORT - CONCRETE DETAILS.rvt
Plot Date: 3/5/2021 8:10:05 AM

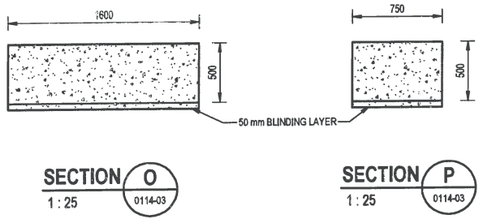
THE MASTER HELD AT ZUTARI, GAUTENG DELIVERY CENTRE, RESOURCES & MANUFACTURING UNIT, BEARS THE ORIGINAL SIGNATURE OF APPROVAL



ISOMETRIC VIEW - STAIRS SUPPORT TYPE 5



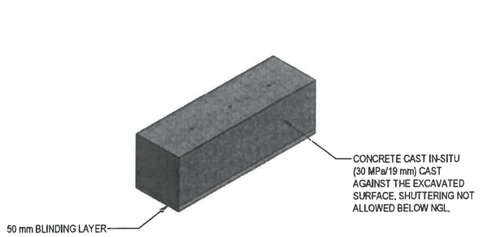
PLAN VIEW - STAIRS SUPPORT TYPE 5
1 : 25



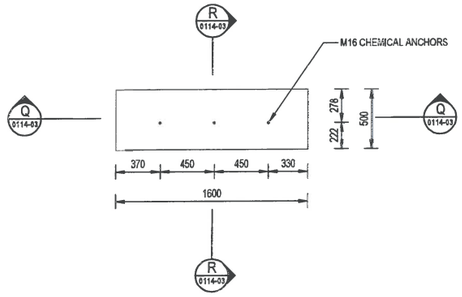
SECTION O 0114-03 1 : 25

SECTION P 0114-03 1 : 25

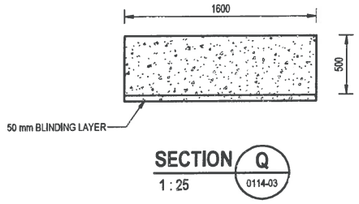
STRUCTURAL REQUIREMENTS	
STRUCTURE TYPE:	BUILDING STRUCTURE
CONCRETE GRADE:	30 MPa/19 mm TO ALL STRUCTURAL CONCRETE
	15 MPa/19 mm TO BLINDING
BLINDING LAYER:	50 mm BELOW ALL STRUCTURES
EXTENDERS:	MAXIMUM FLY ASH TO SPECIFICATION
FORMED SURFACE FINISH:	SMOOTH
	ALL EXPOSED EXTERNAL EDGES IN CONCRETE WORK SHALL HAVE 20 mm X 20 mm CHAMFERS
	POWER FLOAT FINISH TO SLABS
UNFORMED SURFACE FINISH:	STEEL FLOAT FINISH TO TOP OF WALLS
CONCRETE COVER TO REBAR:	75 mm IF CAST AGAINST SOIL OR CAST AGAINST BLINDING
	40 mm FOR WATER CONTACT AREAS
	60 mm FOR SEWAGE CONTACT AREAS
	50 mm FOR SOIL OR BLINDING CONTACT AREAS
	30 mm FOR AIR CONTACT AREAS



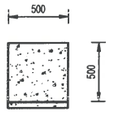
ISOMETRIC VIEW - STAIRS SUPPORT TYPE 6



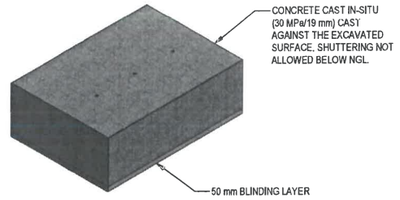
PLAN VIEW - STAIRS SUPPORT TYPE 6
1 : 25



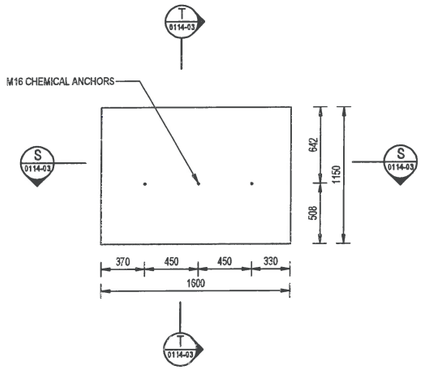
SECTION Q 0114-03 1 : 25



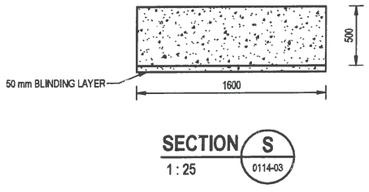
SECTION R 0114-03 1 : 25



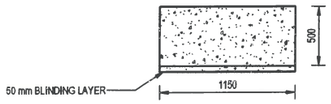
ISOMETRIC VIEW - PIPE SUPPORT TYPE 7



PLAN VIEW - PIPE SUPPORT TYPE 8
1 : 25

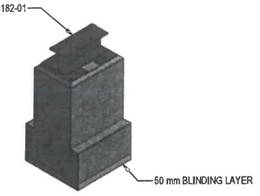


SECTION S 0114-03 1 : 25

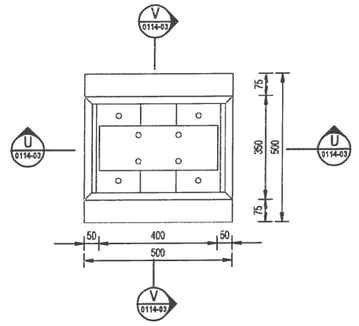


SECTION T 0114-03 1 : 25

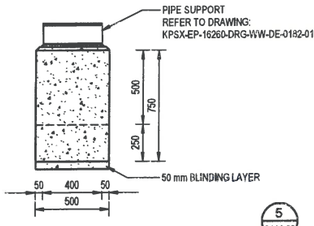
PIPE SUPPORT REFER TO DRAWING: KPSX-EP-16260-DRG-WW-DE-0182-01



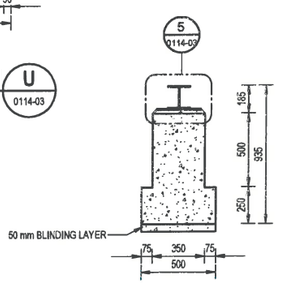
ISOMETRIC VIEW - PIPE SUPPORT TYPE 9



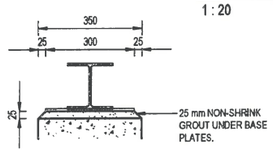
PLAN VIEW -STAIRS SUPPORT TYPE 9
1 : 10



SECTION U 0114-03 1 : 20



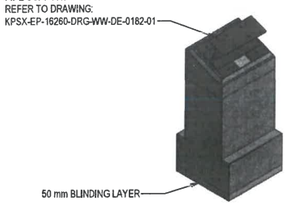
SECTION V 0114-03 1 : 20



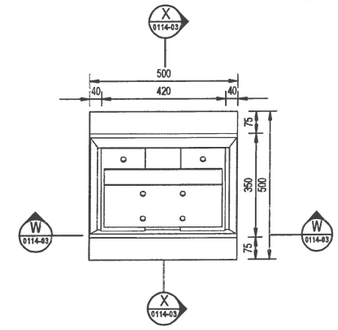
DETAIL 5 0114-03 1 : 10

NOTES
1. IN-SITU MATERIAL TO BE COMPACTED TO AT LEAST 90 % MOD AASHTO DENSITY.
2. HOLDING DOWN BOLTS DIMENSIONS TO BE CONFIRMED WITH SHOP DRAWINGS.

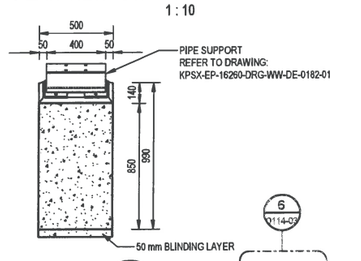
PIPE SUPPORT REFER TO DRAWING: KPSX-EP-16260-DRG-WW-DE-0182-01



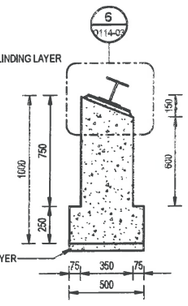
ISOMETRIC VIEW - PIPE SUPPORT TYPE 10



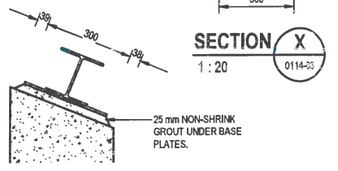
PLAN VIEW -STAIRS SUPPORT TYPE 10
1 : 10



SECTION W 0114-03 1 : 20



SECTION X 0114-03 1 : 20



DETAIL 6 0114-03 1 : 10

AS BUILT DRAWINGS
ZUTARI
21/05/2021

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REFERENCE DRAWINGS	
DRAWING No.	TITLE

REFERENCE DRAWINGS	
KPSX-EP-16260-DRG-WW-DE-0182	PCD 4 ACCESS STAIRCASE - LAYOUT AND DETAILS
KPSX-EP011000-DRG-SC-GE-0001-01	STRUCTURAL CONCRETE - STANDARD CONCRETE NOTES
DRAWING No.	TITLE

ZUTARI PROFESSIONAL ENGINEER		
NAME	VICTOR WENTZEL	DATE
PROF. REG. No.	20130173	
SIGNATURE		21/05/2021

SOUTH 32 PROFESSIONAL APPROVAL		
NAME	SIGN	DATE
CLIENT PROJECT MANAGER		
CLIENT ENGINEERING MANAGER		
ADDITIONAL SIGNATORY		
ZUTARI PROJECT No.	113452	
CLIENT CONTRACT No.	8500084829	

REV.	I.T.	DESCRIPTION	DRWN.	DES.	CHK.	APR.	DATE
*	F	AS BUILT DRAWING	S.N.	S.N.	J.L.	V.W.	23.02.21

I.T. ISSUE TYPE: (A) FOR REVIEW (B) FOR APPROVAL (C) FOR TENDER (D) FOR CONSTRUCTION (E) FOR INFORMATION (F) AS-BUILT (G) CANCELLED

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ZUTARI IMPACT. ENGINEERED.
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KLIPSPRUIT EXTENSION (KPSX)

AREA: POLLUTION CONTROL DAMS

ELEMENT: ACCESS STAIRCASE AND PIPE SUPPORT

TITLE: CONCRETE DETAILS

SCALE:	SHEET SIZE	DRAWING NUMBER	SHEET NO.	REV.
AS SHOWN	(A1)	KPSX - EP - 16260 - DRG - WW - DE - 0114-03	3 OF 3	*

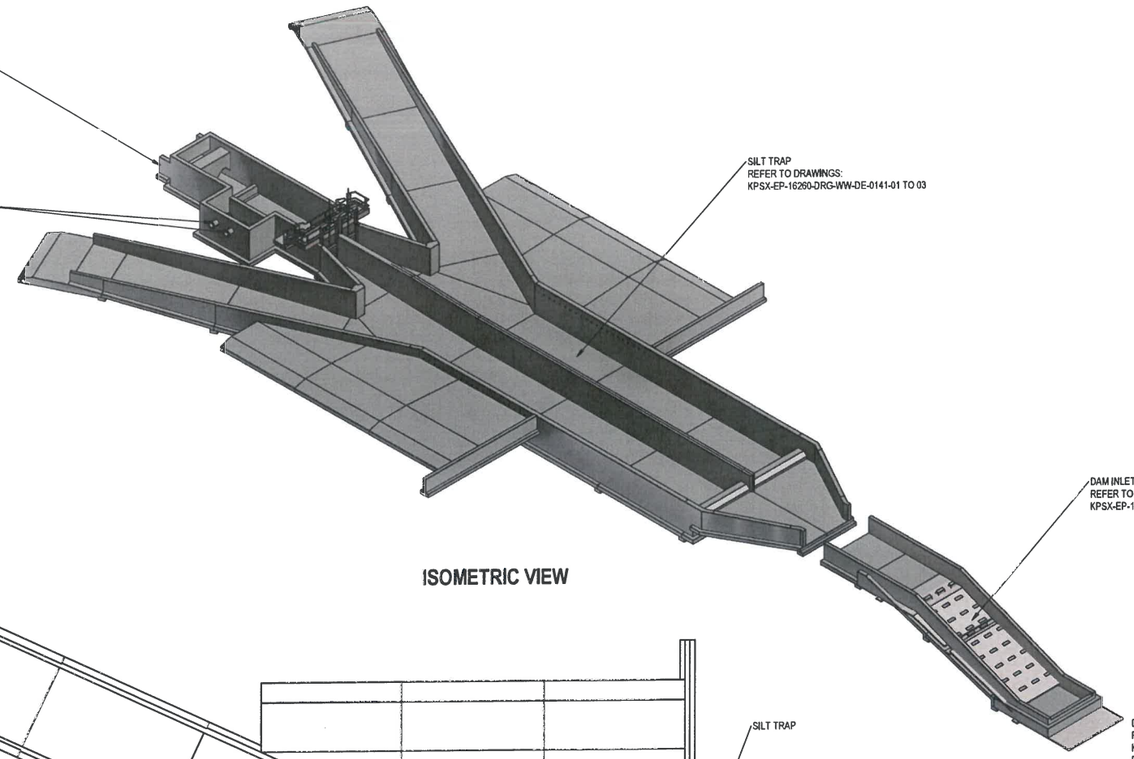
File name: P:\Projects\113452 - KPSX Execution Ph FEL4\Engineering\DEL DESIGNS\2 Modelling\01 Revit Models\01 Revit Files\KPSX-EP-16260-DRG-WW-DE-0114-01 ACCESS STAIRS AND PIPE SUPPORT - CONCRETE DETAILS.rvt

File Date: 3/2/2021 9:14:21 AM

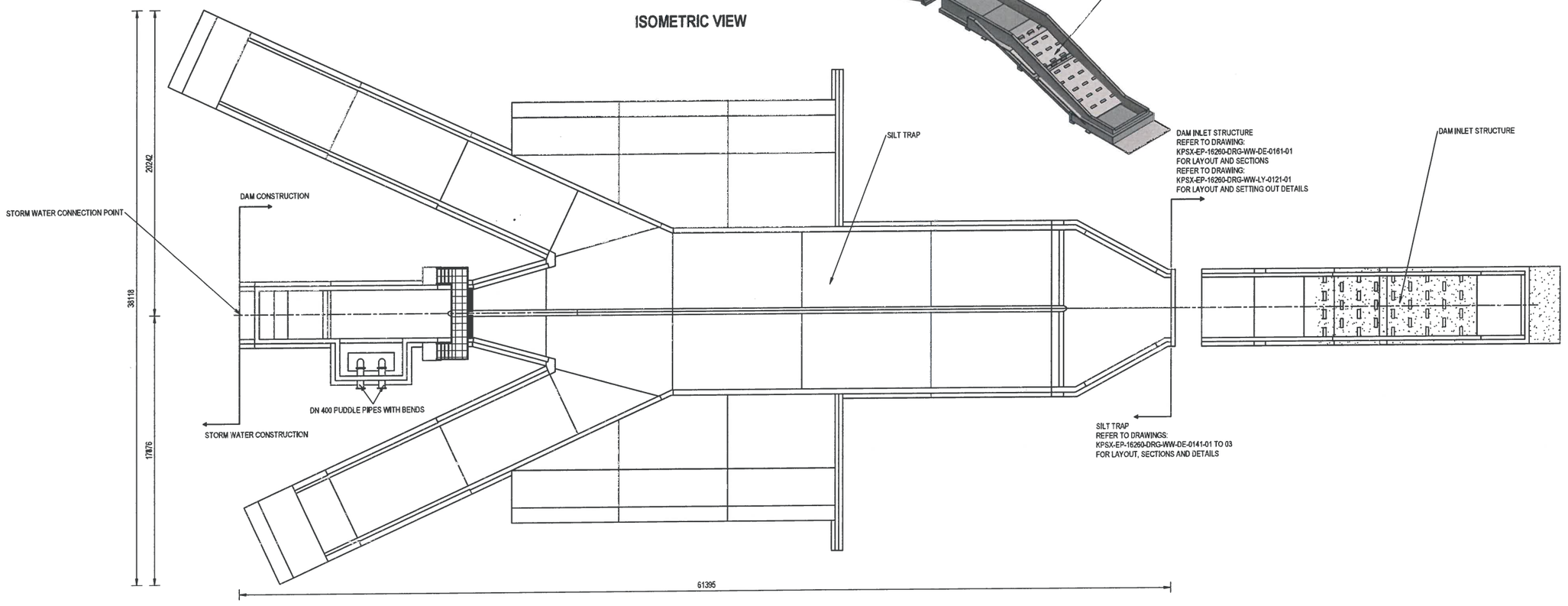
Dbx

THE MASTER HELD AT ZUTARI, GAUTENG DELIVERY CENTRE, RESOURCES & MANUFACTURING UNIT, BEARS THE ORIGINAL SIGNATURE OF APPROVAL

STRUCTURAL REQUIREMENTS	
STRUCTURE TYPE:	WATER RETAINING STRUCTURE
CONCRETE GRADE:	35 MPa/19 mm TO ALL STRUCTURAL CONCRETE
	15 MPa/19 mm TO BLINDING
BLINDING LAYER	50 mm BELOW ALL STRUCTURES
EXTENDERS:	MAXIMUM FLY ASH TO SPECIFICATION
AGGREGATE:	STANDARD
FORMED SURFACE FINISH:	SMOOTH
	ALL EXPOSED EXTERNAL EDGES IN CONCRETE WORK SHALL HAVE 20 mm X 20 mm CHAMFERS
UNFORMED SURFACE FINISH:	STEEL FLOAT FINISH TO TOP OF WALLS AND FLOORS
CONCRETE COVER TO REBAR:	75 mm IF CAST AGAINST SOIL
	40 mm FOR WATER CONTACT AREAS
	50 mm FOR SOIL CONTACT AREAS OR CAST AGAINST BLINDING
	30 mm FOR AIR CONTACT AREAS



ISOMETRIC VIEW



LAYOUT PLAN
1 : 150

REFERENCE DRAWINGS	
KPSX-EP-16240-DRG-WD-LY-0004	STORMWATER - CANALS ON BUILDING TERRACE LAYOUT
KPSX-EP-16260-DRG-WW-LY-0121	DAM INLET - LAYOUT, SECTIONS AND SETTING OUT DETAILS
DRAWING No.	TITLE

REFERENCE DRAWINGS	
KPSX-EP-16260-DRG-WW-DE-0161	DAM INLET STRUCTURE - LAYOUT AND SECTIONS
KPSX-EP-16260-DRG-WW-DE-0142	SILT TRAP - SLUICE GATE DETAILS
KPSX-EP-16260-DRG-WW-DE-0141	SILT TRAP - LAYOUT, SECTIONS AND DETAILS
KPSX-EP-16260-DRG-WW-DE-0106	JOINT DETAILS
KPSX-EP-14110-DRG-WW-DE-0102	PIT DEWATERING PIPELINE - WATER METER CHAMBER
KPSX-EP-11000-DRG-SS-GE-0013	FLOOR GRATING - TYPICAL DETAILS
KPSX-EP-11000-DRG-SS-GE-0012	STRUCTURAL STEELWORK - HANDRAILS
KPSX-EP-11000-DRG-SS-GE-0006	STRUCTURAL STEELWORK - STAIRCASE AND TYPICAL DETAILS
KPSX-EP-11000-DRG-SC-GE-0001	STRUCTURAL CONCRETE - STANDARD CONCRETE NOTES
DRAWING No.	TITLE

ZUTARI PROFESSIONAL ENGINEER		
NAME	VICTOR WENTZEL	DATE
PROF. REG. No.	20130173	
SIGNATURE		21/05/2021

SOUTH 32 PROFESSIONAL APPROVAL		
NAME	SIGN	DATE
CLIENT PROJECT MANAGER		
CLIENT ENGINEERING MANAGER		
ADDITIONAL SIGNATORY		
ZUTARI PROJECT No.	113452	
CLIENT CONTRACT No.	8500084829	

REV.	I.T.	DESCRIPTION	DRWN.	DES.	CHK.	APR.	DATE
*	F	AS-BUILT DRAWING	J.A.V.V.	J.A.V.V.	V.W.	J.L.	23/04/2021

I.T. ISSUE TYPE: (A) FOR REVIEW (B) FOR APPROVAL (C) FOR TENDER (D) FOR CONSTRUCTION (E) FOR INFORMATION (F) AS-BUILT (G) CANCELLED

AS BUILT DRAWINGS
ZUTARI IMPACT. ENGINEERED.
24/05/2021

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ZUTARI IMPACT. ENGINEERED.
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SOUTH32

KLIPSPRUIT EXTENSION (KPSX)

AREA: PCD 4
ELEMENT: SILT TRAP AND DAM INLET
TITLE: GENERAL ARRANGEMENT

SCALE:	SHEET SIZE	DRAWING NUMBER	SHEET NO.	REV.
AS SHOWN	(A1)	KPSX - EP - 16260 - DRG - WW - GA - 0140-01	1 OF 1	*

File Name: P:\Projects\113452 - KPSX Extension Ph FEL4\Engineering\08 DEL DES\02 Models\01 Revit\Rvt\16260\KPSX-EP-16260-MDA-WW-0214 PCD 4 SILT TRAP.rvt
Plot Date: 2021/05/21 12:17:45

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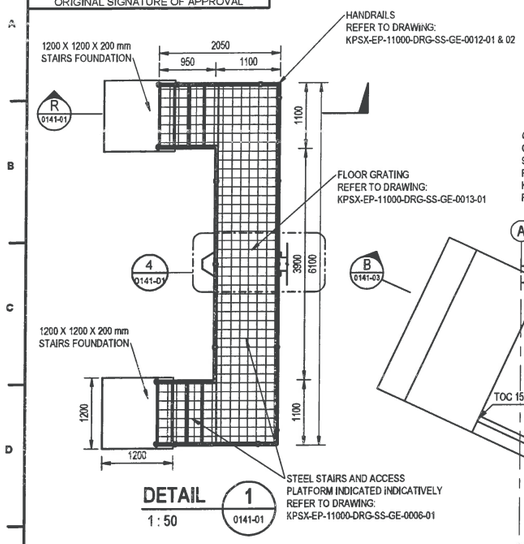
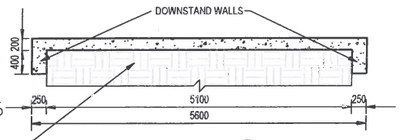
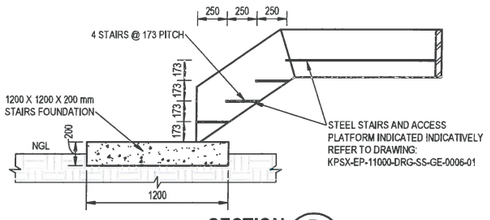
DETAIL 1 — 1 : 50 — 0141-01



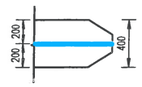
SECTION Q — 1 : 50 — 0141-01



SECTION R — 1 : 25 — 0141-01



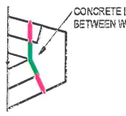
DETAIL 2 — 1 : 25 — 0141-01



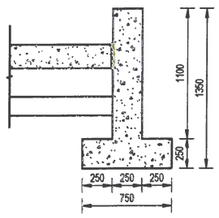
JOINT TYPE

- FLOOR JOINT - A1
- FLOOR JOINT - B1
- WALL JOINT - C
- WALL JOINT - D
- WALL JOINT - E2
- FLOOR & WALL JOINT - E3
- FLOOR & WALL JOINT - F

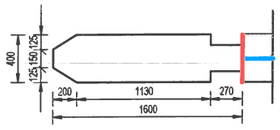
DETAIL 3 — 1 : 50 — 0141-01



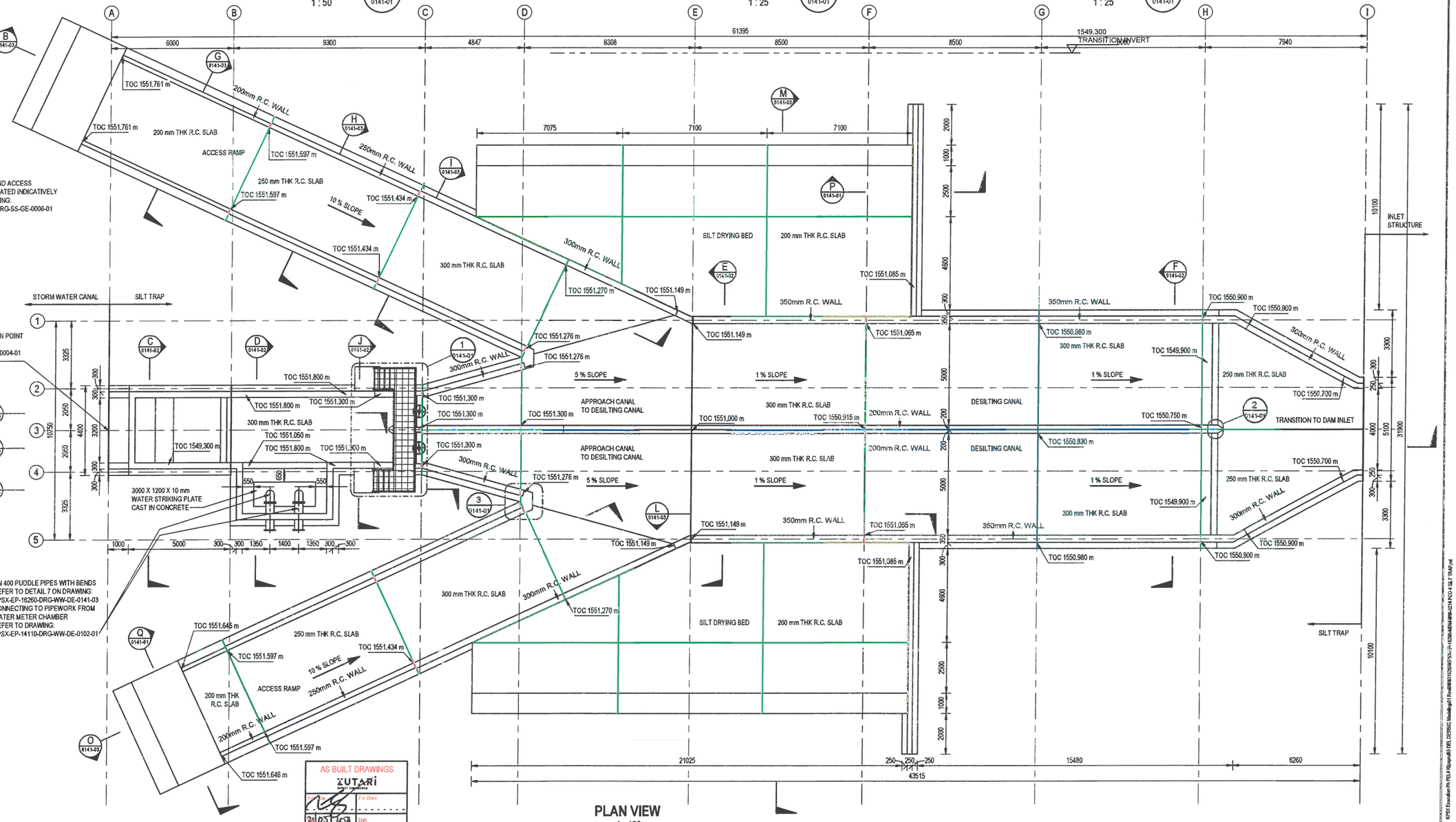
SECTION P — 1 : 25 — 0141-01



DETAIL 4 — 1 : 25 — 0141-01



PLAN VIEW — 1 : 100



AS BUILT DRAWINGS
ZUTARI IMPACT. ENGINEERED.
For Client
For Others
24/05/2021
Date

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REFERENCE DRAWINGS	
DRAWING No.	TITLE

REFERENCE DRAWINGS	
KPSX-EP-16260-DRG-WW-LY-0121	DAM INLET - LAYOUT, SECTIONS AND SETTING OUT DETAILS
KPSX-EP-16260-DRG-WW-DE-0142	SILT TRAP - SLUICE GATE DETAILS
KPSX-EP-16260-DRG-WW-DE-0106	JOINT DETAILS
KPSX-EP-14110-DRG-WW-DE-0102	PIT DEWATERING PIPELINE - WATER METER CHAMBER
KPSX-EP-11000-DRG-SS-GE-0013	FLOOR GRATING - TYPICAL DETAILS
KPSX-EP-11000-DRG-SS-GE-0012	STRUCTURAL STEELWORK - HANDRAILS
KPSX-EP-11000-DRG-SS-GE-0006	STRUCTURAL STEELWORK - STAIRCASE AND TYPICAL DETAILS
KPSX-EP-11000-DRG-SC-GE-0001	STRUCTURAL CONCRETE - STANDARD CONCRETE NOTES
DRAWING No.	TITLE

ZUTARI PROFESSIONAL ENGINEER		
NAME	VICTOR WENTZEL	DATE
PROF. REG. No.	20130173	
SIGNATURE		21/05/2021

SOUTH 32 PROFESSIONAL APPROVAL		
NAME	SIGN	DATE
CLIENT PROJECT MANAGER		
CLIENT ENGINEERING MANAGER		
ADDITIONAL SIGNATORY		

ZUTARI PROJECT No.	113452
CLIENT CONTRACT No.	8500084829

REV.	I.T.	DESCRIPTION	DRWN.	DES.	CHK.	APR.	DATE
*	F	AS-BUILT DRAWING	J.A.V.V.	J.A.V.V.	V.W.	J.L.	23/04/2021

I.T. ISSUE TYPE: (A) FOR REVIEW (B) FOR APPROVAL (C) FOR TENDER (D) FOR CONSTRUCTION (E) FOR INFORMATION (F) AS-BUILT (G) CANCELLED

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ZUTARI IMPACT. ENGINEERED.
Riverwalk Office Park
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Pretoria
0081
T + 27 12 427 2000
E connect@zutari.com

KLIPSPRUIT EXTENSION (KPSX)

AREA: PCD 4
ELEMENT: SILT TRAP
TITLE: LAYOUT, SECTIONS AND DETAILS

SCALE:	SHEET SIZE	DRAWING NUMBER	SHEET NO.	REV.
AS SHOWN	(A1)	KPSX - EP - 16260 - DRG - WW - DE - 0141-01	1 OF 3	*

FileName: P:\Projects\113452 KPSX Extension Ph FEL4\Spatial\DEL DRGS\C Modified\pdf Files\KPSX-EP-16260-DRG-WW-DE-0141-01.dwg
FileDate: 5/7/2021 10:35:54 PM

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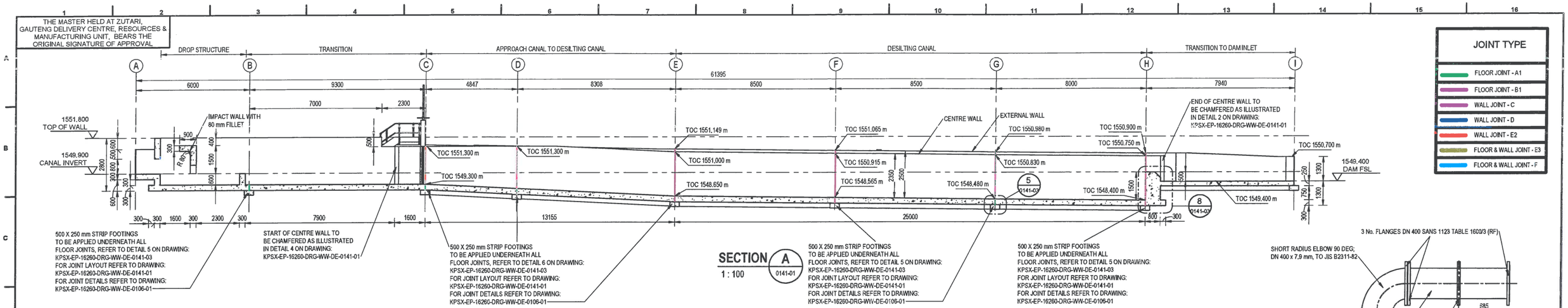
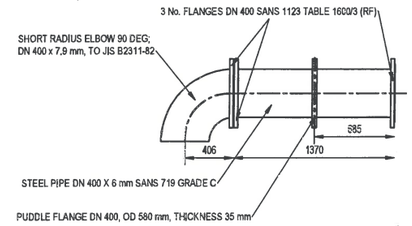
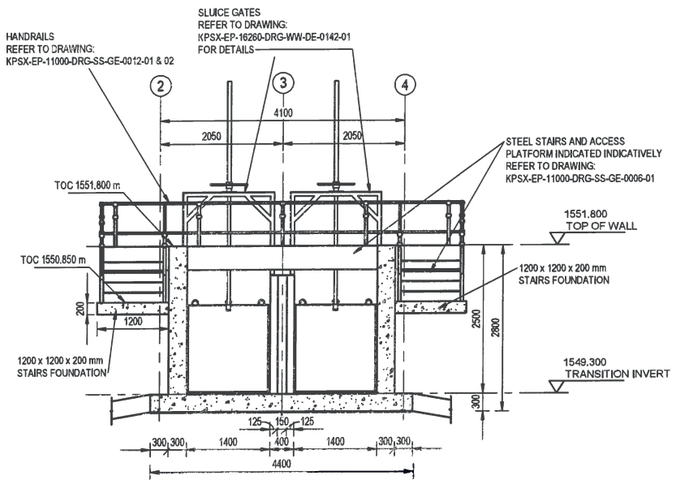


SECTION A 0141-01
1 : 100

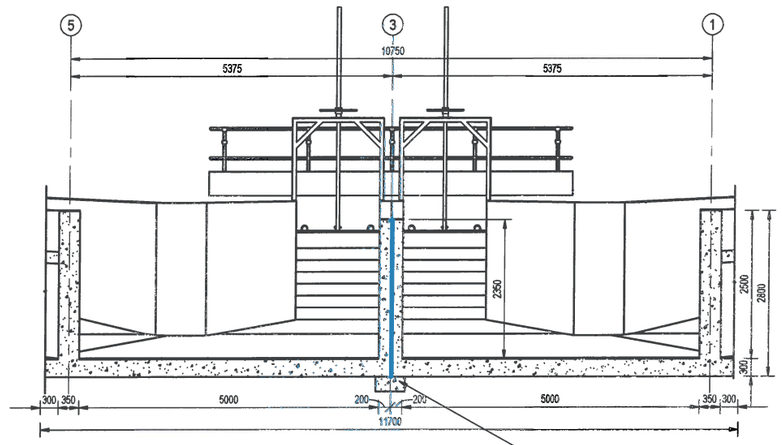
JOINT TYPE
- FLOOR JOINT - A1
- FLOOR JOINT - B1
- WALL JOINT - C
- WALL JOINT - D
- WALL JOINT - E2
- FLOOR & WALL JOINT - E3
- FLOOR & WALL JOINT - F



DETAIL 9 0141-02
1 : 25

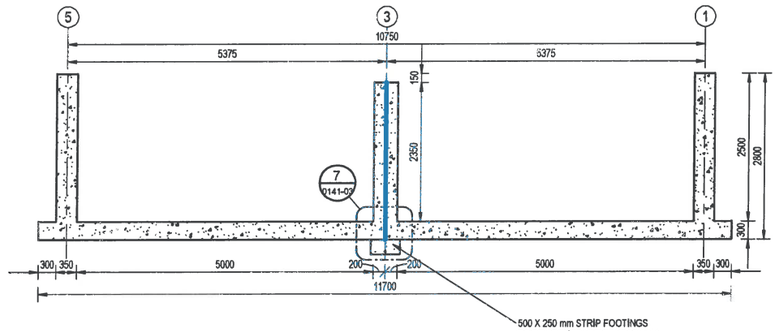


SECTION J 0141-01
1 : 50



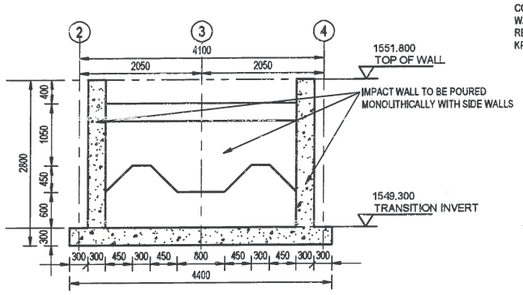
500 X 250 mm STRIP FOOTINGS
TO BE APPLIED UNDERNEATH ALL
FLOOR JOINTS, REFER TO DETAIL 7 ON DRAWING:
KPSX-EP-16260-DRG-WW-DE-0141-03
FOR JOINT LAYOUT REFER TO DRAWING:
KPSX-EP-16260-DRG-WW-DE-0141-01
FOR JOINT DETAILS REFER TO DRAWING:
KPSX-EP-16260-DRG-WW-DE-0106-01

SECTION E 0141-01
1 : 50

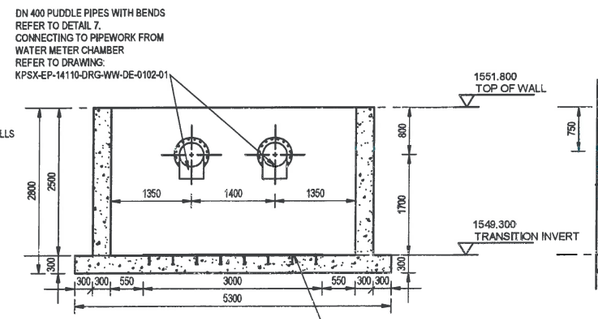


500 X 250 mm STRIP FOOTINGS
TO BE APPLIED UNDERNEATH ALL
FLOOR JOINTS, REFER TO DETAIL 7 ON DRAWING:
KPSX-EP-16260-DRG-WW-DE-0141-03
FOR JOINT LAYOUT REFER TO DRAWING:
KPSX-EP-16260-DRG-WW-DE-0141-01
FOR JOINT DETAILS REFER TO DRAWING:
KPSX-EP-16260-DRG-WW-DE-0106-01

SECTION F 0141-01
1 : 50

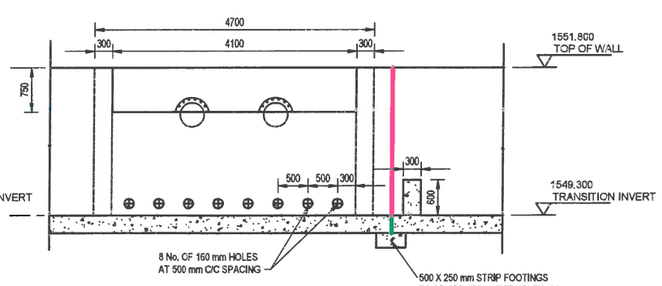


SECTION C 0141-01
1 : 50



3000 X 1200 X 10 mm
WATER STRIKING PLATE
CAST IN CONCRETE

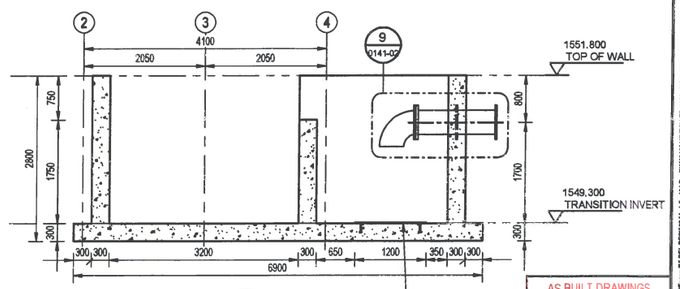
SECTION K 0141-01
1 : 50



8 No. OF 160 mm HOLES
AT 500 mm C/C SPACING

500 X 250 mm STRIP FOOTINGS
TO BE APPLIED UNDERNEATH ALL
FLOOR JOINTS, REFER TO DETAIL 5 ON DRAWING:
KPSX-EP-16260-DRG-WW-DE-0141-03
FOR JOINT LAYOUT REFER TO DRAWING:
KPSX-EP-16260-DRG-WW-DE-0141-01
FOR JOINT DETAILS REFER TO DRAWING:
KPSX-EP-16260-DRG-WW-DE-0106-01

SECTION N 0141-01
1 : 50



3000 X 1200 X 10 mm
WATER STRIKING PLATE
CAST IN CONCRETE

SECTION D 0141-01
1 : 50

AS BUILT DRAWINGS
ZUTARI
For Client
For Client
21/05/2021
Date

This AS BUILT drawing has been prepared based on information provided by the contractor. The levels and coordinates have not been independently checked or verified by Zutari.

REFERENCE DRAWINGS	
DRAWING No.	TITLE

REFERENCE DRAWINGS	
DRAWING No.	TITLE
KPSX-EP-16260-DRG-WW-DE-0142	SILT TRAP - SLUICE GATE DETAILS
KPSX-EP-16260-DRG-WW-DE-0106	JOINT DETAILS
KPSX-EP-14110-DRG-WW-DE-0102	PIT DEWATERING PIPELINE - WATER METER CHAMBER
KPSX-EP-11000-DRG-SS-GE-0013	FLOOR GRATING - TYPICAL DETAILS
KPSX-EP-11000-DRG-SS-GE-0012	STRUCTURAL STEELWORK - HANDRAILS
KPSX-EP-11000-DRG-SS-GE-0006	STRUCTURAL STEELWORK - STAIRCASE AND TYPICAL DETAILS
KPSX-EP-11000-DRG-SC-GE-0001	STRUCTURAL CONCRETE - STANDARD CONCRETE NOTES

ZUTARI PROFESSIONAL ENGINEER		
NAME	VICTOR WENTZEL	DATE
PROF. REG. No.	20130173	
SIGNATURE		21/05/2021

SOUTH 32 PROFESSIONAL APPROVAL		
NAME	SIGN	DATE
CLIENT PROJECT MANAGER		
CLIENT ENGINEERING MANAGER		
ADDITIONAL SIGNATORY		
ZUTARI PROJECT No.	113452	
CLIENT CONTRACT No.	8500084829	

REV.	I.T.	DESCRIPTION	DRWN.	DES.	CHK.	APR.	DATE
*	F	AS-BUILT DRAWING	J.A.V.V.	J.A.V.V.	V.W.	J.L.	23/04/2021

I.T. ISSUE TYPE: (A) FOR REVIEW (B) FOR APPROVAL (C) FOR TENDER (D) FOR CONSTRUCTION (E) FOR INFORMATION (F) AS-BUILT (G) CANCELLED

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SOUTH32

KLIPSPRUIT EXTENSION (KPSX)

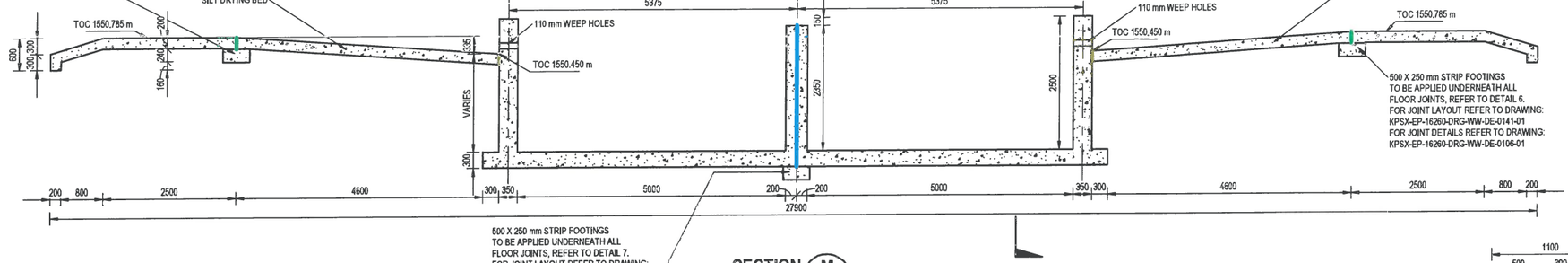
AREA: PCD 4
ELEMENT: SILT TRAP
TITLE: LAYOUT, SECTIONS AND DETAILS

SCALE:	SHEET SIZE	DRAWING NUMBER	SHEET NO.	REV.
AS SHOWN	(A1)	KPSX - EP - 16260 - DRG - WW - DE - 0141-02	2 OF 3	*

File Name: P:\Projects\113452 - KPSX Extension Ph FEL4\Signoff\DEL DRGS\01 Hardcopy\01 Pdf\WW\113452-EP-XXDE0141WW-0001.PCD 4 SILT TRAP.pdf
File Date: 5/7/2021 11:38:38 PM

THE MASTER HELD AT ZUTARI, GAUTENG DELIVERY CENTRE, RESOURCES & MANUFACTURING UNIT, BEARS THE ORIGINAL SIGNATURE OF APPROVAL

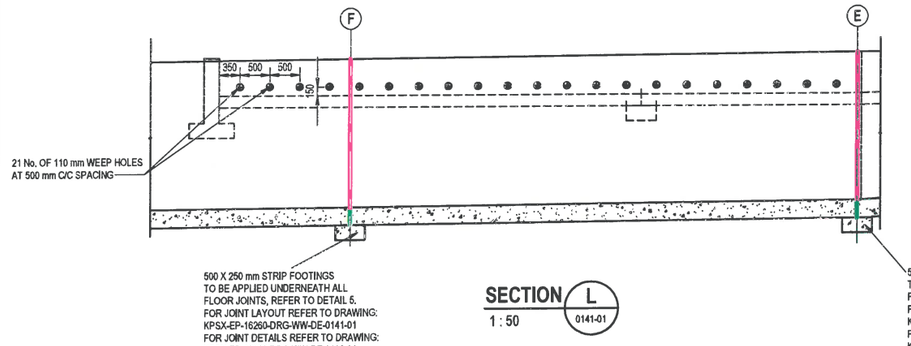
500 X 250 mm STRIP FOOTINGS TO BE APPLIED UNDERNEATH ALL FLOOR JOINTS, REFER TO DETAIL 6. FOR JOINT LAYOUT REFER TO DRAWING: KPSX-EP-16260-DRG-WW-DE-0141-01 FOR JOINT DETAILS REFER TO DRAWING: KPSX-EP-16260-DRG-WW-DE-0106-01



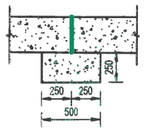
500 X 250 mm STRIP FOOTINGS TO BE APPLIED UNDERNEATH ALL FLOOR JOINTS, REFER TO DETAIL 7. FOR JOINT LAYOUT REFER TO DRAWING: KPSX-EP-16260-DRG-WW-DE-0141-01 FOR JOINT DETAILS REFER TO DRAWING: KPSX-EP-16260-DRG-WW-DE-0106-01

SECTION M (0141-01) 1 : 50

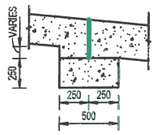
JOINT TYPE
FLOOR JOINT - A1
FLOOR JOINT - B1
WALL JOINT - C
WALL JOINT - D
WALL JOINT - E2
FLOOR & WALL JOINT - E3
FLOOR & WALL JOINT - F



SECTION L (0141-01) 1 : 50



DETAIL 5 (0141-02) 1 : 25



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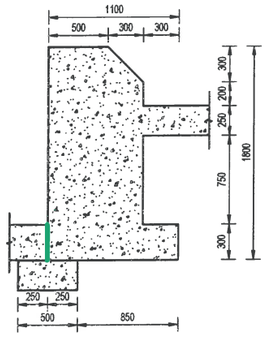
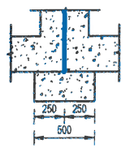


DETAIL 8 (0141-02) 1 : 25



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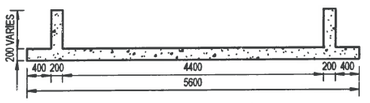
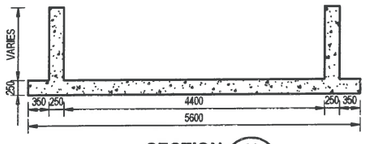


SECTION G (0141-01) 1 : 50



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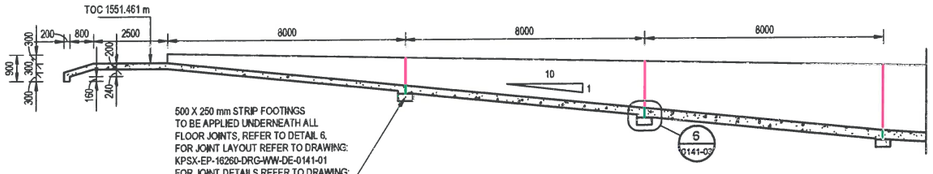
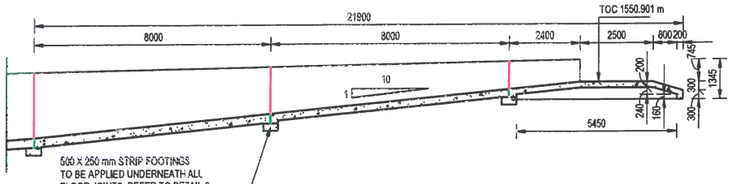


SECTION B (0141-01) 1 : 100



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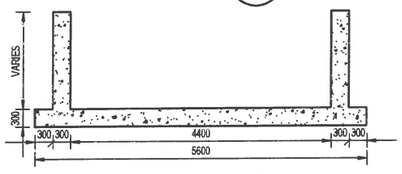

SECTION I (0141-01) 1 : 50

AS BUILT DRAWINGS
ZUTARI IMPACT. ENGINEERED.
Date: 26/03/2021

This AS BUILT drawing has been prepared based on information provided by the contractor. The levels and coordinates have not been independently checked or verified by Zutari.

REFERENCE DRAWINGS	
DRAWING No.	TITLE

REFERENCE DRAWINGS	
KPSX-EP-16260-DRG-WW-DE-0142	SILT TRAP - SLUICE GATE DETAILS
KPSX-EP-16260-DRG-WW-DE-0106	JOINT DETAILS
KPSX-EP-14110-DRG-WW-DE-0102	PIT DEWATERING PIPELINE - WATER METER CHAMBER
KPSX-EP-11000-DRG-SS-GE-0013	FLOOR GRATING - TYPICAL DETAILS
KPSX-EP-11000-DRG-SS-GE-0012	STRUCTURAL STEELWORK - HANDRAILS
KPSX-EP-11000-DRG-SS-GE-0006	STRUCTURAL STEELWORK - STAIRCASE AND TYPICAL DETAILS
KPSX-EP-11000-DRG-SC-GE-0001	STRUCTURAL CONCRETE - STANDARD CONCRETE NOTES
DRAWING No.	TITLE

ZUTARI PROFESSIONAL ENGINEER		
NAME	VICTOR WENTZEL	DATE
PROF. REG. No.	20130173	
SIGNATURE		26/03/2021

SOUTH 32 PROFESSIONAL APPROVAL		
NAME	SIGN	DATE
CLIENT PROJECT MANAGER		
CLIENT ENGINEERING MANAGER		
ADDITIONAL SIGNATORY		
ZUTARI PROJECT No.	113452	
CLIENT CONTRACT No.	8500084829	

REV.	I.T.	DESCRIPTION	DRWN.	DES.	CHK.	APR.	DATE
*	F	AS-BUILT DRAWING	J.A.V.V.	J.A.V.V.	V.W.	J.L.	14/03/2018

I.T. ISSUE TYPE: (A) FOR REVIEW (B) FOR APPROVAL (C) FOR TENDER (D) FOR CONSTRUCTION (E) FOR INFORMATION (F) AS-BUILT (G) CANCELLED

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SOUTH32

ZUTARI IMPACT. ENGINEERED.
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KLIPSPRUIT EXTENSION (KPSX)

AREA: PCD 4

ELEMENT: SILT TRAP

TITLE: LAYOUT, SECTIONS AND DETAILS

SCALE:	SHEET SIZE	DRAWING NUMBER	SHEET NO.	REV.
AS SHOWN	(A1)	KPSX - EP - 16260 - DRG - WW - DE - 0141-03	3 OF 3	*

Filename: P:\Projects\113452 - KPSX Execution Ph FEL4\Deposit\5 DEL\DES\5503 Mandalay\01 Revit\Wet\16260KPSX-EP-1626DMDAWW-0014 PCD 4 SILT TRAP.rvt
Plot Date: 4/26/2021 3:21:34 PM
CAD x:

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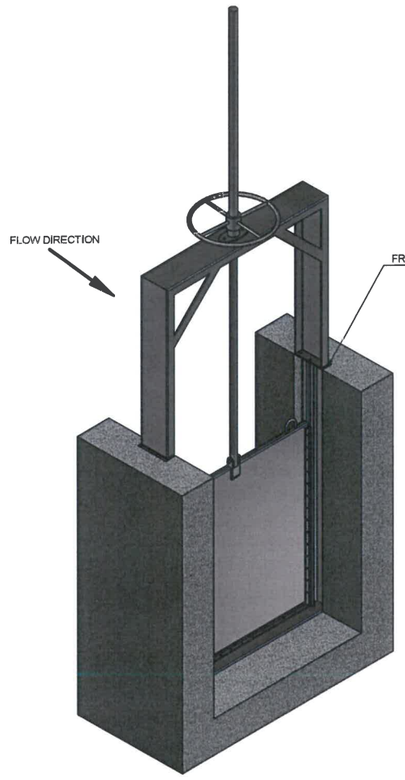
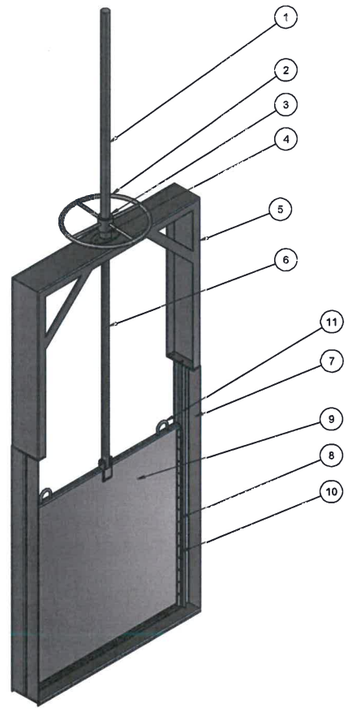
NOTES:
1. CONTRACTOR TO VERIFY CIVIL DIMENSIONS ON-SITE, AND ADJUST GATE DESIGN IF REQUIRED.
2. DRAWING IS INDICATIVE ONLY, CONTRACTOR TO SUBMIT WORKSHOP DRAWINGS TO ENGINEER FOR APPROVAL PRIOR TO FABRICATION.
3. HANDWHEELS SHALL NOT REQUIRE A PERIPHERAL FORCE GREATER THEN 250 NEWTONS, I.E. THE SUM OF THE FORCES ON EACH SIDE SHALL BE LESS THAN 250 NEWTONS. A GEARBOX MUST BE INSTALLED IF THIS REQUIREMENT CANNOT BE MET WITH THE CURRENT DESIGN.
4. GATE TO BE INSTALLED IN ACCORDANCE WITH SUPPLIER'S REQUIREMENTS.

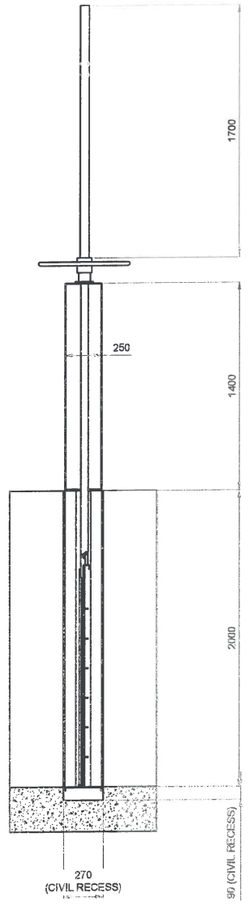
ITEM	DESCRIPTION	MATERIAL
1	SPINDLE COVER TUBE	STAINLESS STEEL 304L
2	HAND WHEEL	ALUMINIUM
3	SPINDLE NUT	MANUFACTURER'S STANDARD FOR WASTE WATER
4	THRUST BEARING	MANUFACTURER'S STANDARD FOR WASTE WATER
5	HEAD STOCK	STAINLESS STEEL 316L
6	SPINDLE	STAINLESS STEEL 316L
7	GATE FRAME	STAINLESS STEEL 316L
8	BEARING BARS	LOW FRICTION HDPE
9	GATE	STAINLESS STEEL 316L
10	GATE SEALS	NEOPRENE / EPDM
11	LIFTING LUG	STAINLESS STEEL 316L



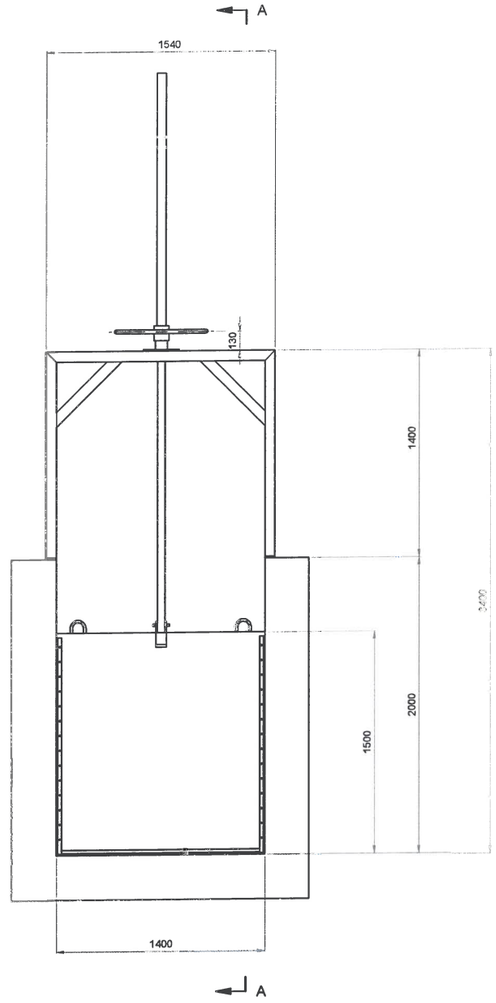
CHANNEL MOUNTED SLUICE GATE
SCALE 1:20



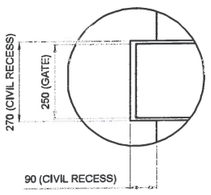
CHANNEL MOUNTED SLUICE GATE
SCALE 1 : 20



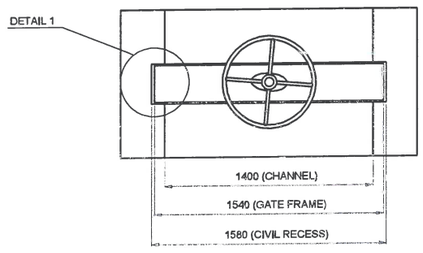
SECTION A-A
SCALE 1 : 20



FRONT VIEW - GATE CLOSED
SCALE 1 : 20



DETAIL 1
SCALE 1 : 10



PLAN VIEW
SCALE 1 : 20

AS BUILT DRAWINGS
ZUTARI
21/05/2021

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REFERENCE DRAWINGS		REFERENCE DRAWINGS	
DRAWING NO.	TITLE	KPSX-EP-16260-DRG-WW-GA-0140	PCD 4 SILT TRAP AND DAM INLET - GENERAL ARRANGEMENT
		DRAWING NO.	TITLE

ZUTARI PROFESSIONAL ENGINEER		
NAME	VICTOR WENTZEL	DATE
PROF. REG. No.	20130173	
SIGNATURE		21/05/2021

SOUTH 32 PROFESSIONAL APPROVAL		
NAME	SIGN.	DATE
CLIENT PROJECT MANAGER		
CLIENT ENGINEERING MANAGER		
ADDITIONAL SIGNATORY		
ZUTARI PROJECT No.	113452	
CLIENT CONTRACT No.	8500084829	

REV.	LT.	DESCRIPTION	DRWN.	DES.	CHK.	APR.	DATE
*	F	AS-BUILT DRAWING	M.B.	M.B.	C.N.	V.W.	23/04/2021

LT. ISSUE TYPE: (A) FOR REVIEW (SQ) (B) INTERNAL PEER REVIEW (C) FOR APPROVAL (CR) (D) FOR CONSTRUCTION (E) FOR INFORMATION (F) AS-BUILT (G) CANCELLED

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SOUTH 32

KLIPSPRUIT EXTENSION (KPSX)

AREA: PCD 4
ELEMENT: SILT TRAP
TITLE: SLUICE GATE DETAILS

SCALE:	SHEET SIZE	Drawing Number	SHEET No.	REV.
AS SHOWN	(A1)	KPSX-EP-16260-DRG-WW-DE-0142-01	1 OF 1	*

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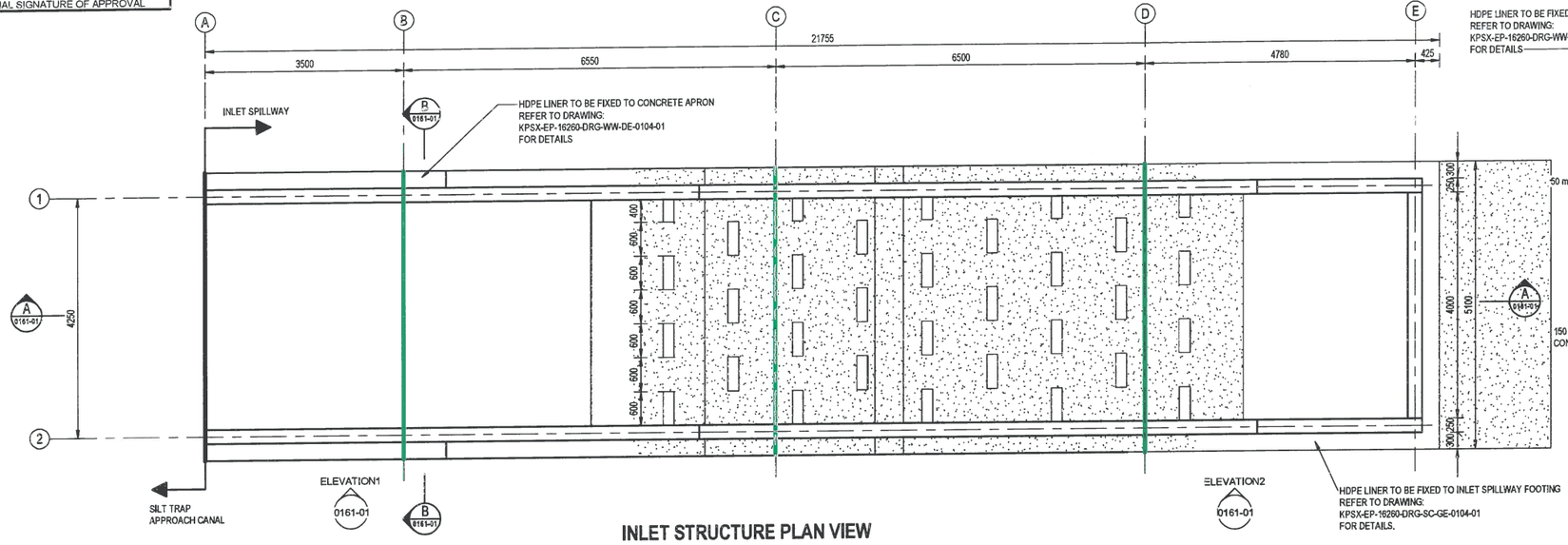
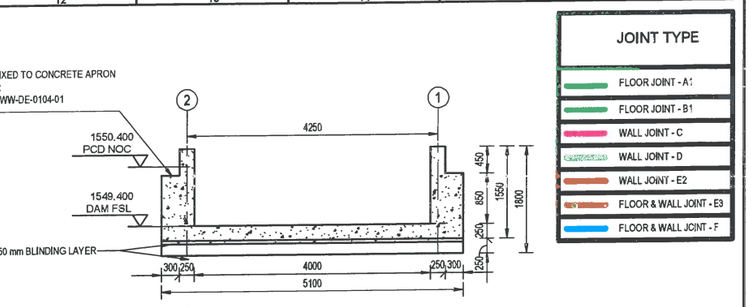
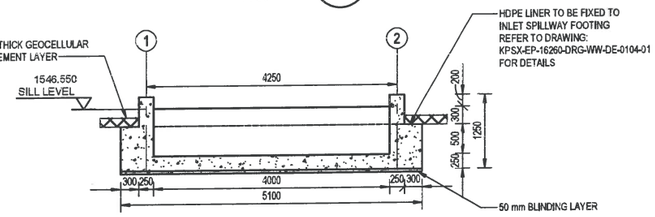


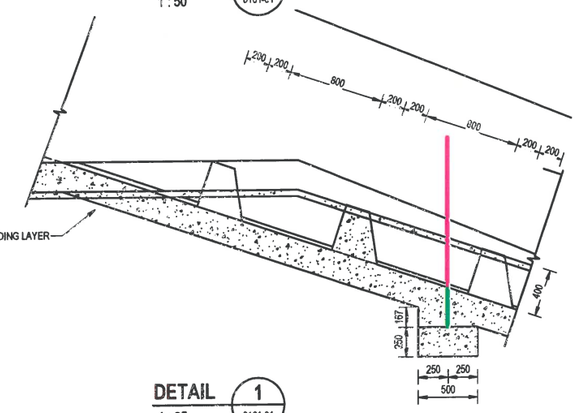
INLET STRUCTURE PLAN VIEW
1 : 50



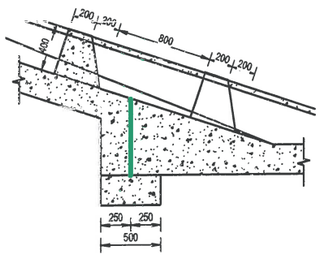
SECTION B
1 : 50 (0161-01)



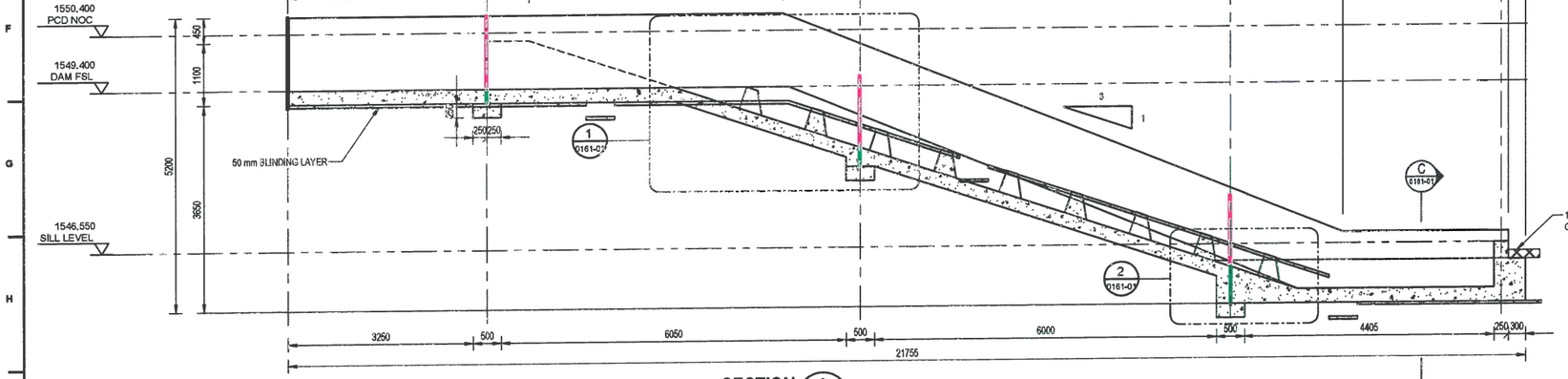
SECTION C
1 : 50 (0161-01)



DETAIL 1
1 : 25 (0161-01)



DETAIL 2
1 : 25 (0161-01)



SECTION A
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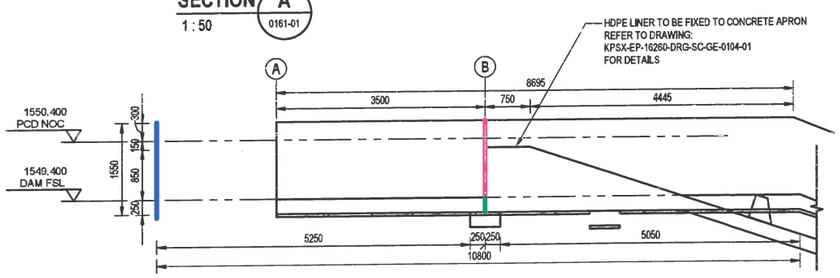
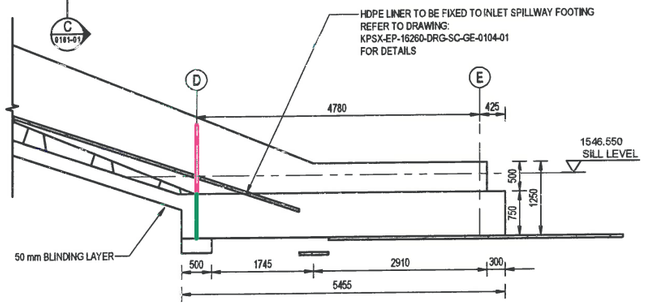


ELEVATION 1
1 : 50



ELEVATION 2
1 : 50

STRUCTURAL REQUIREMENTS	
STRUCTURE TYPE:	WATER RETAINING STRUCTURE
CONCRETE GRADE:	35 MPa/19 mm TO ALL STRUCTURAL CONCRETE
	15 MPa/19 mm TO BLINDING
BLINDING LAYER	50 mm BELOW ALL STRUCTURES
EXTENDERS:	MAXIMUM FLY ASH TO SPECIFICATION
AGGREGATE:	STANDARD
FORMED SURFACE FINISH:	SMOOTH
	ALL EXPOSED EXTERNAL EDGES IN CONCRETE WORK SHALL HAVE 20 mm X 20 mm CHAMFERS
UNFORMED SURFACE FINISH:	STEEL FLOAT FINISH TO TOP OF WALLS AND FLOORS
CONCRETE COVER TO REBAR:	75 mm IF CAST AGAINST SOIL
	40 mm FOR WATER CONTACT AREAS
	50 mm FOR SOIL CONTACT AREAS OR CAST AGAINST BLINDING
	30 mm FOR AIR CONTACT AREAS

REFERENCE DRAWINGS	
DRAWING No.	TITLE

REFERENCE DRAWINGS	
KPSX-EP-16260-DRG-WW-GA-0140	PCD 4 SILT TRAP AND DAM INLET - GENERAL ARRANGEMENT
KPSX-EP-16260-DRG-WW-DE-0106	JOINT DETAILS
KPSX-EP-16260-DRG-WW-DE-0104	TYPICAL DETAILS - LINER FIXING DETAIL
KPSX-EP-16260-DRG-WW-DE-0103	TYPICAL DETAILS - LINING DETAIL
KPSX-EP-16260-DRG-WW-DE-0102	TYPICAL EMBANKMENT DETAILS
KPSX-EP-16260-DRG-WW-GA-0101	PCD 4 INFRASTRUCTURE GENERAL ARRANGEMENT
KPSX-EP-11000-DRG-SC-GE-0001	STRUCTURAL CONCRETE STANDARD CONCRETE NOTES
DRAWING No.	TITLE

ZUTARI PROFESSIONAL ENGINEER		
NAME	VICTOR WENTZEL	DATE
PROF. REG. No.	20130173	
SIGNATURE		21/05/2021
SOUTH 32 PROFESSIONAL APPROVAL		
NAME	SIGN	DATE
CLIENT PROJECT MANAGER		
CLIENT ENGINEERING MANAGER		
ADDITIONAL SIGNATORY		
ZUTARI PROJECT No.	113452	
CLIENT CONTRACT No.	8500084829	

REV.	I.T.	DESCRIPTION	DRWN.	DES.	CHK.	APR.	DATE
*	F	AS-BUILT DRAWING	S.N.	S.N.	J.L.	V.W.	23/04/2021

I.T. ISSUE TYPE: (A) FOR REVIEW (B) FOR APPROVAL (C) FOR TENDER (D) FOR CONSTRUCTION (E) FOR INFORMATION (F) AS-BUILT (G) CANCELLED

AS BUILT DRAWINGS
ZUTARI IMPACT. ENGINEERED.
For Client
21/05/2021 Date

This AS BUILT drawing has been prepared based on information provided by the contractor. The levels and coordinates have not been independently checked or verified by Zutari.

SOUTH32
ZUTARI IMPACT. ENGINEERED.
Riverwalk Office Park
41 Matroosberg Road
Ashlea Gardens, Extension 6
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T + 27 12 427 2000
E connect@zutari.com

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KLIPSPRUIT EXTENSION (KPSX)

AREA: PCD 4
ELEMENT: DAM INLET STRUCTURE
TITLE: LAYOUT & SECTIONS

SCALE:	SHEET SIZE	DRAWING NUMBER	SHEET NO.	REV.
AS SHOWN	(A1)	KPSX - EP - 16260 - DRG - WW - DE - 0161-01	1 OF 1	*

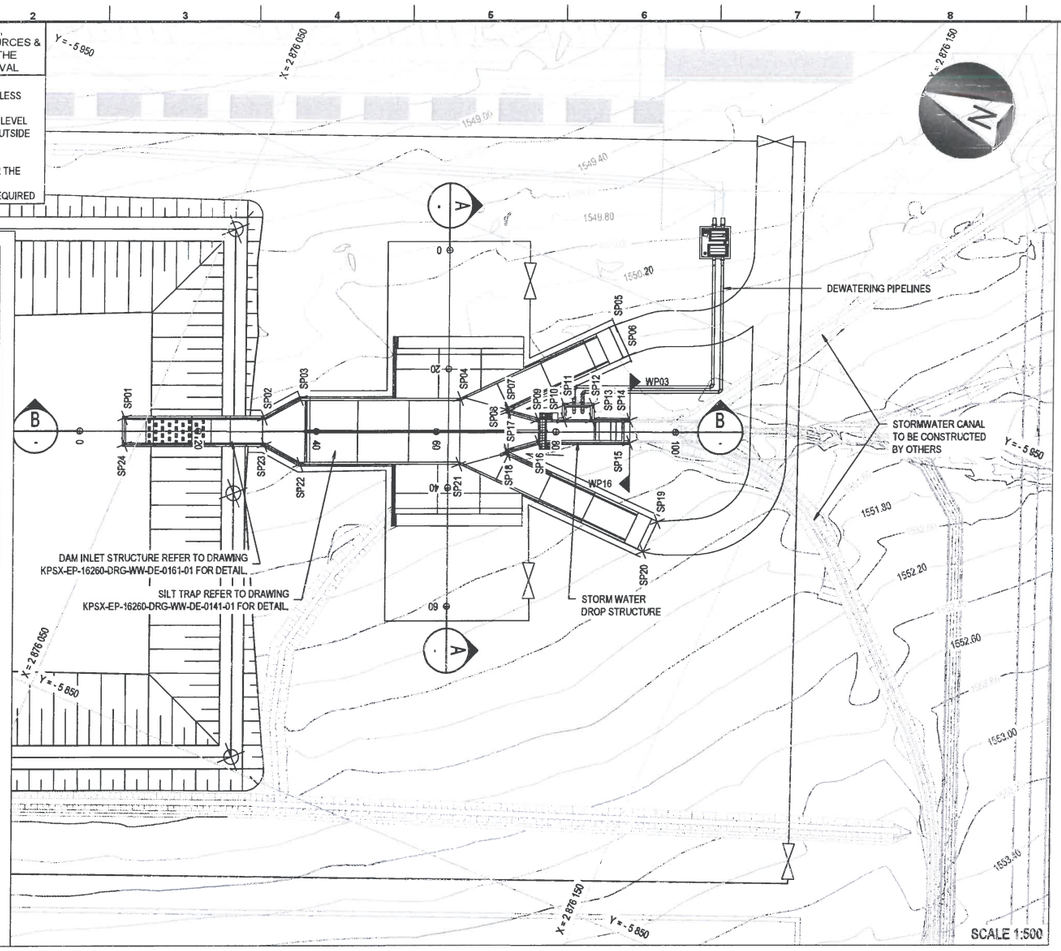
Filename: P:\Projects\113452 - KPSX Execution Ph FEL4 Upgrade\03 DELIVERY\02 Detailed\01 Working\KPSX-EP-16260-DRG-WW-DE-0161-01 PCD 4 DAM INLET STRUCTURE.dwt
Plot Date: 4/21/2021 4:21:11 PM
Plot By: Office

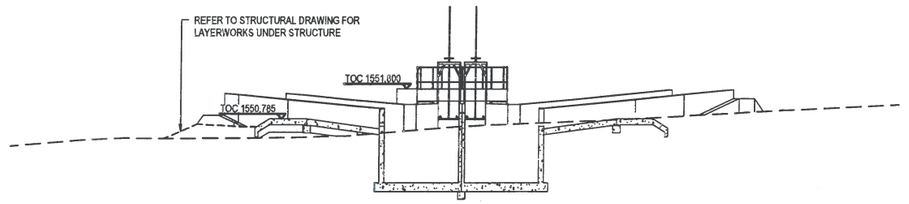
THE MASTER HELD AT ZUTARI, GAUTENG DELIVERY CENTRE, RESOURCES & MANUFACTURING UNIT, BEARS THE ORIGINAL SIGNATURE OF APPROVAL

NOTES:
1. ALL DIMENSION ARE IN MILLIMETRES UNLESS STATED OTHERWISE
2. ALL LEVELS ARE IN METRES ABOVE SEA LEVEL
3. SETTING OUT POINTS POSITIONED ON OUTSIDE CORNERS OF WALLS AS INDICATED
4. REFER TO DRAWING KPSX-EP-16260-DRG-WW-DE-0103-01 FOR THE TYPICAL LINER DETAIL
5. LOCAL EARTHWORKS TO BE DONE AS REQUIRED

CO-ORDINATES WGS 84 HARTBEESHOEK LO29

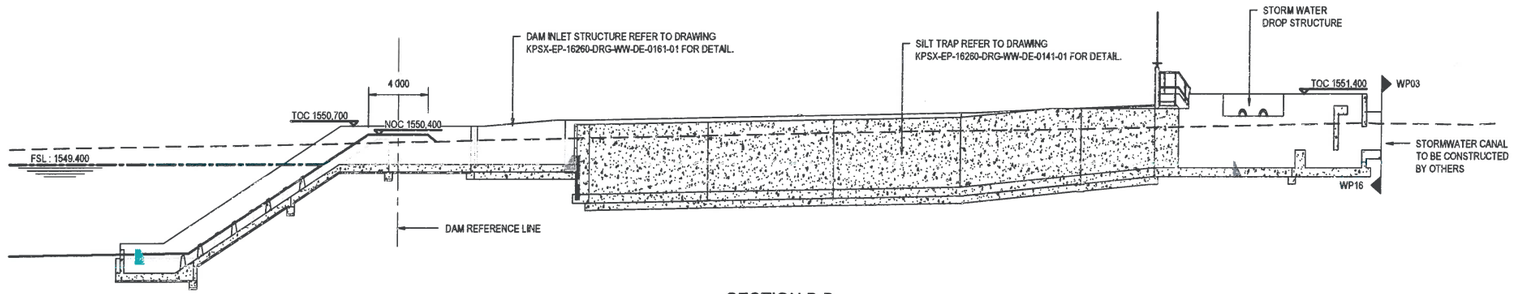
POINT	Y	X
SP01	-5897.438	2876046.433
SP02	-5906.672	2876068.294
SP03	-5912.070	2876072.593
SP04	-5922.448	2876097.161
SP05	-5943.812	2876116.060
SP06	-5940.058	2876120.215
SP07	-5923.868	2876105.182
SP08	-5923.481	2876105.345
SP09	-5924.163	2876110.600
SP10	-5925.852	2876114.599
SP11	-5928.155	2876113.626
SP12	-5929.984	2876117.956
SP13	-5927.681	2876118.929
SP14	-5930.133	2876124.732
SP15	-5926.632	2876126.211
SP16	-5920.663	2876112.079
SP17	-5917.370	2876107.926
SP18	-5916.984	2876108.089
SP19	-5916.270	2876135.773
SP20	-5910.673	2876135.568
SP21	-5912.176	2876101.369
SP22	-5901.845	2876076.912
SP23	-5902.527	2876070.045
SP24	-5893.292	2876048.185





SECTION A-A
FROM 0.000 TO 60.000
HORIZONTAL SCALE 1:100
VERTICAL SCALE 1:50

LEGEND:
- NGL
- FINAL DAM LEVELS
- WATER LEVEL
- BATTERY LIMIT
- NOC NON OVERSPILL CREST
- FSL FULL SUPPLY LEVEL



SECTION B-B
FROM 0.000 TO 100.000
HORIZONTAL SCALE 1:100
VERTICAL SCALE 1:50

AS BUILT DRAWINGS
ZUTARI
For Client:
Date: 27/5/21
For Client:
Date:

This AS BUILT drawing has been prepared based on information provided by the contractor. The levels and coordinates have not been independently checked or verified by Zutari.

REFERENCE DRAWINGS		REFERENCE DRAWINGS	
		KPSX-EP-16260-DRG-WW-DE-0161-01	DAM INLET STRUCTURE LAYOUT AND SECTIONS
		KPSX-EP-16260-DRG-WW-DE-0141-01	SILT TRAP LAYOUTS SECTIONS AND DETAILS
		KPSX-EP-16260-DRG-WW-DE-0104-01	LINER FIXING DETAIL
		KPSX-EP-16260-DRG-WW-DE-0103-01	LINER DETAIL
		KPSX-EP-16260-DRG-WW-DE-0102-02	PCD TYPICAL EMBANKMENT DETAIL
		KPSX-EP-16260-DRG-WW-DE-0102-01	PCD TYPICAL EMBANKMENT DETAIL
DRAWING NO.	TITLE	DRAWING NO.	TITLE

ZUTARI PROFESSIONAL ENGINEER		
NAME	VICTOR WENTZEL	DATE
PROF. REG. No.	20130173	
SIGNATURE		27/5/21

SOUTH 32 PROFESSIONAL APPROVAL		
NAME	SIGN.	DATE
CLIENT PROJECT MANAGER		
CLIENT ENGINEERING MANAGER		
ADDITIONAL SIGNATORY		
ZUTARI PROJECT No.	113452	
CLIENT CONTRACT No.	8500084829	

REV.	I.T.	DESCRIPTION	DRWN.	DES.	CHK.	APR.	DATE
*	F	AS-BUILT	E.E.	S.M.	V.W.	A.C.	26/02/2018

I.T. ISSUE TYPE: (A) FOR REVIEW (SQ) (B) INTERNAL PEER REVIEW (C) FOR APPROVAL (CR) (D) FOR CONSTRUCTION (E) FOR INFORMATION (F) AS-BUILT (G) CANCELED

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SOUTH32

ZUTARI IMPACT. ENGINEERED.
Riverwalk Office Park
41 Matroosberg Road
Ashlea Gardens, Extension 8
Pretoria
0081
T + 27 12 427 2000
E connect@zutari.com

KLIPSPRUIT EXTENSION (KPSX)

AREA: PCD 4

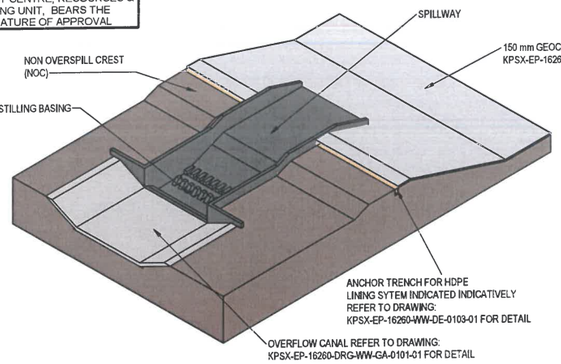
ELEMENT: DAM INLET

TITLE: LAYOUT, SECTIONS AND SETTING OUT DETAILS

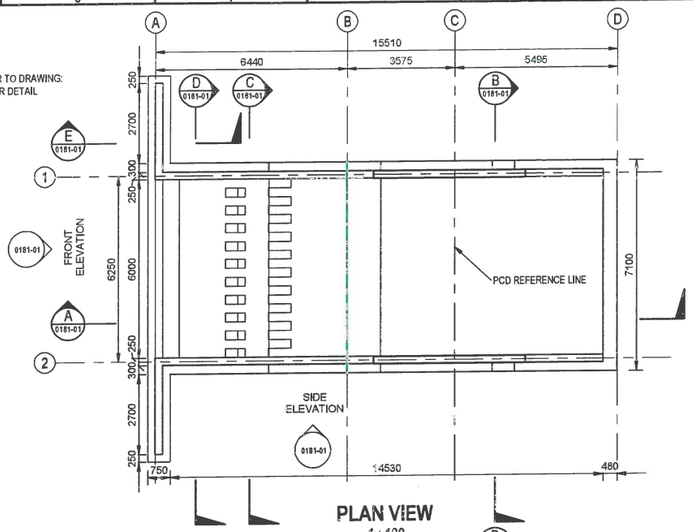
SCALE:	SHEET SIZE	DRAWING NUMBER	SHEET No.	REV.
1:500	(A1)	KPSX-EP-16260-DRG-WW-LY-0121-01	1 OF 1	*

PROJECT FILE: 113452

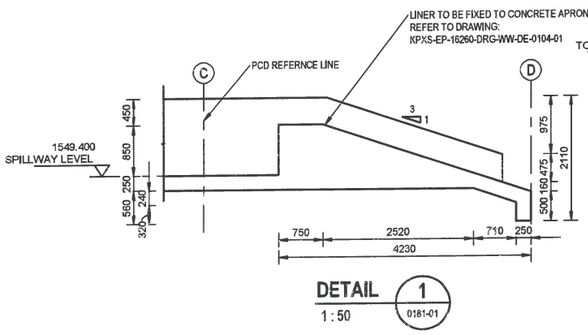
THE MASTER HELD AT ZUTARI, GAUTENG DELIVERY CENTRE, RESOURCES & MANUFACTURING UNIT, BEARS THE ORIGINAL SIGNATURE OF APPROVAL



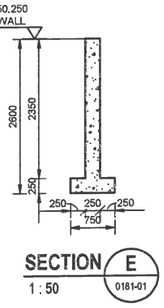
EMERGENCY SPILLWAY



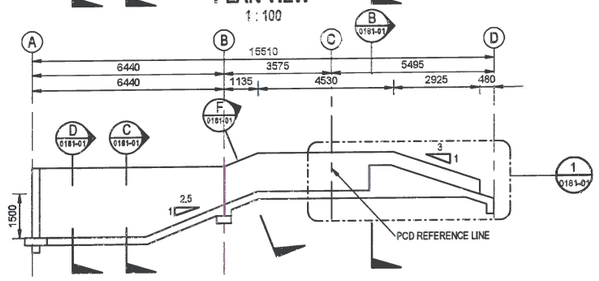
PLAN VIEW
1 : 100



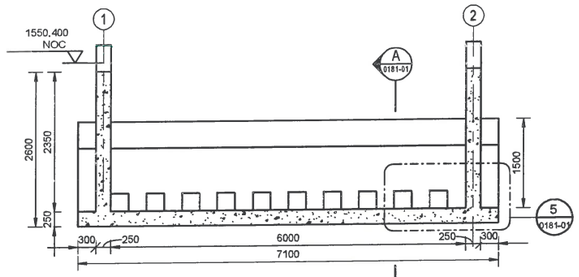
DETAIL 1
1 : 50 — 0181-01



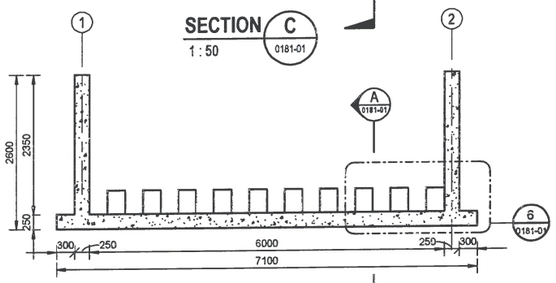
SECTION E
1 : 50 — 0181-01



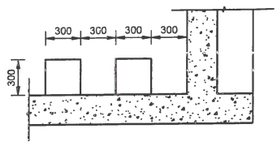
SIDE ELEVATION
1 : 100



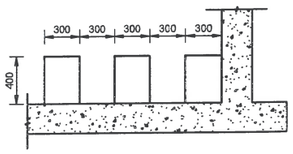
SECTION C
1 : 50 — 0181-01



SECTION D
1 : 50 — 0181-01



DETAIL 5
1 : 25 — 0181-01

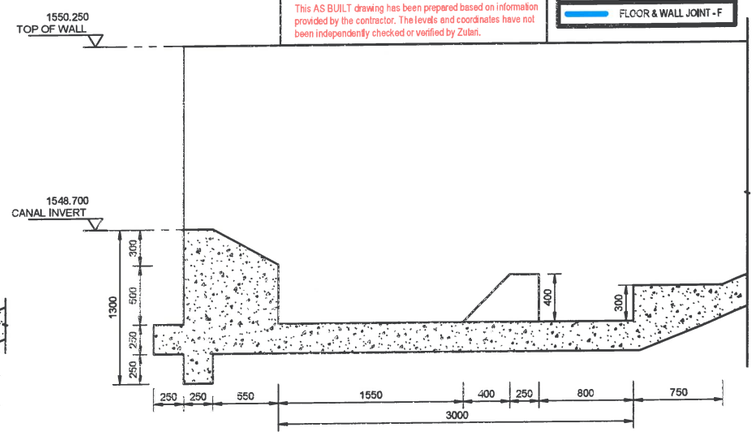


DETAIL 6
1 : 25 — 0181-01

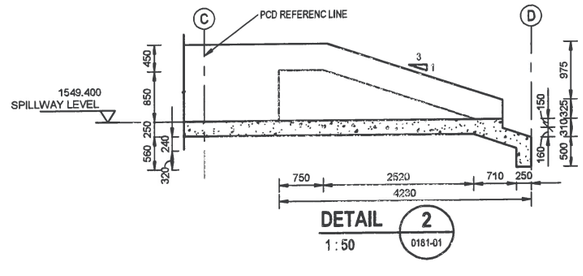
JOINT TYPE
FLOOR JOINT - A1
FLOOR JOINT - B1
WALL JOINT - C
WALL JOINT - D
WALL JOINT - E2
FLOOR & WALL JOINT - E3
FLOOR & WALL JOINT - F

AS BUILT DRAWINGS
ZUTARI
For Client
21/05/2018 Date

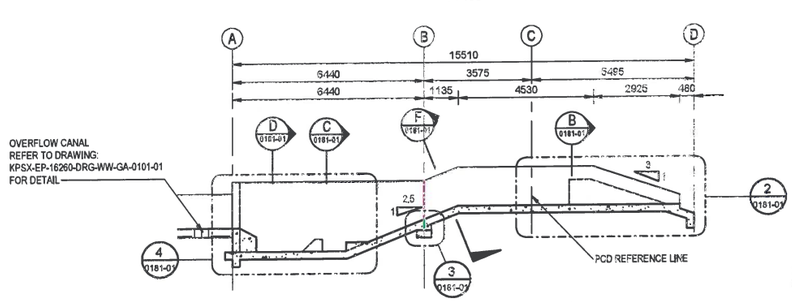
This AS BUILT drawing has been prepared based on information provided by the contractor. The levels and coordinates have not been independently checked or verified by Zutari.



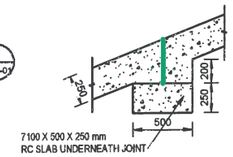
DETAIL 4
1 : 25 — 0181-01



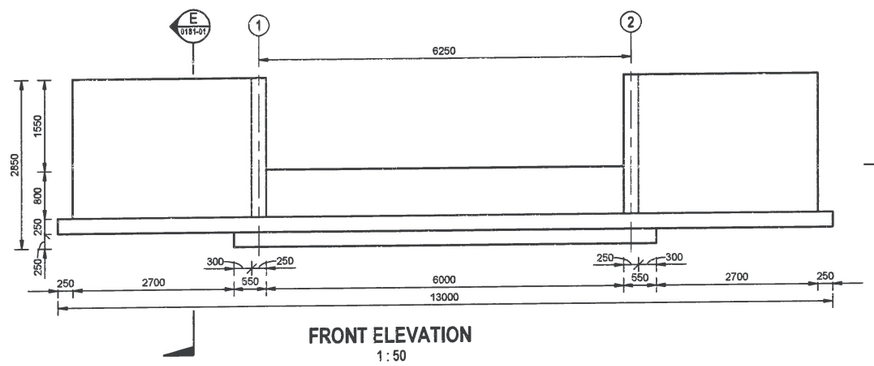
DETAIL 2
1 : 50 — 0181-01



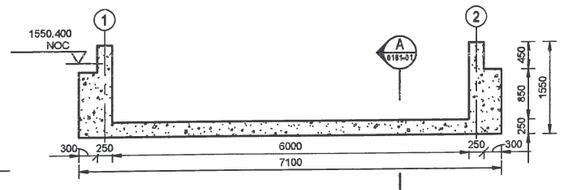
SECTION A
1 : 100 — 0181-01



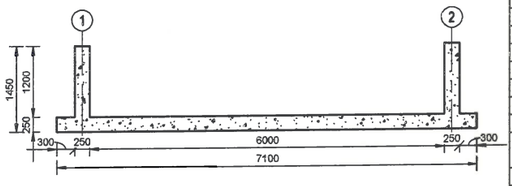
DETAIL 3
1 : 25 — 0181-01



FRONT ELEVATION
1 : 50



SECTION B
1 : 50 — 0181-01



SECTION F
1 : 50 — 0181-01

STRUCTURAL REQUIREMENTS	
STRUCTURE TYPE:	DAM STRUCTURE
CONCRETE GRADE:	35 MPa/19 mm TO ALL STRUCTURAL CONCRETE
	15 MPa/19 mm TO BLINDING
BLINDING LAYER	50 mm BELOW ALL STRUCTURES
EXTENDERS:	MAXIMUM FLY ASH TO SPECIFICATION
AGGREGATE:	STANDARD
FORMED SURFACE FINISH:	SMOOTH
	ALL EXPOSED EXTERNAL EDGES IN CONCRETE WORK SHALL HAVE 20 mm X 20 mm CHAMFERS
UNFORMED SURFACE FINISH:	STEEL FLOAT FINISH TO TOP OF WALLS AND FLOORS
CONCRETE COVER TO REBAR:	75 mm IF CAST AGAINST SOIL
	40 mm FOR WATER CONTACT AREAS
	50 mm FOR SOIL CONTACT AREAS OR CAST AGAINST BLINDING
	30 mm FOR AIR CONTACT AREAS

REFERENCE DRAWINGS	
DRAWING No.	TITLE

REFERENCE DRAWINGS	
KPSX-EP-16260-DRG-WW-LY-0122	PCD 4 EMERGENCY SPILLWAY AND LEAK DETECTION SUMP LAYOUT
KPSX-EP-16260-DRG-WW-DE-0106	JOINT DETAILS
KPSX-EP-16260-DRG-WW-DE-0104	LINER FIXING DETAIL
KPSX-EP-16260-DRG-WW-DE-0103	LINING DETAIL
KPSX-EP-16260-DRG-WW-DE-0102	TYPICAL EMBANKMENT DETAIL
KPSX-EP-16260-DRG-WW-GA-0101	PCD 4 INFRASTRUCTURE GENERAL ARRANGEMENT
KPSX-EP-11000-DRG-SC-GE-0001	STRUCTURAL CONCRETE STANDARD CONCRETE NOTES
DRAWING No.	TITLE

ZUTARI PROFESSIONAL ENGINEER		
NAME	VICTOR WENTZEL	DATE
PROF. REG. No.	20130173	
SIGNATURE		21/05/2018
SOUTH 32 PROFESSIONAL APPROVAL		
NAME	SIGN	DATE
CLIENT PROJECT MANAGER		
CLIENT ENGINEERING MANAGER		
ADDITIONAL SIGNATORY		
ZUTARI PROJECT No.	113452	
CLIENT CONTRACT No.	8500084829	

REV.	I.T.	DESCRIPTION	DRWN.	DES.	CHK.	APR.	DATE
*	F	AS-BUILT DRAWING	J.A.V.V.	J.A.V.V.	V.W.	J.L.	14/03/2018

I.T. ISSUE TYPE: (A) FOR REVIEW (B) FOR APPROVAL (C) FOR TENDER (D) FOR CONSTRUCTION (E) FOR INFORMATION (F) AS-BUILT (G) CANCELLED

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ZUTARI
Riverwalk Office Park
41 Matroosberg Road
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Pretoria
0081
T + 27 12 427 2000
E connect@zutari.com

KLIPSPRUIT EXTENSION (KPSX)

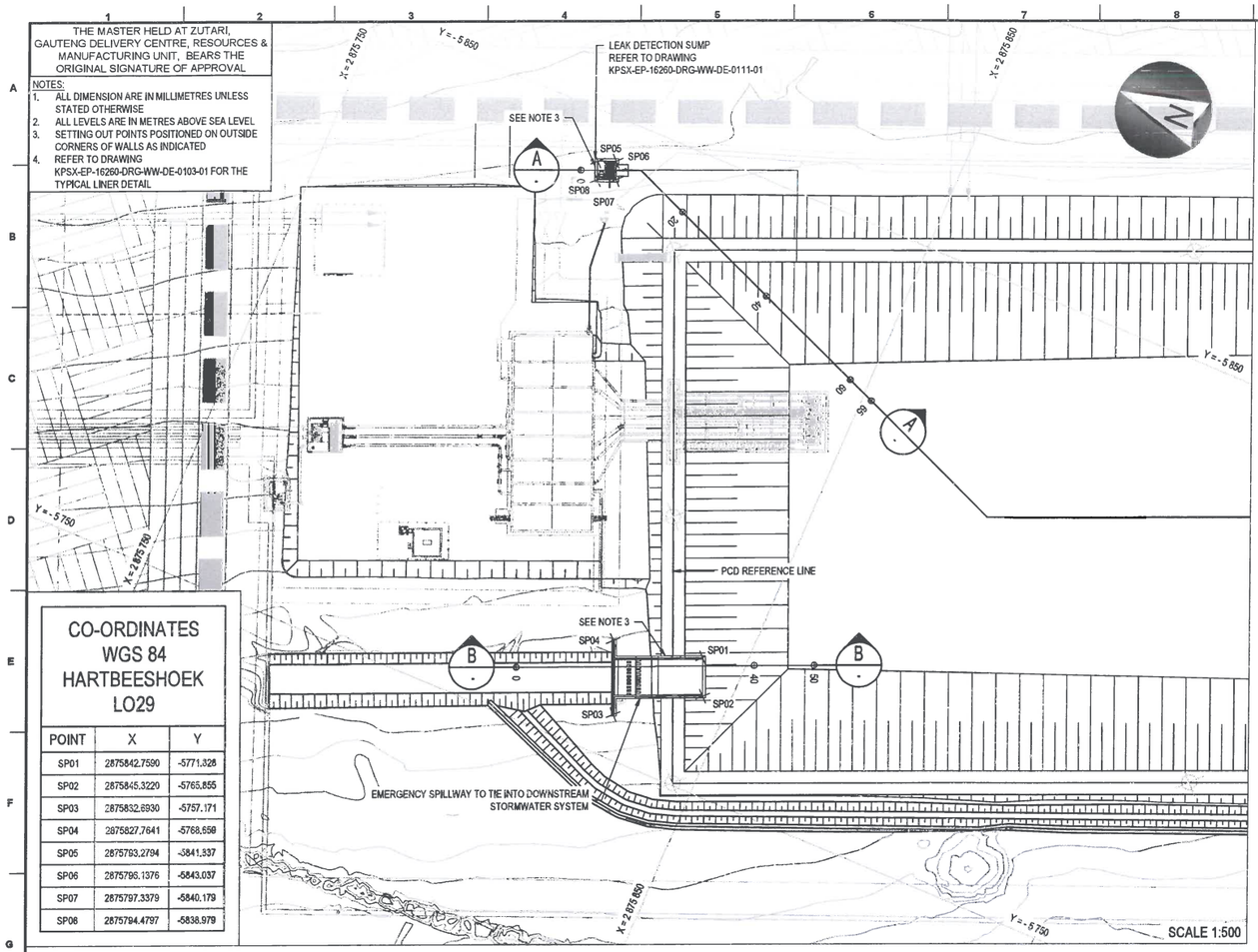
AREA: PCD 4
ELEMENT: EMERGENCY SPILLWAY
TITLE: LAYOUT, SECTIONS AND DETAILS

SCALE:	SHEET SIZE	DRAWING NUMBER	SHEET NO.	REV.
AS SHOWN	(A1)	KPSX - EP - 16260 - DRG - WW - DE - 0181-01	1 OF 1	*

File name: P:\Projects\113452 - KPSX Execution Ph FEL 4\Deposits\05 DELIVERED\Model\ge\Revit\WW\16260WW2124 PCD 4 EMERGENCY SPILLWAY.rvt
Plot Date: 02/05/2018 4:44:16 PM
Office:

THE MASTER HELD AT ZUTARI, GAUTENG DELIVERY CENTRE, RESOURCES & MANUFACTURING UNIT, BEARS THE ORIGINAL SIGNATURE OF APPROVAL

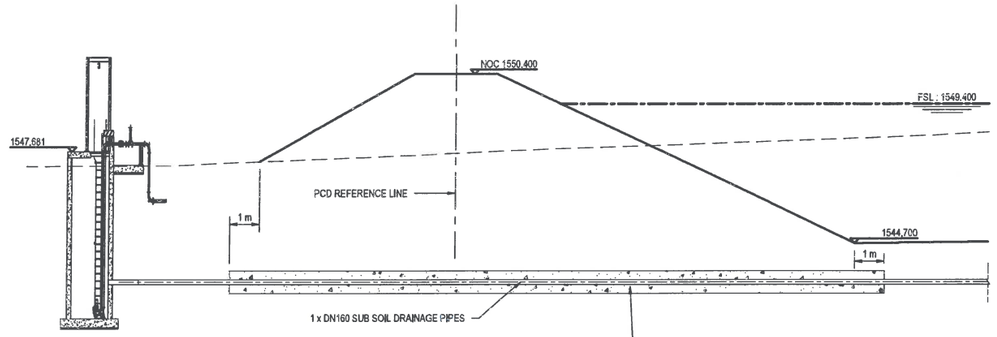
NOTES:
1. ALL DIMENSION ARE IN MILLIMETRES UNLESS STATED OTHERWISE
2. ALL LEVELS ARE IN METRES ABOVE SEA LEVEL
3. SETTING OUT POINTS POSITIONED ON OUTSIDE CORNERS OF WALLS AS INDICATED
4. REFER TO DRAWING KPSX-EP-16260-DRG-WW-DE-0103-01 FOR THE TYPICAL LINER DETAIL



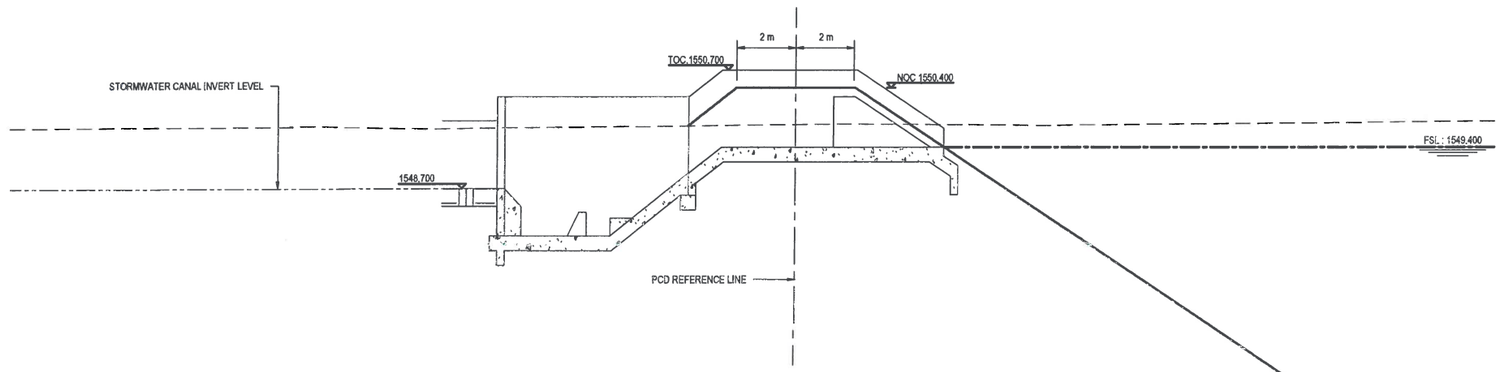
CO-ORDINATES WGS 84 HARTBEESHOEK LO29

POINT	X	Y
SP01	2875842.7590	-5771.326
SP02	2875845.3220	-5765.855
SP03	2875832.8930	-5757.171
SP04	2875827.7641	-5768.656
SP05	2875793.2794	-5841.937
SP06	2875796.1376	-5843.037
SP07	2875797.3379	-5840.179
SP08	2875794.4797	-5838.979

LEGEND:
- NGL
- STORMWATER CHANNEL
- FINAL DAM LEVELS
- WATER LEVEL
- NOC NON OVERSPILL CREST
- FSL FULL SUPPLY LEVEL



SECTION A-A
FROM 0.000 TO 65.000
HORIZONTAL SCALE 1:200
VERTICAL SCALE 1:100



SECTION B-B
FROM 0.000 TO 50.000
HORIZONTAL SCALE 1:100
VERTICAL SCALE 1:50

AS BUILT DRAWINGS
ZUTARI IMPACT. ENGINEERED.
Per Zutari: Date: 27/5/21
Per Client: Date:

This AS BUILT drawing has been prepared based on information provided by the contractor. The levels and coordinates have not been independently checked or verified by Zutari.

REFERENCE DRAWINGS	
DRAWING NO.	TITLE

REFERENCE DRAWINGS	
XPSX-EP-16260-DRG-WW-LY-0222-01	PCD 4 LEAK DETECTION SUMP AND PIPELINE LAYOUT
KPSX-EP-16260-DRG-WW-DE-0111-01	SUBSOIL DRAINAGE AND LEAK DETECTION COLLECTION SUMP
KPSX-EP-16260-DRG-WW-DE-0181-01	PCD 4 EMERGENCY SPILLWAY LAYOUT AND DETAILS
KPSX-EP-16260-DRG-WW-LY-0104-01	STORMWATER DRAINAGE LAYOUT
KPSX-EP-16260-DRG-WW-DE-0104-01	LINER FIXING DETAIL
KPSX-EP-16260-DRG-WW-DE-0103-01	LINER DETAIL
KPSX-EP-16260-DRG-WW-DE-0102-02	PCD TYPICAL EMBANKMENT DETAIL
KPSX-EP-16260-DRG-WW-DE-0102-01	PCD TYPICAL EMBANKMENT DETAIL
DRAWING NO.	TITLE

ZUTARI PROFESSIONAL ENGINEER		
NAME	VICTOR WENTZEL	DATE
PROF. REG. No.	20160073	
SIGNATURE		27/5/21

SOUTH 32 PROFESSIONAL APPROVAL		
NAME	SIGN.	DATE
CLIENT PROJECT MANAGER		
CLIENT ENGINEERING MANAGER		
ADDITIONAL SIGNATORY		
ZUTARI PROJECT No.	113452	
CLIENT CONTRACT No.	8500084829	

REV.	I.T.	DESCRIPTION	DRWN.	DES.	CHK.	APR.	DATE
*	F	AS-BUILT DRAWING	S.L.M.	S.M.	V.W.	A.C.	26/02/2018

I.T. ISSUE TYPE: (A) FOR REVIEW (SQ) (B) INTERNAL PEER REVIEW (C) FOR APPROVAL (CR) (D) FOR CONSTRUCTION (E) FOR INFORMATION (F) AS-BUILT (G) CANCELED

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SOUTH32

KLIPSPRUIT EXTENSION (KPSX)

AREA: PCD 4

ELEMENT: EMERGENCY SPILLWAY AND LEAK DETECTION SUMP

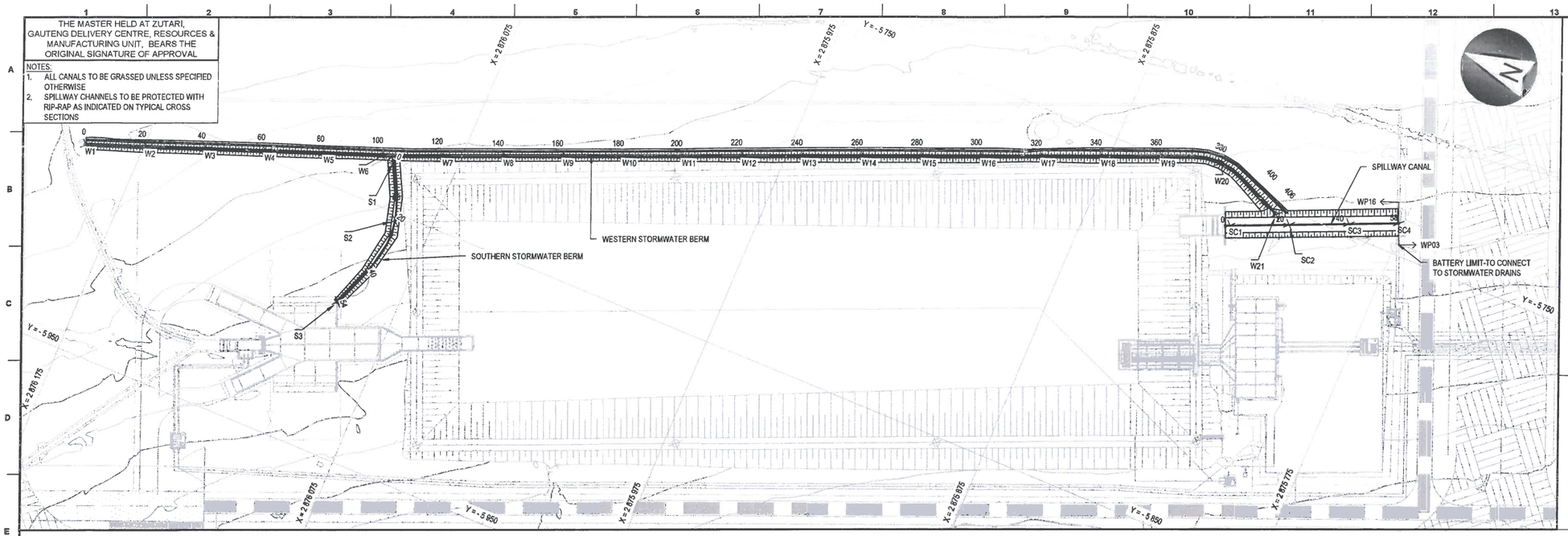
TITLE: LAYOUT, SECTIONS AND SETTING OUT DETAILS

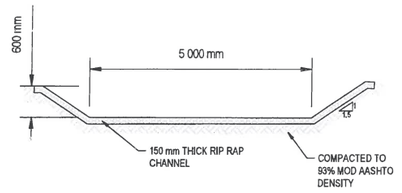
SCALE:	SHEET SIZE	DRAWING NUMBER	SHEET No.	REV.
1:500	(A1)	KPSX-EP-16260-DRG-WW-LY-0122-01	1 OF 1	*

PROJECT FILE: 113452

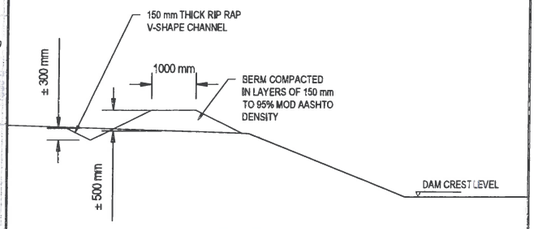
THE MASTER HELD AT ZUTARI, GAUTENG DELIVERY CENTRE, RESOURCES & MANUFACTURING UNIT, BEARS THE ORIGINAL SIGNATURE OF APPROVAL

NOTES:
1. ALL CANALS TO BE GRASSED UNLESS SPECIFIED OTHERWISE
2. SPILLWAY CHANNELS TO BE PROTECTED WITH RIP-RAP AS INDICATED ON TYPICAL CROSS SECTIONS





SPILLWAY CANAL DETAIL
N.T.S



TYPICAL STORMWATER BERM DETAILS
N.T.S

NGL
INVERT

SCALES:
Horizontal 1:1250
Vertical 1:125

DATUM 1547.000

CHAINAGE (m)	0	20	40	57
GROUND LEVELS ON CL	1549.772	1549.725	1549.753	1549.617	1548.608
INVERT LEVELS	1548.700	1548.689	1548.679	1548.658	1548.647	1548.640
SLOPE		-0.106%		

PCD4 SPILLWAY CANAL FROM 0.00 TO 57.00

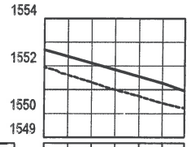
POINT TABLE WGS 84 HARTBEESHOEK LO29

POINT	Y	X	LEVEL
SC1	-5762.349	2875828.831	1549.043
SC2	-5754.474	2875810.447	1548.943
SC3	-5746.598	2875792.063	1548.843
SC4	-5740.042	2875776.757	1548.759

NGL
BERM TOP

SCALES:
Horizontal 1:1250
Vertical 1:125

DATUM 1549.000



CHAINAGE (m)	0	10	20	30	40	50	59
BERM TOP LEVEL	1552.699	1552.409	1552.129	1551.848	1551.567	1551.286	1550.965
GROUND LEVELS ON CL	1551.626	1551.315	1551.004	1550.724	1550.435	

PCD4 SOUTH BERM FROM 0.00 TO 60.00

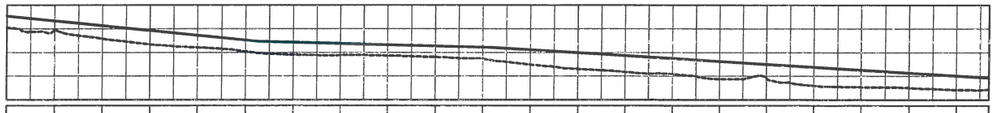
POINT TABLE WGS 84 HARTBEESHOEK LO29

POINT	Y	X	LEVEL
S1	-5849.357	2876095.393	1552.690
S2	-5867.537	2876087.199	1552.225
S3	-5900.106	2876094.526	1550.982

NGL
BERM TOP

SCALES:
Horizontal 1:1250
Vertical 1:125

DATUM 1550.000



CHAINAGE (m)	0	20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	320	340	360	380	400	414
GROUND LEVELS ON CL	1552.935	1552.584	1552.340	1552.216	1552.039	1551.990	1551.909	1551.887	1551.864	1551.808	1551.734	1551.699	1551.491	1551.309	1551.182	1551.088	1550.878	1550.879	1550.938	1550.991	1550.541	1550.512	1550.434	1550.439
BERM TOP LEVEL	1553.537	1553.336	1553.135	1552.934	1552.733	1552.532	1552.438	1552.387	1552.336	1552.285	1552.233	1552.127	1552.005	1551.883	1551.760	1551.638	1551.516	1551.394	1551.271	1551.149	1551.027	1550.943

PCD 4 WEST BERM FROM 0.00 TO 414.00

POINT TABLE WGS 84 HARTBEESHOEK LO29

POINT	Y	X	LEVEL
W1	-5883.972	2876193.057	1553.537
W2	-5876.977	2876174.320	1553.336
W3	-5869.982	2876155.584	1553.135
W4	-5862.987	2876136.847	1552.934
W5	-5855.992	2876118.110	1552.733
W6	-5848.997	2876099.373	1552.532
W7	-5841.650	2876080.774	1552.438
W8	-5834.017	2876062.291	1552.387
W9	-5826.382	2876043.807	1552.336
W10	-5818.747	2876025.321	1552.285
W11	-5811.111	2876006.832	1552.233

POINT TABLE WGS 84 HARTBEESHOEK LO29

POINT	Y	X	LEVEL
W12	-5803.480	2875988.356	1552.127
W13	-5796.846	2875969.872	1552.005
W14	-5788.210	2875951.385	1551.883
W15	-5780.577	2875932.902	1551.760
W16	-5772.944	2875914.422	1551.638
W17	-5765.317	2875895.955	1551.516
W18	-5757.686	2875877.479	1551.394
W19	-5750.052	2875858.996	1551.272
W20	-5744.336	2875839.969	1551.149
W21	-5753.104	2875815.852	1550.991

AS BUILT DRAWINGS
ZUTARI
Date: 27/5/21

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REFERENCE DRAWINGS		REFERENCE DRAWINGS	
DRAWING NO.	TITLE	DRAWING NO.	TITLE
		KPSX-EP-16260-DRG-WW-DE-0181-01	PCD4 EMERGENCY SPILLWAY LAYOUT AND DETAILS

ZUTARI PROFESSIONAL ENGINEER
NAME: VICTOR WENTZEL DATE:
PROF. REG. No.: 20130173
SIGNATURE: 27/5/21

SOUTH 32 PROFESSIONAL APPROVAL

NAME	SIGN.	DATE
CLIENT PROJECT MANAGER		
CLIENT ENGINEERING MANAGER		
ADDITIONAL SIGNATORY		

ZUTARI PROJECT No.: 113452
CLIENT CONTRACT No.: 8500084829

REV.	I.T.	DESCRIPTION	DRWN.	DES.	CHK.	APR.	DATE
*	F	AS-BUILT	Y.P.	Y.P.	V.W.	A.C.	19/03/2018

I.T. ISSUE TYPE: (A) FOR REVIEW (BC) (B) INTERNAL PEER REVIEW (C) FOR APPROVAL (CR) (D) FOR CONSTRUCTION (E) FOR INFORMATION (F) AS-BUILT (G) CANCELED

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SOUTH32

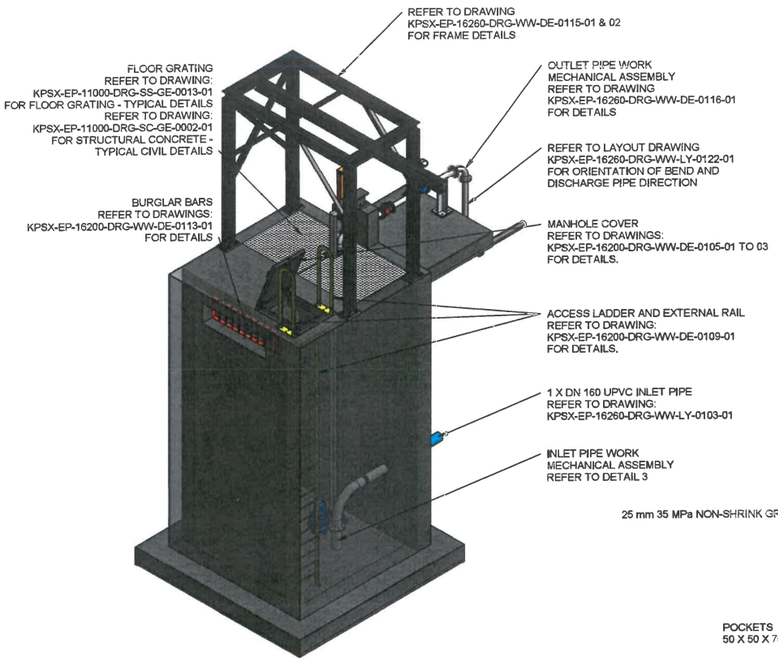
KLIPSPRUIT EXTENSION (KPSX)

AREA:
ELEMENT: PCD 4 STORMWATER DRAINAGE
TITLE: SITE DRAINAGE LAYOUT

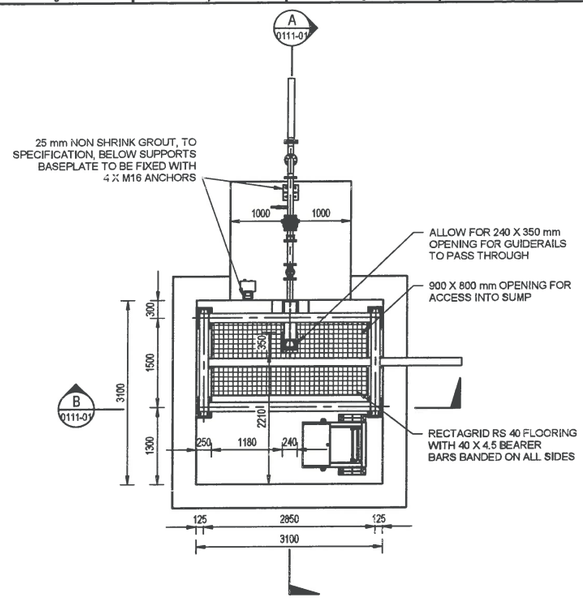
SCALE:	SHEET SIZE	DRAWING NUMBER	SHEET No.	REV.
1:1500	(A1)	KPSX-EP-16260-DRG-WW-LY-0104-01	1 OF 1	*

PROJECT FILE: 15962

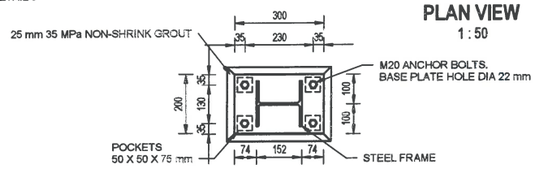
THE MASTER HELD AT ZUTARI, GAUTENG DELIVERY CENTRE, RESOURCES & MANUFACTURING UNIT, BEARS THE ORIGINAL SIGNATURE OF APPROVAL



ISOMETRIC VIEW LEAK DETECTION SUMP

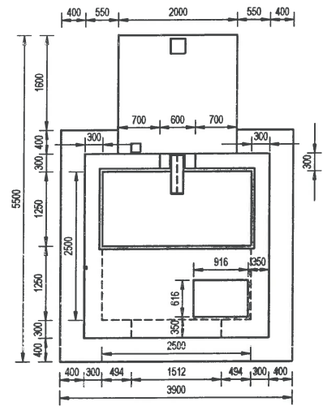


PLAN VIEW
1 : 50



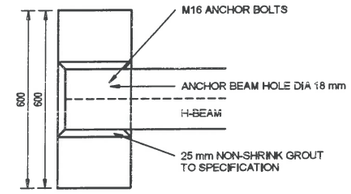
STEEL FRAME BASE PLATE DETAIL
1 : 10

NOTES:
1. ALL WELDS TO BE: ⊓ OR ⊔
2. REMOVE ALL SHARP EDGES AND BURS
3. HOT DIP GALVANIZE AFTER MANUFACTURING
4. STEEL TO SANS 1431 GR 350 WA

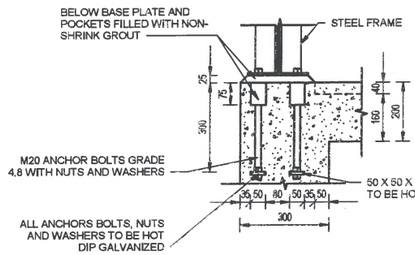


PLAN VIEW WITHOUT MECHANICAL
1 : 50

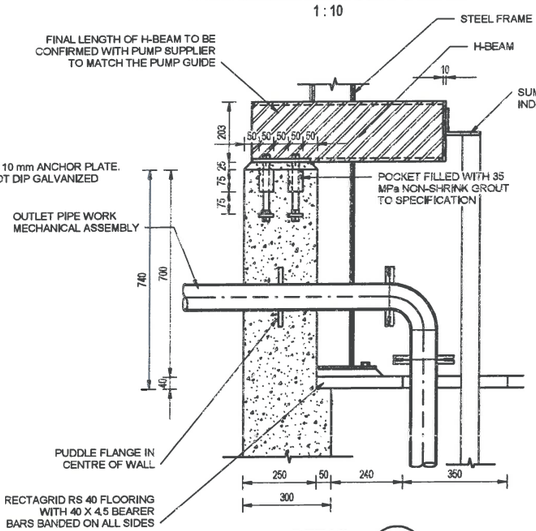
STRUCTURAL REQUIREMENTS	
STRUCTURE TYPE:	WATER RETAINING STRUCTURE
CONCRETE GRADE:	35 MPa/19 mm TO ALL STRUCTURAL CONCRETE
	15 MPa/19 mm TO BLINDING
BLINDING LAYER	50 mm BELOW ALL STRUCTURES
EXTENDERS:	MAXIMUM FLY ASH TO SPECIFICATION
AGGREGATE:	STANDARD
FORMED SURFACE FINISH:	SMOOTH
	ALL EXPOSED EXTERNAL EDGES IN CONCRETE WORK SHALL HAVE 20 mm X 20 mm CHAMFERS
UNFORMED SURFACE FINISH:	STEEL FLOAT FINISH TO TOP OF WALLS AND FLOORS
CONCRETE COVER TO REBAR:	75 mm IF CAST AGAINST SOIL
	40 mm FOR WATER CONTACT AREAS
	50 mm FOR SOIL CONTACT AREAS OR CAST AGAINST BLINDING
	30 mm FOR AIR CONTACT AREAS



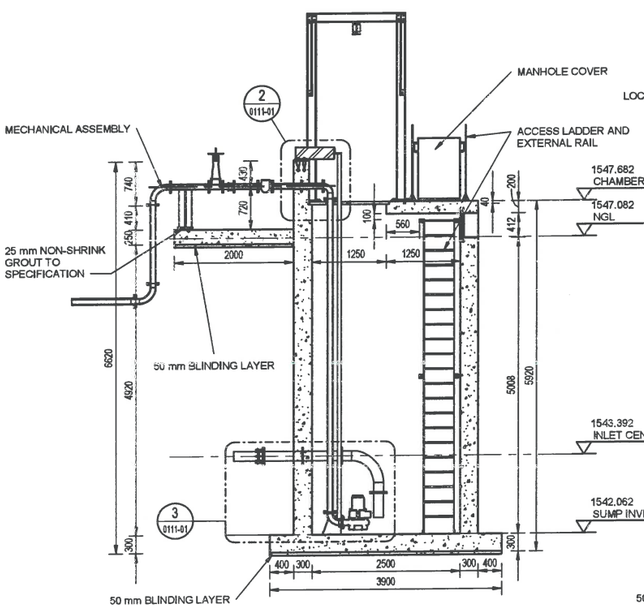
H-BEAM ANCHOR BOLTS DETAIL
1 : 10



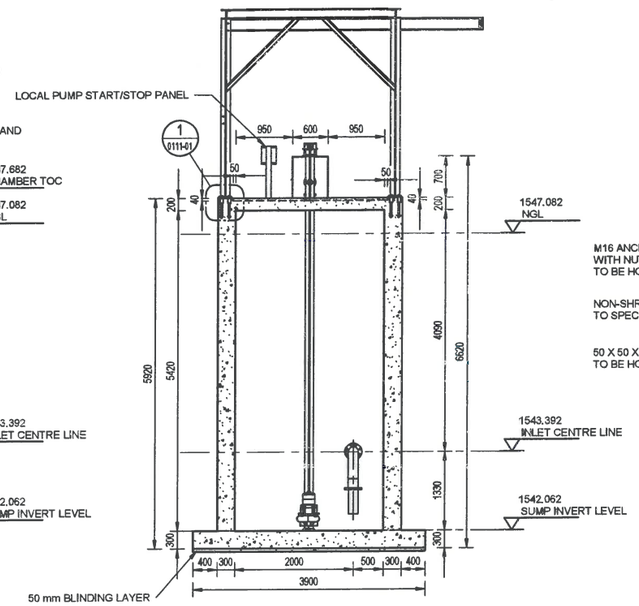
DETAIL 1 (0111-01)
1 : 10



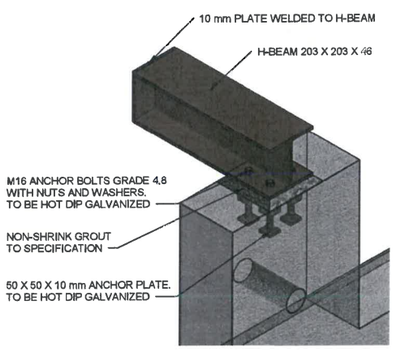
DETAIL 2 (0111-01)
1 : 10



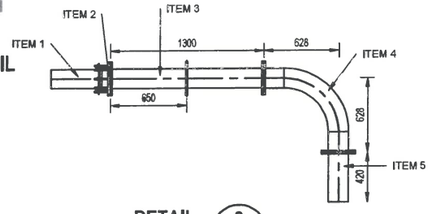
SECTION A (0111-01)
1 : 50



SECTION B (0111-01)
1 : 50



H-BEAM ISOMETRIC DETAIL



DETAIL 3 (0111-01)
1 : 25

PARTS LIST		
ITEM	QTY	DESCRIPTION
1	1	DN 160 UPVC-L CLASS 34 SOLID WALL PIPE; SANS 791
2	1	FLANGE ADAPTER FOR DN 160 UPVC TO DN 150 STEEL PIPE CONNECTION
3	1	SPOOL PIECE DN 150 X 4,2 mm SANS 62; FLANGED BOTH ENDS SANS 1123 TABLE 1000/3 (RF) WITH PUDDLE FLANGE
4	1	LONG RADIUS BEND (3 D); 90 DEGREE DN 150 X 4,2 mm SANS 62; FLANGED BOTH ENDS SANS 1123 TABLE 1000/3 (RF)
5	1	SPOOL PIECE DN 150 X 4,2 mm SANS 62; FLANGED ONE END SANS 1123 TABLE 1000/3 (RF)

AS BUILT DRAWINGS
ZUTARI IMPACT. ENGINEERED.
For Client
21/05/2021 Date

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REFERENCE DRAWINGS	
KPSX-EP-11000-DRG-SS-GE-0013	FLOOR GRATING - TYPICAL DETAILS
KPSX-EP-11000-DRG-SC-GE-0002	STRUCTURAL CONCRETE - TYPICAL CIVIL DETAILS
DRAWING No.	TITLE

REFERENCE DRAWINGS	
KPSX-EP-11000-DRG-SC-GE-0001	STRUCTURAL CONCRETE - STANDARD CONCRETE NOTES
KPSX-EP-16260-DRG-WW-LY-0122	PCD 4 - LEAK DETECTION SUMP AND PIPELINE LAYOUT
KPSX-EP-16260-DRG-WW-LY-0103	PCD 4 - SUBSOIL DRAINAGE AND LEAK DETECTION LAYOUT
KPSX-EP-16260-DRG-WW-DE-0116	SUBSOIL DRAINAGE AND LEAK DETECTION - MECHANICAL DETAILS
KPSX-EP-16260-DRG-WW-DE-0115	SUBSOIL DRAINAGE AND LEAK DETECTION - GANTRY DETAILS
KPSX-EP-16260-DRG-WW-GA-0101	PCD 4 INFRASTRUCTURE - GENERAL ARRANGEMENT
KPSX-EP-16200-DRG-WW-DE-0113	TYPICAL DETAIL - BURGLAR BARS
KPSX-EP-16200-DRG-WW-DE-0109	TYPICAL DETAIL - ACCESS LADDER
KPSX-EP-16200-DRG-WW-DE-0105	TYPICAL DETAIL - MANHOLE COVER
DRAWING No.	TITLE

ZUTARI PROFESSIONAL ENGINEER		
NAME	VICTOR WENTZEL	DATE
PROF. REG. No.	20130173	
SIGNATURE		21/05/2021
SOUTH 32 PROFESSIONAL APPROVAL		
NAME	SIGN	DATE
CLIENT PROJECT MANAGER		
CLIENT ENGINEERING MANAGER		
ADDITIONAL SIGNATORY		
ZUTARI PROJECT No.	113452	
CLIENT CONTRACT No.	8500084829	

REV.	I.T.	DESCRIPTION	DRWN.	DES.	CHK.	APR.	DATE
"	F	AS-BUILT DRAWING	G.W.	G.W.	V.W.	J.L.	16/04/2021

I.T. ISSUE TYPE: (A) FOR REVIEW (B) FOR APPROVAL (C) FOR TENDER (D) FOR CONSTRUCTION (E) FOR INFORMATION (F) AS-BUILT (G) CANCELLED

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SOUTH32

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KLIPSPRUIT EXTENSION (KPSX)

AREA: PCD 4
ELEMENT: LEAK DETECTION SUMP
TITLE: LAYOUT, SECTIONS AND DETAILS

SCALE:	SHEET SIZE	DRAWING NUMBER	SHEET NO.	REV.
AS SHOWN	(A1)	KPSX-EP-16260 - DRG - WW - DE - 0111-01	1 OF 1	*

File Name: P:\Projects\113452 KPSX Klipspruit DEL 2\2\Design\Civil\Drawings\KPSX-EP-16260-DRG-WW-DE-0111-01.dwg
File Date: 4/16/2021 1:51:18 PM
Office: GC

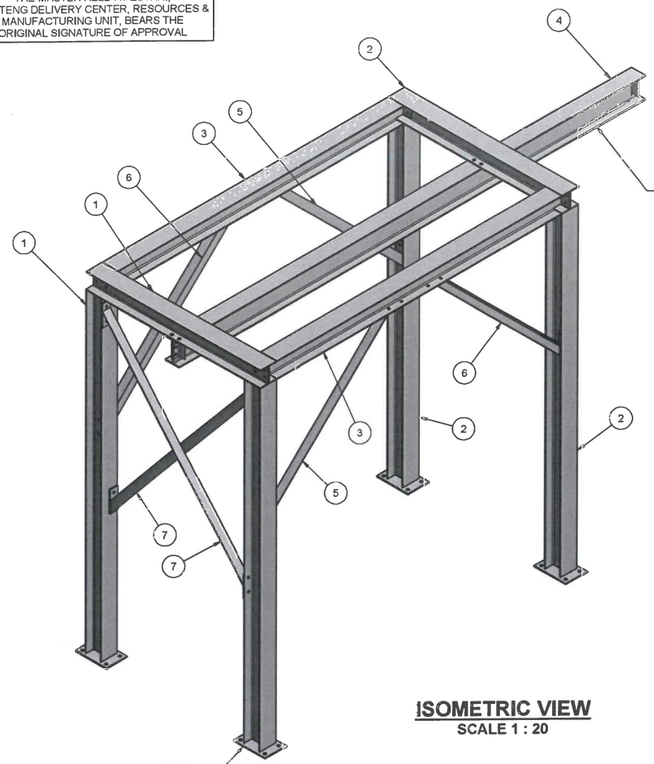
THE MASTER HELD AT ZUTARI, GAUTENG DELIVERY CENTER, RESOURCES & MANUFACTURING UNIT, BEARS THE ORIGINAL SIGNATURE OF APPROVAL

PARTS LIST		
ITEM	QTY	DESCRIPTION
1	1	END FRAME (BACK)
2	1	END FRAME (FRONT)
3	2	SUPPORT BEAM
4	1	GANTRY BEAM WITH END STOPS
5	2	ANGLE BRACE (RH)
6	2	ANGLE BRACE (LH)
7	2	END BRACE

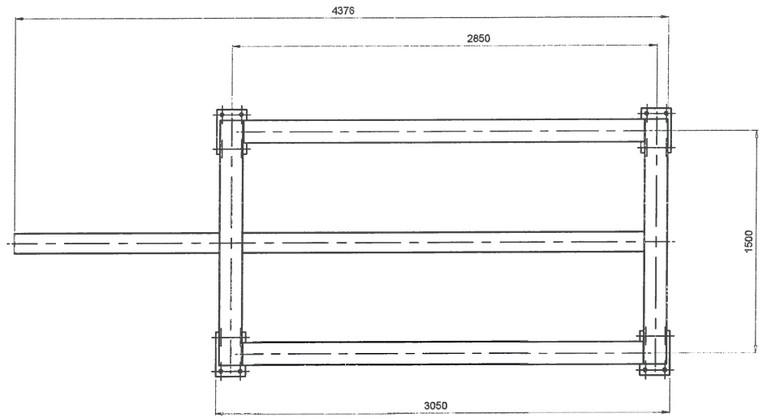
TOTAL MASS 720.108 kg

NOTES:

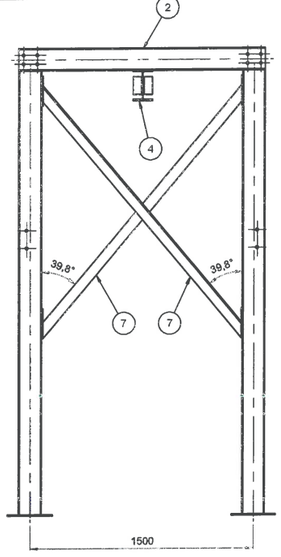
1. ALL WELDS TO BE 6 OR 6
2. REMOVE ALL SHARP EDGES AND BURS.
3. HOT DIP GALVANIZE AFTER MANUFACTURING.
4. STEEL TO SANS 1431 GR 350 WA



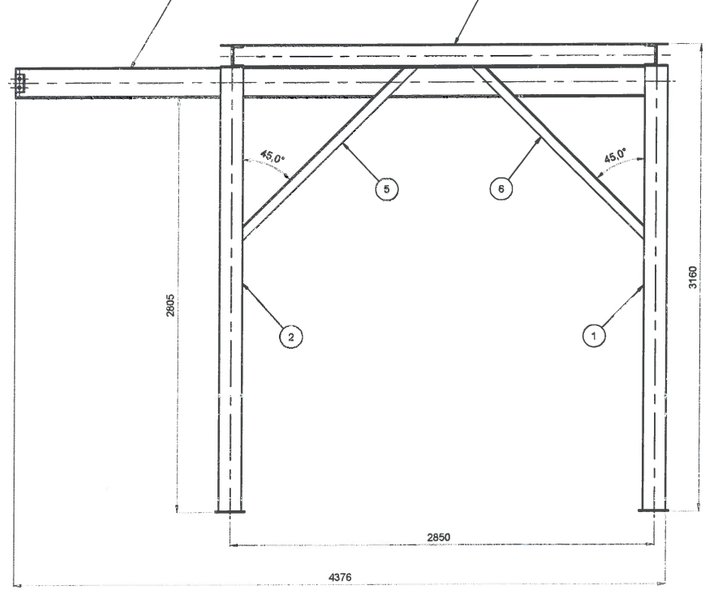
ISOMETRIC VIEW
SCALE 1 : 20



PLAN VIEW
SCALE 1 : 20

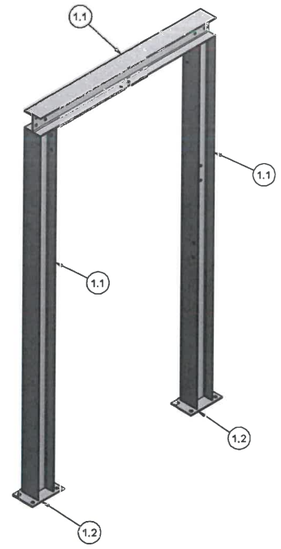


REAR ELEVATION
SCALE 1 : 20

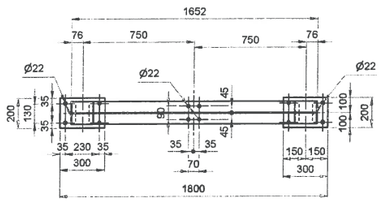


SIDE ELEVATION
SCALE 1 : 20

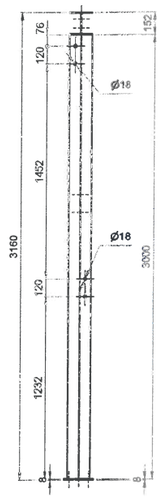
PARTS LIST		
ITEM	QTY	DESCRIPTION
1.1	7652.400 mm	H-BEAM 152 x 152 x 23 kg/m
1.2	2	PLATE 300 x 200 x 8 mm THK



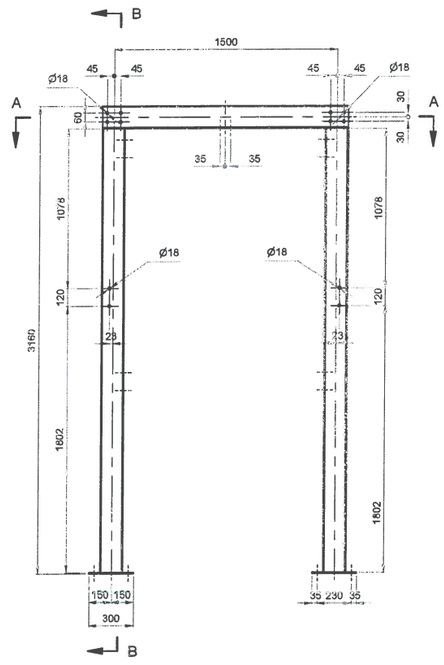
ISOMETRIC VIEW ITEM 1
SCALE 1:20



SECTION A-A
SCALE 1:20



SECTION B-B
SCALE 1:20



FRONT ELEVATION
SCALE 1:20

AS BUILT DRAWINGS
ZUTARI
31/05/2021

This AS BUILT drawing has been prepared based on information provided by the contractor. The levels and coordinates have not been independently checked or verified by Zutari.

REFERENCE DRAWINGS	
KPSX-EP-16260-DRG-WW-DE-0111-01	PCD 4 - LEAK DETECTION SUMP 1 - STRUCTURAL DETAILS
DRAWING NO.	TITLE

REFERENCE DRAWINGS	
KPSX-EP-16260-DRG-WW-DE-0472-01	PCD 3 - LEAK DETECTION SUMP 2 - STRUCTURAL DETAILS
KPSX-EP-16260-DRG-WW-DE-0372-01	PCD 2 - LEAK DETECTION SUMP 2 - STRUCTURAL DETAILS
KPSX-EP-16260-DRG-WW-DE-0471-01	PCD 3 - LEAK DETECTION SUMP 1 - STRUCTURAL DETAILS
KPSX-EP-16260-DRG-WW-DE-0371-01	PCD 2 - LEAK DETECTION SUMP 1 - STRUCTURAL DETAILS
KPSX-EP-16260-DRG-WW-DE-0272-01	PCD 1 - LEAK DETECTION SUMP 2 - STRUCTURAL DETAILS
KPSX-EP-16260-DRG-WW-DE-0271-01	PCD 1 - LEAK DETECTION SUMP 1 - STRUCTURAL DETAILS
KPSX-EP-11000-DRG-SS-GE-0007-01	STRUCTURAL STEELWORK - MONORAIL DETAILS
KPSX-EP-11000-DRG-SS-GE-0005-01	STRUCTURAL CONCRETE - HOLDING DOWN BOTLS
KPSX-EP-11000-DRG-SS-GE-0001-01	STRUCTURAL STEELWORK - STANDARD STEELWORK NOTES
DRAWING NO.	TITLE

ZUTARI PROFESSIONAL ENGINEER		
NAME	VICTOR WENTZEL	DATE
PROF. REG. No.	20130173	
SIGNATURE		21/05/2021
SOUTH 32 PROFESSIONAL APPROVAL		
NAME	SIGN.	DATE
CLIENT PROJECT MANAGER		
CLIENT ENGINEERING MANAGER		
ADDITIONAL SIGNATORY		
ZUTARI PROJECT No.	113452	
CLIENT CONTRACT No.	8500084829	

REV.	I.T.	DESCRIPTION	DRWN.	DES.	CHK.	APR.	DATE
-	F	AS BUILT DRAWING	G.W.	C.R.	V.W.	J.L.	23.02.21

I.T. ISSUE TYPE: (A) FOR REVIEW (SQ) (B) INTERNAL PEER REVIEW (C) FOR APPROVAL (CR) (D) FOR CONSTRUCTION (E) FOR INFORMATION (F) AS-BUILT (G) CANCELLED

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SOUTH32
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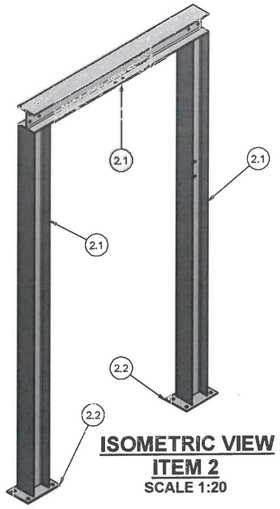
KLIPSPRUIT EXTENSION (KPSX)

AREA: POLLUTION CONTROL DAMS
ELEMENT: SUBSOIL DRAINAGE AND LEAK DETECTION
TITLE: GANTRY DETAILS

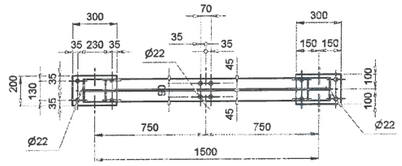
SCALE:	SHEET SIZE	Drawing Number	SHEET No.	REV.
AS SHOWN	(A1)	KPSX-EP-16260-DRG-WW-DE-0115-01	1 OF 2	*

THE MASTER HELD AT ZUTARI, GAUTENG DELIVERY CENTER, RESOURCES & MANUFACTURING UNIT, BEARS THE ORIGINAL SIGNATURE OF APPROVAL

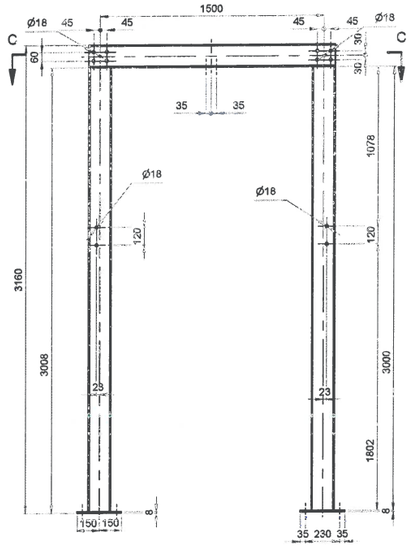
PARTS LIST		
ITEM	QTY	DESCRIPTION
2.1	7652.400 mm	H-BEAM 152 x 152 x 23 kg/m
2.2	2	PLATE 300 x 200 x 8 mm THK



ISOMETRIC VIEW
ITEM 2
SCALE 1:20

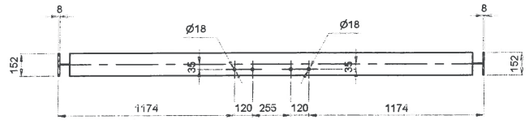


SECTION C-C
SCALE 1:20

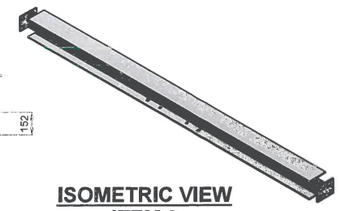


FRONT ELEVATION
SCALE 1:20

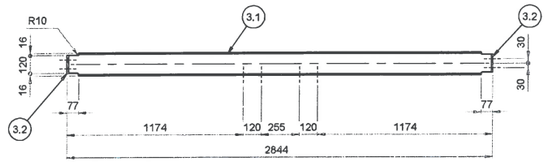
PARTS LIST		
ITEM	QTY	DESCRIPTION
3.1	3300.000 mm	H-BEAM 152 x 152 x 23 kg/m
3.2	2	PLATE 152 x 120 x 8 mm THK



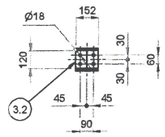
BOTTOM VIEW
SCALE 1:20



ISOMETRIC VIEW
ITEM 3
SCALE 1:20



FRONT VIEW
SCALE 1:20

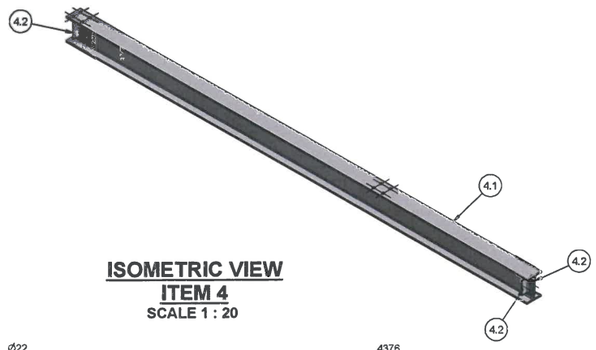


SIDE VIEW
SCALE 1:20

NOTES:

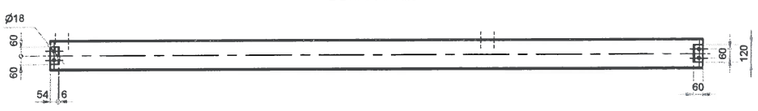
1. ALL WELDS TO BE 6 OR 6
2. REMOVE ALL SHARP EDGES AND BURS.
3. HOT DIP GALVANIZE AFTER MANUFACTURING.
4. STEEL TO SANS 1431 GR 350 WA

PARTS LIST		
ITEM	QTY	DESCRIPTION
4.1	4376.200 mm	I-BEAM 203 x 133 x 31 kg/m
4.2	480.000 mm	ANGLE 60 x 60 x 6 mm

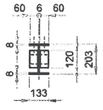


ISOMETRIC VIEW
ITEM 4
SCALE 1 : 20

PLAN VIEW
SCALE 1 : 20

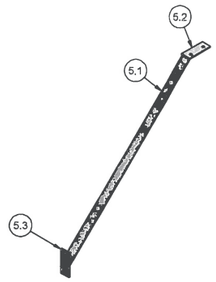


FRONT VIEW
SCALE 1 : 20

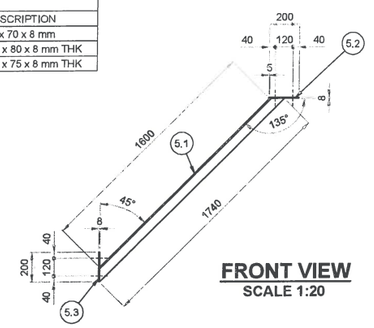


SIDE VIEW
SCALE 1 : 20

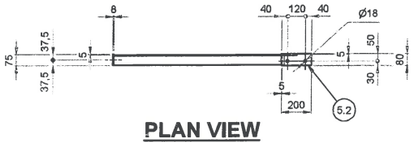
PARTS LIST		
ITEM	QTY	DESCRIPTION
5.1	1740.116 mm	ANGLE 70 x 70 x 8 mm
5.2	1	PLATE 200 x 80 x 8 mm THK
5.3	1	PLATE 200 x 75 x 8 mm THK



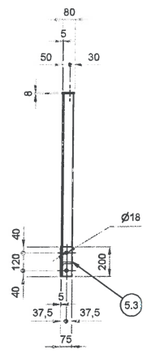
ISOMETRIC VIEW
ITEM 5
SCALE 1:20



FRONT VIEW
SCALE 1:20

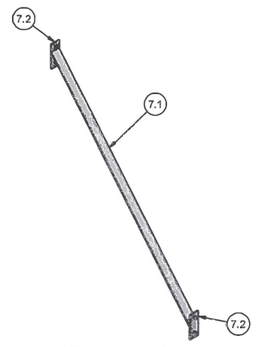


PLAN VIEW
SCALE 1:20

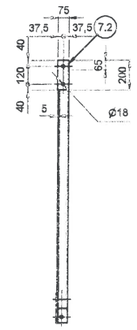


SIDE VIEW
SCALE 1:20

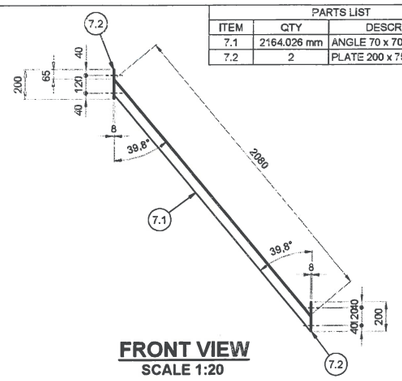
PARTS LIST		
ITEM	QTY	DESCRIPTION
7.1	2164.026 mm	ANGLE 70 x 70 x 8 mm
7.2	2	PLATE 200 x 75 x 8 mm THK



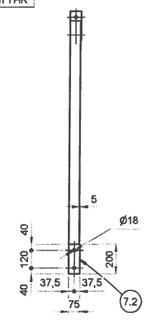
ISOMETRIC VIEW
ITEM 7
SCALE 1:20



SIDE VIEW
SCALE 1:20

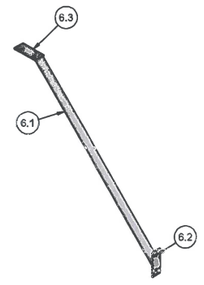


FRONT VIEW
SCALE 1:20

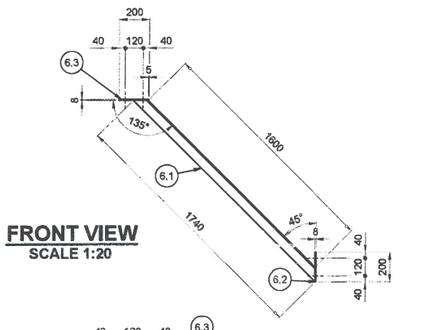


SIDE VIEW
SCALE 1:20

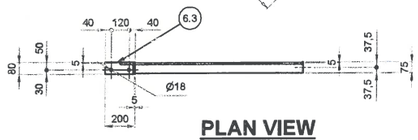
PARTS LIST		
ITEM	QTY	DESCRIPTION
6.1	1740.116 mm	ANGLE 70 x 70 x 8 mm
6.2	1	PLATE 200 x 75 x 8 mm THK
6.3	1	PLATE 200 x 80 x 8 mm THK



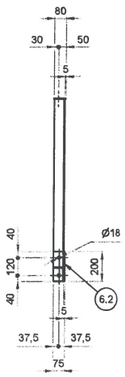
ISOMETRIC VIEW
ITEM 6
SCALE 1:20



FRONT VIEW
SCALE 1:20



PLAN VIEW
SCALE 1:20



SIDE VIEW
SCALE 1:20

AS BUILT DRAWINGS
ZUTARI
Prepared: For Client
21/05/2021 Date

This AS BUILT drawing has been prepared based on information provided by the contractor. The levels and coordinates have not been independently checked or verified by Zutari.

REFERENCE DRAWINGS	
KPSX-EP-16260-DRG-WW-DE-0111-01	PCD 4 - LEAK DETECTION SUMP - STRUCTURAL DETAILS
DRAWING NO.	TITLE

REFERENCE DRAWINGS	
KPSX-EP-16260-DRG-WW-DE-0372-01	PCD 2 - LEAK DETECTION SUMP 2 - STRUCTURAL DETAILS
KPSX-EP-16260-DRG-WW-DE-0472-01	PCD 3 - LEAK DETECTION SUMP 2 - STRUCTURAL DETAILS
KPSX-EP-16260-DRG-WW-DE-0471-01	PCD 3 - LEAK DETECTION SUMP 1 - STRUCTURAL DETAILS
KPSX-EP-16260-DRG-WW-DE-0371-01	PCD 2 - LEAK DETECTION SUMP 1 - STRUCTURAL DETAILS
KPSX-EP-16260-DRG-WW-DE-0272-01	PCD 1 - LEAK DETECTION SUMP 2 - STRUCTURAL DETAILS
KPSX-EP-16260-DRG-WW-DE-0271-01	PCD 1 - LEAK DETECTION SUMP 1 - STRUCTURAL DETAILS
KPSX-EP-11000-DRG-SS-GE-0007-01	STRUCTURAL STEELWORK - MONORAIL DETAILS
KPSX-EP-11000-DRG-SS-GE-0005-01	STRUCTURAL CONCRETE - HOLDING DOWN BOTLS
KPSX-EP-11000-DRG-SS-GE-0001-01	STRUCTURAL STEELWORK - STANDARD STEELWORK NOTES
DRAWING NO.	TITLE

ZUTARI PROFESSIONAL ENGINEER		
NAME	VICTOR WENTZEL	DATE
PROF. REG. No.	20130173	
SIGNATURE		21/05/2021
SOUTH 32 PROFESSIONAL APPROVAL		
NAME	SIGN.	DATE
CLIENT PROJECT MANAGER		
CLIENT ENGINEERING MANAGER		
ADDITIONAL SIGNATORY		
ZUTARI PROJECT No.	113452	
CLIENT CONTRACT No.	8500084829	

REV.	I.T.	DESCRIPTION	DRWN.	DES.	CHK.	APR.	DATE
*	F	AS BUILT DRAWING	G.W.	C.R.	V.W.	J.L.	23.02.21

I.T. ISSUE TYPE: (A) FOR REVIEW (SQ) (B) INTERNAL PEER REVIEW (C) FOR APPROVAL (CR) (D) FOR CONSTRUCTION (E) FOR INFORMATION (F) AS-BUILT (G) CANCELLED

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ZUTARI IMPACT. ENGINEERED.
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0081
Tel: +27 12 427 2000
E connect@zutari.com

SOUTH32

KLIPSPRUIT EXTENSION (KPSX)

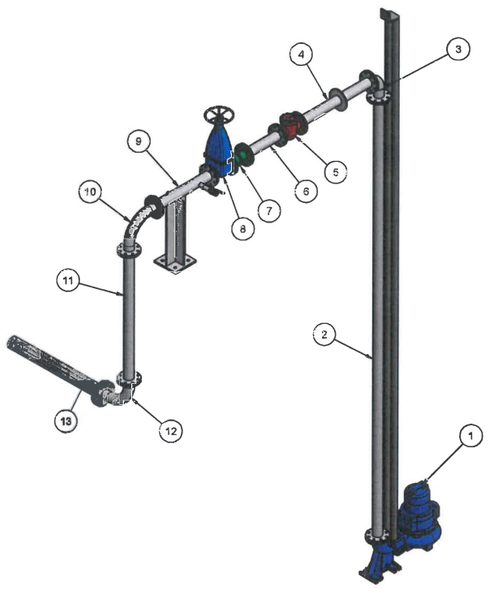
AREA: POLLUTION CONTROL DAMS
ELEMENT: SUBSOIL DRAINAGE AND LEAK DETECTION
TITLE: GANTRY DETAILS

SCALE:	SHEET SIZE	Drawing Number	SHEET No.	REV.
AS SHOWN	(A1)	KPSX-EP-16260-DRG-WW-DE-0115-02	2 OF 2	*

THE MASTER HELD AT ZUTARI, GAUTENG DELIVERY CENTER, RESOURCES & MANUFACTURING UNIT, BEARS THE ORIGINAL SIGNATURE OF APPROVAL

PUMP STATION GENERAL NOTES

1. ALL PIPEWORK IS INDICATIVE AND SHALL NOT BE MANUFACTURED FROM THIS DRAWING. THE CONTRACTOR IS RESPONSIBLE FOR THE DESIGN AND LAYOUT OF THE PIPEWORK, VALVES AND SPECIALS. THE CONTRACTOR SHALL SUBMIT HIS DESIGN CALCULATIONS AND SHOP DRAWINGS TO THE ENGINEER FOR APPROVAL BEFORE MANUFACTURING OR FABRICATION COMMENCES. THE DESIGN MUST BE IN ACCORDANCE WITH THE MECHANICAL SPECIFICATION.
2. THE LEVELS AND DIMENSIONS ARE BASED ON THE TOPOGRAPHIC SURVEY AND AVAILABLE INFORMATION AT THE DESIGN STAGE. THE CONTRACTOR SHALL ENSURE THAT ALL EXISTING SERVICES ARE SURVEYED. IF ANY DISCREPANCIES ARISE OR DESIGN CHANGES ARE REQUIRED; IT MUST IMMEDIATELY BE BROUGHT TO THE ATTENTION OF THE ENGINEER.
3. THE CONTRACTOR SHALL MAKE PROVISION FOR FITTINGS TO C&I CONNECTIONS.
4. ALL FLANGES AND FITTINGS BELOW GROUND SHALL BE COVERED WITH A VISCO-ELASTIC COATING (STOPAQ OR SIMILAR APPROVED) AND WRAPPED WITH PVC TAPE.
5. THE RESTRAINED FLANGE ADAPTORS AND FLANGES ON THE SUCTION AND DISCHARGE PIPEWORK SHALL MATCH THE PRESSURE CLASS AND DRILLING PATTERN OF THE PUMP SET.
6. ANY DISCREPANCIES BETWEEN THE DRAWINGS, SPECIFICATIONS AND BILL OF QUANTITIES MUST BE REPORTED IMMEDIATELY TO THE ENGINEER.
7. REFER TO MECHANICAL SPECIFICATION FOR CORROSION PROTECTION.
8. ALL VALVES TO BE PROVIDED WITH LOCK OUT MECHANISMS.
9. SPOOL PIECES WITHIN A STRUCTURE SHALL BE PROVIDED WITH APPROPRIATE LIFTING LUGS TO FIT LIFTING EQUIPMENT PROVIDED IN THE PUMP STATION.
10. INSULATION MATERIAL SHALL BE PLACED BETWEEN DISSIMILAR MATERIALS.

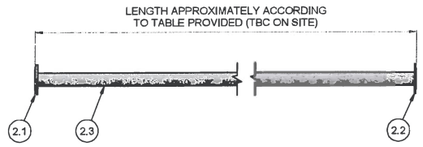


ISOMETRIC VIEW OF MECHANICAL ASSEMBLY
SCALE 1 : 25

PARTS LIST		
ITEM	QTY	DESCRIPTION
1	1	SUB-MERSIBLE PUMP, REFER TO TECHINCAL DATA SHEET FOR DETAILS
2	1	SPOOL PIECE DN 80 X 3.5 mm SANS 62; FLANGED ONE END SANS 1123 TABLE 1600/3 (RF) AND OTHER END FLANGED TO SUIT DRILLING OF PUMP DELIVERY FLANGE
3	1	DN 80 90 DEGREE LONG RADIUS ELBOW TO JIS B2311-82 WITH PIPE SPOOL; FLANGED BOTH ENDS SANS 1123 TABLE 1600/3 (RF)
4	1	SPOOL PIECE DN 80 X 3.5 mm SANS 62; FLANGED BOTH ENDS SANS 1123 TABLE 1600/3 (RF) WITH PUDDLE FLANGE
5	1	NON-RETURN SWING TYPE VALVE DN 80 PN 16; FLANGED SANS 1123 TABLE 1600/3 (RF)
6	1	SPOOL PIECE DN 80 X 3.5 mm SANS 62; FLANGED BOTH ENDS SANS 1123 TABLE 1600/3 (RF)
7	1	DISMANTLING JOINT DN 80 SANS 1123 TABLE 1600/3 (RF)
8	1	GATE VALVE DN 80 PN 16; SANS 664 RISING SPINDLE - SHORT PATTERN; FLANGED SANS 1123 TABLE 1600/3 (RF)
9	1	SPOOL PIECE WITH PIPE SUPPORT (650 mm HIGH) DN 80 X 3.5 mm SANS 62; FLANGED BOTH ENDS SANS 1123 TABLE 1600/3 (RF), INCLUDING DN 25 BALL VALVE AND SOCKET ASSEMBLY
10	1	LONG RADIUS BEND (3D); 90 DEGREE DN 80 X 3.5 mm SANS 62; FLANGED SANS 1123 TABLE 1600/3 (RF); REFER TO TYPICAL FITTING DETAILS
11	1	SPOOL PIECE DN 80 X 3.5 mm SANS 62; FLANGED BOTH ENDS SANS 1123 TABLE 1600/3 (RF)
12	1	LONG RADIUS BEND (3D); 90 DEGREE DN 80 X 3.5 mm SANS 62; FLANGED DN 80 SANS 1123 TABLE 1600/3 (RF) ONE END AND FLANGED DN 100 SANS 1123 TABLE 1600/3 (RF) MACHINED TO FIT DN 80 STEEL PIPE OTHER END; REFER TO TYPICAL FITTING DETAILS
13	1	DN 110 HDPE TO DN 80 STEEL CONNECTION, REFER TO TYPICAL DETAIL: KPSX-EP-16200-DRG-WW-DE-0103-01

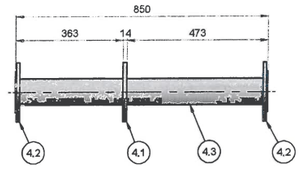
PARTS LIST		
ITEM	QTY	DESCRIPTION
2.1	1	FLANGE DN 80 PN 16 WITH DRILLING PATTERN TO MATCH THE DELIVERY FLANGE OF THE PUMP
2.2	1	FLANGE DN 80 SANS 1123 TABLE 1600/3 (RF)
2.3	VARIES	STEEL PIPE DN 80 X 3.5 mm SANS 62

LIST OF PIPE LENGTHS	
LOCATION	PIPE LENGTH
PCD 1 SUMP A	4545.15 mm
PCD 1 SUMP B	3235.15 mm
PCD 2 SUMP A	2335.15 mm
PCD 2 SUMP B	2835.15 mm
PCD 3 SUMP A	2535.15 mm
PCD 3 SUMP B	2535.15 mm
PCD 4 SUMP	5295.15 mm
PCD SOUTH SUMP	5605.15 mm



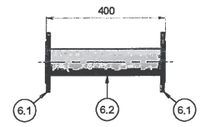
ITEM 2
SCALE 1 : 20

PARTS LIST		
ITEM	QTY	DESCRIPTION
4.1	1	PUDDLE FLANGE DN 100, OD 220 mm, THICKNESS 14 mm
4.2	2	FLANGE DN 80 SANS 1123 TABLE 1600/3 (RF)
4.3	850.000 mm	STEEL PIPE DN 80 X 3.5 mm SANS 62



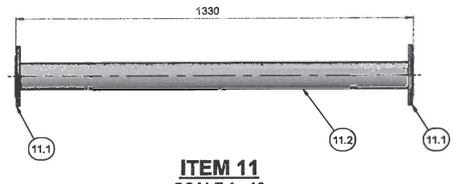
ITEM 4
SCALE 1 : 10

PARTS LIST		
ITEM	QTY	DESCRIPTION
6.1	2	FLANGE DN 80 SANS 1123 TABLE 1600/3 (RF)
6.2	400.000 mm	STEEL PIPE DN 80 X 3.5 mm SANS 62



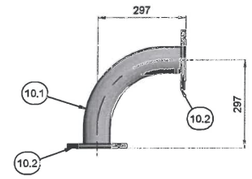
ITEM 6
SCALE 1 : 10

PARTS LIST		
ITEM	QTY	DESCRIPTION
11.1	2	FLANGE DN 80 SANS 1123 TABLE 1600/3 (RF)
11.2	1330.450 mm	STEEL PIPE DN 80 X 3.5 mm SANS 62



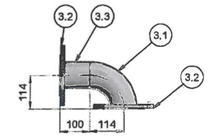
ITEM 11
SCALE 1 : 10

PARTS LIST		
ITEM	QTY	DESCRIPTION
10.1	1	LONG RADIUS BEND (3 D); 90 DEGREE DN 80 X 3.5 MM SANS 62
10.2	2	FLANGE DN 80 SANS 1123 TABLE 1600/3 (RF)



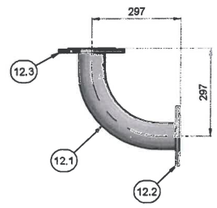
ITEM 10
SCALE 1 : 10

PARTS LIST		
ITEM	QTY	DESCRIPTION
3.1	1	DN 80 ELBOW 90° LONG RADIUS WALL THK 4.2mm TO JIS B2311-82
3.2	2	FLANGE DN 80 SANS 1123 TABLE 1600/3 (RF)
3.3	100.000 mm	STEEL PIPE DN 80 X 3.5 mm SANS 62



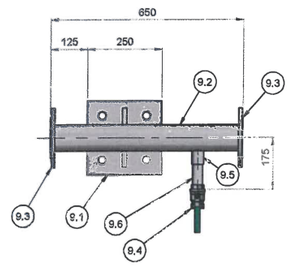
ITEM 3
SCALE 1 : 10

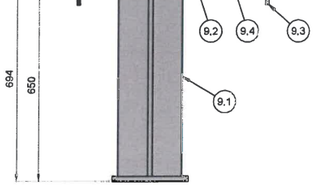
PARTS LIST		
ITEM	QTY	DESCRIPTION
12.1	1	LONG RADIUS BEND (3 D); 90 DEGREE DN 80 X 3.5 mm SANS 62
12.2	1	FLANGE DN 80 SANS 1123 TABLE 1600/3 (RF)
12.3	1	BLIND FLANGE DN 100 SANS 1123 TABLE 1600/3 (RF) MACHINED TO FIT DN 80 STEEL PIPE (OD)



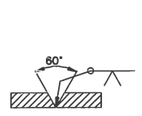
ITEM 12
SCALE 1 : 10

PARTS LIST		
ITEM	QTY	DESCRIPTION
9.1	1	PIPE SUPPORT SINGLE DN 100, MANUFACTURED
9.2	650.000 mm	STEEL PIPE DN 80 X 3.5 mm SANS 62
9.3	2	FLANGE DN 80 SANS 1123 TABLE 1600/3 (RF)
9.4	1	BALL VALVE DN 25 PN 16 TREADED ISO 7 (RP)
9.5	1	STANDARD SOCKET DN 25 WELDED TO DN100 PIPE WITH PIPE THREAD ISO 7 (RP) OTHER SIDE
9.6	100.000 mm	STEEL PIPE DN 25 X 2.8 mm SANS 62 THREADED BOTH ENDS ISO 7 (R)

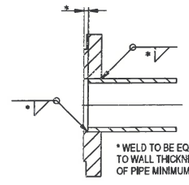




ITEM 9
SCALE 1 : 10



TYPICAL BUTT PIPE WELD
EQUAL WALL THICKNESS



* WELD TO BE EQUAL TO WALL THICKNESS OF PIPE MINIMUM 5mm

TYPICAL FLANGE WELD

REFERENCE DRAWINGS	
KPSX-EP-16260-DRG-WW-LY-0122-01	PCD 4 - EMERGENCY SPILLWAY AND LEAK DETECTION SUMP
KPSX-EP-16260-DRG-WW-LY-0422-01	PCD 3 - LEAK DETECTION SUMP AND PIPELINE
DRAWING NO.	TITLE

REFERENCE DRAWINGS	
KPSX-EP-16260-DRG-WW-LY-0322-01	PCD 2 - LEAK DETECTION SUMP AND PIPELINE
KPSX-EP-16260-DRG-WW-LY-0222-01	PCD 1 - LEAK DETECTION SUMP AND PIPELINE
KPSX-EP-16260-DRG-WW-DE-0111-01	PCD 4 - LEAK DETECTION SUMP - LAYOUT, SECTIONS AND DETAILS
KPSX-EP-16260-DRG-WW-DE-0472-01	PCD 3 - LEAK DETECTION SUMP B - LAYOUT, SECTIONS AND DETAILS
KPSX-EP-16260-DRG-WW-DE-0471-01	PCD 3 - LEAK DETECTION SUMP A - LAYOUT, SECTIONS AND DETAILS
KPSX-EP-16260-DRG-WW-DE-0372-01	PCD 2 - LEAK DETECTION SUMP B - LAYOUT, SECTIONS AND DETAILS
KPSX-EP-16260-DRG-WW-DE-0371-01	PCD 2 - LEAK DETECTION SUMP A - LAYOUT, SECTIONS AND DETAILS
KPSX-EP-16260-DRG-WW-DE-0272-01	PCD 1 - LEAK DETECTION SUMP B - LAYOUT, SECTIONS AND DETAILS
KPSX-EP-16260-DRG-WW-DE-0271-01	PCD 1 - LEAK DETECTION SUMP A - LAYOUT, SECTIONS AND DETAILS
DRAWING NO.	TITLE

ZUTARI PROFESSIONAL ENGINEER

NAME	VICTOR WENTZEL	DATE
PROF. REG. No.	20130173	
SIGNATURE		31/05/2021

SOUTH 32 PROFESSIONAL APPROVAL

NAME	SIGN.	DATE
CLIENT PROJECT MANAGER		
CLIENT ENGINEERING MANAGER		
ADDITIONAL SIGNATORY		
ZUTARI PROJECT No.	113452	
CLIENT CONTRACT No.	8500084829	

REV.	I.T.	DESCRIPTION	DRWN.	DES.	CHK.	APR.	DATE
*	F	AS BUILT DRAWING	G.W.	C.R.	C.N.	V.W.	23.02.21

I.T. ISSUE TYPE: (A) FOR REVIEW (SQ) (B) INTERNAL PEER REVIEW (C) FOR APPROVAL (CR) (D) FOR CONSTRUCTION (E) FOR INFORMATION (F) AS-BUILT (G) CANCELLED

AS BUILT DRAWINGS
ZUTARI
Pre-Con Engineer | Pre-Start
31/05/2021 Date

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SOUTH32

ZUTARI IMPACT. ENGINEERED.
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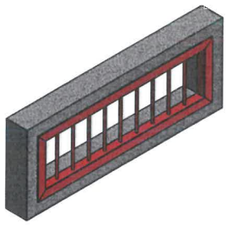
Tel: +27 12 427 2000
E connect@zutari.com

KLIPSPRUIT EXTENSION (KPSX)

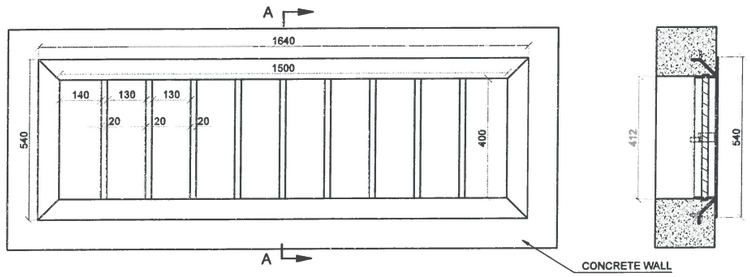
AREA: POLLUTION CONTROL DAMS
ELEMENT: SUBSOIL DRAINAGE AND LEAK DETECTION
TITLE: MECHANICAL DETAILS

SCALE:	SHEET SIZE	Drawing Number	SHEET No.	REV.
AS SHOWN	(A1)	KPSX-EP-16260-DRG-WW-DE-0116-01	1 OF 1	*

THE MASTER HELD AT ZUTARI, GAUTENG DELIVERY CENTER, RESOURCES & MANUFACTURING UNIT, BEARS THE ORIGINAL SIGNATURE OF APPROVAL

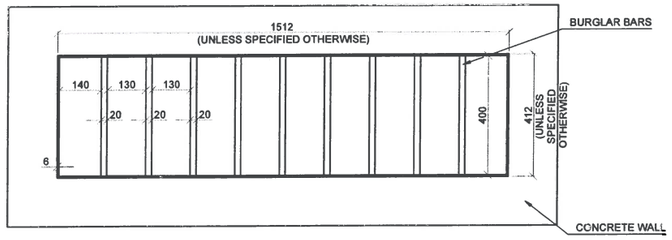


ISOMETRIC VIEW
SCALE 1:20

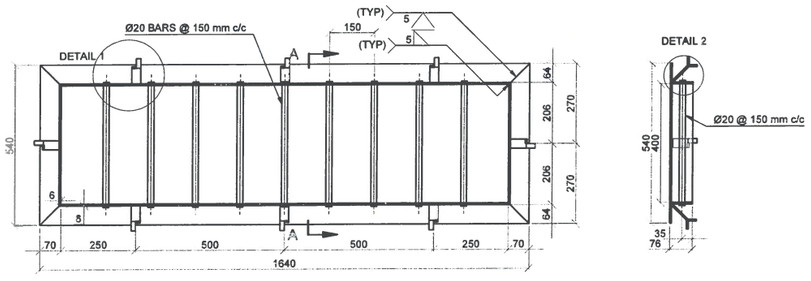


FRONT VIEW: BURGLAR BARS
SCALE 1:10

SECTION A-A
SCALE 1:10

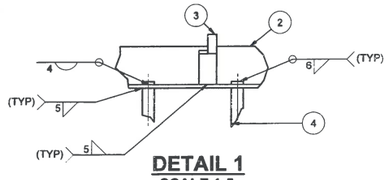


BACK VIEW: BURGLAR BARS
SCALE 1:10

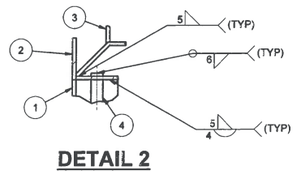


BURGLAR BARS
SCALE 1:10

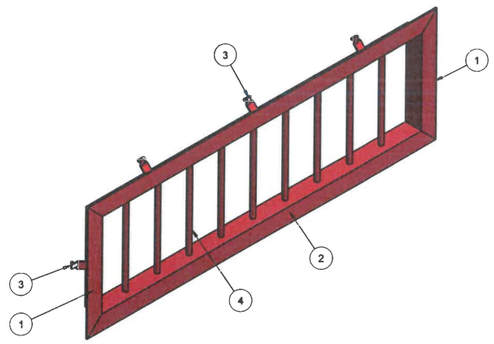
SECTION A-A
SCALE 1:10



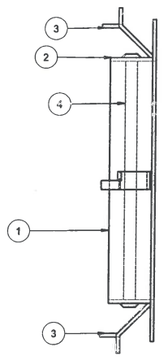
DETAIL 1
SCALE 1:5



DETAIL 2
SCALE 1:5

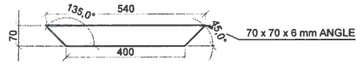


ISOMETRIC VIEW: BURGLAR BAR
SCALE 1:10

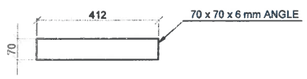


SIDE VIEW: BURGLAR BAR
SCALE 1:5

PARTS LIST		
ITEM	QTY	DESCRIPTION
1	2	70 x 70 x 6 mm ANGLE (EQUAL LEG)
2	2	70 x 70 x 6 mm ANGLE (EQUAL LEG)
3	10	FISH TAIL (TO BE CAST INTO CONCRETE)
4	9	DIA 20 mm STEEL BAR

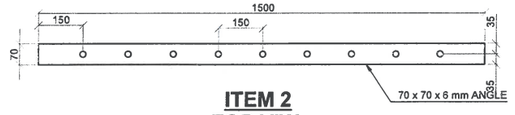


ITEM 1
FRONT VIEW
SCALE 1:10

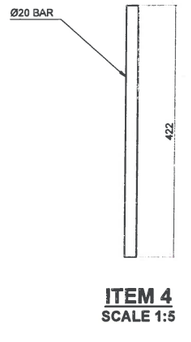


ITEM 1
TOP VIEW
SCALE 1:10

ITEM 2
FRONT VIEW
SCALE 1:10



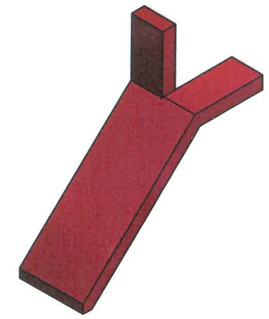
ITEM 2
TOP VIW
SCALE 1:10



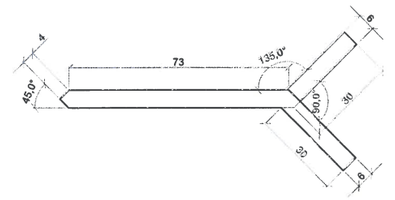
ITEM 4
SCALE 1:5

NOTES:

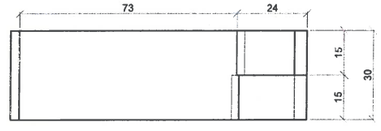
1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE SHOWN.
2. DIMENSIONS OF CONCRETE SUPPORT WORK SHALL BE CONFIRMED BY THE CONTRACTOR BEFORE CONSTRUCTION.
3. THE CONTRACTOR SHALL PRODUCE WORKSHOP DRAWINGS FOR APPROVAL.
4. ALL STEEL TO BE HOT DIP GALVANIZED MILD STEEL.



ITEM 3
SCALE 1:1



FRONT VIEW: ITEM 3
SCALE 1:1



PLAN VIEW: ITEM 3
SCALE 1:1

ZUTARI
IMPACT. ENGINEERED.
APPROVED PROFESSIONAL PERSON
DAM ENGINEERS
A.G. CHEMALY
870130
Signature
Date: 2021-03-31

AS BUILT DRAWINGS
ZUTARI
IMPACT. ENGINEERED.
For Zutari
For Client
Date: 31/3/21 Date:

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REFERENCE DRAWINGS		REFERENCE DRAWINGS	
DRAWING NO.	TITLE	DRAWING NO.	TITLE
		KPSX-EP-11000-DRG-SS-GE-0001-01	STRUCTURAL STEELWORK TYPICAL BASE PLATE DETAILS

ZUTARI PROFESSIONAL ENGINEER		
NAME	VICTOR WENTZEL	DATE
PROF. REG. No.	20130178	
SIGNATURE		31/3/21

SOUTH 32 PROFESSIONAL APPROVAL		
NAME	SIGN.	DATE
CLIENT PROJECT MANAGER		
CLIENT ENGINEERING MANAGER		
ADDITIONAL SIGNATORY		
ZUTARI PROJECT No.	113452	
CLIENT CONTRACT No.	8500084829	

REV.	I.T.	DESCRIPTION	DRWN.	DES.	CHK.	APR.	DATE
-	F	AS-BUILT DRAWING	M.O.T.	M.O.T.	C.N.	V.W.	16/03/2021

I.T. ISSUE TYPE: (A) FOR REVIEW (SQ) (B) INTERNAL PEER REVIEW (C) FOR APPROVAL (CR) (D) FOR CONSTRUCTION (E) FOR INFORMATION (F) AS-BUILT (G) CANCELLED

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ZUTARI IMPACT. ENGINEERED.
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SOUTH32

KLIPSPRUIT EXTENSION (KPSX)

AREA: WATER MANAGEMENT
ELEMENT: TYPICAL DETAIL
TITLE: BURGLAR BAR

SCALE:	SHEET SIZE	Drawing Number	SHEET No.	REV.
AS SHOWN	(A1)	KPSX-EP-16200-DRG-WW-DE-0113-01	1 OF 1	*

THE MASTER HELD AT ZUTARI, GAUTENG DELIVERY CENTRE, RESOURCES & MANUFACTURING UNIT, BEARS THE ORIGINAL SIGNATURE OF APPROVAL

LEGEND:

HDPE FLEXIBLE SLOTTED OR PERFORATED PIPES: DN 110 ----------

uPVC-L CLASS 34 SOLID WALL (SANS 791): DN 160 ▬▬

NOTE:

1. PERFORATED PIPE TO BE LAID ON DRAINAGE BEDDING
2. SOLID WALL PIPES TO BE LAID ON A FLEXIBLE BEDDING UNLESS SPECIFIED OTHERWISE
3. WATER QUALITY IN THE LEAK DETECTION SUMP SHOULD BE MONITORED FOR LEAK DETECTION
4. UPVC PIPE CAST INTO CONCRETE WALL OF LEAK DETECTION SUMP, SEE DRAWING KPSX-EP-16260-DRG-WW-DE-0111
5. REFER TO DRAWING KPSX-EP-16260-DRG-WW-DE-0101 FOR TYPICAL PIPE CONNECTION DETAILS

SETTING OUT CO-ORDINATES WGS 84 HARTBEESHOEK LO29

POINTS	X	Y	Z
P1	2876055.589	-5887.524	1545.414
P2	2876037.354	-5879.822	1545.258
P3	2876028.227	-5875.967	1545.182
P4	2876010.769	-5868.594	1545.038
P5	2876002.705	-5865.188	1544.962
P6	2875984.224	-5857.382	1544.816
P7	2875977.158	-5854.398	1544.742
P8	2875957.692	-5846.176	1544.597
P9	2875951.665	-5843.631	1544.523
P10	2875931.343	-5835.048	1544.377
P11	2875926.002	-5832.792	1544.302
P12	2875905.174	-5823.995	1544.157
P13	2875900.539	-5822.038	1544.083
P14	2875877.053	-5812.118	1543.902
P15	2875859.630	-5819.115	1543.757
P16	2876047.887	-5905.752	1545.397
P17	2876026.786	-5908.039	1545.252
P18	2875999.809	-5896.003	1545.022
P19	2875973.041	-5883.977	1544.794
P20	2875947.113	-5872.371	1544.566
P21	2875919.864	-5860.173	1544.339
P22	2875891.390	-5847.426	1544.093
P23	2875886.970	-5836.494	1543.852
P24	2876067.068	-5860.187	1545.394
P25	2876041.914	-5849.277	1545.173
P26	2876015.563	-5838.803	1544.952
P27	2875989.309	-5828.345	1544.732
P28	2875962.823	-5817.841	1544.510
P29	2875936.571	-5807.407	1544.290
P30	2875912.328	-5797.787	1543.997
P31	2875866.262	-5779.459	1543.785
P32	2875884.901	-5786.877	1543.859
P33	2875849.105	-5823.396	1543.667
P34	2875800.532	-5843.206	1543.258
P35	2875796.738	-5841.608	1543.226

AS BUILT DRAWINGS
ZUTARI
Date: 27/5/21 For Client: Date:

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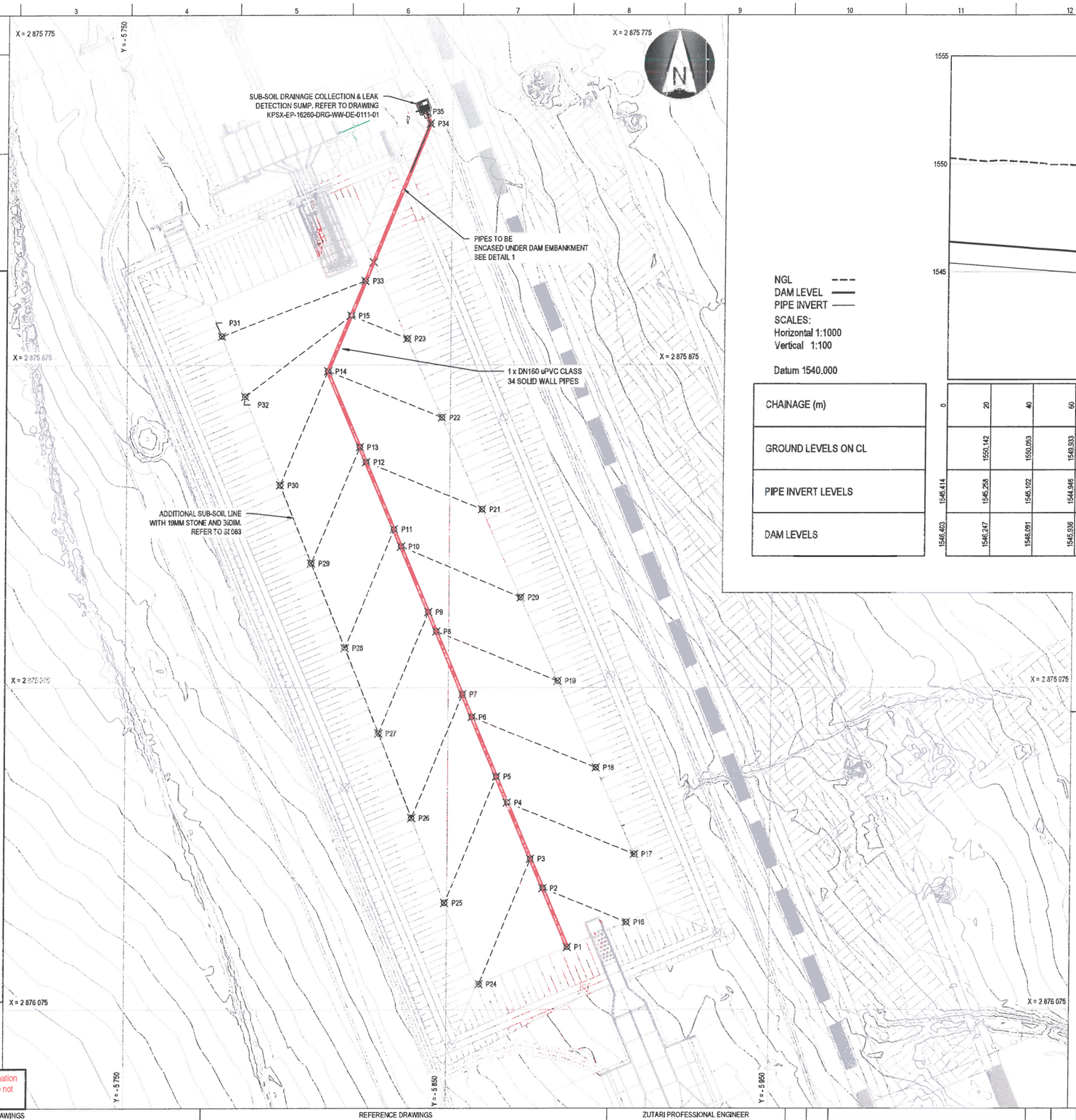
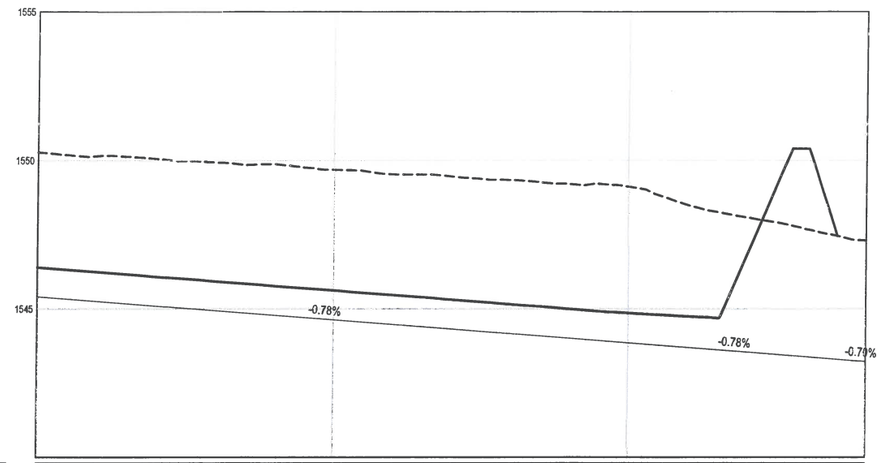




NGL - - -
DAM LEVEL ——
PIPE INVERT ——
SCALES:
Horizontal 1:1000
Vertical 1:100

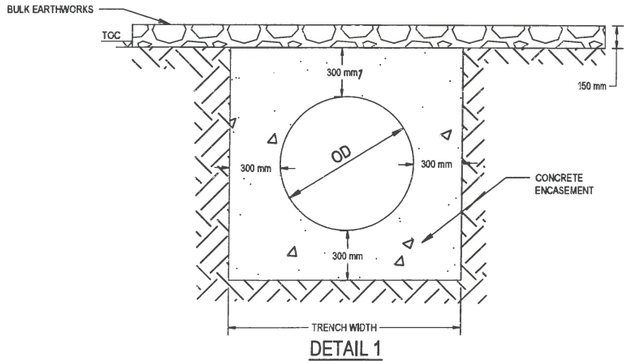
Datum 1540.000

CHAINAGE (m)	0	20	40	60	80	100		120	140	160	180	200	220	240	260	280	281
GROUND LEVELS ON CL		1550.142	1550.053	1549.933	1549.875	1549.684	1549.673	1549.528	1549.460	1549.337	1549.201	1549.110	1549.013	1548.488	1548.071	1547.666	1547.301	
PIPE INVERT LEVELS	1545.414	1545.258	1545.102	1544.946	1544.790	1544.634		1544.478	1544.322	1544.166	1544.010	1543.902	1543.854	1543.698	1543.542	1543.386	1543.258	1543.233	1543.229
DAM LEVELS	1546.403	1546.247	1546.091	1545.936	1545.780	1545.625		1545.469	1545.314	1545.158	1545.003	1544.861		1544.752	1546.969	1550.400			

SUBSOIL DRAINAGE MAIN PIPE FROM 0.00 TO 281.00

NOTE:

1. TOP OF CONCRETE TO BE BELOW EXCAVATION LEVEL
2. IF THE TOP OF CONCRETE IS NOT AT LEAST 150 mm BELOW THE BULK EARTHWORKS EXCAVATION LINE THE EARTHWORKS FOR THE EMBANKMENT SHOULD BE COMPLETED TO A MINIMUM HEIGHT OF 150 mm ABOVE TOP OF CONCRETE BEFORE TRENCH EXCAVATION COMMENCES.
3. CONCRETE FOR ENCASEMENT TO BE CAST AGAINST EXCAVATED TRENCH FACE.



DETAIL 1
N.T.S.

REFERENCE DRAWINGS		REFERENCE DRAWINGS	
		KPSX-FS-16260-DRG-WW-LY-0102	PCD4 BULK EARTHWORKS EMBANKMENT LAYOUT
		KPSX-FS-16260-DRG-WW-DE-0101-01	SUBSOIL DRAINAGE TYPICAL DETAILS
		KPSX-FS-16260-DRG-WW-DE-0111-01	PCD4 SUBSOIL DRAINAGE AND LEAK DETECTION COLLECTION SUMP
		KPSX-FS-16260-DRG-WW-SE-0122-01	SUBSOIL DRAINAGE AND LEAK DETECTION COLLECTION LONG SECTIONS
		KPSX-FS-16260-DRG-WW-DE-0101	BEDDING DETAILS
DRAWING NO.	TITLE	DRAWING NO.	TITLE

ZUTARI PROFESSIONAL ENGINEER
NAME: VICTOR WENTZEL DATE:
PROF.REG.No. 20130173
SIGNATURE: 27/5/21
SOUTH 32 PROFESSIONAL APPROVAL
NAME: SIGN: DATE:
CLIENT PROJECT MANAGER
CLIENT ENGINEERING MANAGER
ADDITIONAL SIGNATORY
ZUTARI PROJECT No. 113452
CLIENT CONTRACT No. 8500084829

REV.	I.T.	DESCRIPTION	DRWN.	DES.	CHK.	APR.	DATE
*	F	AS-BUILT DRAWING	Y.P.	Y.P.	V.W.	A.C.	19/03/2019

I.T. ISSUE TYPE: (A) FOR REVIEW (SQ) (B) INTERNAL PEER REVIEW (C) FOR APPROVAL (CR) (D) FOR CONSTRUCTION (E) FOR INFORMATION (F) AS-BUILT (G) CANCELED

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SOUTH32

KLIPSPRUIT EXTENSION (KPSX)

AREA: PCD 4
ELEMENT: SUBSOIL DRAINAGE AND LEAK DETECTION
TITLE: SUBSOIL DRAINAGE LAYOUT

SCALE:	SHEET SIZE	DRAWING NUMBER	SHEET No.	REV.
1:750	(A1)	KPSX-EP-16260-DRG-WW-LY-0103-01	1 OF 1	*

PROJECT No: 16260

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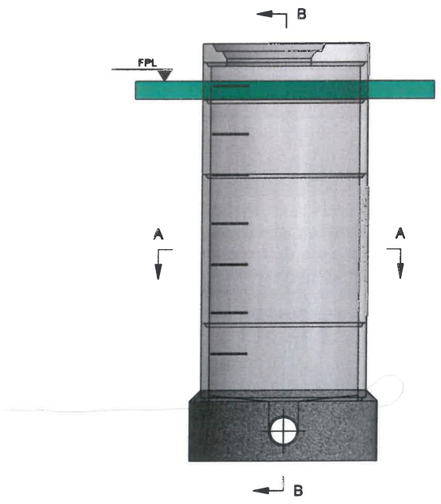
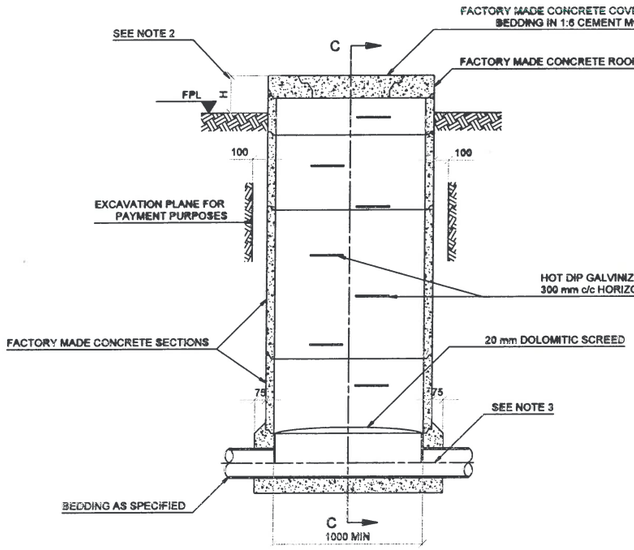
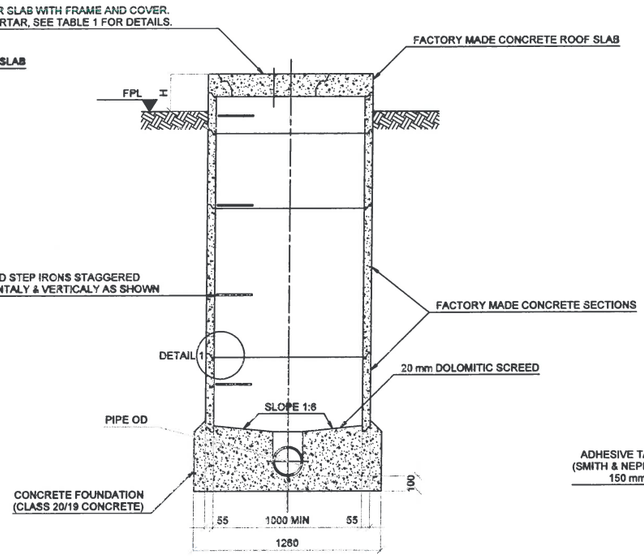


SINGLE PIPE
SCALE 1:20



SECTION B-B
SCALE 1:20

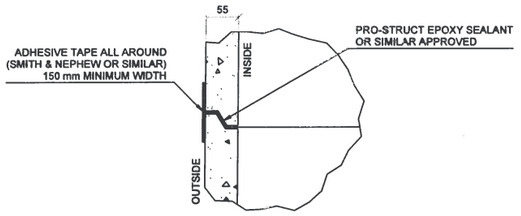


SECTION C-C
SCALE 1:20

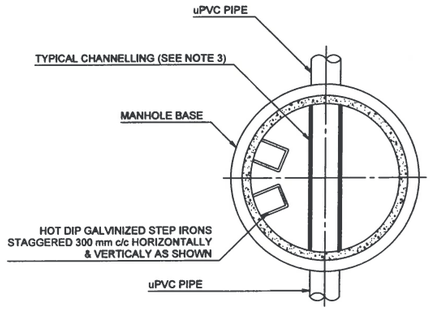
NOTES:

1. CONCRETE FOR MANHOLES MUST BE OF DOLIMITIC ORIGIN
2. TYPICAL VALUES FOR H.
   H = 0 IN CARRIAGE WAY
   = 50 - 75 mm ON BUILDING AREAS AROUND TRAFFICABLE AREAS AS SPECIFIED ON THE DESIGN DRAWINGS.
   = 250 mm ON BUILDING TERRACES, DAM EMBANKMENTS AND UNDEFINED ROADWAYS AS SPECIFIED ON THE DESIGN DRAWINGS.
   = 500 mm OPEN VELD OR ROAD RESERVES WHERE POSITION OF MANHOLES CAN BE CONCEALED BY LONG GRASS OR OTHER GROWTH.
3. CHANNELLING:
   NOMINAL DIAMETERS.
   Ø < 300 mm CLAY OR DOLOMITIC CONCRETE OR NUTEC CEMENT.
4. CONCRETE MANHOLE SECTIONS MUST BE FIXED WITH AN EPOXY SEALER SUCH AS EPIDERMIX 344 OR PRO- STRUCT 687 OR SIMILAR APPROVED.
5. FACTORY MADE MANHOLE SECTIONS MUST BE IN ACCORDANCE WITH SANS 1294.
6. MANHOLE FRAMES MAY ONLY BE BUILT IN ON SLOPED FINISHED SIDEWALKS ON A WRITTEN INSTRUCTION BY THE ENGINEER.
7. OVER EXCAVATION MAY ONLY BE FILLED AFTER APPROVAL BY THE ENGINEER WITH GRADE 20/19 CONCRETE OR SUITABLE MATERIAL AS DIRECTED BY THE ENGINEER.
8. NO PART OF THE MANHOLE MAY BE FINISHED OFF WITH CEMENT-WASH OR MORTAR.

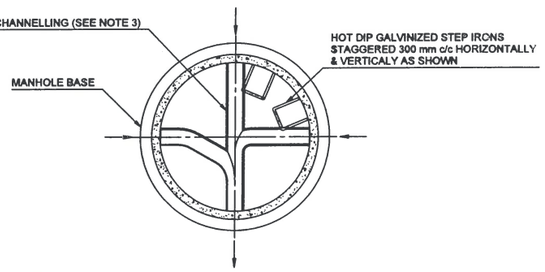
TABLE 1: MANHOLE COVERS (SANS 558/2009)	
POSITION OF MANHOLE	TYPE OF COVER
CARRIAGE WAY	TYPE 2A CAST IRON FRAME AND COVER
ROAD RESERVE/ GENERAL	TYPE 4 CONCRETE FRAME AND COVER



DETAIL 1
SCALE 1 : 5



SECTION A-A
SCALE 1:20

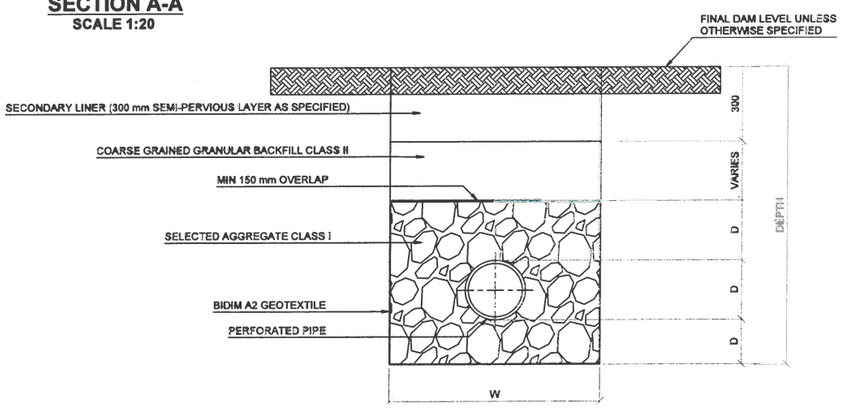


SECTION THROUGH MULTIPLE CONNECTION
SCALE 1:20

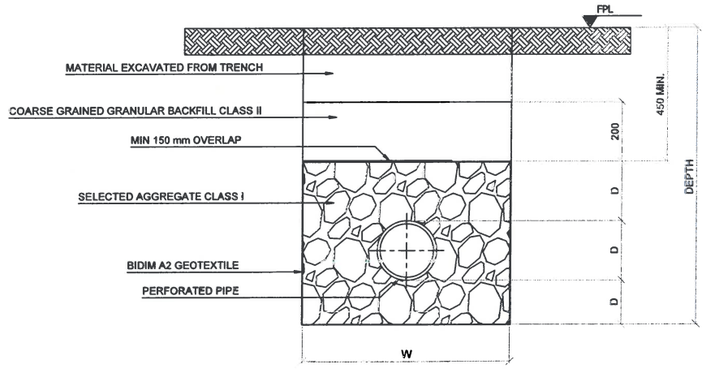
NOTES:

PIPE BEDDING

CLASS I = CRUSHED ROCK STONE AGGREGATE WITH LITTLE OR NO FINES (9-38 mm).
CLASS II = COARSE GRAINED FREE DRAINING NON-COHESIVE GRANULAR SOILS (0.5-38 mm, FINES<5%)

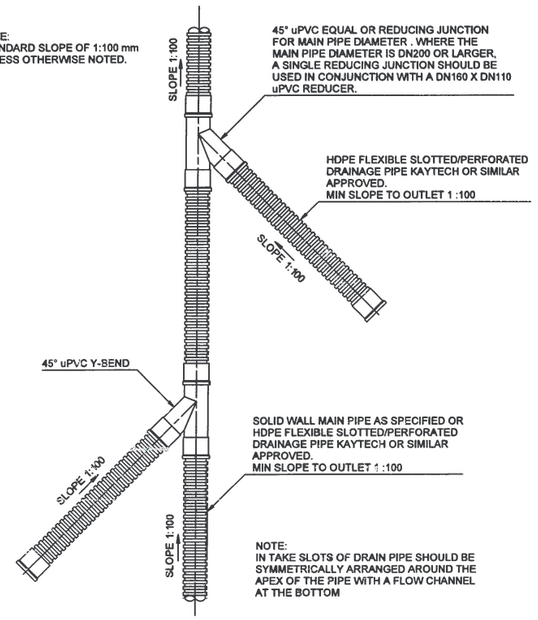


TYPICAL DRAINAGE PIPE BEDDING DETAILS FOR PCD DRAINAGE (STONE DRAIN CROSS-SECTION)
SCALE 1:10



TYPICAL DRAINAGE PIPE BEDDING DETAILS (STONE DRAIN CROSS-SECTION)
SCALE 1:10

NOTE:
STANDARD SLOPE OF 1:100 mm UNLESS OTHERWISE NOTED.



TYPICAL CONNECTION DETAIL FOR M100 (DN 110) GEOPIPE (STONE AND GEOTEXTILE NOT SHOWN)
SCALE 1:20

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APPROVED PROFESSIONAL PERSON
DAM ENGINEER
A.G. CHEMALY
870130
Signature
Date: 2021-03-31

AS BUILT DRAWINGS
ZUTARI
For Site / For Client
Date 31/3/21 Date

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REFERENCE DRAWINGS		REFERENCE DRAWINGS	
DRAWING NO.	TITLE	DRAWING NO.	TITLE
		KPSX-FS-16200-DRG-WW-DE-1101-01	BEDDING DETAILS

ZUTARI PROFESSIONAL ENGINEER		
NAME	VICTOR WENTZEL	DATE
PROF. REG. No.	20130173	
SIGNATURE		31/3/21

SOUTH 32 PROFESSIONAL APPROVAL		
NAME	SIGN.	DATE
CLIENT PROJECT MANAGER		
CLIENT ENGINEERING MANAGER		
ADDITIONAL SIGNATORY		
ZUTARI PROJECT No.	113452	
CLIENT CONTRACT No.	8500084829	

REV.	I.T.	DESCRIPTION	DRWN.	DES.	CHK.	APR.	DATE
*	F	AS-BUILT DRAWING	M.O.T.	M.O.T.	C.N.	V.W.	01/04/2021

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KLIPSPRUIT EXTENSION (KPSX)

AREA: POLLUTION CONTROL DAMS
ELEMENT: TYPICAL DETAIL
TITLE: DAM DETAILS

SCALE:	SHEET SIZE	DRAWING NUMBER	SHEET No.	REV.
AS SHOWN	(A1)	KPSX-EP-16260-DRG-WW-DE-0101-01	1 OF 1	*

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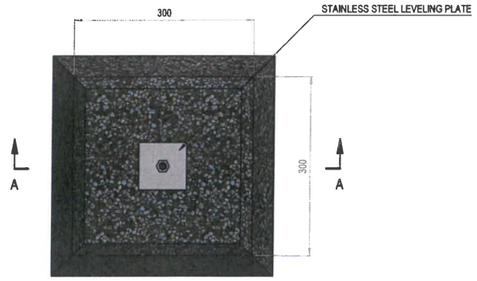
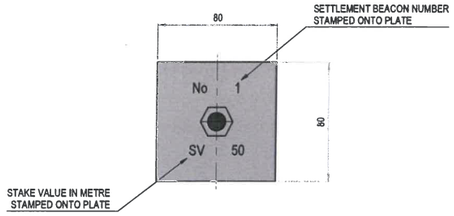
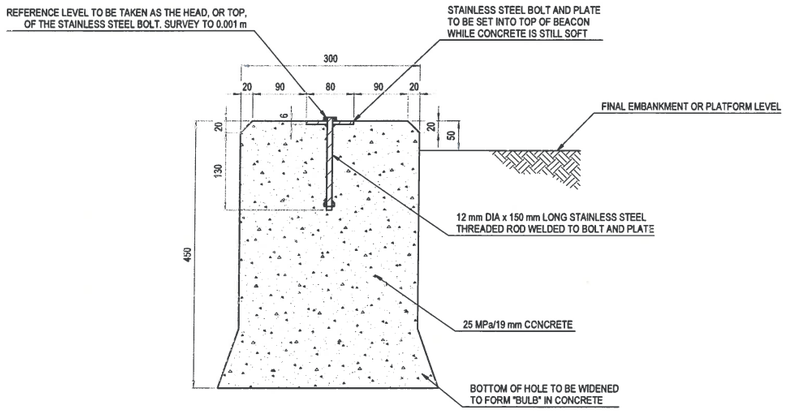
SETTLEMENT BEACON OR BENCHMARK DETAILS



PLAN VIEW:
SETTLEMENT BEACON OR BENCH MARK
SCALE 1 : 5



PLAN VIEW:
STAINLESS STEEL LEVELING PLATE
SCALE 1 : 2

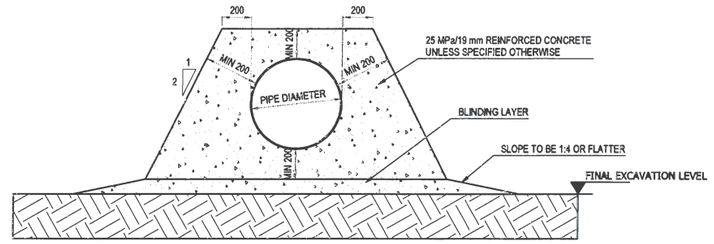


SECTION A-A
SCALE 1 : 5

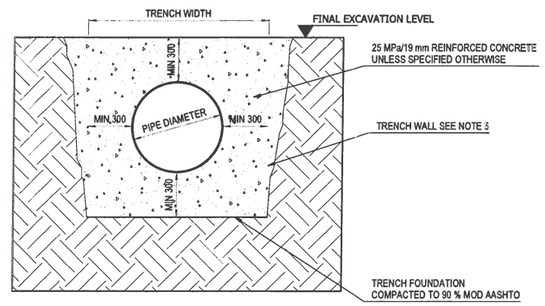
NOTES:

1. CONCRETE SETTLEMENT BEACON TO BE INSTALLED ON DOWNSTREAM EDGE OF DAM CREST
2. GRADE 25 MPa/19 mm TO STRUCTURAL CONCRETE
3. 20 mm x 20 mm CHAMFER FOR ALL CORNERS ABOVE NATURAL GROUND LEVEL

ENCASEMENT DETAILS



SECTION VIEW:
ENCASEMENT DETAIL THROUGH EMBANKMENT ABOVE FEL
SCALE 1 : 20



NOTE:
CONCRETE TO BE CAST AGAINST TRENCH FACE, SHUTTERING OF CONCRETE IS NOT ALLOWED.

SECTION VIEW:
ENCASEMENT DETAIL THROUGH EMBANKMENT BELOW FEL
SCALE 1 : 20

NOTES:

1. TRENCH SPECIFICATION BASED ON SANS 1200
2. FOR MINIMUM TRENCH WIDTH REFER TO DRAWING: KPSX-EP-16200-DRG-WW-DE-0101-01
3. GRADE 25 MPa/19 mm TO STRUCTURAL CONCRETE
4. GRADE 15 MPa/19 mm TO BLINDING
5. CONCRETE TO BE CAST AGAINST TRENCH FACE, SHUTTERING OF CONCRETE IS NOT ALLOWED.

ZUTARI
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DAM ENGINEER
A.G. CHEMALY
870130
Signature:
Date: 2021-03-31

AS BUILT DRAWINGS
ZUTARI
IMPACT. ENGINEERED.
For Safety For Client
Date 31/3/21 Date

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REFERENCE DRAWINGS		REFERENCE DRAWINGS	
		KPSX-EP-16200-DRG-WW-DE-0101	BEDDING DETAILS
DRAWING NO.	TITLE	DRAWING NO.	TITLE

ZUTARI PROFESSIONAL ENGINEER		
NAME	VICTOR WENTZEL	DATE
PROF. REG. No.	20130173	
SIGNATURE		31/3/21

SOUTH 32 PROFESSIONAL APPROVAL		
NAME	SIGN.	DATE
CLIENT PROJECT MANAGER		
CLIENT ENGINEERING MANAGER		
ADDITIONAL SIGNATORY		

ZUTARI PROJECT No.	113452
CLIENT CONTRACT No.	8500084829

REV.	I.T.	DESCRIPTION	DRWN.	DES.	CHK.	APR.	DATE
*	F	AS BUILT DRAWING	M.O.T.	M.O.T.	C.N.	V.W.	23.02.21

I.T. ISSUE TYPE: (A) FOR REVIEW (SQ) (B) INTERNAL PEER REVIEW (C) FOR APPROVAL (CR) (D) FOR CONSTRUCTION (E) FOR INFORMATION (F) AS-BUILT (G) CANCELLED

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KLIPSPRUIT EXTENSION (KPSX)

AREA: POLLUTION CONTROL DAMS
ELEMENT: TYPICAL DETAILS
TITLE: DAM DETAILS

SCALE:	SHEET SIZE	Drawing Number	SHEET No.	REV.
AS SHOWN	(A1)	KPSX-EP-16260-DRG-WW-DE-0105-01	1 OF 1	*

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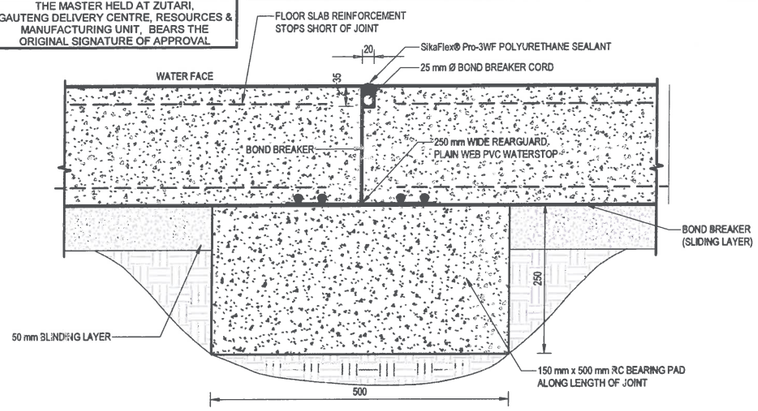
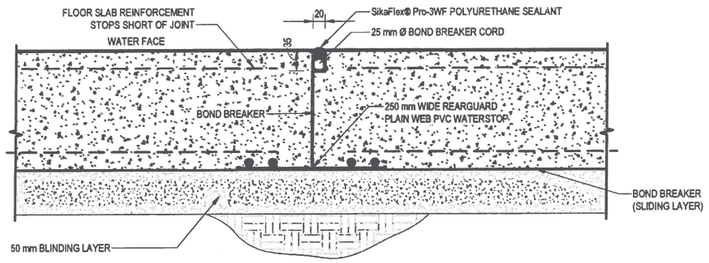
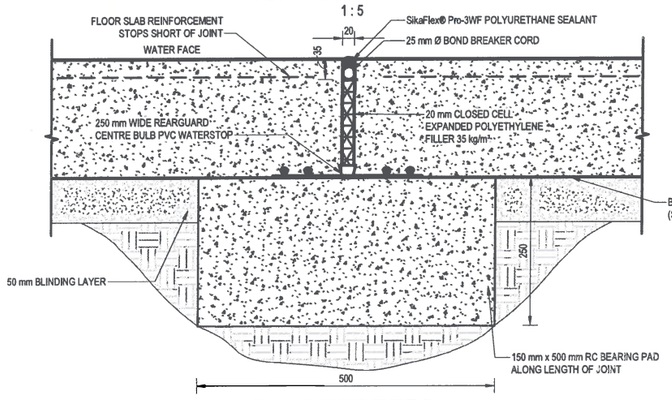


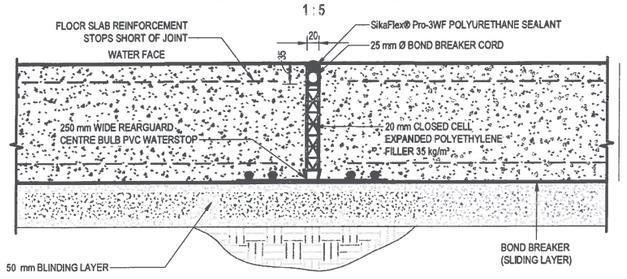
FLOOR JOINT TYPE A1
1 : 5



FLOOR JOINT TYPE A2
1 : 5



FLOOR JOINT TYPE B1
1 : 5



FLOOR JOINT TYPE B2
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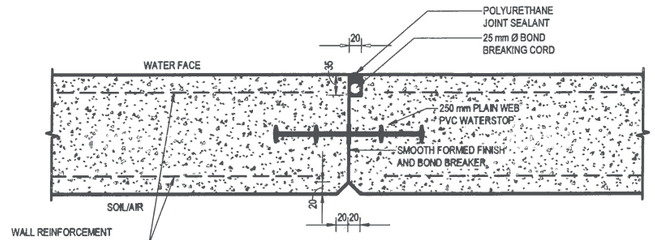
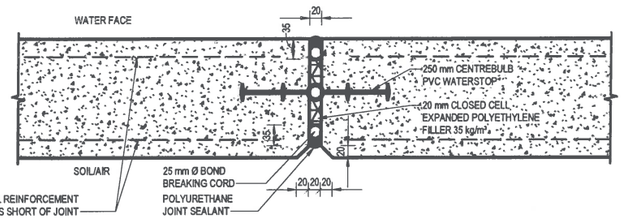
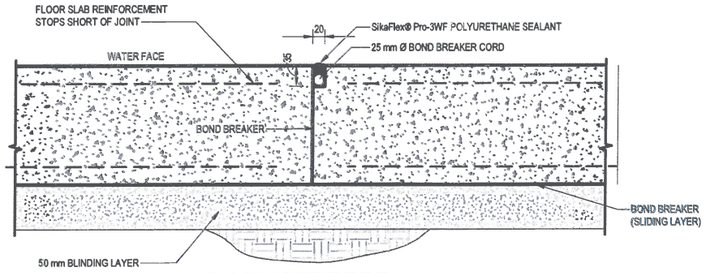


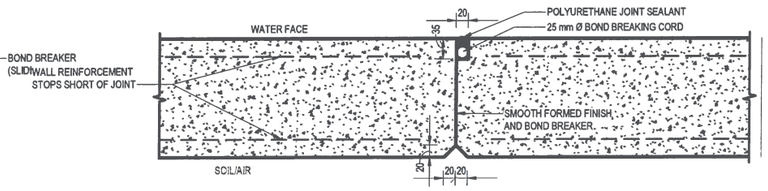
WALL JOINT TYPE C
1 : 5



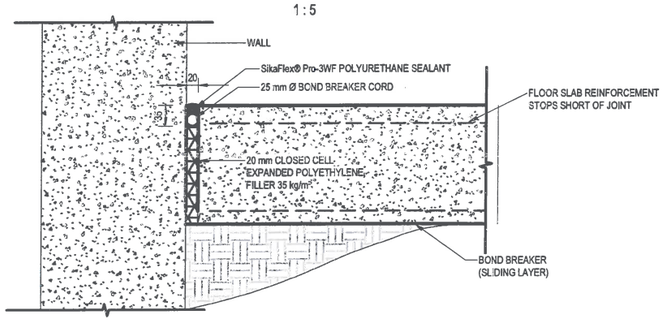
WALL JOINT TYPE D
1 : 5



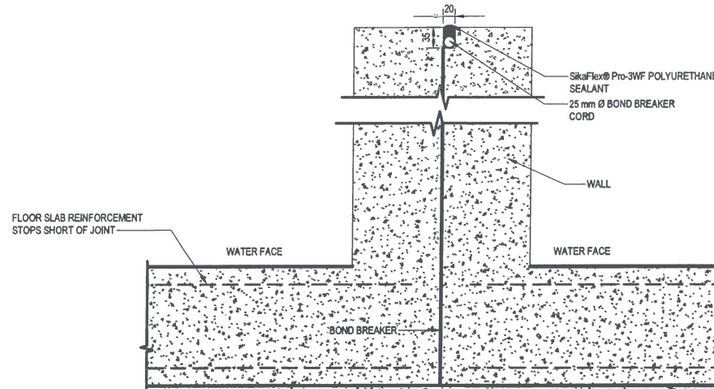
FLOOR JOINT TYPE E1
1 : 5



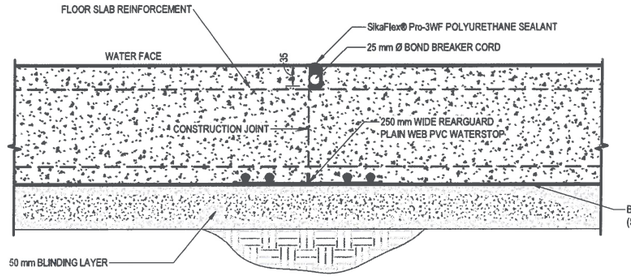
FLOOR - WALL JOINT TYPE E2
1 : 5



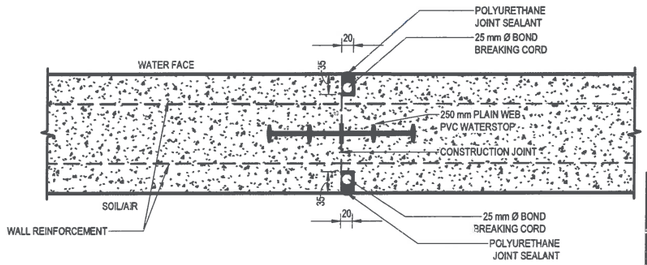
FLOOR - WALL JOINT TYPE E3
1 : 5



FLOOR - WALL JOINT TYPE F
1 : 5



FLOOR JOINT TYPE G
1 : 5



WALL JOINT TYPE H
1 : 5

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APPROVED PROFESSIONAL PERSON
DAM ENGINEERING
A.G. CHEMALY
870130
Signature
Date: 2021-03-31

AS BUILT DRAWINGS
ZUTARI IMPACT. ENGINEERS.
For Zutari: For Client:
Date: 31/3/21 Date:

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REFERENCE DRAWINGS		REFERENCE DRAWINGS	
DRAWING No.	TITLE	DRAWING No.	TITLE

ZUTARI PROFESSIONAL ENGINEER		
NAME	VICTOR WENTZEL	DATE
PROF. REG. No.	20130173	31/3/21
SIGNATURE		

SOUTH 32 PROFESSIONAL APPROVAL		
NAME	SIGN	DATE
CLIENT PROJECT MANAGER		
CLIENT ENGINEERING MANAGER		
ADDITIONAL SIGNATORY		

ZUTARI PROJECT No.	113452
CLIENT CONTRACT No.	8500084829

REV.	I.T.	DESCRIPTION	DRWN.	DES.	CHK.	APR.	DATE
*	F	AS BUILT DRAWING	E.E.	J.L.	C.N.	V.W.	23.02.21

I.T. ISSUE TYPE: (A) FOR REVIEW (B) FOR APPROVAL (C) FOR TENDER (D) FOR CONSTRUCTION (E) FOR INFORMATION (F) AS-BUILT (G) CANCELLED

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KLIPSPRUIT EXTENSION (KPSX)

AREA: POLLUTION CONTROL DAM
ELEMENT: TYPICAL DETAIL
TITLE: JOINT DETAILS

SCALE:	SHEET SIZE	DRAWING NUMBER	SHEET NO.	REV.
AS SHOWN	(A1)	KPSX - EP - 16260 - DRG - WW - DE - 0106-01	1 OF 1	*

Filename: P:\Projects\113452 KPSX Execution Ph FEL4\Report\5 DEL DES\02 Models\01 Rev\WW\16260KPSX-EP-16260-DRG-WW-DE-0106-01_B.PDD TYPICAL JOINT DETAILS.zut

Plot Date: 30/2021 10:29:29 AM Office:

Drawings – Mechanical

THE MASTER HELD AT ZUTARI, GAUTENG DELIVERY CENTRE, RESOURCES & MANUFACTURING UNIT, BEARS THE ORIGINAL SIGNATURE OF APPROVAL

GP244

PCD 4 LEAK DETECTION SUMP PUMP
15L/S @ 16m HEAD.
INSTALLED POWER: 7.5 kW
VOLTAGE: 525 V

RW 14110-DRG-II-PI-0001-01 — PIT BD DEWATERING
PD16 CS16
GP111A-WP002 — PD16-RW-560
GP111A-WP002 — CS16-RW-400
CL241 FI 001 L, CL241 FQI 001, CL241 FIT 001
CL241 FY 002, CL241 ZT 002, CL241 HS 002, CL241 FCV 002, CL241 M
400

RW 14110-DRG-II-PI-0001-01 — PIT BD DEWATERING
PD16 CS16
GP111B-WP002 — PD16-RW-560
GP111B-WP002 — CS16-RW-400
CL241 FI 003 L, CL241 FQI 003, CL241 FIT 003
CL241 FY 004, CL241 ZT 004, CL241 HS 004, CL241 FCV 004, CL241 M
400

O/F
CL242

RW . | . — DYNAMIC OIL WATER SEPARATOR
RW . | 16520-DRG-II-PI-0001-02 — CRUSHING AREA SUMP PUMP
GP001-WP001 — CS16-RW-100
. | 16290-DRG-II-PI-0001-03 — ROM AND TERRACE SW

CL241 U 001 H L, CL241 LIT 001
O/F
HN241

CL241

GP241-WP001 — CS16-RW-250 — RW . | 16290-DRG-II-PI-0004-02 — PCD 4 PUMP No. 1 GP241
GP242A-WP001 — CS16-RW-300 — RW . | 16290-DRG-II-PI-0004-02 — PCD 4 PUMP No. 2A GP242A
GP242B-WP001 — CS16-RW-300 — RW . | 16290-DRG-II-PI-0004-02 — PCD 4 PUMP No. 2B GP242B
GP243A-WP001 — CS16-RW-500 — RW . | 16290-DRG-II-PI-0004-03 — PCD 4 PUMP No. 3A GP243A
GP243B-WP001 — CS16-RW-500 — RW . | 16290-DRG-II-PI-0004-03 — PCD 4 PUMP No. 3B GP243B
GP243C-WP001 — CS16-RW-500 — RW . | 16290-DRG-II-PI-0004-03 — PCD 4 PUMP No. 3C GP243C

CS16 PD16
CL241-WP001 — CS16-RW-80
PD16 CS16
CL241-WP001 — PD16-RW-110
O/F
ENVIRONMENT
SAMPLING POINT 25
CL241-WP001 — CS16-RW-80
80
CL241-WP002 — PD16-RW-160
CL243 U 001 H L, CL243 LIT 001
GP244 LSH 001, GP244 LSL 001
GP244
CL243

AS BUILT DRAWINGS
ZUTARI IMPACT. ENGINEERED.
For Zutari: R MARCUS Date: 29/7/21
For Client: Date:

This AS BUILT drawing has been prepared based on information provided by the contractor. The levels and coordinates have not been independently checked or verified by Zutari.

CL242
PCD 4 INLET SUMP

HN241
PCD 4 SILT TRAP

CL241
PCD 4
CAPACITY: 60 000m³

CL243
PCD 4 LEAK DETECTION SUMP

REFERENCE DRAWINGS		REFERENCE DRAWINGS	
DRAWING NO.	TITLE	DRAWING NO.	TITLE

ZUTARI PROFESSIONAL ENGINEER		
NAME	REGARDT MARCUS	DATE
PROF. REG. No.	20150230	
SIGNATURE		29/7/21

SOUTH 32 PROFESSIONAL APPROVAL		
NAME	SIGN.	DATE
CLIENT PROJECT MANAGER		
CLIENT ENGINEERING MANAGER		
ADDITIONAL SIGNATORY		
ZUTARI PROJECT No.	113452	
CLIENT CONTRACT No.	8500088746	

REV.	I.T.	DESCRIPTION	DRWN.	DES.	CHK.	APR.	DATE
2	F	AS-BUILT	LS	LS	SM	RM	27/07/2021
1	D	GENERAL UPDATES	SEM	SEM	JvN	RM	27/09/2018
0	D	FOR CONSTRUCTION	DJ	DJ	JvN	RM	13/07/2018

I.T. ISSUE TYPE: (A) FOR REVIEW (SQ) (B) INTERNAL PEER REVIEW (C) FOR APPROVAL (CR) (D) FOR CONSTRUCTION (E) FOR INFORMATION (F) AS-BUILT (G) CANCELED

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ZUTARI IMPACT. ENGINEERED.
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Ashlea Gardens, Extension 6
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E connect@zutari.com

KLIPSPRUIT EXTENSION (KPSX)

AREA: RAW WATER SYSTEM
ELEMENT: PCD 4
TITLE: P&ID

SCALE:	SHEET SIZE	DRAWING NUMBER	SHEET No.	REV.
NTS	(A1)	KPSX-EP-16290-DRG-II-PI-0004-01	1 OF 3	2

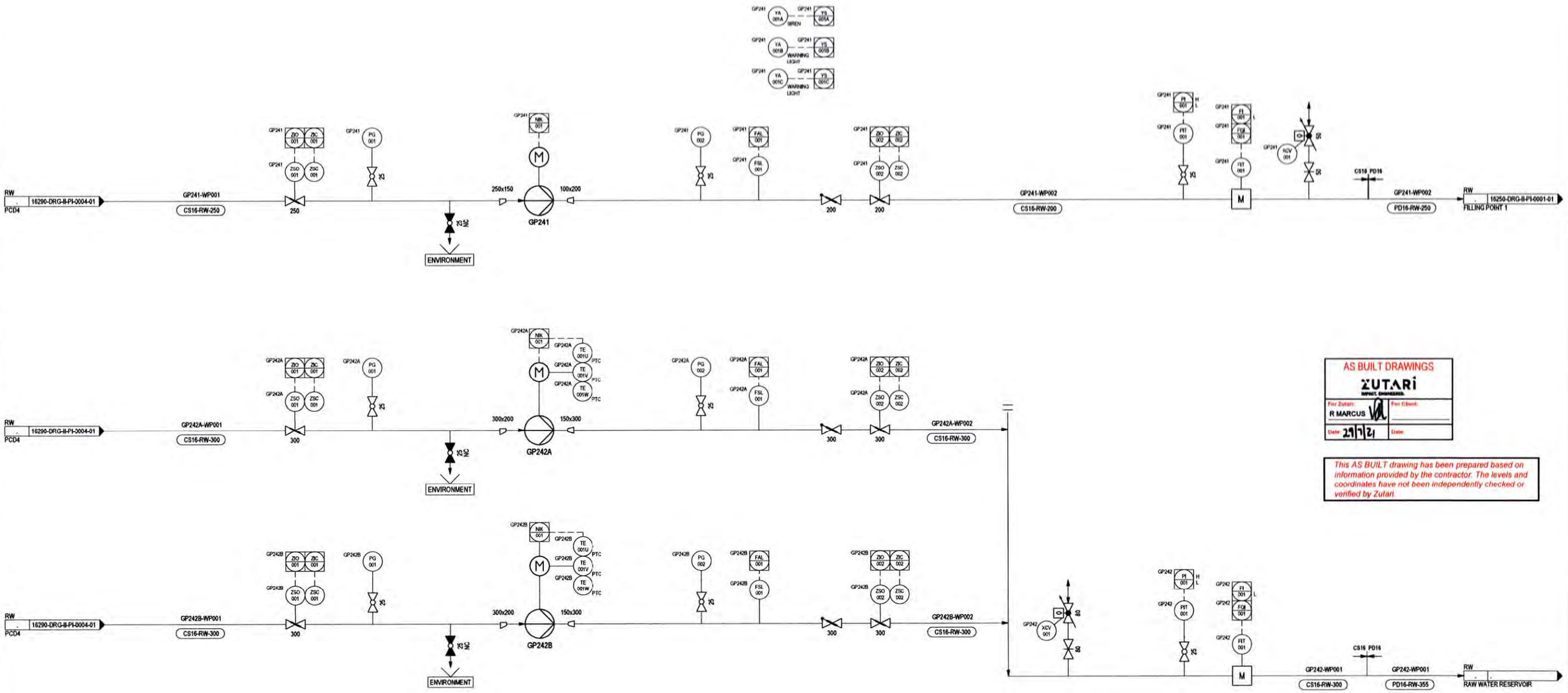
PROJECT FILE: 113452

THE MASTER HELD AT ZUTARI, GAUTENG DELIVERY CENTRE, RESOURCES & MANUFACTURING UNIT, BEARS THE ORIGINAL SIGNATURE OF APPROVAL

GP241
PCD 4 PUMP No.1
53.1L/s @ 25.3m HEAD.
INSTALLED POWER: 22kW
VOLTAGE: 525V

GP242A
PCD 4 PUMP No.2A
86.1L/s @ 34m HEAD.
INSTALLED POWER: 45kW
VOLTAGE: 525V

GP242B
PCD 4 PUMP No.2B
86.1L/s @ 34m HEAD.
INSTALLED POWER: 45kW
VOLTAGE: 525V



AS BUILT DRAWINGS
ZUTARI IMPACT ENGINEERS
For Zutari: R MARCUS Date: 29/7/21
For Client: Date:

This AS BUILT drawing has been prepared based on information provided by the contractor. The levels and coordinates have not been independently checked or verified by Zutari.

REFERENCE DRAWINGS		REFERENCE DRAWINGS	
DRAWING NO.	TITLE	DRAWING NO.	TITLE

ZUTARI PROFESSIONAL ENGINEER		
NAME	REGARDT MARCUS	DATE
PROF. REG. No.	20150230	
SIGNATURE		29/7/21

SOUTH 32 PROFESSIONAL APPROVAL		
NAME	SIGN.	DATE
CLIENT PROJECT MANAGER		
CLIENT ENGINEERING MANAGER		
ADDITIONAL SIGNATORY		
ZUTARI PROJECT No.	113452	
CLIENT CONTRACT No.	8500088746	

REV.	I.T.	DESCRIPTION	DRWN.	DES.	CHK.	APR.	DATE
2	F	AS-BUILT	LS	LS	SM	RM	27/07/2021
1	D	GENERAL UPDATES	SEM	SEM	JvN	RM	27/09/2018
0	D	FOR CONSTRUCTION	DJ	DJ	JvN	RM	13/07/2018

I.T. ISSUE TYPE: (A) FOR REVIEW (SQ) (B) INTERNAL PEER REVIEW (C) FOR APPROVAL (CR) (D) FOR CONSTRUCTION (E) FOR INFORMATION (F) AS-BUILT (G) CANCELED

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ZUTARI IMPACT ENGINEERS
Riverwalk Office Park
41 Metroonberg Road
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Pretoria
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E connect@zutari.com

SOUTH32

KLIPSPRUIT EXTENSION (KPSX)

AREA:
ELEMENT: RAW WATER SYSTEM
TITLE: PCD 4 PUMP STATION P&ID

SCALE	SHEET SIZE	DRAWING NUMBER	SHEET No.	REV.
NTS	(A1)	KPSX-EP-16290-DRG-II-PI-0004-02	2 OF 3	2

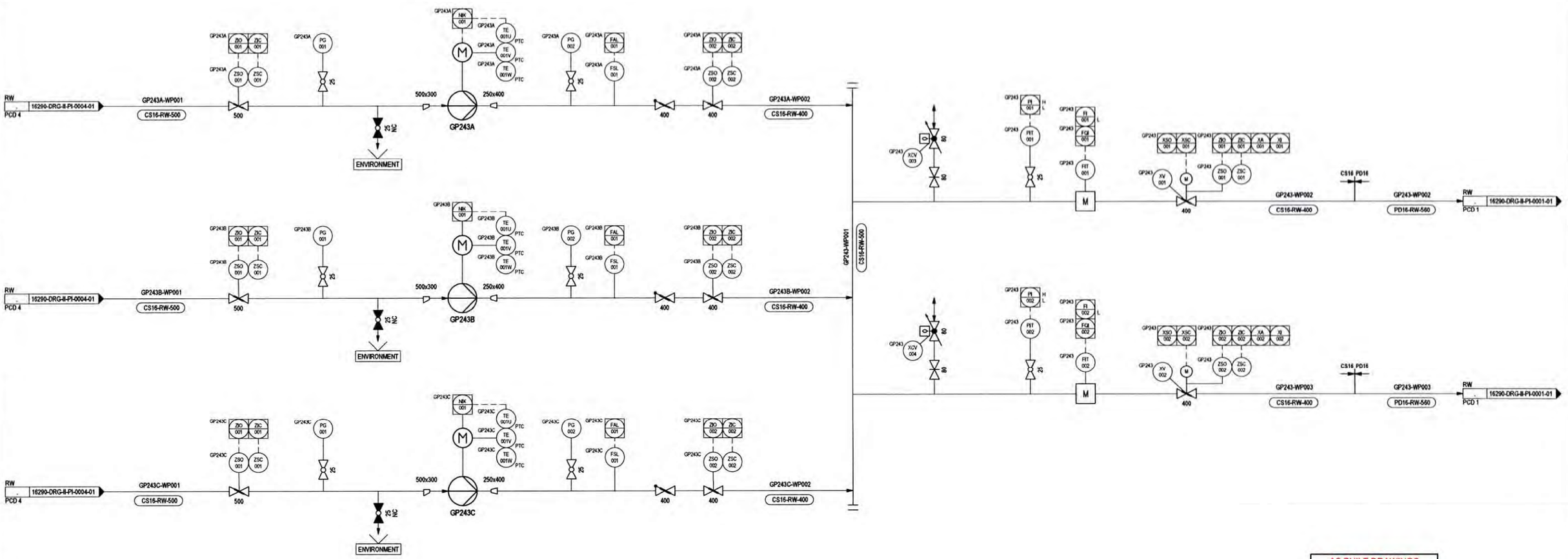
PROJECT FILE 113452

THE MASTER HELD AT ZUTARI, GAUTENG DELIVERY CENTRE, RESOURCES & MANUFACTURING UNIT, BEARS THE ORIGINAL SIGNATURE OF APPROVAL

GP243A
PCD 4 PUMP No.3A
271L/s @ 30.7m HEAD.
INSTALLED POWER: 132kW
VOLTAGE: 525V

GP243B
PCD 4 PUMP No.3B
271L/s @ 30.7m HEAD.
INSTALLED POWER: 132kW
VOLTAGE: 525V

GP243C
PCD 4 PUMP No.3C
271L/s @ 30.7m HEAD.
INSTALLED POWER: 132kW
VOLTAGE: 525V



AS BUILT DRAWINGS
ZUTARI IMPACT. ENGINEERED.
For Zutari: R MARCUS
For Client:
Date: 24/7/21
Date:

This AS BUILT drawing has been prepared based on information provided by the contractor. The levels and coordinates have not been independently checked or verified by Zutari.

REFERENCE DRAWINGS			REFERENCE DRAWINGS		
DRAWING NO.	TITLE		DRAWING NO.	TITLE	

ZUTARI PROFESSIONAL ENGINEER		
NAME	REGARDT MARCUS	DATE
PROF. REG. No.	20150230	
SIGNATURE		24/7/21

SOUTH 32 PROFESSIONAL APPROVAL		
NAME	SIGN.	DATE
CLIENT PROJECT MANAGER		
CLIENT ENGINEERING MANAGER		
ADDITIONAL SIGNATORY		
ZUTARI PROJECT No.	113452	
CLIENT CONTRACT No.	8500088746	

REV.	I.T.	DESCRIPTION	DRWN.	DES.	CHK.	APR.	DATE
2	F	AS-BUILT	LS	LS	SM	RM	27/07/2021
1	D	GENERAL UPDATES	SEM	SEM	JvN	RM	27/09/2018
0	D	FOR CONSTRUCTION	DJ	DJ	JvN	RM	13/07/2018

I.T. ISSUE TYPE: (A) FOR REVIEW (SQ) (B) INTERNAL PEER REVIEW (C) FOR APPROVAL (CR) (D) FOR CONSTRUCTION (E) FOR INFORMATION (F) AS-BUILT (G) CANCELED

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SOUTH32

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KLIPSPRUIT EXTENSION (KPSX)

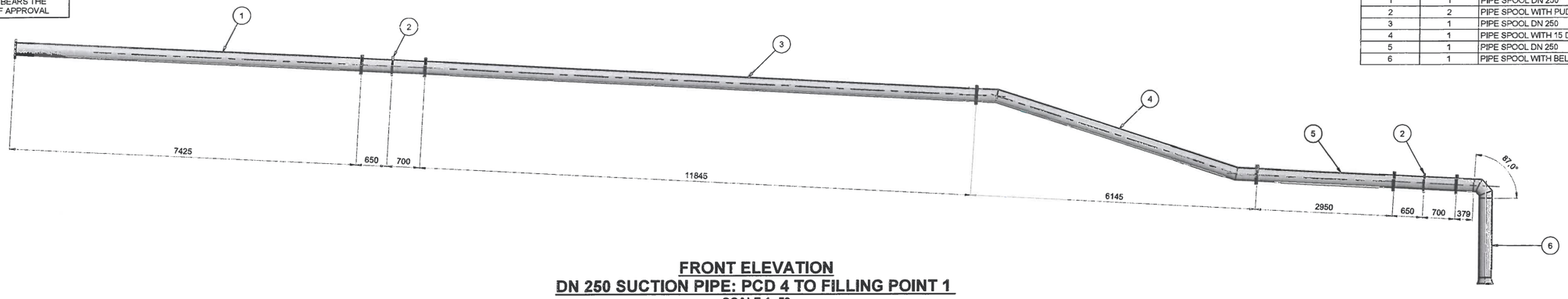
AREA:
ELEMENT: RAW WATER SYSTEM
TITLE: PCD 4 PUMP STATION P&ID

SCALE:	SHEET SIZE	DRAWING NUMBER	SHEET No.	REV.
NTS	(A1)	KPSX-EP-16290-DRG-II-PI-0004-03	3 OF 3	2

PROJECT FILE: 113452

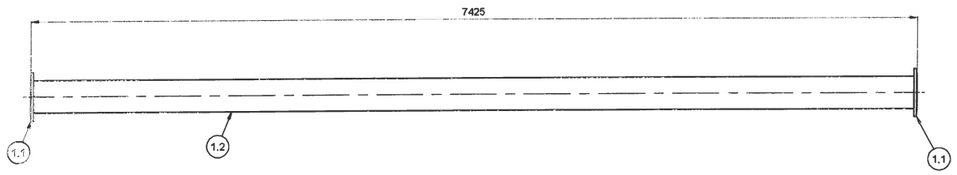
THE MASTER HELD AT ZUTARI, GAUTENG DELIVERY CENTER, RESOURCES & MANUFACTURING UNIT, BEARS THE ORIGINAL SIGNATURE OF APPROVAL

PARTS LIST		
ITEM	QTY	DESCRIPTION
1	1	PIPE SPOOL DN 250
2	2	PIPE SPOOL WITH PUDDLE FLANGE DN 250
3	1	PIPE SPOOL DN 250
4	1	PIPE SPOOL WITH 15 DEG BENDS DN 250
5	1	PIPE SPOOL DN 250
6	1	PIPE SPOOL WITH BELLMOUTH AND 87 DEGREE SHORT RADIUS BEND DN 250



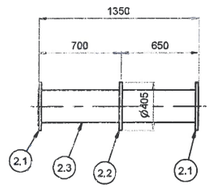
FRONT ELEVATION
DN 250 SUCTION PIPE: PCD 4 TO FILLING POINT 1
SCALE 1 :50

PARTS LIST		
ITEM	QTY	DESCRIPTION
1.1	2	FLANGE DN 250 SANS 1123 TABLE 1600/3 (RF)
1.2	7425.000 mm	STEEL PIPE DN 250 X 6 mm SANS 719 GRADE C



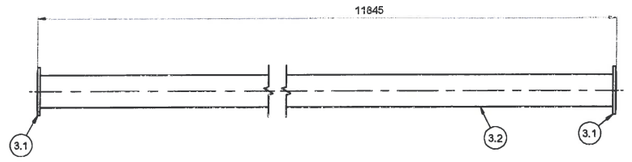
PLAN VIEW
ITEM 1
SCALE 1 : 25

PARTS LIST		
ITEM	QTY	DESCRIPTION
2.1	2	FLANGE DN 250 SANS 1123 TABLE 1600/3 (RF)
2.2	1	PUDDLE FLANGE DN 250, OD 405mm, THICKNESS 25mm
2.3	1350.000 mm	STEEL PIPE DN 250 X 6 mm SANS 719 GRADE C



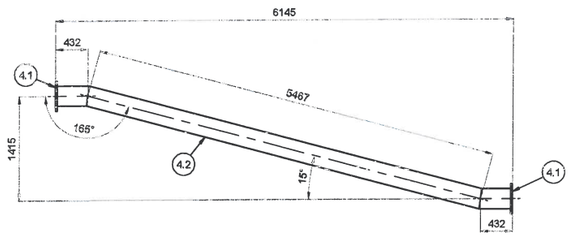
PLAN VIEW
ITEM 2
SCALE 1 :25

PARTS LIST		
ITEM	QTY	DESCRIPTION
3.1	2	FLANGE DN 250 SANS 1123 TABLE 1600/3 (RF)
3.2	11845.000 mm	STEEL PIPE DN 250 X 6 mm SANS 719 GRADE C



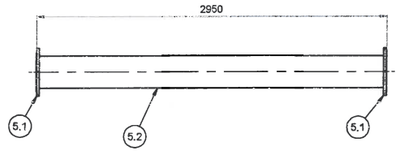
PLAN VIEW
ITEM 3
SCALE 1 :25

PARTS LIST		
ITEM	QTY	DESCRIPTION
4.1	2	FLANGE DN 250 SANS 1123 TABLE 1600/3 (RF)
4.2	6331.533 mm	STEEL PIPE DN 250 X 6 mm SANS 719 GRADE C



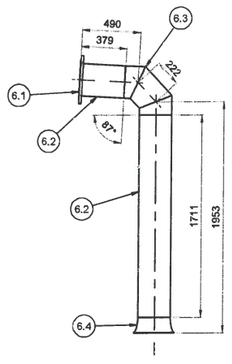
PLAN VIEW
ITEM 4
SCALE 1 :40

PARTS LIST		
ITEM	QTY	DESCRIPTION
5.1	2	FLANGE DN 250 SANS 1123 TABLE 1600/3 (RF)
5.2	2950.000 mm	STEEL PIPE DN 250 X 6 mm SANS 719 GRADE C



PLAN VIEW
ITEM 5
SCALE 1 :25

PARTS LIST		
ITEM	QTY	DESCRIPTION
6.1	1	FLANGE DN 250 SANS 1123 TABLE 1600/3 (RF)
6.2	2090.794 mm	STEEL PIPE DN 250 X 6 mm SANS 719 GRADE C
6.3	1	SHORT RADIUS BEND (1 D) ; 87 DEGREE DN 250 X 6 MM SANS 719 GRADE C
6.4	1	USBR BELLMOUTH



PLAN VIEW
ITEM 6
SCALE 1 :25

AS BUILT DRAWINGS
ZUTARI
21/05/2024

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REFERENCE DRAWINGS		
DRAWING NO.	TITLE	

REFERENCE DRAWINGS		
DRAWING NO.	TITLE	

ZUTARI PROFESSIONAL ENGINEER		
NAME	VICTOR WENTZEL	DATE
PROF. REG. No.	20130173	
SIGNATURE		21/05/2024
SOUTH 32 PROFESSIONAL APPROVAL		
NAME	SIGN.	DATE
CLIENT PROJECT MANAGER		
CLIENT ENGINEERING MANAGER		
ADDITIONAL SIGNATORY		
ZUTARI PROJECT No.	113452	
CLIENT CONTRACT No.	8500084829	

REV.	I.T.	DESCRIPTION	DRWN.	DES.	CHK.	APR.	DATE
*	F	AS-BUILT DRAWING	C.R.	C.R.	C.N.	V.W.	23/04/2021

I.T. ISSUE TYPE: (A) FOR REVIEW (SQ) (B) INTERNAL PEER REVIEW (C) FOR APPROVAL (CR) (D) FOR CONSTRUCTION (E) FOR INFORMATION (F) AS-BUILT (G) CANCELLED

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SOUTH32

ZUTARI IMPACT. ENGINEERED

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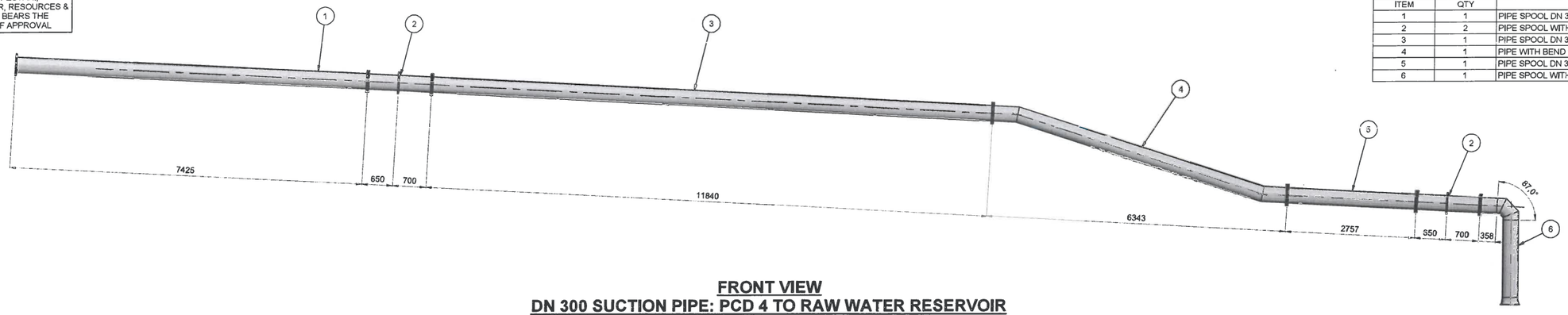
KLIPSPRUIT EXTENSION (KPSX)

AREA: PCD 4
ELEMENT: PUMP STATION INTAKE STRUCTURE
TITLE: MECHANICAL DETAILS

SCALE:	SHEET SIZE	Drawing Number	SHEET No.	REV.
AS SHOWN	(A1)	KPSX-EP-16260-DRG-WW-DE-0122-01	1 OF 3	*

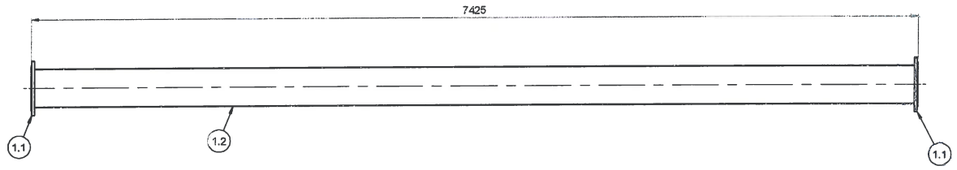
THE MASTER HELD AT ZUTARI, GAUTENG DELIVERY CENTER, RESOURCES & MANUFACTURING UNIT, BEARS THE ORIGINAL SIGNATURE OF APPROVAL

PARTS LIST		
ITEM	QTY	DESCRIPTION
1	1	PIPE SPOOL DN 300
2	2	PIPE SPOOL WITH PUDDLE FLANGE DN 300
3	1	PIPE SPOOL DN 300
4	1	PIPE WITH BEND 15 DEG DN 300
5	1	PIPE SPOOL DN 300
6	1	PIPE SPOOL WITH BELLMOUTH AND 87 DEGREE SHORT RADIUS BEND DN 300



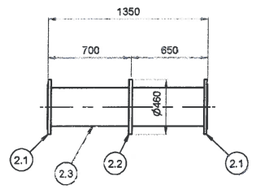
FRONT VIEW
DN 300 SUCTION PIPE: PCD 4 TO RAW WATER RESERVOIR
SCALE 1 :50

PARTS LIST		
ITEM	QTY	DESCRIPTION
1.1	2	FLANGE DN 300 SANS 1123 TABLE 1600/3 (RF)
1.2	7425.000 mm	STEEL PIPE DN 300 X 3 mm SANS 719 GRADE C



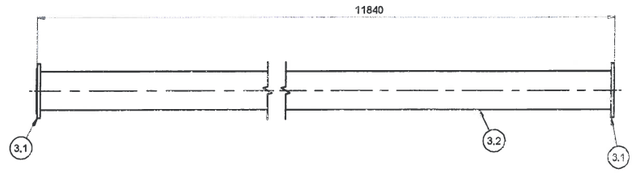
PLAN VIEW
ITEM 1
SCALE 1 : 25

PARTS LIST		
ITEM	QTY	DESCRIPTION
2.1	2	FLANGE DN 300 SANS 1123 TABLE 1600/3 (RF)
2.2	1	PUDDLE FLANGE DN 300, OD 460mm, THICKNESS 28mm
2.3	1350.000 mm	STEEL PIPE DN 300 X 6 mm SANS 719 GRADE C



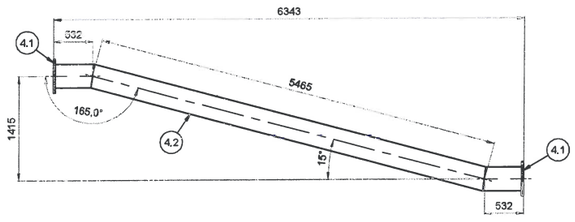
PLAN VIEW
ITEM 2
SCALE 1 :25

PARTS LIST		
ITEM	QTY	DESCRIPTION
3.1	2	FLANGE DN 300 SANS 1123 TABLE 1600/3 (RF)
3.2	11840.000 mm	STEEL PIPE DN 300 X 6 mm SANS 719 GRADE C



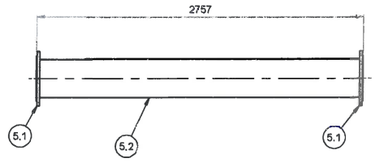
PLAN VIEW
ITEM 3
SCALE 1 :25

PARTS LIST		
ITEM	QTY	DESCRIPTION
4.1	2	FLANGE DN 300 SANS 1123 TABLE 1600/3 (RF)
4.2	6529.536 mm	STEEL PIPE DN 300 X 6 mm SANS 719 GRADE C



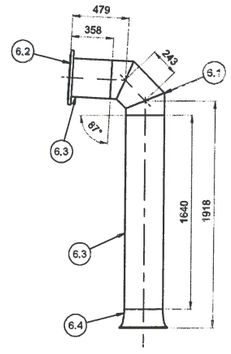
PLAN VIEW
ITEM 4
SCALE 1 :40

PARTS LIST		
ITEM	QTY	DESCRIPTION
5.1	2	FLANGE DN 300 SANS 1123 TABLE 1600/3 (RF)
5.2	2757.000 mm	STEEL PIPE DN 300 X 6 mm SANS 719 GRADE C



PLAN VIEW
ITEM 5
SCALE 1 :25

PARTS LIST		
ITEM	QTY	DESCRIPTION
6.1	1	SHORT RADIUS BEND (1 D) ; 87 DEGREE DN 300 X 6 MM SANS 719 GRADE C
6.2	1	FLANGE DN 300 SANS 1123 TABLE 1600/3 (RF)
6.3	1997.928 mm	STEEL PIPE DN 300 X 6 mm SANS 719 GRADE C
6.4	1	USBR BELLMOUTH



PLAN VIEW
ITEM 6
SCALE 1 :25

AS BUILT DRAWINGS
ZUTARI
Date: 21/05/2021

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REFERENCE DRAWINGS		
DRAWING NO.	TITLE	

REFERENCE DRAWINGS		
DRAWING NO.	TITLE	

ZUTARI PROFESSIONAL ENGINEER		
NAME	VICTOR WENTZEL	DATE
PROF. REG. No.	20130173	
SIGNATURE		21/05/2021
SOUTH 32 PROFESSIONAL APPROVAL		
NAME	SIGN.	DATE
CLIENT PROJECT MANAGER		
CLIENT ENGINEERING MANAGER		
ADDITIONAL SIGNATORY		
ZUTARI PROJECT No.	113452	
CLIENT CONTRACT No.	8500084829	

REV.	I.T.	DESCRIPTION	DRWN.	DES.	CHK.	APR.	DATE
*	F	AS-BUILT DRAWING	C.R.	C.R.	C.N.	V.W.	23/04/2021

I.T. ISSUE TYPE: (A) FOR REVIEW (SQ) (B) INTERNAL PEER REVIEW (C) FOR APPROVAL (CR) (D) FOR CONSTRUCTION (E) FOR INFORMATION (F) AS-BUILT (G) CANCELLED

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SOUTH32

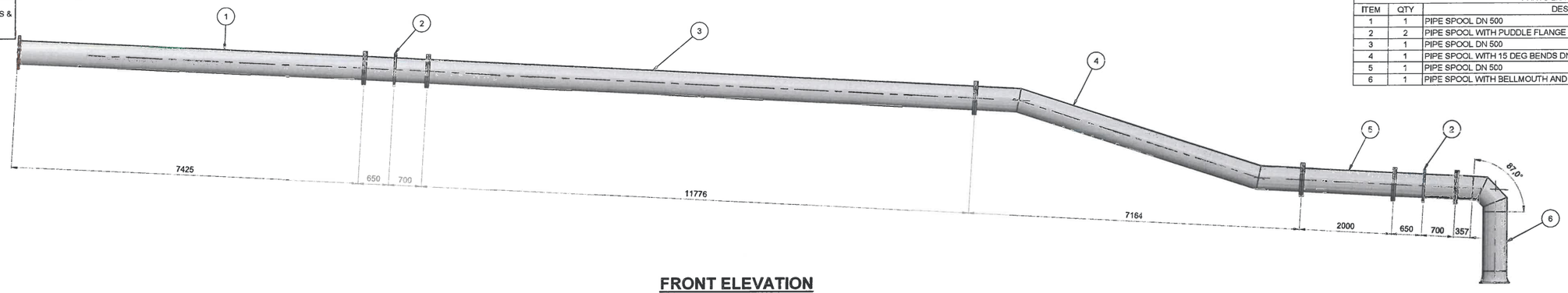
KLIPSPRUIT EXTENSION (KPSX)

AREA: PCD 4
ELEMENT: PUMP STATION INTAKE STRUCTURE
TITLE: MECHANICAL DETAILS

SCALE:	SHEET SIZE	Drawing Number	SHEET No.	REV.
AS SHOWN	(A1)	KPSX-EP-16260-DRG-WW-DE-0122-02	2 OF 3	*

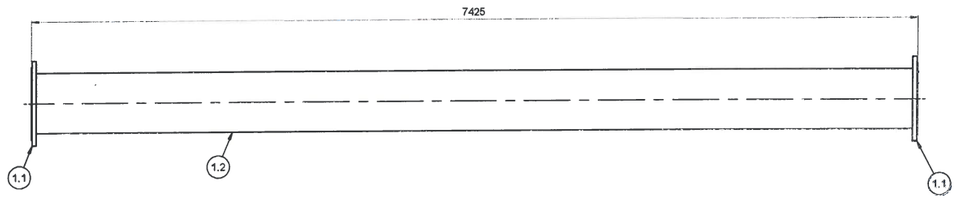
THE MASTER HELD AT ZUTARI, GAUTENG DELIVERY CENTER, RESOURCES & MANUFACTURING UNIT, BEARS THE ORIGINAL SIGNATURE OF APPROVAL

PARTS LIST		
ITEM	QTY	DESCRIPTION
1	1	PIPE SPOOL DN 500
2	2	PIPE SPOOL WITH PUDDLE FLANGE DN 500
3	1	PIPE SPOOL DN 500
4	1	PIPE SPOOL WITH 15 DEG BENDS DN 500
5	1	PIPE SPOOL DN 500
6	1	PIPE SPOOL WITH BELLMOUTH AND 87 DEGREE SHORT RADIUS BEND DN 500



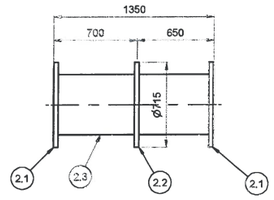
FRONT ELEVATION
DN 500 SUCTION PIPE: PCD 4 TO PCD 1
SCALE 1 :50

PARTS LIST		
ITEM	QTY	DESCRIPTION
1.1	2	FLANGE DN 500 SANS 1123 TABLE 1600/3 (RF)
1.2	7425.000 mm	STEEL PIPE DN 500 X 6 mm SANS 719 GRADE C



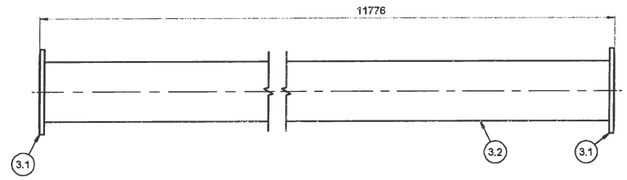
PLAN VIEW
ITEM 1
SCALE 1 : 25

PARTS LIST		
ITEM	QTY	DESCRIPTION
2.1	2	FLANGE DN 500 SANS 1123 TABLE 1600/3 (RF)
2.2	1	PUDDLE FLANGE DN 500, OD 715 mm x 40 mm THK
2.3	1350.000 mm	STEEL PIPE DN 500 X 6 mm SANS 719 GRADE C



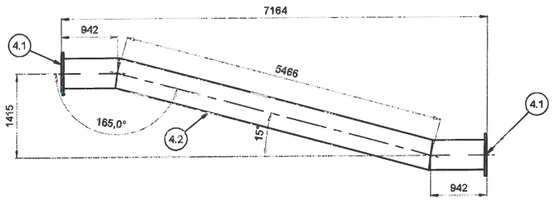
PLAN VIEW VIEW5
ITEM 2
SCALE 1 :25

PARTS LIST		
ITEM	QTY	DESCRIPTION
3.1	2	FLANGE DN 500 SANS 1123 TABLE 1600/3 (RF)
3.2	11776.000 mm	STEEL PIPE DN 500 X 6 mm SANS 719 GRADE C



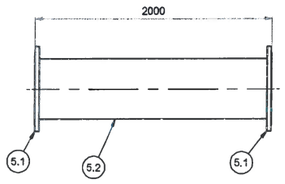
PLAN VIEW
ITEM 3
SCALE 1 :25

PARTS LIST		
ITEM	QTY	DESCRIPTION
4.1	2	FLANGE DN 500 SANS 1123 TABLE 1600/3 (RF)
4.2	7350.544 mm	STEEL PIPE DN 500 X 6 mm SANS 719 GRADE C



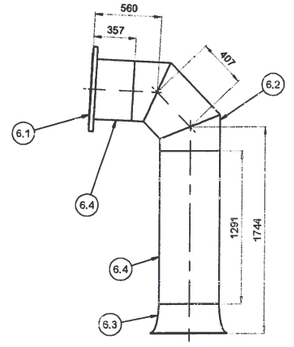
PLAN VIEW
ITEM 4
SCALE 1 :50

PARTS LIST		
ITEM	QTY	DESCRIPTION
5.1	2	FLANGE DN 500 SANS 1123 TABLE 1600/3 (RF)
5.2	2000.000 mm	STEEL PIPE DN 500 X 6 mm SANS 719 GRADE C



PLAN VIEW
ITEM 5
SCALE 1 :25

PARTS LIST		
ITEM	QTY	DESCRIPTION
6.1	1	FLANGE DN 500 SANS 1123 TABLE 1600/3 (RF)
6.2	1	SPECIAL SHORT RADIUS BEND (1 D); 87 DEGREE DN 500 X 6 MM SANS 719 GRADE C
6.3	1	USBR BELLMOUTH
6.4	1647.800 mm	STEEL PIPE DN 500 X 6 mm SANS 719 GRADE C



PLAN VIEW
ITEM 6
SCALE 1 :25

AS BUILT DRAWINGS
ZUTARI
Prepared by: Verified by:
21/05/2021
Date

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REFERENCE DRAWINGS	
DRAWING NO.	TITLE

REFERENCE DRAWINGS	
DRAWING NO.	TITLE

ZUTARI PROFESSIONAL ENGINEER		
NAME	VICTOR WENTZEL	DATE
PROF. REG. No.	20130173	
SIGNATURE		21/05/2021
SOUTH 32 PROFESSIONAL APPROVAL		
NAME	SIGN.	DATE
CLIENT PROJECT MANAGER		
CLIENT ENGINEERING MANAGER		
ADDITIONAL SIGNATORY		
ZUTARI PROJECT No.	113452	
CLIENT CONTRACT No.	8500084829	

REV.	I.T.	DESCRIPTION	DRWN.	DES.	CHK.	APR.	DATE
*	F	AS-BUILT DRAWING	C.R.	C.R.	C.N.	V.W.	23/04/2021

I.T. ISSUE TYPE: (A) FOR REVIEW (SQ) (B) INTERNAL PEER REVIEW (C) FOR APPROVAL (CR) (D) FOR CONSTRUCTION (E) FOR INFORMATION (F) AS-BUILT (G) CANCELLED

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KLIPSPRUIT EXTENSION (KPSX)

AREA: PCD 4
ELEMENT: PUMP STATION INTAKE STRUCTURE
TITLE: MECHANICAL DETAILS

SCALE:	SHEET SIZE	Drawing Number	SHEET No.	REV.
AS SHOWN	(A1)	KPSX-EP-16260-DRG-WW-DE-0122-03	3 OF 3	*

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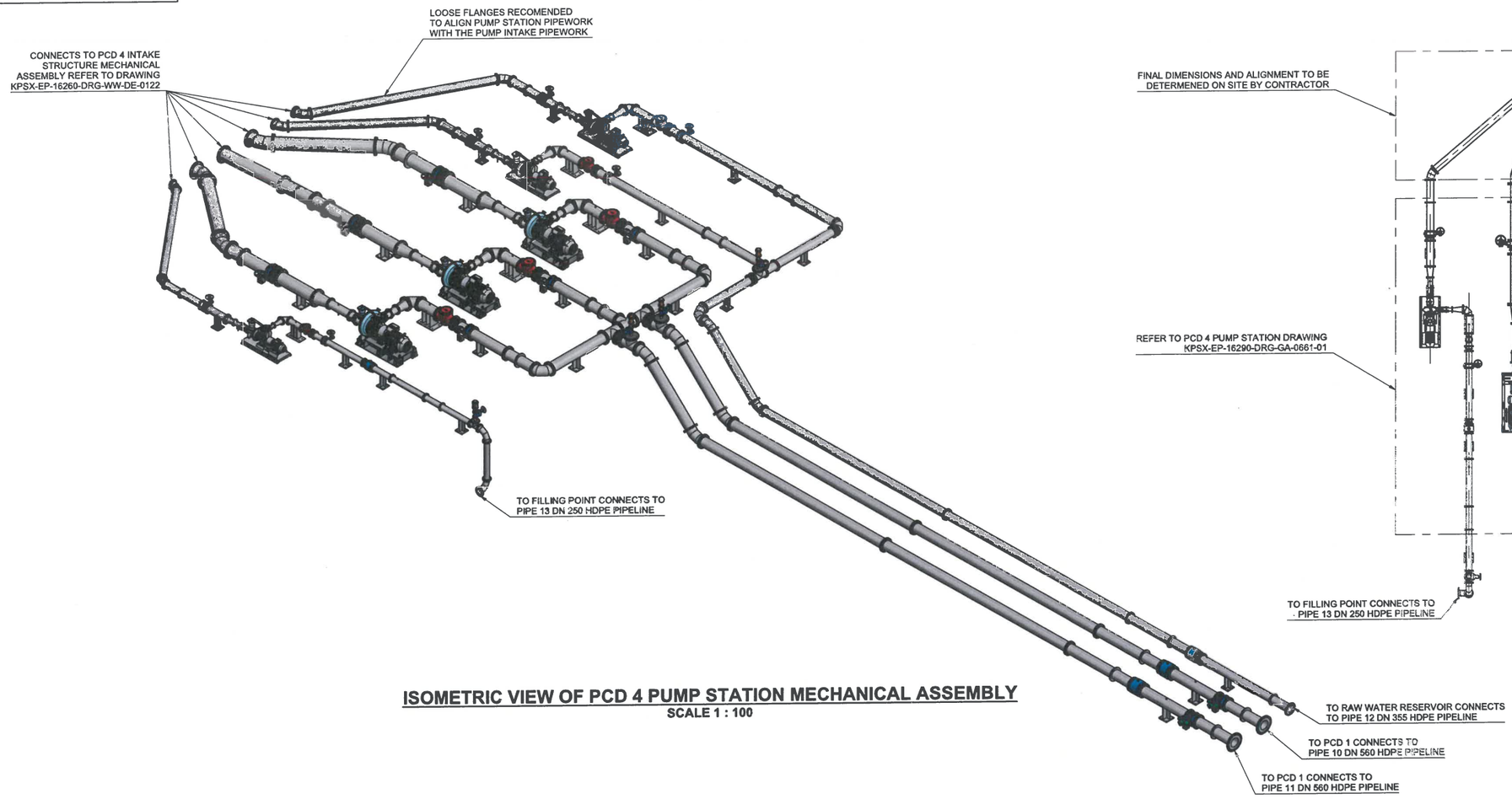
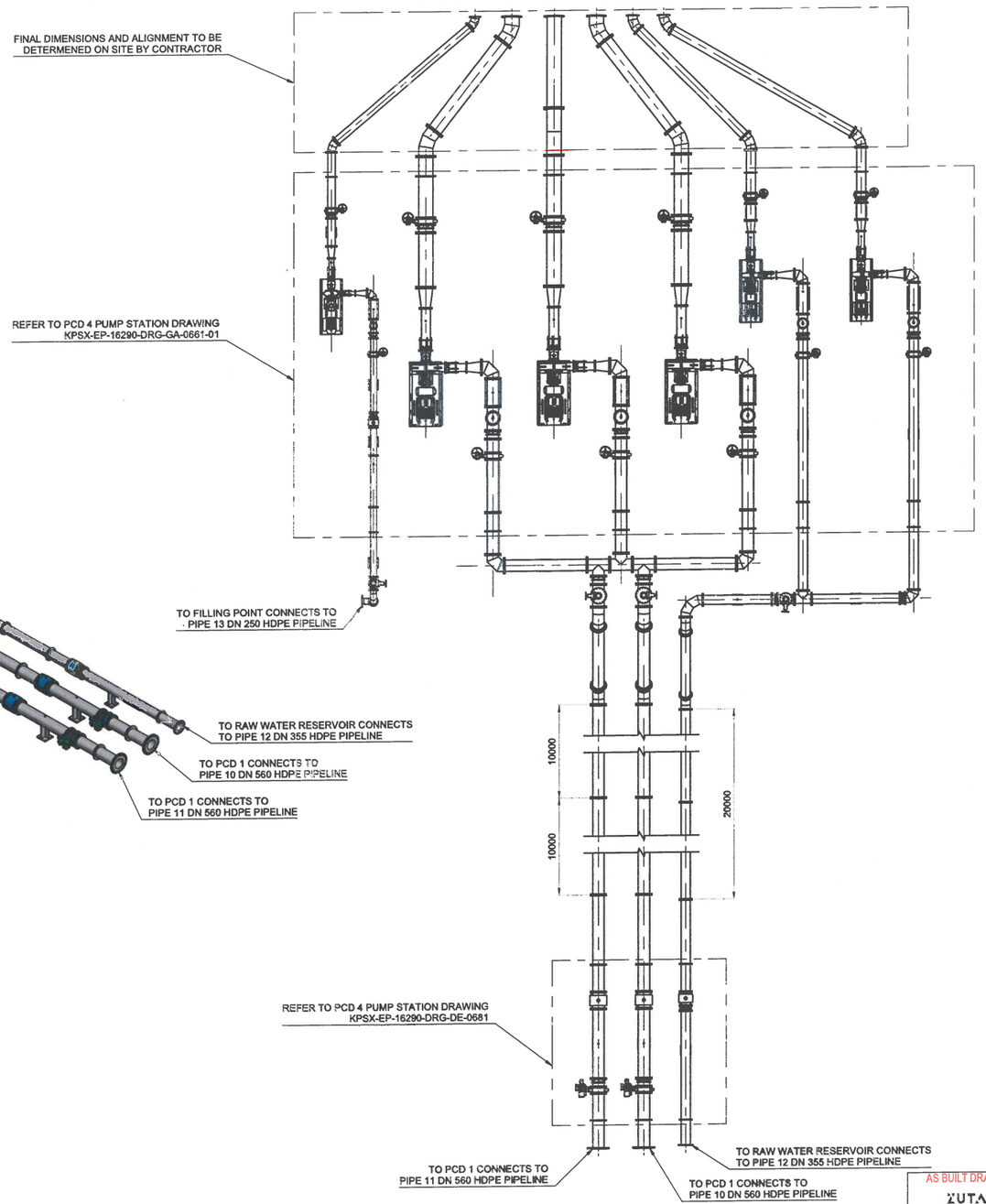


ISOMETRIC VIEW OF PCD 4 PUMP STATION MECHANICAL ASSEMBLY
SCALE 1 : 100



PLAN VIEW
SCALE 1 : 100

PUMP STATION GENERAL NOTES

1. ALL PIPEWORK IS INDICATIVE AND SHALL NOT BE MANUFACTURED FROM THIS DRAWING. THE CONTRACTOR IS RESPONSIBLE FOR THE DESIGN AND LAYOUT OF THE PIPEWORK, VALVES AND SPECIALS. THE CONTRACTOR SHALL SUBMIT HIS DESIGN CALCULATIONS AND SHOP DRAWINGS TO THE ENGINEER FOR APPROVAL BEFORE MANUFACTURING OR FABRICATION COMMENCES. THE DESIGN MUST BE IN ACCORDANCE WITH THE MECHANICAL SPECIFICATION.
2. THE LEVELS AND DIMENSIONS ARE BASED ON THE TOPOGRAPHIC SURVEY AND AVAILABLE INFORMATION AT THE DESIGN STAGE. THE CONTRACTOR SHALL ENSURE THAT ALL EXISTING SERVICES ARE SURVEYED. IF ANY DISCREPANCIES ARISE OR DESIGN CHANGES ARE REQUIRED; IT MUST IMMEDIATELY BE BROUGHT TO THE ATTENTION OF THE ENGINEER.
3. THE CONTRACTOR SHALL MAKE PROVISION FOR FITTINGS TO C&I CONNECTIONS, LOCAL DRAIN POINTS AND QUICK-COUPLING CONNECTION POINTS TO FLUSH THE LINE WITH COMPRESSED AIR.
4. ALL FLANGES AND FITTINGS BELOW GROUND SHALL BE COVERED WITH A VISCO-ELASTIC COATING (STOPAQ OR SIMILAR APPROVED) AND WRAPPED WITH PVC TAPE.
5. THE RESTRAINED FLANGE ADAPTORS AND FLANGES ON THE SUCTION AND DISCHARGE PIPEWORK SHALL MATCH THE PRESSURE CLASS AND DRILLING PATTERN OF THE PUMP SET.
6. ANY DISCREPANCIES BETWEEN THE DRAWINGS, SPECIFICATIONS AND BILL OF QUANTITIES MUST BE REPORTED IMMEDIATELY TO THE ENGINEER.
7. REFER TO MECHANICAL SPECIFICATION FOR CORROSION PROTECTION.
8. ALL VALVES TO BE PROVIDED WITH LOCK OUT MECHANISMS.
9. SPOOL PIECES WITHIN A STRUCTURE SHALL BE PROVIDED WITH APPROPRIATE LIFTING LUGS TO FIT LIFTING EQUIPMENT PROVIDED IN THE PUMP STATION.
10. INSULATION MATERIAL SHALL BE PLACED BETWEEN DISSIMILAR MATERIALS.

AS BUILT DRAWINGS
ZUTARI
For Build / For Client
Date 1/6/21 Date

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REFERENCE DRAWINGS	
DRAWING NO.	TITLE

REFERENCE DRAWINGS		
KPSX-EP-16290-DRG-WW-DE-0681	PCD 4 INFRASTRUCTURE GENERAL ARRANGEMENT	
KPSX-EP-16290-DRG-WW-DE-0673	PCD 4 PUMP STATION SYSTEM VALVE CHAMBER	
KPSX-EP-16290-DRG-WW-DE-0672	PCD 4 PUMP STATION SYSTEM TO FILLING POINT MECHANICAL DETAILS	
KPSX-EP-16290-DRG-WW-DE-0671	PCD 4 PUMP STATION SYSTEM TO PCD 1 MECHANICAL DETAILS	
DRAWING NO.	PCD 4 PUMP STATION SYSTEM TO RAW WATER RESERVOIR MECHANICAL DETAILS	TITLE

ZUTARI PROFESSIONAL ENGINEER		
NAME	VICTOR WENTZEL	DATE
PROF. REG. No.	20130573	
SIGNATURE		1/6/21

SOUTH 32 PROFESSIONAL APPROVAL		
NAME	SIGN.	DATE
CLIENT PROJECT MANAGER		
CLIENT ENGINEERING MANAGER		
ADDITIONAL SIGNATORY		
ZUTARI PROJECT No.		113452
CLIENT CONTRACT No.		8500084829

REV.	I.T.	DESCRIPTION	DRWN.	DES.	CHK.	APR.	DATE
*	F	AS-BUILT DRAWING	C.N.	C.N.	H.G.	V.W.	16/04/2021

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KLIPSPRUIT EXTENSION (KPSX)

AREA: PCD 4
ELEMENT: PUMP STATION
TITLE: GENERAL ARRANGEMENT

SCALE:	SHEET SIZE	Drawing Number	SHEET No.	REV.
AS SHOWN	(A1)	KPSX-EP-16290-DRG-WW-GA-0671-01	1 OF 1	*

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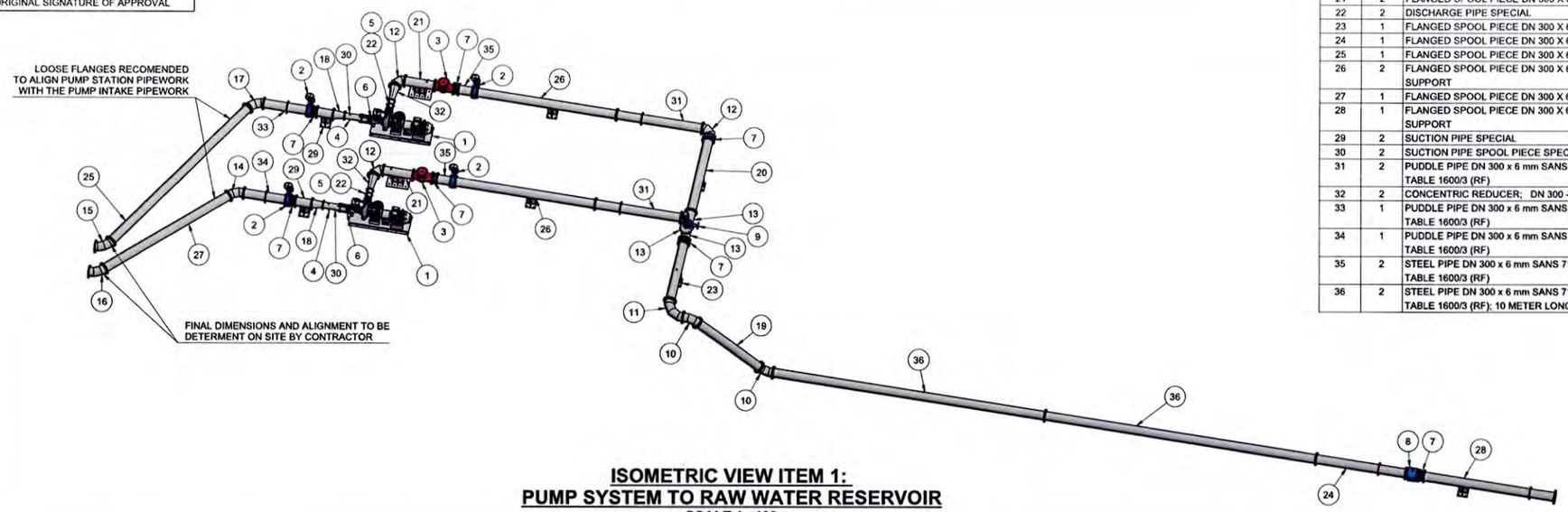
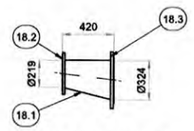


ISOMETRIC VIEW ITEM 1: PUMP SYSTEM TO RAW WATER RESERVOIR
SCALE 1 : 100

PARTS LIST		
ITEM	QTY	DESCRIPTION
21	2	FLANGED SPOOL PIECE DN 300 X 6 mm WITH PIPE ANCHOR
22	2	DISCHARGE PIPE SPECIAL
23	1	FLANGED SPOOL PIECE DN 300 X 6 mm WITH PIPE SUPPORT
24	1	FLANGED SPOOL PIECE DN 300 X 6 mm WITH PUDDLE FLANGE
25	1	FLANGED SPOOL PIECE DN 300 X 6 mm
26	2	FLANGED SPOOL PIECE DN 300 X 6 mm WITH PUDDLE FLANGE AND PIPE SUPPORT
27	1	FLANGED SPOOL PIECE DN 300 X 6 mm
28	1	FLANGED SPOOL PIECE DN 300 X 6 mm WITH PUDDLE FLANGE AND PIPE SUPPORT
29	2	SUCTION PIPE SPECIAL
30	2	SUCTION PIPE SPOOL PIECE SPECIAL
31	2	PUDDLE PIPE DN 300 x 6 mm SANS 719 GRADE C; FLANGE DN 300 SANS 1123 TABLE 1600/3 (RF)
32	2	CONCENTRIC REDUCER; DN 300 - DN 150 X 6 mm SANS 719 GRADE C
33	1	PUDDLE PIPE DN 300 x 6 mm SANS 719 GRADE C; FLANGE DN 300 SANS 1123 TABLE 1600/3 (RF)
34	1	PUDDLE PIPE DN 300 x 6 mm SANS 719 GRADE C; FLANGE DN 300 SANS 1123 TABLE 1600/3 (RF)
35	2	STEEL PIPE DN 300 x 6 mm SANS 719 GRADE C; FLANGE DN 300 SANS 1123 TABLE 1600/3 (RF)
36	2	STEEL PIPE DN 300 x 6 mm SANS 719 GRADE C; FLANGE DN 300 SANS 1123 TABLE 1600/3 (RF); 10 METER LONG

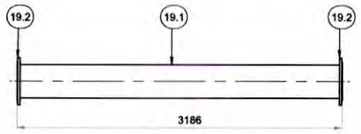
PARTS LIST		
ITEM	QTY	DESCRIPTION
1	2	PUMP SET CORNELL 6NHTA
2	4	BUTTERFLY VALVE DN 300 PN16; SANS 1849 DOUBLE FLANGED LH-RHP; FLANGED SANS 1123 TABLE 1600/3 (RF)
3	2	NON-RETURN SWING TYPE VALVE DN 300 PN 16; FLANGED SANS 1123 TABLE 1600/3 (RF)
4	2	BALL VALVE DN 25
5	2	RESTRAINT FLANGE ADAPTER DN 150 PN 16; TO SUIT PUMP FLANGE DRILLING PATTERN
6	2	RESTRAINT FLANGE ADAPTER DN 200 PN 16; TO SUIT PUMP FLANGE DRILLING PATTERN
7	7	DISMANTLING JOINT DN 300 SANS 1123 TABLE 1600/3 (RF)
8	1	ELECTRO MAG FLOWMETER DN 300; SANS 1123 TABLE 1600/3 (RF)
9	1	AIR VALVE ASSEMBLY FOR DN 300 PIPE & DN 80 AIR VALVE: REFER TO DRAWING: KPSX-EP-16200-DRG-WW-DE-0112-01 FOR DETAILS
10	2	MEDIUM RADIUS BEND (2 D); 45 DEGREE DN 300 X 6 mm SANS 719 GRADE C; FLANGE DN 300 SANS 1123 1600/3 (RF)
11	1	FLANGED ON BOTH ENDS MEDIUM RADIUS BEND (2 D); 90 DEGREE DN 300 X 6 mm SANS 719 GRADE C; FLANGE DN 300 SANS 1123 1600/3 (RF)
12	3	SHORT RADIUS BEND (1 D) ; 90 DEGREE DN 300 X 5 MM SANS 719 GRADE C; FLANGED DN 300 SANS 1123 TABLE 1600/3 (RF)
13	2	FLANGED EQUAL TEE DN 300 X 6 mm EXTENDED WITH EXTRA SPOOL
14	1	MEDIUM RADIUS BEND (2 D); 45 DEGREE DN 300 X 6 mm SANS 719 GRADE C; FLANGE DN 300 SANS 1123 1600/3 (RF)
15	1	MEDIUM RADIUS BEND (2 D) FLANGED ON BOTH ENDS; 60 DEGREE DN 300 X 6 mm SANS 719 GRADE C; FLANGE DN 300 SANS 1123 1600/3 (RF)
16	1	MEDIUM RADIUS BEND (2 D); 45 DEGREE DN 300 X 6 mm SANS 719 GRADE C; FLANGE DN 300 SANS 1123 1600/3 (RF)
17	1	MEDIUM RADIUS BEND (2 D) FLANGED ON BOTH ENDS; 60 DEGREE DN 300 X 6 mm SANS 719 GRADE C; FLANGE DN 300 SANS 1123 1600/3 (RF)
18	2	ECCENTRIC REDUCER; DN 300 - DN 200 X 6 mm SANS 719 GRADE C
19	1	FLANGED SPOOL PIECE DN 300 X 6 mm
20	1	FLANGED SPOOL PIECE DN 300 X 6 mm WITH PIPE SUPPORT

PARTS LIST		
ITEM	QTY	DESCRIPTION
18.1	1	ECCENTRIC REDUCER; 4 X (D1-D2) LONG DN 300 - DN 200 X 6 MM SANS 719 GRADE C
18.2	1	FLANGE DN 200 SANS 1123 TABLE 1600/3 (RF)
18.3	1	FLANGE DN 300 SANS 1123 TABLE 1600/3 (RF)



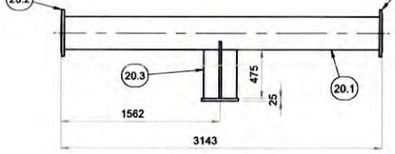
PLAN VIEW ITEM 18
SCALE 1 : 25

PARTS LIST		
ITEM	QTY	DESCRIPTION
19.1	3.186 m	STEEL PIPE DN 300 X 6 mm SANS 719 GRADE C
19.2	2	FLANGE DN 300 SANS 1123 TABLE 1600/3 (RF)

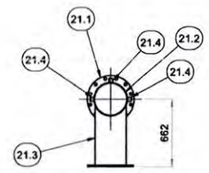


PLAN VIEW ITEM 19
SCALE 1 : 30

PARTS LIST		
ITEM	QTY	DESCRIPTION
20.1	3.143 m	STEEL PIPE DN 300 X 6 mm SANS 719 GRADE C
20.2	2	FLANGE DN 300 SANS 1123 TABLE 1600/3 (RF)
20.3	1	PIPE SUPPORT SINGLE DN 300

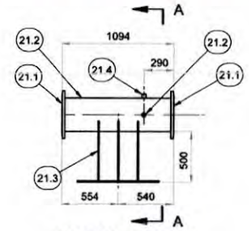


PLAN VIEW ITEM 20
SCALE 1 : 30



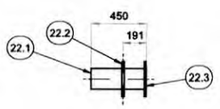
SECTION A-A
SCALE 1 : 30

PARTS LIST		
ITEM	QTY	DESCRIPTION
21.1	2	FLANGE DN 300 SANS 1123 TABLE 1600/3 (RF)
21.2	1.094 m	STEEL PIPE DN 300 X 6 mm SANS 719 GRADE C
21.3	1	ANCHOR SUPPORT DN 300
21.4	3	STANDARD SOCKET DN 25



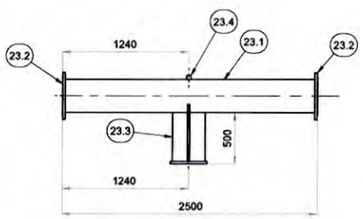
FRONT VIEW ITEM 21
SCALE 1 : 30

PARTS LIST		
ITEM	QTY	DESCRIPTION
22.1	0.450 m	STEEL PIPE DN 150 X 4.7 mm SANS 62
22.2	1	RESTRAINING FLANGE FOR RESTRAINT FLANGE ADAPTER DN 150; TO SUIT PUMP FLANGE DRILLING PATTERN
22.3	1	FLANGE DN 150 SANS 1123 TABLE 1600/3 (RF)



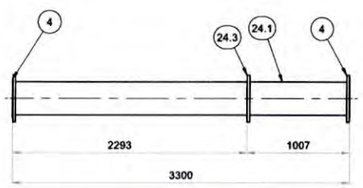
PLAN VIEW ITEM 22
SCALE 1 : 25

PARTS LIST		
ITEM	QTY	DESCRIPTION
23.1	2.500 m	STEEL PIPE DN 300 X 6 mm SANS 719 GRADE C
23.2	2	FLANGE DN 300 SANS 1123 TABLE 1600/3 (RF)
23.3	1	PIPE SUPPORT SINGLE DN 300
23.4	1	STANDARD SOCKET DN 25



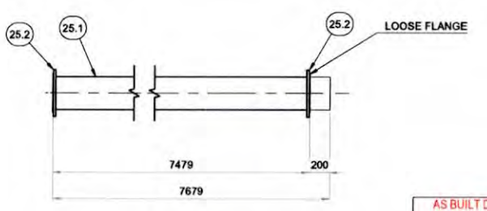
PLAN VIEW ITEM 23
SCALE 1 : 30

PARTS LIST		
ITEM	QTY	DESCRIPTION
24.1	3.300 m	STEEL PIPE DN 300 X 6 MM SANS 719 GRADE C
24.3	1	PUDDLE FLANGE DN 300, OD 460 mm, THICKNESS 28 mm
4	2	FLANGE DN 300 SANS 1123 TABLE 1600/3 (RF)



PLAN VIEW ITEM 24
SCALE 1 : 30

PARTS LIST		
ITEM	QTY	DESCRIPTION
25.1	7.479 m	STEEL PIPE DN 300 X 6 mm SANS 719 GRADE C
25.2	2	FLANGE DN 300 SANS 1123 TABLE 1600/3 (RF)



PLAN VIEW ITEM 25
SCALE 1 : 30

AS BUILT DRAWINGS
ZUTARI
Date 1/6/21

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REFERENCE DRAWINGS	
DRAWING NO.	TITLE

REFERENCE DRAWINGS	
KPSX-EP-16200-DRG-WW-DE-0104	TYPICAL DETAIL STEEL PIPE FITTINGS
KPSX-EP-16200-DRG-WW-DE-0103	TYPICAL DETAIL HDPE PIPE CONNECTION DETAILS
KPSX-EP-16200-DRG-WW-DE-0102	TYPICAL DETAILS PIPE SUPPORT DETAIL
KPSX-EP-16200-DRG-WW-DE-0112	TYPICAL DETAIL AIR VALVE
KPSX-EP-16290-DRG-WW-DE-0671-02	PUMP SYSTEM TO RAW WATER RESERVOIR
DRAWING NO.	TITLE

ZUTARI PROFESSIONAL ENGINEER		
NAME	VICTOR WENZEL	DATE
PROF. REG. No.	20130173	
SIGNATURE		1/6/21

SOUTH 32 PROFESSIONAL APPROVAL		
NAME	SIGN.	DATE
CLIENT PROJECT MANAGER		
CLIENT ENGINEERING MANAGER		
ADDITIONAL SIGNATORY		
ZUTARI PROJECT No.	113452	
CLIENT CONTRACT No.	8500084829	

REV.	I.T.	DESCRIPTION	DRWN.	DES.	CHK.	APR.	DATE
-	F	AS-BUILT DRAWING	C.N.	C.N.	H.G.	V.W.	16/04/2021

I.T. ISSUE TYPE: (A) FOR REVIEW (SO) (B) INTERNAL PEER REVIEW (C) FOR APPROVAL (CR) (D) FOR CONSTRUCTION (E) FOR INFORMATION (F) AS-BUILT (G) CANCELLED

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SOUTH32
ZUTARI IMPACT. ENGINEERED.
Riverwalk Office Park
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Ashlea Gardens, Extension 6
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0081
Tel: +27 12 427 2000
E connect@zutari.com

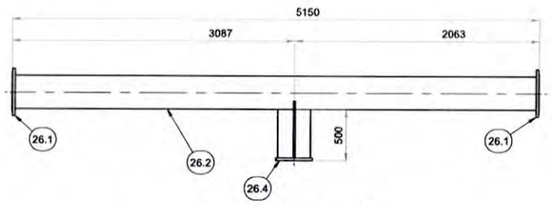
KLIPSPRUIT EXTENSION (KPSX)

AREA: PCD 4 PUMP STATION
ELEMENT: PUMP SYSTEM TO RAW WATER RESERVOIR
TITLE: MECHANICAL DETAILS

SCALE:	SHEET SIZE	Drawing Number	SHEET No.	REV.
AS SHOWN	(A1)	KPSX-EP-16290-DRG-WW-DE-0671-01	1 OF 2	*

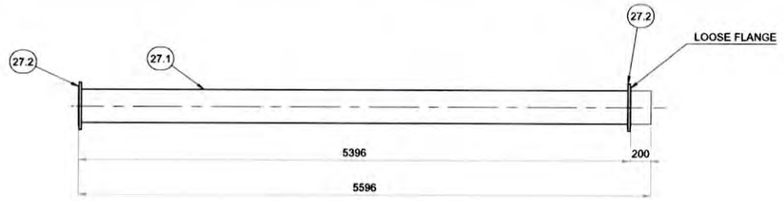
THE MASTER HELD AT ZUTARI GAUTENG DELIVERY CENTER, RESOURCES & MANUFACTURING UNIT, BEARS THE ORIGINAL SIGNATURE OF APPROVAL

PARTS LIST		
ITEM	QTY	DESCRIPTION
26.1	2	FLANGE DN 300 SANS 1123 TABLE 1600/3 (RF)
26.2	5.150 m	STEEL PIPE DN 300 X 6 mm SANS 719 GRADE C
26.4	1	PIPE SUPPORT SINGLE DN 300



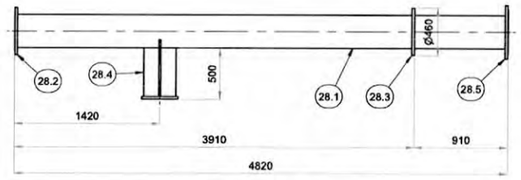
FRONT VIEW
ITEM 26
SCALE 1 : 30

PARTS LIST		
ITEM	QTY	DESCRIPTION
27.1	5.396 m	STEEL PIPE DN 300 X 6 mm SANS 719 GRADE C
27.2	2	FLANGE DN 300 SANS 1123 TABLE 1600/3 (RF)



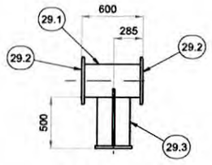
PLAN VIEW
ITEM 27
SCALE 1 : 30

PARTS LIST		
ITEM	QTY	DESCRIPTION
28.1	4.820 m	STEEL PIPE DN 300 X 6 MM SANS 719 GRADE C
28.2	1	FLANGE DN 300 SANS 1123 TABLE 1600/3 (RF)
28.3	1	PUDDLE FLANGE DN 300, OD 460 mm, THICKNESS 28 mm
28.4	1	PIPE SUPPORT SINGLE DN 300
28.5	1	FLANGE DN 350 DRILLED FOR DN 200 SPOOL SANS 1123 TABLE 1600-3



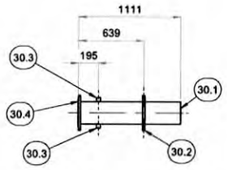
PLAN VIEW
ITEM 28
SCALE 1 : 30

PARTS LIST		
ITEM	QTY	DESCRIPTION
29.1	0.600 m	STEEL PIPE DN 300 X 6 mm SANS 719 GRADE C
29.2	2	FLANGE DN 300 SANS 1123 TABLE 1600/3 (RF)
29.3	1	PIPE SUPPORT SINGLE DN 300



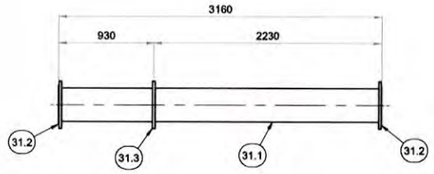
PLAN VIEW
ITEM 29
SCALE 1 : 30

PARTS LIST		
ITEM	QTY	DESCRIPTION
30.1	1.111 m	STEEL PIPE DN 200 X 6 mm SANS 719 GRADE C
30.2	1	RESTRAINING FLANGE FOR RESTRAINT FLANGE ADAPTER DN 200; TO SUIT PUMP FLANGE DRILLING PATTERN
30.3	2	STANDARD SOCKET DN 25
30.4	1	FLANGE DN 200 SANS 1123 TABLE 1600/3 (RF)



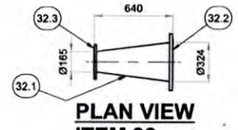
PLAN VIEW
ITEM30
SCALE 1 : 30

PARTS LIST		
ITEM	QTY	DESCRIPTION
31.1	3.160 m	STEEL PIPE DN 300 x 6 mm SANS 719 GRADE C
31.2	2	FLANGE DN 300 SANS 1123 TABLE 1600/3 (RF)
31.3	1	PUDDLE FLANGE DN 300, OD 460 mm, THICKNESS 28 mm



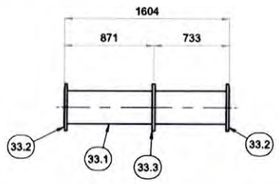
PLAN VIEW
ITEM 31
SCALE 1 : 30

PARTS LIST		
ITEM	QTY	DESCRIPTION
32.1	1	CONCENTRIC REDUCER; 4 X (D1-D2) LONG DN 300 - DN 150 X 6 MM SANS 719 GRADE C
32.2	1	FLANGE DN 300 SANS 1123 TABLE 1600/3 (RF)
32.3	1	FLANGE DN 150 SANS 1123 TABLE 1600/3 (RF)



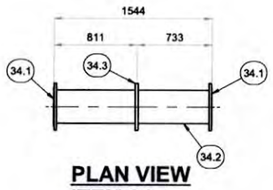
PLAN VIEW
ITEM 32
SCALE 1 : 25

PARTS LIST		
ITEM	QTY	DESCRIPTION
33.1	1.604 m	STEEL PIPE DN 300 x 6 mm SANS 719 GRADE C
33.2	2	FLANGE DN 300 SANS 1123 TABLE 1600/3 (RF)
33.3	1	PUDDLE FLANGE DN 300, OD 460mm, THICKNESS 28mm



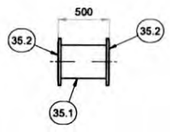
PLAN VIEW
ITEM 33
SCALE 1 : 30

PARTS LIST		
ITEM	QTY	DESCRIPTION
34.1	2	FLANGE DN 300 SANS 1123 TABLE 1600/3 (RF)
34.2	1.544 m	STEEL PIPE DN 300 x 6 mm SANS 719 GRADE C
34.3	1	PUDDLE FLANGE DN 300, OD 460mm, THICKNESS 28mm

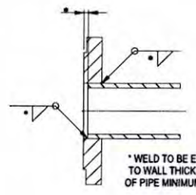


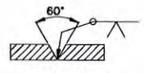
PLAN VIEW
ITEM 34
SCALE 1 : 30

PARTS LIST		
ITEM	QTY	DESCRIPTION
35.1	0.500 m	STEEL PIPE DN 300 x 6 mm SANS 719 GRADE C
35.2	2	FLANGE DN 300 SANS 1123 TABLE 1600/3 (RF)



PLAN VIEW
ITEM 35
SCALE 1 : 30





AS BUILT DRAWINGS
ZUTARI
Date 1/6/21

This AS BUILT drawing has been prepared based on information provided by the contractor. The levels and coordinates have not been independently checked or verified by Zutari.

REFERENCE DRAWINGS	
DRAWING NO.	TITLE

REFERENCE DRAWINGS	
DRAWING NO.	TITLE
KPSX-EP-16200-DRG-WW-DE-0104	TYPICAL DETAIL STEEL PIPE FITTING DETAILS
KPSX-EP-16200-DRG-WW-DE-0103	TYPICAL DETAIL HDPE PIPE CONNECTION DETAILS
KPSX-EP-16200-DRG-WW-DE-0102	TYPICAL DETAIL PIPE SUPPORT DETAIL
KPSX-EP-16200-DRG-WW-DE-0112	TYPICAL DETAIL AIR VALVE

ZUTARI PROFESSIONAL ENGINEER		
NAME	VICTOR WENTZEL	DATE
PROF. REG. No.	20130173	
SIGNATURE		1/6/21

SOUTH 32 PROFESSIONAL APPROVAL		
NAME	SIGN.	DATE
CLIENT PROJECT MANAGER		
CLIENT ENGINEERING MANAGER		
ADDITIONAL SIGNATORY		
ZUTARI PROJECT No.	113452	
CLIENT CONTRACT No.	8500084829	

REV.	I.T.	DESCRIPTION	DRWN.	DES.	CHK.	APR.	DATE
.	F	AS-BUILT DRAWING	C.N.	C.N.	H.G.	V.W.	16/04/2021

I.T. ISSUE TYPE: (A) FOR REVIEW (SQ) (B) INTERNAL PEER REVIEW (C) FOR APPROVAL (CR) (D) FOR CONSTRUCTION (E) FOR INFORMATION (F) AS-BUILT (G) CANCELLED

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Tel: +27 12 427 2000
E connect@zutari.com

KLIPSPRUIT EXTENSION (KPSX)

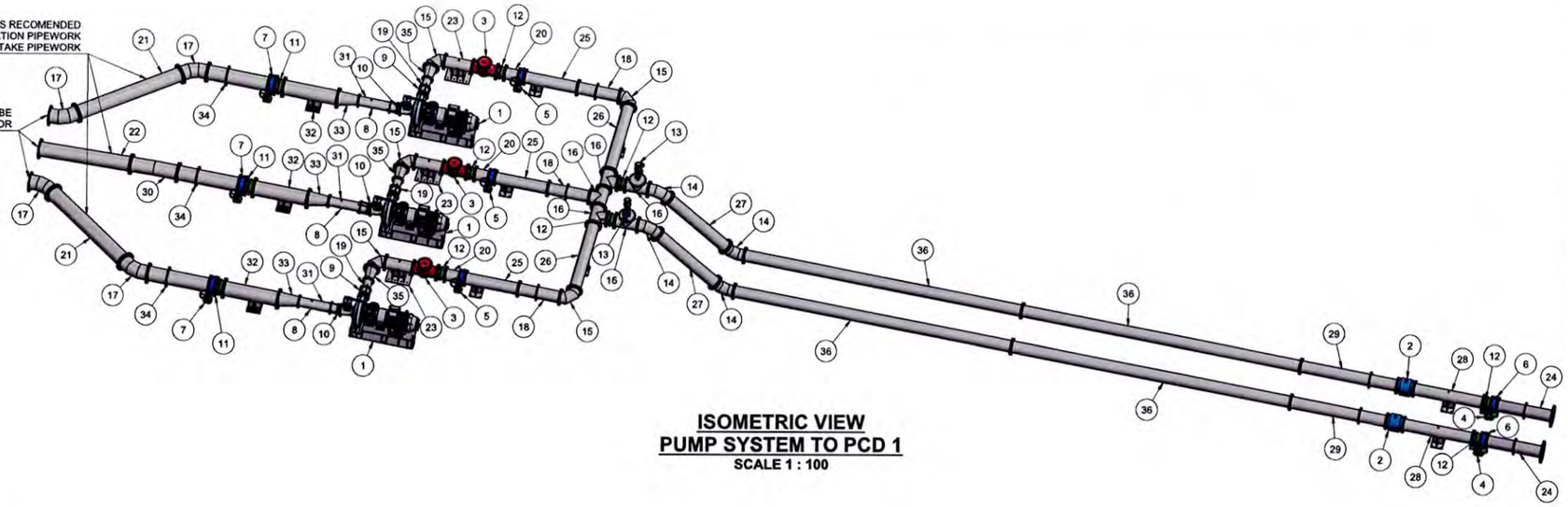
AREA: PCD 4 PUMP STATION
ELEMENT: PUMP SYSTEM TO RAW WATER RESERVOIR
TITLE: MECHANICAL DETAILS

SCALE:	SHEET SIZE	Drawing Number	SHEET No.	REV.
AS SHOWN	(A1)	KPSX-EP-16290-DRG-WW-DE-0671-02	2 OF 2	*

THE MASTER HELD AT ZUTARI, GAUTENG DELIVERY CENTER, RESOURCES & MANUFACTURING UNIT, BEARS THE ORIGINAL SIGNATURE OF APPROVAL

LOOSE FLANGES RECOMENDED TO ALIGN PUMP STATION PIPEWORK WITH THE PUMP INTAKE PIPEWORK

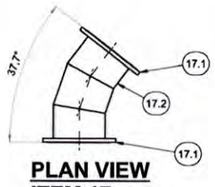
FINAL DIMENSIONS AND ALIGNMENT TO BE DETERMENT ON SITE BY CONTRACTOR



ISOMETRIC VIEW
PUMP SYSTEM TO PCD 1
SCALE 1 : 100

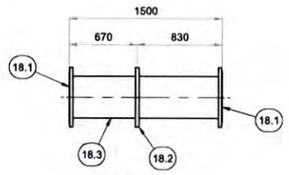
PARTS LIST		
ITEM	QTY	DESCRIPTION
1	3	PUMP SET CORNELL 10NHTA
2	2	ELECTRO MAG FLOWMETER DN 400; SANS 1123 TABLE 1600/3 (RF)
3	3	NON-RETURN SWING TYPE VALVE DN 400 PN 16; FLANGED SANS 1123 TABLE 1600/3 (RF)
4	2	ACTUATOR
5	3	BUTTERFLY VALVE DN 400 PN16; SANS 1849 DOUBLE FLANGED RH-LHP; FLANGED SANS 1123 TABLE 1600/1 (RF)
6	2	ELECTRICALLY ACTUATED BUTTERFLY VALVE DN 400 PN16; SANS 1849 DOUBLE FLANGED RH-LHP; FLANGED SANS 1123 TABLE 1600/3 (RF)
7	3	BUTTERFLY VALVE DN 500 PN16; SANS 1849 DOUBLE FLANGED RH-LHP; FLANGED SANS 1123 TABLE 1600/3 (RF)
8	3	BALL VALVE DN 25
9	3	RESTRAINT FLANGE ADAPTER DN 250 PN 16; TO SUIT PUMP FLANGE DRILLING PATTERN
10	3	RESTRAINT FLANGE ADAPTER DN 300 PN 16; TO SUIT PUMP FLANGE DRILLING PATTERN
11	3	DISMANTLING JOINT DN 500 SANS 1123 TABLE 1600/3 (RF)
12	7	DISMANTLING JOINT DN 400 SANS 1123 TABLE 1600/3 (RF)
13	2	AIR VALVE DN 80 FOR DN 400 PIPE; SEE AIR VALVE ASSEMBLY DRAWING KPSX-FS-16200-DRG-WW-DE-0112
14	4	MEDIUM RADIUS BEND (2 D); 45 DEG DN 400 X 6 mm SANS 719 GRADE C; FLANGED SANS 1123 TABLE 1600/3 (RF); REFER TO TYPICAL FITTING
15	5	SHORT RADIUS BEND (1 D) 90 DEG DN 400 x 6 mm SANS 719; FLANGED DN 400 SANS 1123 TABLE 1600/3 (RF); REFER TO TYPICAL FITTING DETAILS
16	5	EQUAL TEE DN 400 X 6 mm SANS 719 GRADE C ; FLANGED SANS 1123 TABLE 1600/3 (RF); REFER TO TYPICAL FITTING DETAILS
17	4	FLANGED MEDIUM RADIUS BEND (2 D); 37.7 DEGREE DN 500 X 6 mm SANS 719 GRADE C; FLANGE DN 500 SANS 1123 1600/3 (RF); REFER TO TYPICAL FITTING DETAILS
18	3	FLANGED SPOOL PIECE DN 400 X 6 mm WITH PIPE SUPPORT AND PUDDLE FLANGE
19	3	DISCHARGE PIPE SPECIAL DN 250 X 6 mm SANS 719 GRADE C
20	3	PIPE SPOOL DN 400; FLANGE DN 400 SANS 1123 TABLE 1600/3 (RF)
21	2	FLANGED SPOOL PIECE DN 500 X 6 mm
22	1	FLANGED SPOOL PIECE DN 500 X 6 mm
23	3	FLANGED SPOOL PIECE DN 400 X 6 mm WITH ANCHOR SUPPORT
24	2	FLANGED SPOOL PIECE DN 400 X 6 mm WITH PUDDLE FLANGE
25	3	FLANGED SPOOL PIECE DN 400 X 6 mm WITH PIPE SUPPORT AND PUDDLE FLANGE
26	2	PIPE SPECIAL WITH PIPE SUPPORT
27	2	FLANGED PIPE SPOOL PIECE DN 400 X 6 mm
28	2	FLANGED SPOOL PIECE DN 400 X 6 mm WITH PIPE SUPPORT
29	2	FLANGED PIPE SPOOL PIECE DN 400 X 6 mm WITH PUDDLE FLANGE
30	1	SPECIAL MITRE BEND DN 500 x 6mm 3 DEGREE
31	3	SUCTION PIPE SPECIAL
32	3	PIPE SPOOL DN 500 X 6 mm SANS 719 GRADE C; FLANGED DN 500 SANS 1123 TABLE 1600/3 (RF)
33	3	ECCENTRIC REDUCER DN 500 - DN 300 X 6 MM SANS 719 GRADE C; FLANGED SANS 1123 TABLE 1600/3 (RF)
34	3	FLANGED SPOOL PIECE DN 500 X 6 mm WITH PUDDLE FLANGE
35	3	CONCENTRIC REDUCER DN 400 - DN 250 x 6 mm SANS 719 GRADE C; FLANGED SANS 1123 TABLE 1600/3 (RF)
36	4	STEEL PIPE DN 400 x 6 mm SANS 719 GRADE C; FLANGE DN 400 SANS 1123 TABLE 1600/3 (RF); 10 METER LONG

PARTS LIST		
ITEM	QTY	DESCRIPTION
17.1	2	FLANGE DN 500 SANS 1123 TABLE 1600/3 (RF)
17.2	1	MEDIUM RADIUS SEGMENT BEND (2D) 37.7 DEG; DN 500 x 6.0 mm SANS 719 GRADE C



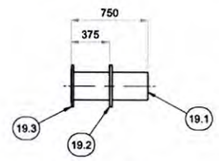
PLAN VIEW
ITEM 17
SCALE 1 : 30

PARTS LIST		
ITEM	QTY	DESCRIPTION
18.1	2	FLANGE DN 400 SANS 1123 TABLE 1600/3 (RF)
18.2	1	PUDDLE FLANGE DN 400, OD 580mm, THICKNESS 35mm
18.3	1.500 m	STEEL PIPE DN 400 X 6 mm SANS 719 GRADE C



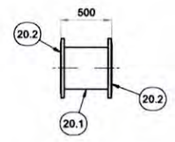
PLAN VIEW
ITEM 18
SCALE 1 : 30

PARTS LIST		
ITEM	QTY	DESCRIPTION
19.1	0.750 m	STEEL PIPE DN 250 X 6 mm SANS 719 GRADE C
19.2	1	RESTRAINING FLANGE FOR RESTRAINT FLANGE ADAPTER DN 250; TO SUIT PUMP FLANGE DRILLING PATTERN
19.3	1	FLANGE DN 250 SANS 1123 TABLE 1600/3 (RF)



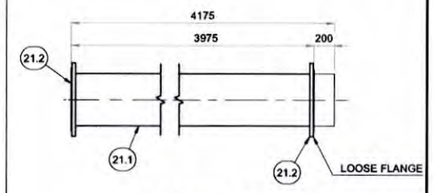
PLAN VIEW
ITEM 19
SCALE 1 :30

PARTS LIST		
ITEM	QTY	DESCRIPTION
20.1	0.500 m	STEEL PIPE DN 400 x 6 mm SANS 719 GRADE C
20.2	2	FLANGE DN 400 SANS 1123 TABLE 1600/3 (RF)



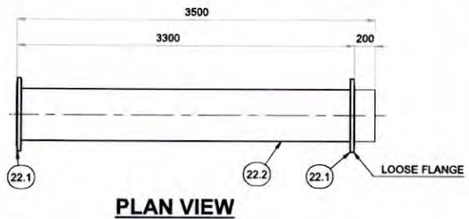
PLAN VIEW
ITEM 20
SCALE 1 : 30

PARTS LIST		
ITEM	QTY	DESCRIPTION
21.1	3.975 m	STEEL PIPE DN 500 X 6 mm SANS 719 GRADE C
21.2	2	FLANGE DN 500 SANS 1123 TABLE 1600/3 (RF)



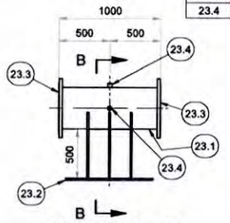
PLAN VIEW
ITEM 21
SCALE 1 : 30

PARTS LIST		
ITEM	QTY	DESCRIPTION
22.1	2	FLANGE DN 500 SANS 1123 TABLE 1600/3 (RF)
22.2	3.300 m	STEEL PIPE DN 500 X 6 mm SANS 719 GRADE C

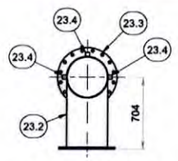


PLAN VIEW
ITEM 22
SCALE 1 : 30

PARTS LIST		
ITEM	QTY	DESCRIPTION
23.1	1.000 m	STEEL PIPE DN 400 X 6 mm SANS 719 GRADE C
23.2	1	ANCHOR SUPPORT DN 400
23.3	2	FLANGE DN 400 SANS 1123 TABLE 1600/3 (RF)
23.4	3	STANDARD SOCKET DN 25

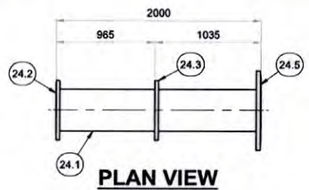


FRONT VIEW
ITEM 23
SCALE 1 : 30



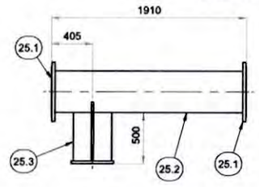
SECTION B-B
SCALE 1 : 30

PARTS LIST		
ITEM	QTY	DESCRIPTION
24.1	2.000 m	STEEL PIPE DN 400 X 6 mm SANS 719 GRADE C
24.2	1	FLANGE DN 400 SANS 1123 TABLE 1600/3 (RF)
24.3	1	PUDDLE FLANGE DN 400, OD 580mm, THICKNESS 35mm
24.5	1	SPECIAL FLANGE DN 550 DRILLED FOR DN 400 PIPE 1123 TABLE 1600/3 (RF) TO BE WELDED ON TO DN 400 PIPE



PLAN VIEW
ITEM 24
SCALE 1 : 30

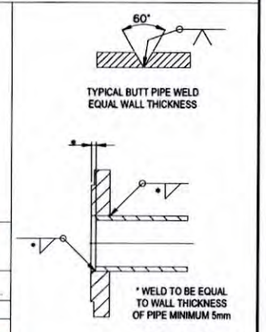
PARTS LIST		
ITEM	QTY	DESCRIPTION
25.1	2	FLANGE DN 400 SANS 1123 TABLE 1600/3 (RF)
25.2	1.910 m	STEEL PIPE DN 400 X 6 mm SANS 719 GRADE C
25.3	1	PIPE SUPPORT SINGLE DN 400



FRONT VIEW
ITEM 25
SCALE 1 :30

AS BUILT DRAWINGS
ZUTARI
1/6/21

This AS BUILT drawing has been prepared based on information provided by the contractor. The levels and coordinates have not been independently checked or verified by Zutari.



REFERENCE DRAWINGS	
DRAWING NO.	TITLE

REFERENCE DRAWINGS	
KPSX-EP-16200-DRG-WW-DE-0104	TYPICAL DETAILS STEEL PIPE FITTINGS
KPSX-EP-16200-DRG-WW-DE-0103	TYPICAL DETAIL HDPE PIPE CONNECTION DETAILS
KPSX-EP-16200-DRG-WW-DE-0102	TYPICAL DETAILS PIPE SUPPORT DETAILS
KPSX-EP-16200-DRG-WW-DE-0112	TYPICAL DETAIL AIR VALVE
KPSX-EP-16290-DRG-WW-DE-0672-02	PUMP SYSTEM TO PCD 1
DRAWING NO.	TITLE

ZUTARI PROFESSIONAL ENGINEER		
NAME	VICTOR WENTZEL	DATE
PROF. REG. No.	20130173	
SIGNATURE		1/6/21

SOUTH 32 PROFESSIONAL APPROVAL		
NAME	SIGN.	DATE
CLIENT PROJECT MANAGER		
CLIENT ENGINEERING MANAGER		
ADDITIONAL SIGNATORY		
ZUTARI PROJECT No.	113452	
CLIENT CONTRACT No.	8500084829	

REV.	I.T.	DESCRIPTION	DRWN.	DES.	CHK.	APR.	DATE
•	F	AS-BUILT DRAWING	C.N.	C.N.	H.G.	V.W.	16/04/2021

I.T. ISSUE TYPE: (A) FOR REVIEW (SQ) (B) INTERNAL PEER REVIEW (C) FOR APPROVAL (CR) (D) FOR CONSTRUCTION (E) FOR INFORMATION (F) AS-BUILT (G) CANCELLED

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SOUTH32

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E connect@zutari.com

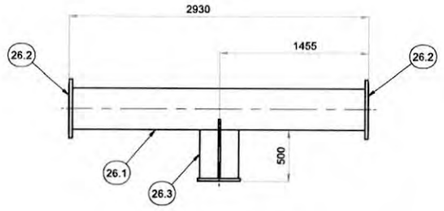
KLIPSPRUIT EXTENSION (KPSX)

AREA: PCD 4 PUMP STATION
ELEMENT: PUMP SYSTEM TO PCD 1
TITLE: MECHANICAL DETAILS

SCALE:	SHEET SIZE	Drawing Number	SHEET No.	REV.
AS SHOWN	(A1)	KPSX-EP-16290-DRG-WW-DE-0672-01	1 OF 2	*

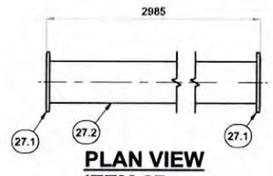
THE MASTER HELD AT ZUTARI, GAUTENG DELIVERY CENTER, RESOURCES & MANUFACTURING UNIT, BEARS THE ORIGINAL SIGNATURE OF APPROVAL

PARTS LIST		
ITEM	QTY	DESCRIPTION
26.1	2.930 m	STEEL PIPE DN 400 X 6 mm SANS 719 GRADE C
26.2	2	FLANGE DN 400 SANS 1123 TABLE 1600/3 (RF)
26.3	1	PIPE SUPPORT SINGLE DN 400



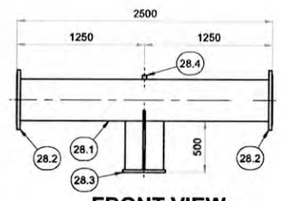
FRONT VIEW
ITEM 26
SCALE 1 :30

PARTS LIST		
ITEM	QTY	DESCRIPTION
27.1	2	FLANGE DN 400 SANS 1123 TABLE 1600/3 (RF)
27.2	2.985 m	STEEL PIPE DN 400 X 6 mm SANS 719 GRADE C



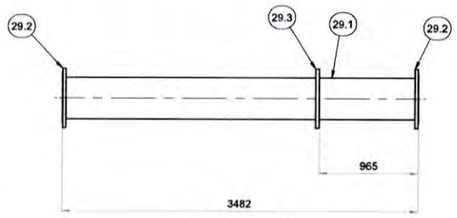
PLAN VIEW
ITEM 27
SCALE 1 : 30

PARTS LIST		
ITEM	QTY	DESCRIPTION
28.1	2.500 m	STEEL PIPE DN 400 X 6 mm SANS 719 GRADE C
28.2	2	FLANGE DN 400 SANS 1123 TABLE 1600/3 (RF)
28.3	1	PIPE SUPPORT SINGLE DN 400
28.4	1	STANDARD SOCKET DN 25



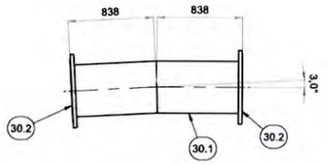
FRONT VIEW
ITEM 28
SCALE 1 : 30

PARTS LIST		
ITEM	QTY	DESCRIPTION
29.1	3.482 m	STEEL PIPE DN 400 X 6 mm SANS 719 GRADE C
29.2	2	FLANGE DN 400 SANS 1123 TABLE 1600/3 (RF)
29.3	1	PUDDLE FLANGE DN 400, OD 580mm, THICKNESS 35mm



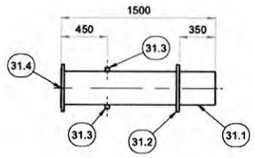
PLAN VIEW
ITEM 29
SCALE 1 :30

PARTS LIST		
ITEM	QTY	DESCRIPTION
30.1	1.676 m	STEEL PIPE DN 500 x 6 mm SANS 719 GRADE C
30.2	2	FLANGE DN 500 SANS 1123 TABLE 1600/3 (RF)



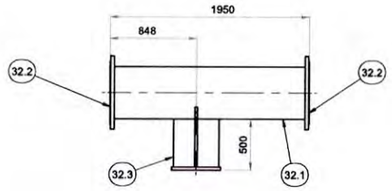
SIDE ELEVATION
ITEM 30
SCALE 1 : 30

PARTS LIST		
ITEM	QTY	DESCRIPTION
31.1	1.500 m	STEEL PIPE DN 300 X 6 mm SANS 719 GRADE C
31.2	1	RESTRAINING FLANGE FOR RESTRAINT FLANGE ADAPTER DN 300; TO SUIT PUMP FLANGE DRILLING PATTERN
31.3	2	STANDARD SOCKET DN 25
31.4	1	FLANGE DN 300 SANS 1123 TABLE 1600/3 (RF)



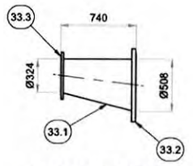
PLAN VIEW
ITEM 31
SCALE 1 :30

PARTS LIST		
ITEM	QTY	DESCRIPTION
32.1	1.950 m	STEEL PIPE DN 500 X 6 mm SANS 719 GRADE C
32.2	2	FLANGE DN 500 SANS 1123 TABLE 1600/3 (RF)
32.3	1	PIPE SUPPORT SINGLE DN 500



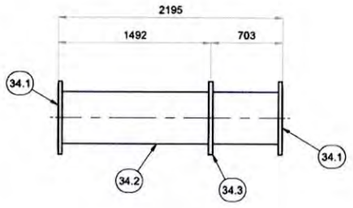
FRONT VIEW
ITEM 32
SCALE 1 :30

PARTS LIST		
ITEM	QTY	DESCRIPTION
33.1	1	ECCENTRIC REDUCER; 4 x (D1-D2) LONG DN 500 - DN 300 x 6 mm SANS 719 GRADE C
33.2	1	FLANGE DN 500 SANS 1123 TABLE 1600/3 (RF)
33.3	1	FLANGE DN 300 SANS 1123 TABLE 1600/3 (RF)



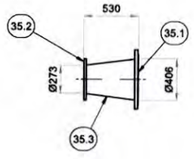
FRONT VIEW
ITEM 33
SCALE 1 :30

PARTS LIST		
ITEM	QTY	DESCRIPTION
34.1	2	FLANGE DN 500 SANS 1123 TABLE 1600/3 (RF)
34.2	2.195 m	STEEL PIPE DN 500 X 6 mm SANS 719 GRADE C
34.3	1	PUDDLE FLANGE DN 500, OD 715 mm x 40 mm THK

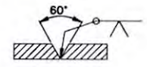


PLAN VIEW
ITEM 34
SCALE 1 : 30

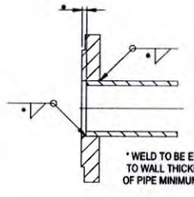
PARTS LIST		
ITEM	QTY	DESCRIPTION
35.1	1	FLANGE DN 400 SANS 1123 TABLE 1600/3 (RF)
35.2	1	FLANGE DN 250 SANS 1123 TABLE 1600/3 (RF)
35.3	1	CONCENTRIC REDUCER; 4 x (D1-D2) LONG DN 400 - DN 250 x 6 mm SANS 719 GRADE C



PLAN VIEW
ITEM 35
SCALE 1 :30



TYPICAL BUTT PIPE WELD
EQUAL WALL THICKNESS



TYPICAL FLANGE WELD

AS BUILT DRAWINGS
ZUTARI
For Client
Date: 1/6/21

This AS BUILT drawing has been prepared based on information provided by the contractor. The levels and coordinates have not been independently checked or verified by Zutari.

REFERENCE DRAWINGS	
DRAWING NO.	TITLE

REFERENCE DRAWINGS	
DRAWING NO.	TITLE
KPSX-EP-16200-DRG-WW-DE-0104	TYPICAL DETAIL PIPE FITTINGS
KPSX-EP-16200-DRG-WW-DE-0103	TYPICAL DETAIL HDPE PIPE CONNECTION DETAILS
KPSX-EP-16200-DRG-WW-DE-0102	TYPICAL DETAIL PIPE SUPPORT DETAILS
KPSX-EP-16200-DRG-WW-DE-0112	TYPICAL DETAIL AIR VALVE

ZUTARI PROFESSIONAL ENGINEER		
NAME	VICTOR WENTZEL	DATE
PROF. REG. No.	20130173	
SIGNATURE		1/6/21
SOUTH 32 PROFESSIONAL APPROVAL		
NAME	SIGN.	DATE
CLIENT PROJECT MANAGER		
CLIENT ENGINEERING MANAGER		
ADDITIONAL SIGNATORY		
ZUTARI PROJECT No.	113452	
CLIENT CONTRACT No.	8500084829	

REV.	I.T.	DESCRIPTION	DRWN.	DES.	CHK.	APR.	DATE
•	F	AS-BUILT DRAWING	C.N.	C.N.	H.G.	V.W.	16/04/2021

I.T. ISSUE TYPE: (A) FOR REVIEW (SQ) (B) INTERNAL PEER REVIEW (C) FOR APPROVAL (CR) (D) FOR CONSTRUCTION (E) FOR INFORMATION (F) AS-BUILT (G) CANCELLED

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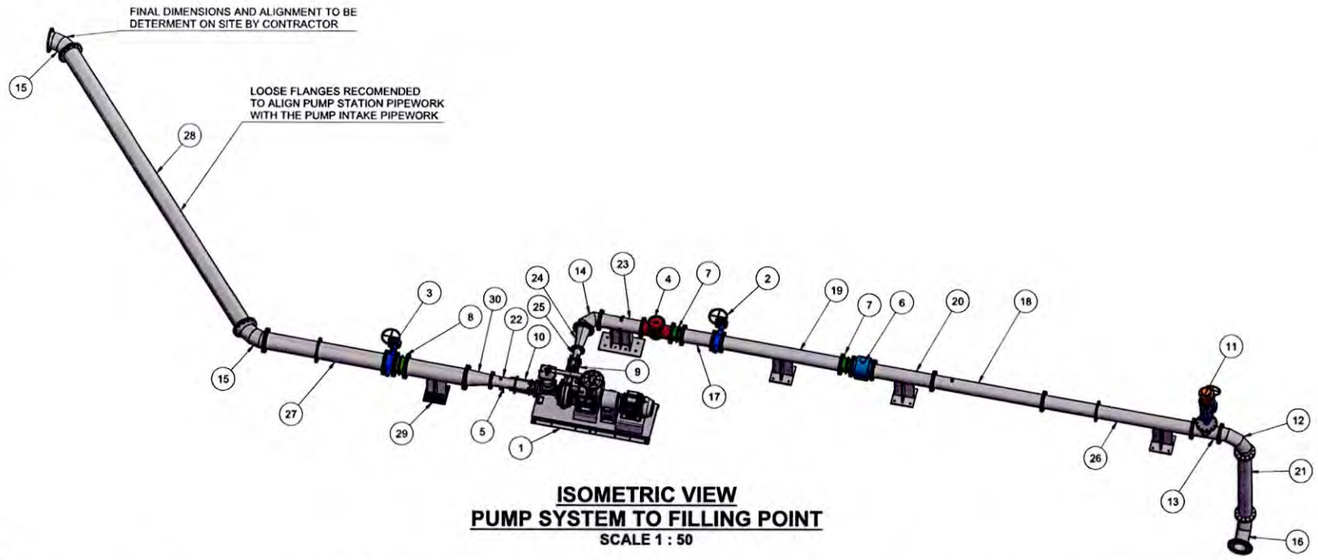
SOUTH32

KLIPSPRUIT EXTENSION (KPSX)

AREA: PCD 4 PUMP STATION
ELEMENT: PUMP SYSTEM TO PCD 1
TITLE: MECHANICAL DETAILS

SCALE:	SHEET SIZE	Drawing Number	SHEET No.	REV.
AS SHOWN	(A1)	KPSX-EP-16290-DRG-WW-DE-0672-02	2 OF 2	*

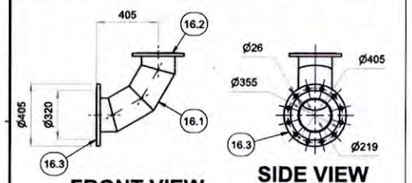
THE MASTER HELD AT ZUTARI, GAUTENG DELIVERY CENTER, RESOURCES & MANUFACTURING UNIT, BEARS THE ORIGINAL SIGNATURE OF APPROVAL



ISOMETRIC VIEW
PUMP SYSTEM TO FILLING POINT
SCALE 1 : 50

PARTS LIST		
ITEM	QTY	DESCRIPTION
2	1	BUTTERFLY VALVE DN 200 PN16; SANS 1849 DOUBLE FLANGED LH-RHP; FLANGED SANS 1123 TABLE 1600/3 (RF)
3	1	BUTTERFLY VALVE DN 250 PN16; SANS 1849 DOUBLE FLANGED LH-RHP; FLANGED SANS 1123 TABLE 1600/3 (RF)
4	1	NON-RETURN SWING TYPE VALVE DN 200 PN 16; FLANGED SANS 1123 TABLE 1600/3 (RF)
5	1	BALL VALVE DN 25
6	1	ELECTRO MAG FLOWMETER DN 200; SANS 1123 TABLE 1600/3 (RF)
7	2	DISMANTLING JOINT DN 200 SANS 1123 TABLE 1600/3 (RF)
8	1	DISMANTLING JOINT DN 250 SANS 1123 TABLE 1600/3 (RF)
9	1	RESTRAINT FLANGE ADAPTER DN 100; TO SUIT PUMP FLANGE DRILLING PATTERN
10	1	RESTRAINT FLANGE ADAPTER DN 150 PN 16; TO SUIT PUMP FLANGE DRILLING PATTERN
11	1	AIR VALVE ASSEMBLY FOR DN 200 PIPE & DN 80 AIR VALVE: REFER TO DRAWING: KPSX-EP-16200-DRG-WW-DE-0112-01 FOR DETAILS
12	1	FLANGED MEDIUM RADIUS BEND (2 D); 90 DEGREE DN 200 X 6 mm SANS 719 GRADE C; FLANGE DN 200 SANS 1123 1600/3 (RF)
13	1	FLANGED EQUAL TEE DN 200 X 6 mm SANS 719 GRADE C ; FLANGED SANS 1123 TABLE 1600/3 (RF);REFER TO TYPICAL FITTING DETAILS
14	1	SHORT RADIUS SEGMENT BEND DN 200 x 4.5 (1D) 90 DEG; FLANGE DN 200 SANS 1123 TABLE 1600/3 (RF);REFER TO TYPICAL FITTING DETAILS
15	2	MEDIUM RADIUS BEND (2 D); 50 DEGREE DN 250 x 6 mm SANS 719 GRADE C; FLANGE DN 250 SANS 1123 1600/3 (RF);REFER TO TYPICAL FITTING DETAILS
16	1	FLANGED MEDIUM RADIUS BEND (2 D); 90 DEGREE DN 200 X 6 mm SANS 719 GRADE C; FLANGE DN 200 SANS 1123 1600/3 (RF)
17	1	PIPE SPOOL DN 200; FLANGE DN 200 SANS 1123 TABLE 1600/3 (RF)
18	1	FLANGED SPOOL PIECE DN 200 WITH PIPE SUPPORT AND PUDDLE FLANGE
19	1	FLANGED SPOOL PIECE DN 200 WITH PIPE SUPPORT
20	1	FLANGED SPOOL PIECE DN 200 WITH PIPE SUPPORT
21	1	FLANGED SPOOL PIECE DN 200
22	1	SUCTION PIPE SPECIAL
23	1	DISCHARGE PIPE SPECIAL
24	1	CONCENTRIC REDUCER; 4 x (D1-D2) LONG DN 200 - DN 100 x 5 mm SANS 719 GRADE C
25	1	PIPE SPOOL DN 100
26	1	FLANGED SPOOL PIECE DN 200 WITH PIPE SUPPORT AND PUDDLE FLANGE
27	1	PIPE SPOOL DN 250 WITH PUDDLE FLANGE; FLANGE DN 250 SANS 1123 TABLE 1600/3 (RF)
28	1	FLANGED SPOOL PIECE DN 250
29	1	PIPE SPOOL DN 250 WITH SUPPORT; FLANGE DN 250 SANS 1123 TABLE 1600/3 (RF)
30	1	SUCTION PIPE SPECIAL
1	1	PUMP SET CORNELL 4NHTA

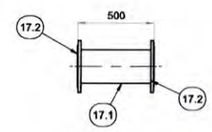
PARTS LIST		
ITEM	QTY	DESCRIPTION
16.1	1	MEDIUM RADIUS BEND (2 D); 90 DEGREE DN 200 X 6 MM SANS 719 GRADE C
16.2	1	FLANGE DN 200 SANS 1123 TABLE 1600/3 (RF)
16.3	1	FLANGE DN 200 DRILLED TO DN 250 SANS 1123 TABLE 1600/3 (RF)



FRONT VIEW
ITEM 16
SCALE 1 : 20

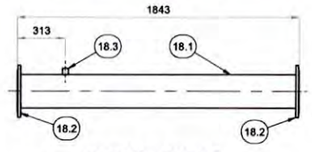
SIDE VIEW
SCALE 1 : 20

PARTS LIST		
ITEM	QTY	DESCRIPTION
17.1	0.500 m	STEEL PIPE DN 200 x 4.5 mm SANS 719 GRADE C
17.2	2	FLANGE DN 200 SANS 1123 TABLE 1600/3 (RF)



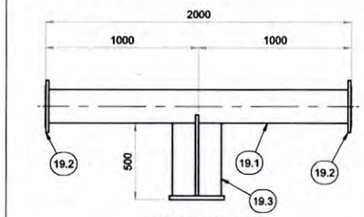
PLAN VIEW
ITEM 17
SCALE 1 : 20

PARTS LIST		
ITEM	QTY	DESCRIPTION
18.1	1.843 m	STEEL PIPE DN 200 X 6 mm SANS 719 GRADE C
18.2	2	FLANGE DN 200 SANS 1123 TABLE 1600/3 (RF)
18.3	1	STANDARD SOCKET DN 25



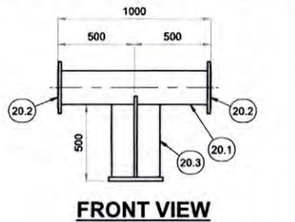
FRONT VIEW
ITEM 18
SCALE 1 : 20

PARTS LIST		
ITEM	QTY	DESCRIPTION
19.1	2.000 m	STEEL PIPE DN 200 X 6 mm SANS 719 GRADE C
19.2	2	FLANGE DN 200 SANS 1123 TABLE 1600/3 (RF)
19.3	1	PIPE SUPPORT SINGLE DN 200



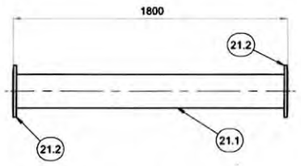
SIDE VIEW
ITEM 19
SCALE 1 : 20

PARTS LIST		
ITEM	QTY	DESCRIPTION
20.1	1.000 m	STEEL PIPE DN 200 X 6 mm SANS 719 GRADE C
20.2	2	FLANGE DN 200 SANS 1123 TABLE 1600/3 (RF)
20.3	1	PIPE SUPPORT SINGLE DN 200



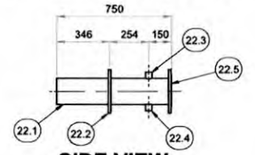
FRONT VIEW
ITEM 20
SCALE 1 : 20

PARTS LIST		
ITEM	QTY	DESCRIPTION
21.1	1.800 m	STEEL PIPE DN 200 X 6 mm SANS 719 GRADE C
21.2	2	FLANGE DN 200 SANS 1123 TABLE 1600/3 (RF)



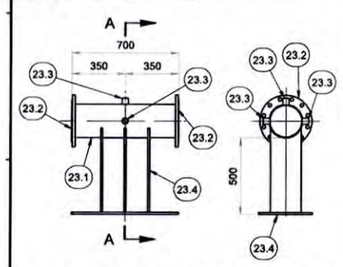
PLAN VIEW
ITEM 21
SCALE 1 : 20

PARTS LIST		
ITEM	QTY	DESCRIPTION
22.1	0.750 m	STEEL PIPE DN 150 X 4.7 MM SANS 62
22.2	1	RESTRAINING FLANGE FOR RESTRAINT FLANGE ADAPTER DN 150; TO SUIT PUMP FLANGE DRILLING PATTERN
22.3	1	STANDARD SOCKET DN 25
22.4	1	STANDARD SOCKET DN 25
22.5	1	FLANGE DN 150 SANS 1123 TABLE 1600/3 (RF)



SIDE VIEW
ITEM 22
SCALE 1 : 20

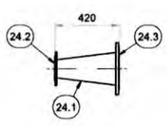
PARTS LIST		
ITEM	QTY	DESCRIPTION
23.1	0.700 m	STEEL PIPE DN 200 X 6 mm SANS 719 GRADE C
23.2	2	FLANGE DN 200 SANS 1123 TABLE 1600/3 (RF)
23.3	[illegible]	STANDARD SOCKET DN 25
23.4	[illegible]	ANCHOR SUPPORT DN 200



FRONT VIEW
ITEM 23
SCALE 1 : 20

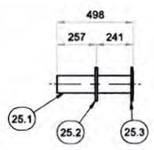
SECTION A-A
SCALE 1 : 20

PARTS LIST		
ITEM	QTY	DESCRIPTION
24.1	1	CONCENTRIC REDUCER; 4 x (D1-D2) LONG DN 200 - DN 100 x 5 mm SANS 719 GRADE C
24.2	1	FLANGE DN 100 SANS 1123 TABLE 1600/3 (RF)
24.3	1	FLANGE DN 200 SANS 1123 TABLE 1600/3 (RF)



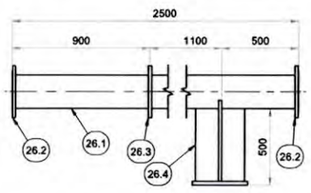
PLAN VIEW
ITEM 24
SCALE 1 : 20

PARTS LIST		
ITEM	QTY	DESCRIPTION
25.1	0.498 m	STEEL PIPE DN 100 X 4.7 MM SANS 62
25.2	1	RESTRAINING FLANGE FOR RESTRAINT FLANGE ADAPTER DN 100; TO SUIT PUMP FLANGE DRILLING PATTERN
25.3	1	FLANGE DN 100 SANS 1123 TABLE 1600/3 (RF)



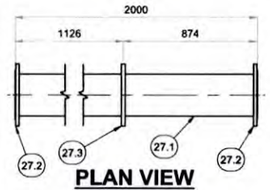
PLAN VIEW
ITEM 25
SCALE 1 : 20

PARTS LIST		
ITEM	QTY	DESCRIPTION
26.1	2.500 m	STEEL PIPE DN 200 X 6 mm SANS 719 GRADE C
26.2	2	FLANGE DN 200 SANS 1123 TABLE 1600/3 (RF)
26.3	1	PUDDLE FLANGE DN 200, OD 340mm, THICKNESS 22mm
26.4	1	PIPE SUPPORT SINGLE DN 200



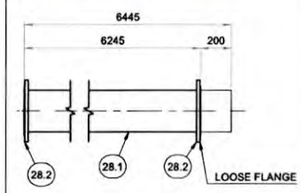
FRONT ELEVATION
ITEM 26
SCALE 1 : 20

PARTS LIST		
ITEM	QTY	DESCRIPTION
27.1	2.000 m	STEEL PIPE DN 250 x 5 mm SANS 719 GRADE C
27.2	2	FLANGE DN 250 SANS 1123 TABLE 1600/3 (RF)
27.3	1	PUDDLE FLANGE DN 250, OD 405mm, THICKNESS 25mm



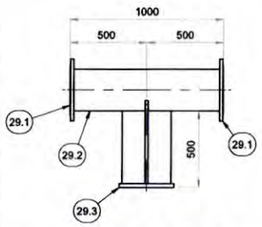
PLAN VIEW
ITEM 27
SCALE 1 : 20

PARTS LIST		
ITEM	QTY	DESCRIPTION
28.1	6.245 m	STEEL PIPE DN 250 X 6 mm SANS 719 GRADE C
28.2	2	FLANGE DN 250 SANS 1123 TABLE 1600/3 (RF)



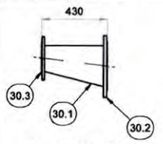
PLAN VIEW
ITEM 28
SCALE 1 : 20

PARTS LIST		
ITEM	QTY	DESCRIPTION
29.1	2	FLANGE DN 250 SANS 1123 TABLE 1600/3 (RF)
29.2	1.000 m	STEEL PIPE DN 250 X 6 MM SANS 719 GRADE C
29.3	1	PIPE SUPPORT SINGLE DN 250



FRONT VIEW
ITEM 29
SCALE 1 : 20

PARTS LIST		
ITEM	QTY	DESCRIPTION
30.1	1	ECCENTRIC REDUCER; 4 X (D1-D2) LONG DN 250 - DN 150 X 5 MM SANS 719 GRADE C
30.2	1	FLANGE DN 250 SANS 1123 TABLE 1600/3 (RF)
30.3	1	FLANGE DN 150 SANS 1123 TABLE 1600/3 (RF)



SIDE VIEW
ITEM 30
SCALE 1 : 20

AS BUILT DRAWINGS
ZUTARI
Date 1/6/21

This AS BUILT drawing has been prepared based on information provided by the contractor. The levels and coordinates have not been independently checked or verified by Zutari.

REFERENCE DRAWINGS	
DRAWING NO.	TITLE

REFERENCE DRAWINGS		
KPSX-EP-16200-DRG-WW-DE-0104	TYPICAL DETAIL STEEL PIPE FITTINGS	
KPSX-EP-16200-DRG-WW-DE-0103	TYPICAL DETAIL HDPE PIPE CONNECTION DETAILS	
KPSX-EP-16200-DRG-WW-DE-0102	TYPICAL DETAIL PIPE SUPPORT DETAIL	
KPSX-EP-16200-DRG-WW-DE-0112	TYPICAL DETAIL AIR VALVE	
DRAWING NO.	TITLE	TITLE

ZUTARI PROFESSIONAL ENGINEER		
NAME	VICTOR WENZEL	DATE
PROF. REG. No.	20130173	
SIGNATURE		1/6/21

SOUTH 32 PROFESSIONAL APPROVAL		
NAME	SIGN.	DATE
CLIENT PROJECT MANAGER		
CLIENT ENGINEERING MANAGER		
ADDITIONAL SIGNATORY		
ZUTARI PROJECT No.	113452	
CLIENT CONTRACT No.	8500084829	

REV.	I.T.	DESCRIPTION	DRWN.	DES.	CHK.	APR.	DATE
*	F	AS-BUILT DRAWING	C.N.	C.N.	H.G.	V.W.	16/04/2021

I.T. ISSUE TYPE: (A) FOR REVIEW (SQ) (B) INTERNAL PEER REVIEW (C) FOR APPROVAL (CR) (D) FOR CONSTRUCTION (E) FOR INFORMATION (F) AS-BUILT (G) CANCELLED

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E connect@zutari.com

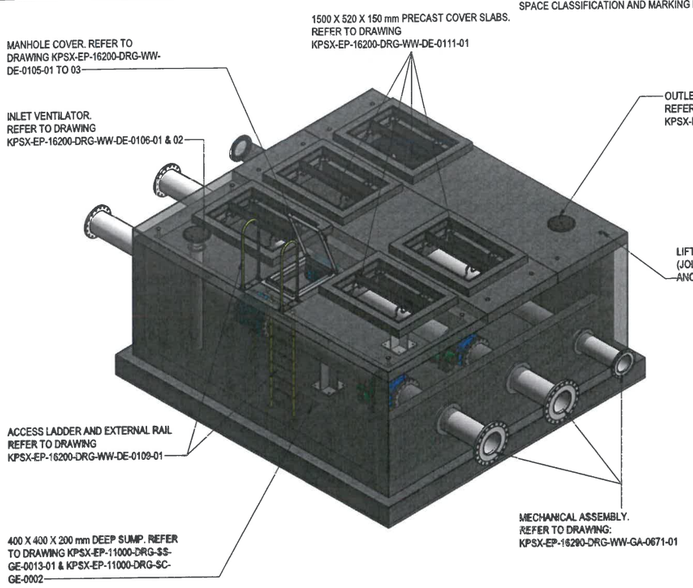
KLIPSPRUIT EXTENSION (KPSX)

AREA: PCD 4 PUMP STATION
ELEMENT: PUMP SYSTEM TO FILLING POINT
TITLE: MECHANICAL DETAILS

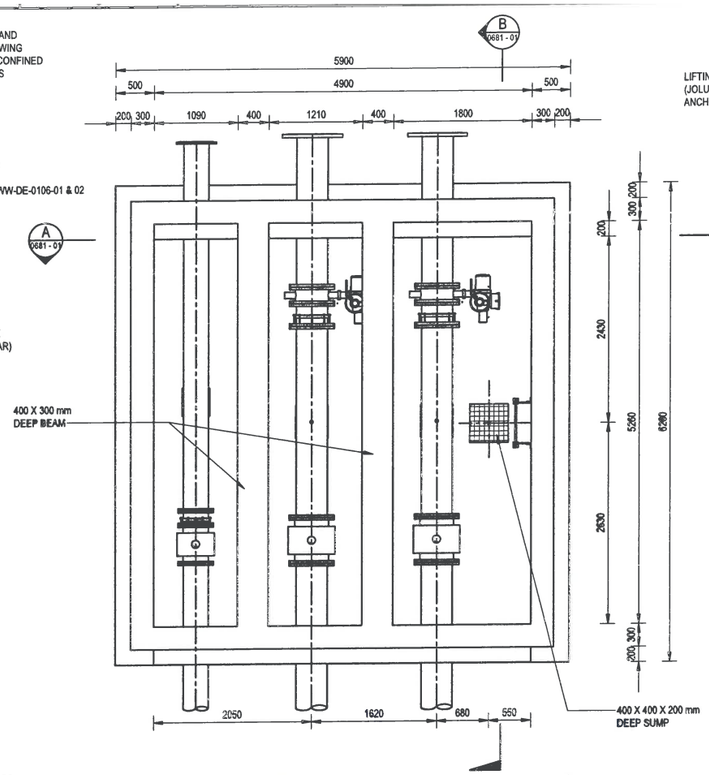
SCALE:	SHEET SIZE	Drawing Number	SHEET No.	REV.
AS SHOWN	(A1)	KPSX-EP-16290-DRG-WW-DE-0673-01	1 OF 1	*

THE MASTER HELD AT ZUTARI, GAUTENG DELIVERY CENTRE, RESOURCES & MANUFACTURING UNIT, BEARS THE ORIGINAL SIGNATURE OF APPROVAL

NOTE:
THIS CHAMBER IS CLASSIFIED AS A CONFINED SPACE AND NEEDS TO BE MARKED ACCORDINGLY. REFER TO DRAWING KPSX-EP-16200-DRG-WW-DE-0125-01 FOR DETAILS OF CONFINED SPACE CLASSIFICATION AND MARKING REQUIREMENTS

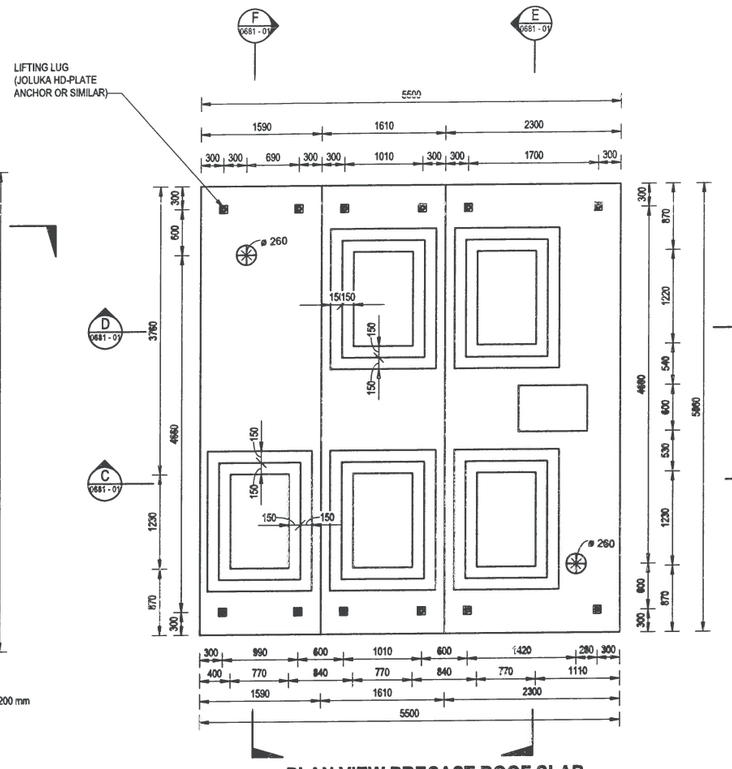


VALVE CHAMBER ISOMETRIC VIEW



PLAN VIEW PRECAST SLAB REMOVED

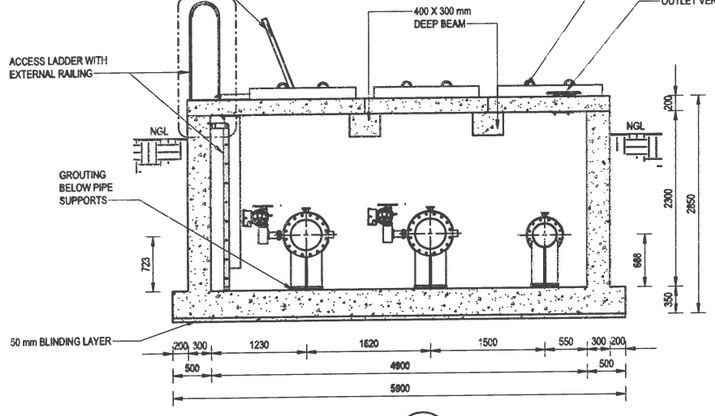
1 : 40



1. ALL BURIED SECTIONS OF STEEL PIPE, FLANGES AND BOLTS TO BE COVERED BY VISCO ELASTIC ELASTIC TAPE WITH PVC WRAPPING (STOPAQ OR SIMILAR APPROVED)
2. 28 DAY CONCRETE CUBE COMPRESSIVE STRENGTH
   - A) BLINDING LAYER: CLASS 15/19 15 MPa
   - B) FOOTINGS: CLASS 30/19 30 MPa
   - C) COLUMNS & WALLS: CLASS 30/19 30 MPa
   - D) SLABS: CLASS 30/19 30 MPa
3. PIPES THROUGH SLAB
   - A) POLYURETHANE APPLICATION AREA TO BE CLEAN, SOUND, FREE OF LOOSE PARTICLES, DUST, LAITANCE OILS AND OTHER CONTAMINANTS.
   - B) POLYURETHANE SEALANT TO BE APPLIED AROUND ENTIRE PIPE.
   - C) MINIMUM THICKNESS OF REINFORCED CONCRETE TO BE 100 mm ON EACH SIDE.
   - D) APPLICATION PROCEDURE TO BE ACCORDING TO MANUFACTURER SPECIFICATIONS.
4. ALL EXPOSED EXTERNAL EDGES IN CONCRETE WORK SHALL HAVE 20 mm x 20 mm CHAMFERS.
5. FINAL CHAMBER LEVEL TO BE AT LEAST 400 mm ABOVE NGL. CHAMBER HEIGHT TO BE CONFIRMED ON SITE.

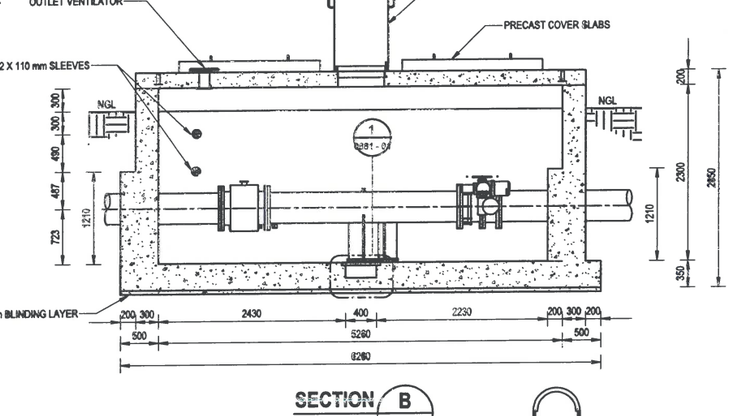
AS BUILT DRAWINGS
ZUTARI
Date: 1/6/21

This AS BUILT drawing has been prepared based on information provided by the contractor. The levels and coordinates have not been independently checked or verified by Zutari.



SECTION A

1 : 40 — 0681 - 01

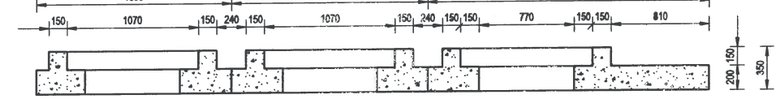


SECTION B

1 : 40 — 0681 - 01

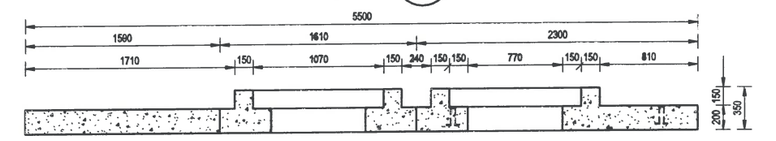
SECTION C

1 : 25 — 0681 - 01



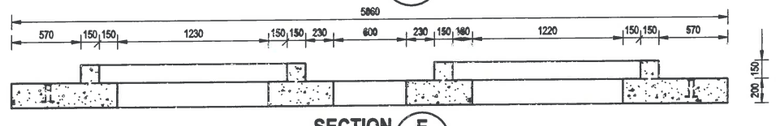
SECTION D

1 : 25 — 0681 - 01



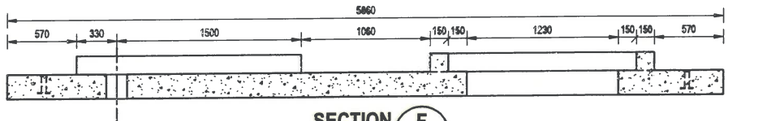
SECTION E

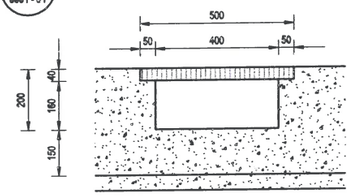
1 : 25 — 0681 - 01



SECTION F

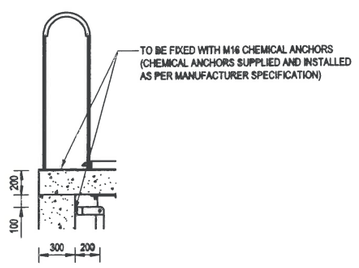
1 : 25 — 0681 - 01





DETAIL 1

1 : 10 — 0681 - 01



DETAIL 2

1 : 25 — 0681 - 01

REFERENCE DRAWINGS	
DRAWING No.	TITLE

REFERENCE DRAWINGS	
DRAWING No.	TITLE
XPSX-EP-11000-DRG-SS-GE-0013-01	FLOOR GRATING TYPICAL DETAILS
KPSX-EP-16290-DRG-WW-GA-0671-01	PCD 4 PUMP STATION GENERAL ARRANGEMENT MECHANICALS
KPSX-EP-11000-DRG-SC-GE-0002-01	GENERAL STRUCTRAL CONCRETE TYPICAL CIVIL DETAILS
KPSX-EP-11000-DRG-SC-GE-0001-01	GENERAL CONCRETE NOTES
KPSX-EP-16200-DRG-WW-DE-0109-01	TYPICAL DETAIL ACCESS LADDER
KPSX-EP-16200-DRG-WW-DE-0106-02	TYPICAL DETAIL AIR VENTILATOR
KPSX-EP-16200-DRG-WW-DE-0105-01	TYPICAL DETAIL MANHOLE COVER
KPSX-EP-16290-DRG-WW-GA-0661-01	PCD 4 PUMP STATION GENERAL ARRANGEMENT

ZUTARI PROFESSIONAL ENGINEER		
NAME	VICTOR WENTZEL	DATE
PROF. REG. No.	20190173	
SIGNATURE		1/6/21

SOUTH 32 PROFESSIONAL APPROVAL		
NAME	SIGN	DATE
CLIENT PROJECT MANAGER		
CLIENT ENGINEERING MANAGER		
ADDITIONAL SIGNATORY		
ZUTARI PROJECT No.	113452	
CLIENT CONTRACT No.	8500084829	

REV.	I.T.	DESCRIPTION	DRWN.	DES.	CHK.	APR.	DATE
*	F	AS-BUILT DRAWING	G.W	C.N	V.W	J.L	26/04/2018

I.T. ISSUE TYPE: (A) FOR REVIEW (B) FOR APPROVAL (C) FOR TENDER (D) FOR CONSTRUCTION (E) FOR INFORMATION (F) AS-BUILT (G) CANCELLED

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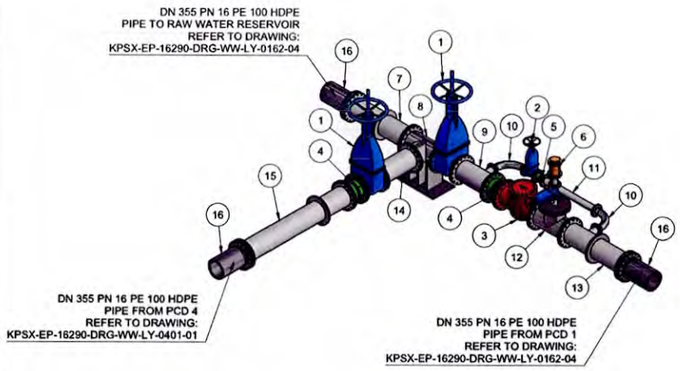
KLIPSPRUIT EXTENSION (KPSX)

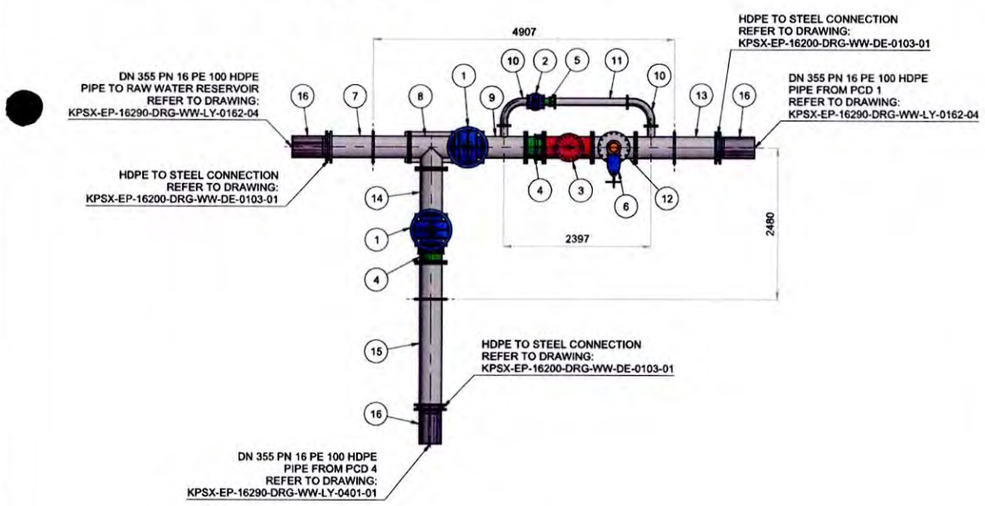
AREA:	PCD 4 PUMP STATION
ELEMENT:	VALVE CHAMBER
TITLE:	CHAMBER DETAILS
SCALE: AS SHOWN	SHEET SIZE (A1)
DRAWING NUMBER	16290 - DRG - WW - DE - 0681 - 01
SHEET NO.	1 OF 1
REV.	*

THE MASTER HELD AT ZUTARI, GAUTENG DELIVERY CENTER, RESOURCES & MANUFACTURING UNIT, BEARS THE ORIGINAL SIGNATURE OF APPROVAL

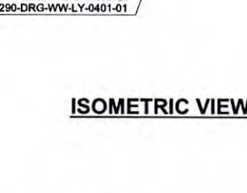


ISOMETRIC VIEW: MECHANICAL ASSEMBLY
SCALE 1:50

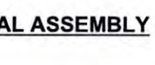
PARTS LIST		
ITEM	QTY	DESCRIPTION
1	2	GATE VALVE DN 350 PN 16; SANS 664 RISING SPINDLE - SHORT PATTERN; FLANGED SANS 1123 TABLE 1600/3 (RF)
2	1	GATE VALVE DN 100 PN 16; SANS 664 RISING SPINDLE - SHORT PATTERN; FLANGED SANS 1123 TABLE 1600/1 (RF)
3	1	NON-RETURN SWING TYPE VALVE DN 350 PN 16: FLANGED SANS 1123 TABLE 1600/3 (RF)
4	2	DISMANTLING JOINT DN 350 SANS 1123 TABLE 1600/3 (RF)
5	1	DISMANTLING JOINT DN 100 SANS 1123 TABLE 1600/3 (RF)
6	1	AIR VALVE ASSEMBLY FOR DN 350 PIPE & DN 80 AIR VALVE: REFER TO DRAWING: KPSX-EP-16200-DRG-WW-DE-0112-01 FOR DETAILS
7	1	SPOOL PIECE DN 350 X 6 mm SANS 719 GRADE C; FLANGED BOTH ENDS SANS 1123 TABLE 1600/3 (RF) WITH PUDDLE FLANGE
8	1	EQUAL TEE DN 350 X 6 mm SANS 719 GRADE C ; FLANGED SANS 1123 TABLE 1600/3 (RF) WITH ANCHOR SUPPORT
9	1	UNEQUAL TEE; DN 350 - DN 100 x 6 mm SANS 719 GRADE C; FLANGE SANS 1123 TABLE 1600/3 (RF)
10	2	LONG RADIUS BEND (3 D); 90 DEGREE DN 100 X 3.9 mm SANS 62; FLANGED SANS 1123 TABLE 1600/3 (RF)
11	1	SPOOL PIECE DN 100 X 3.9 mm SANS 62; FLANGED BOTH ENDS SANS 1123 TABLE 1600/3 (RF)
12	1	EQUAL TEE DN 350 X 6 mm SANS 719 GRADE C ; FLANGED SANS 1123 TABLE 1600/3 (RF)
13	1	DN 350 PIPE SPECIAL
14	1	SPOOL PIECE DN 350 X 6 mm SANS 719 GRADE C; FLANGED BOTH ENDS SANS 1123 TABLE 1600/3 (RF)
15	1	SPOOL PIECE DN 350 X 6 mm SANS 719 GRADE C; FLANGED BOTH ENDS SANS 1123 TABLE 1600/3 (RF) WITH PUDDLE FLANGE
16	3	DN 355 PN 16 PE 100 HDPE PIPE



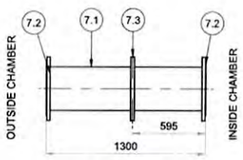
PLAN VIEW: MECHANICAL ASSEMBLY
SCALE 1:50



TYPICAL FLANGE WELD

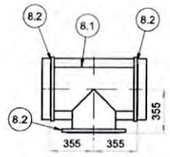


TYPICAL BUTT PIPE WELD EQUAL WALL THICKNESS

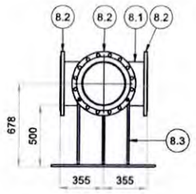


ITEM 7
SCALE 1:25

PARTS LIST		
ITEM	QTY	DESCRIPTION
7.1	1.300 m	STEEL PIPE DN 350 x 6 mm SANS 719 GRADE C
7.2	2	FLANGE DN 350 SANS 1123 TABLE 1600/3 (RF)
7.3	1	PUDDLE FLANGE DN 350, OD 520mm, THICKNESS 30mm

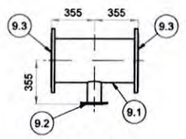


PLAN VIEW ITEM 8
SCALE 1:25



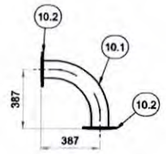
SIDE VIEW ITEM 8
SCALE 1:25

PARTS LIST		
ITEM	QTY	DESCRIPTION
8.1	1	EQUAL TEE DN 350 X 6 MM SANS 719 GRADE C
8.2	3	FLANGE DN 350 SANS 1123 TABLE 1600/3 (RF)
8.3	1	ANCHOR SUPPORT DN 350



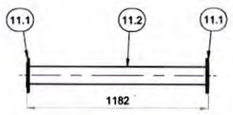
ITEM 9
SCALE 1:25

PARTS LIST		
ITEM	QTY	DESCRIPTION
9.1	1	UNEQUAL TEE; DN 350 - DN 100 x 6 mm SANS 719 GRADE C
9.2	1	FLANGE DN 100 SANS 1123 TABLE 1600/3 (RF)
9.3	2	FLANGE DN 350 SANS 1123 TABLE 1600/3 (RF)



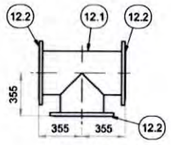
ITEM 10
SCALE 1 : 20

PARTS LIST		
ITEM	QTY	DESCRIPTION
10.1	1	LONG RADIUS BEND (3 D); 90 DEGREE DN 100 X 3.9 MM SANS 62
10.2	2	FLANGE DN 100 SANS 1123 TABLE 1600/3 (RF)



ITEM 11
SCALE 1:20

PARTS LIST		
ITEM	QTY	DESCRIPTION
11.1	2	FLANGE DN 100 SANS 1123 TABLE 1600/3 (RF)
11.2	1.182 m	STEEL PIPE DN 100 x 3.9 mm SANS 62

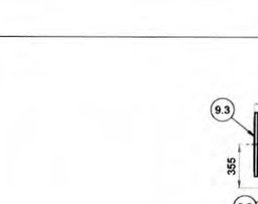


ITEM 12
SCALE 1:25

PARTS LIST		
ITEM	QTY	DESCRIPTION
12.1	1	EQUAL TEE DN 350 X 6 MM SANS 719 GRADE C
12.2	3	FLANGE DN 350 SANS 1123 TABLE 1600/3 (RF)

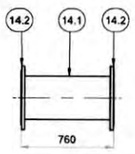
ITEM 15
SCALE 1:25

PARTS LIST		
ITEM	QTY	DESCRIPTION
15.1	2.340 m	STEEL PIPE DN 350 x 6 mm SANS 719 GRADE C
15.2	1	PUDDLE FLANGE DN 350, OD 520mm, THICKNESS 30mm
15.3	2	FLANGE DN 350 SANS 1123 TABLE 1600/3 (RF)



ITEM 13
SCALE 1:25

PARTS LIST		
ITEM	QTY	DESCRIPTION
13.1	1.320 m	STEEL PIPE DN 350 x 6 mm SANS 719 GRADE C
13.2	1	PUDDLE FLANGE DN 350, OD 520mm, THICKNESS 30mm
13.3	2	FLANGE DN 350 SANS 1123 TABLE 1600/3 (RF)
13.4	1	FLANGE DN 100 SANS 1123 TABLE 1600/3 (RF)
13.5	0.200 m	STEEL PIPE DN 100 x 3.9 mm SANS 62



ITEM 14
SCALE 1:25

PARTS LIST		
ITEM	QTY	DESCRIPTION
14.1	0.760 m	STEEL PIPE DN 350 x 6 mm SANS 719 GRADE C
14.2	2	FLANGE DN 350 SANS 1123 TABLE 1600/3 (RF)

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ZUTARI
Date: 1/6/21

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REFERENCE DRAWINGS	
DRAWING NO.	TITLE

REFERENCE DRAWINGS	
KPSX-EP-16290-DRG-WW-LY-0401	PCD 4 PIPELINE TO RAW WATER TANKS
KPSX-EP-16290-DRG-WW-LY-0162	PCD 1 SUPPLY PIPELINE TO THE RAW WATER RESERVOIR
KPSX-EP-16200-DRG-WW-DE-0112	TYPICAL DETAIL - AIR VALVE
KPSX-EP-16200-DRG-WW-DE-0104	TYPICAL DETAIL - STEEL PIPE FITTINGS
KPSX-EP-16200-DRG-WW-DE-0103	TYPICAL DETAIL - HDPE TO STEEL PIPE CONNECTION DETAILS
KPSX-EP-16200-DRG-WW-DE-0102	TYPICAL DETAIL - STEEL PIPE SUPPORT DETAIL
DRAWING NO.	TITLE

ZUTARI PROFESSIONAL ENGINEER		
NAME	VICTOR WENTZEL	DATE
PROF. REG. No.	20130173	
SIGNATURE		1/6/21

SOUTH 32 PROFESSIONAL APPROVAL		
NAME	SIGN.	DATE
CLIENT PROJECT MANAGER		
CLIENT ENGINEERING MANAGER		
ADDITIONAL SIGNATORY		
ZUTARI PROJECT No.	113452	
CLIENT CONTRACT No.	8500084829	

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KLIPSPRUIT EXTENSION (KPSX)

AREA: RAW WATER PIPELINE
ELEMENT: TIE-IN CHAMBER 2 - PCD 4 SUPPLY TO RAW WATER RESERVOIR
TITLE: MECHANICAL DETIALS

SCALE:	SHEET SIZE:	Drawing Number	SHEET No.	REV.
AS SHOWN	(A1)	KPSX-EP-16290-DRG-WW-DE-0084-01	1 OF 1	*

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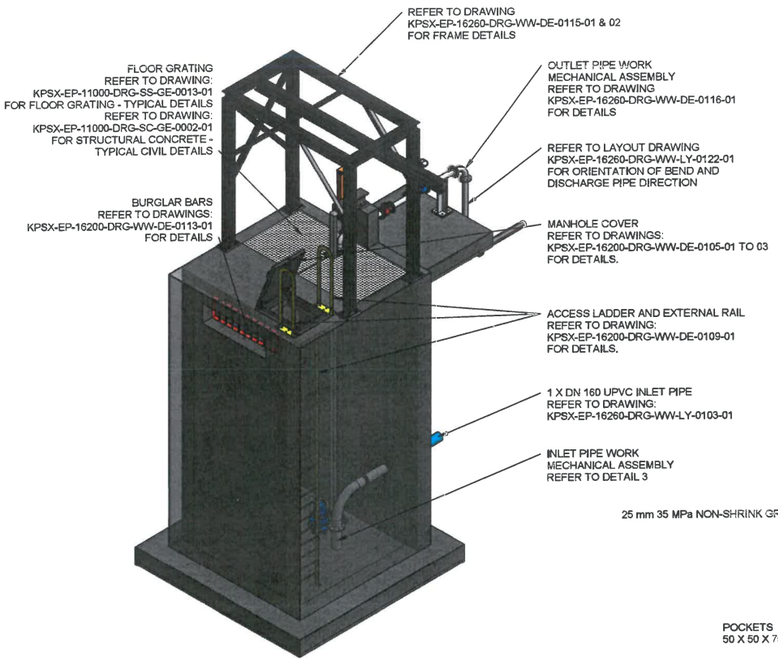
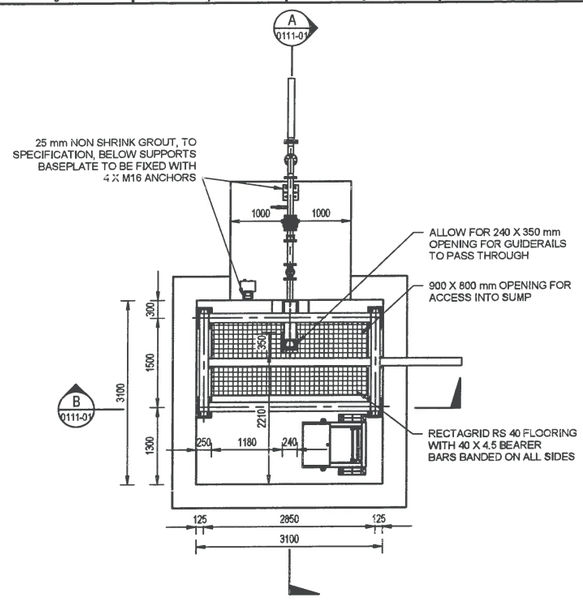
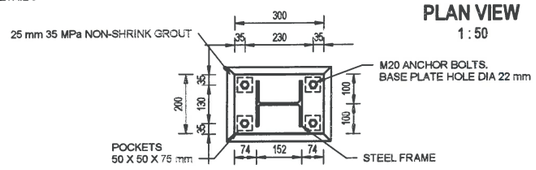


ISOMETRIC VIEW LEAK DETECTION SUMP

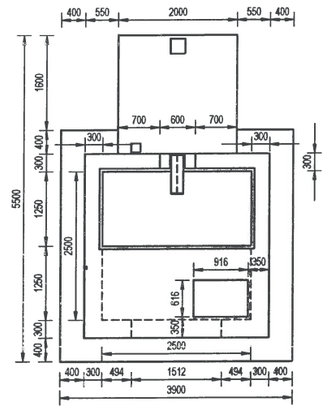


PLAN VIEW
1 : 50



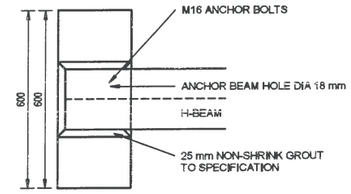
STEEL FRAME BASE PLATE DETAIL
1 : 10

NOTES:
1. ALL WELDS TO BE: ⊓ OR ⊔
2. REMOVE ALL SHARP EDGES AND BURS
3. HOT DIP GALVANIZE AFTER MANUFACTURING
4. STEEL TO SANS 1431 GR 350 WA

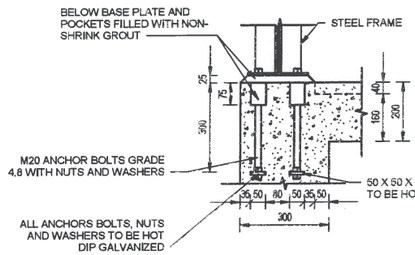


PLAN VIEW WITHOUT MECHANICAL
1 : 50

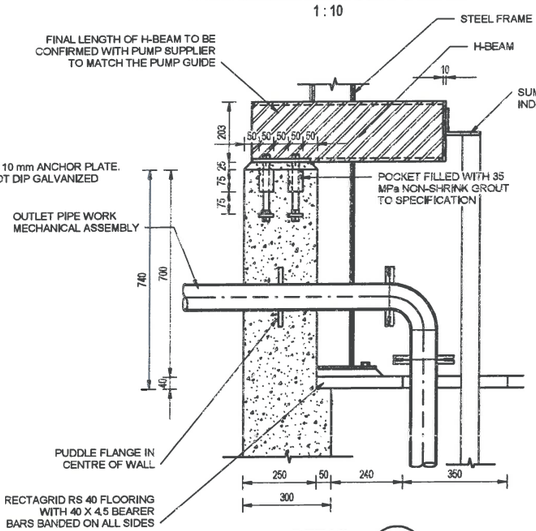
STRUCTURAL REQUIREMENTS	
STRUCTURE TYPE:	WATER RETAINING STRUCTURE
CONCRETE GRADE:	35 MPa/19 mm TO ALL STRUCTURAL CONCRETE
	15 MPa/19 mm TO BLINDING
BLINDING LAYER	50 mm BELOW ALL STRUCTURES
EXTENDERS:	MAXIMUM FLY ASH TO SPECIFICATION
AGGREGATE:	STANDARD
FORMED SURFACE FINISH:	SMOOTH
	ALL EXPOSED EXTERNAL EDGES IN CONCRETE WORK SHALL HAVE 20 mm X 20 mm CHAMFERS
UNFORMED SURFACE FINISH:	STEEL FLOAT FINISH TO TOP OF WALLS AND FLOORS
CONCRETE COVER TO REBAR:	75 mm IF CAST AGAINST SOIL
	40 mm FOR WATER CONTACT AREAS
	50 mm FOR SOIL CONTACT AREAS OR CAST AGAINST BLINDING
	30 mm FOR AIR CONTACT AREAS



H-BEAM ANCHOR BOLTS DETAIL
1 : 10



DETAIL 1 (0111-01)
1 : 10



DETAIL 2 (0111-01)
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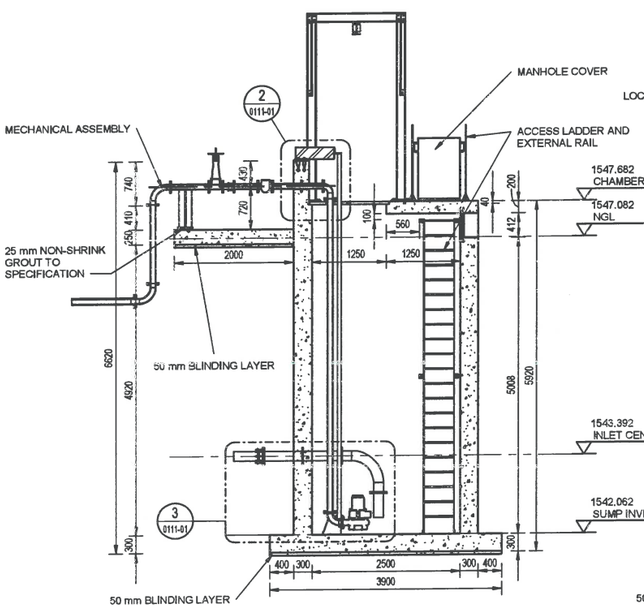

SECTION A (0111-01)
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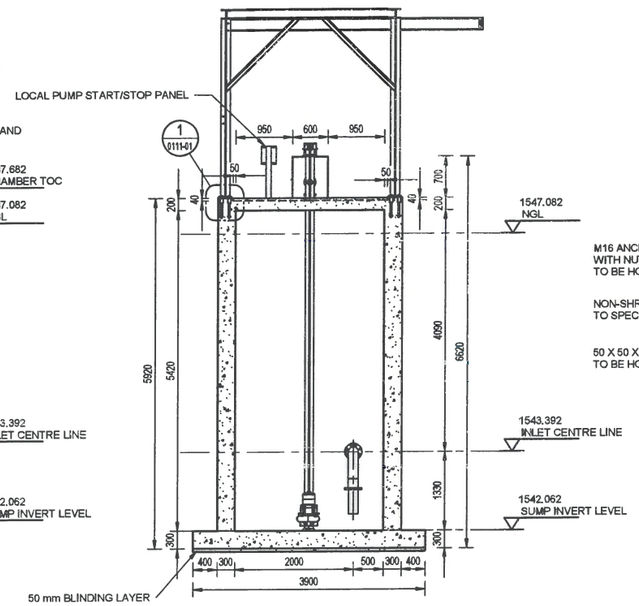

SECTION B (0111-01)
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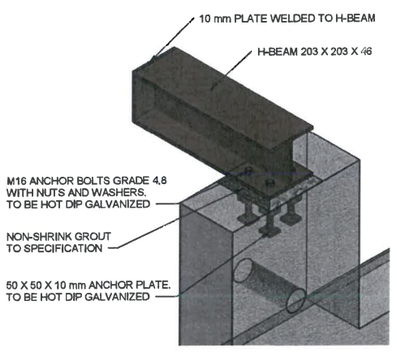
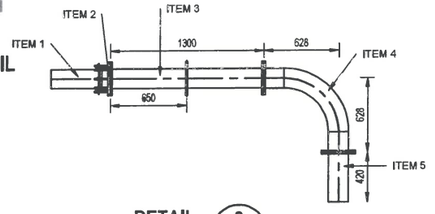


H-BEAM ISOMETRIC DETAIL



DETAIL 3 (0111-01)
1 : 25

PARTS LIST		
ITEM	QTY	DESCRIPTION
1	1	DN 160 UPVC-L CLASS 34 SOLID WALL PIPE; SANS 791
2	1	FLANGE ADAPTER FOR DN 160 UPVC TO DN 150 STEEL PIPE CONNECTION
3	1	SPOOL PIECE DN 150 X 4,2 mm SANS 62; FLANGED BOTH ENDS SANS 1123 TABLE 1000/3 (RF) WITH PUDDLE FLANGE
4	1	LONG RADIUS BEND (3 D); 90 DEGREE DN 150 X 4,2 mm SANS 62; FLANGED BOTH ENDS SANS 1123 TABLE 1000/3 (RF)
5	1	SPOOL PIECE DN 150 X 4,2 mm SANS 62; FLANGED ONE END SANS 1123 TABLE 1000/3 (RF)

AS BUILT DRAWINGS
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For Client
21/05/2021 Date

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REFERENCE DRAWINGS	
KPSX-EP-11000-DRG-SS-GE-0013	FLOOR GRATING - TYPICAL DETAILS
KPSX-EP-11000-DRG-SC-GE-0002	STRUCTURAL CONCRETE - TYPICAL CIVIL DETAILS
DRAWING No.	TITLE

REFERENCE DRAWINGS	
KPSX-EP-11000-DRG-SC-GE-0001	STRUCTURAL CONCRETE - STANDARD CONCRETE NOTES
KPSX-EP-16260-DRG-WW-LY-0122	PCD 4 - LEAK DETECTION SUMP AND PIPELINE LAYOUT
KPSX-EP-16260-DRG-WW-LY-0103	PCD 4 - SUBSOIL DRAINAGE AND LEAK DETECTION LAYOUT
KPSX-EP-16260-DRG-WW-DE-0116	SUBSOIL DRAINAGE AND LEAK DETECTION - MECHANICAL DETAILS
KPSX-EP-16260-DRG-WW-DE-0115	SUBSOIL DRAINAGE AND LEAK DETECTION - GANTRY DETAILS
KPSX-EP-16260-DRG-WW-GA-0101	PCD 4 INFRASTRUCTURE - GENERAL ARRANGEMENT
KPSX-EP-16200-DRG-WW-DE-0113	TYPICAL DETAIL - BURGLAR BARS
KPSX-EP-16200-DRG-WW-DE-0109	TYPICAL DETAIL - ACCESS LADDER
KPSX-EP-16200-DRG-WW-DE-0105	TYPICAL DETAIL - MANHOLE COVER
DRAWING No.	TITLE

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PROF. REG. No.	20130173	
SIGNATURE		21/05/2021
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KLIPSPRUIT EXTENSION (KPSX)

AREA: PCD 4
ELEMENT: LEAK DETECTION SUMP
TITLE: LAYOUT, SECTIONS AND DETAILS

SCALE:	SHEET SIZE	DRAWING NUMBER	SHEET NO.	REV.
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In diversity there is beauty and there is strength.

MAYA ANGELOU

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aurecon

KLIPSPRUIT EXTENSION PROJECT EXECUTION PHASE

Operation and Maintenance Manual and Emergency Preparedness Plan for KPSX Weltevreden PCD 1

SOUTH32

18 February 2020
Revision: A
Reference: 502420

Dam Safety Office Reference Number: 12/2/B203/32

Bringing ideas to life

SOUTH32

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Document ID		KPSX-EP-16260-O&M-WW-0001	**Project number**		502420	
File path		P:\Projects\113452 KPSX Execution Ph FEL4 Klipspruit\5 DEL DES\501 Engineering\Water\Dam Safety (O&M Manuals)\KPSX-EP-16260-O&M-WW-0001.docx				
Dam Safety Office (of the Department of Human Settlements, Water and Sanitation - DHSWS)		**Reference Number: 12/2/B203/32**				
Client		**SOUTH32**				
Client contact		**Mike Koen**	**Client reference**			
Rev	**Date**	**Revision details/status**	**Author**	**Reviewer**	**Verifier**	**APP**
A	18 February 2020	Final	JM	AGC, RM & MB	VW	AGC
Current revision		**A**				

APP = Approved Professional Person

Approval			
Rev. No	**Date of Issue**	**Originator**	
A	**2020/02/18**	**JD Mentz**	
Approved Professional Person (APP)			
Name: AG Chemaly Pr Eng		**Date: 18 February 2020**	
		Signature:	

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KPSX Weltevreden Pollution Control Dam 1 Locality Map

Appendix D

KPSX Weltevreden Pollution Control Dam 1 Dam Break Analysis

Appendix E

KPSX Pollution Control Dam 1 Gross Capacity Table

Appendix F

KPSX Pollution Control Dam 1 Nett Capacity Table

Appendix G

KPSX Pollution Control Dam 1 Surface Area Table

Appendix H

KPSX Weltevreden Pollution Control Dam 1 Draw Down Table

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Appendix J

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List of Abbreviations and Acronyms

Abbreviation / Acronym	Description
APP	Approved Professional Person
DSO	Dam Safety Office (of the Department of Water and Sanitation)
DWA	Department of Water Affairs (now Department of Water and Sanitation)
DHSWS	Department of Human Settlements, Water and Sanitation
DWS	Department of Water and Sanitation (now Department of Human Settlements, Water and Sanitation)
ELLS	Electric Leak Location Survey
FSL	Full Supply Level
FOC	Fibre-optic cable
HDPE	High Density Polyethylene
KPS	Klipspruit Mine
KPSX	Klipspruit Extension (KPSX) Project
MAP	Mean Annual Precipitation
MSL	Mean Sea Level
NEMA	National Environmental Management Act
NOC	Non - overspill crest (of an embankment dam or concrete dam)
NWA	National Water Act, 1998 (Act No. 36, 1998)
O&M	Operation and Maintenance
PCD	Pollution Control Dam
PCPP	Phola Coal Processing Plant
PPE	Personal Protection Equipment
RDF	Recommended Design Flood
RL	Reduced Level
SCADA	Supervisory Control and Data Acquisition
SEF	Safety Evaluation Flood
uPVC	Unplasticized Polyvinyl Chloride
USBR	United States Bureau of Reclamation

1 Introduction

This manual is drawn up in terms of Regulations 7; 8; 9 and 11 of the Regulations made by the Minister of Water Affairs in terms of Chapter 12 of the National Water Act, 1998 (Act 36 of 1998). An extract from the Government Gazette No 10366 of 25 July 1986 in which the Operation and Maintenance Regulations were promulgated is provided in Appendix B.

This manual describes the general operation and maintenance (O&M) procedures to be performed to ensure the safe use of PCD 1 throughout its life. It outlines the routine inspections which must be undertaken and the records thereof which must be kept. In the event of unusual conditions arising, emergency planning procedures are outlined.

This manual must be kept up to date and available for use at PCD 1. Alteration to any procedures may only be done on the instruction of an experienced dam engineer or approved professional person (APP) specifically appointed for the ***'task'***.

The operation and maintenance procedures are the responsibility of the owner of the dam and must be complied with in terms of the Water Act. Any change in the particulars of responsible persons shall be made known in writing to the Director-General within thirty (30) days.

2 Description of the dam

The project area is located approximately 40 km west of Emalahleni (formerly known as Witbank), close to the town of Ogies, in Mpumalanga, South Africa. KPSX Weltevreden PCD 1 is located approximately 9 km north of Ogies, adjacent to the D432 road, between Ogies (R555) and Clewer Towns (R104).

Klipspruit Extension (KPSX) Weltevreden Pollution Control Dam 1 is a 7.6 m high (as built height) lined homogeneous earthfill embankment dam. The dam is an off-channel reservoir and is located on the farm Tweefontein No 328JS Portion 3, 4 and remainder of the farm Tweefontein No 328JS (see Drawing No. KPSX-EP-16260-DRG-WW-GA- 0011-01, titled Pit BD KPSX Weltevreden PCD 1: Locality Plan in Appendix C).

The dam is owned by South32 Energy Coal Holdings South Africa (South Africa) and will be used as a buffer dam for the dirty water of the mine including dirty storm water runoff and pit dewatering water. Water from the PCD will be used for dust suppression and process water demands of the KPSX project and Phola Coal Processing Plant (PCPP) situated at South32's existing Klipspruit (KPS) operation situated approximately 3 km east of Ogies.

The PCD is rectangular in shape with the outer walls comprising of homogeneous earthfill embankments. A homogeneous earthfill wall at the centre of the PCD divides the PCD into two (2) equal compartments, i.e. Compartment 1, which is south of the dividing wall and Compartment 2, which is north of the dividing wall, respectively (see Drawing No. KPSX-EP-16260-DRG-WW-GA-0201-01 in Appendix J).

Each compartment is provided with its own top intake and bottom outlet structure. The intake into each compartment comprises an inlet spillway (baffled chute) that is supplied from a common silt trap and pump discharge chamber situated directly upstream of the southern embankment (see Drawing No. KPSX-EP-16260-DRG-WW-GA-0221-01 in Appendix J). The inlet spillway was designed as a baffled chute to reduce the velocity of inflow and protect the PCD's lining system.

The outlet works from each compartment consists of a bottom outlet sump with a steel grating, which discharges into a DN600 steel balancing pipe. The balancing pipes from each compartment connects to a central balancing sump that is situated inside the 6 m wide dividing wall between the compartments. A DN500 steel outlet pipe, positioned underneath the dividing wall, connects the balancing sump to the PCD 1 pump station immediately downstream of the PCD and to the Impact Stilling Basin used to scour and/or empty the dam. From the pump station water is pumped to various demand nodes, reservoirs and dams in the larger water system of the project. The balancing sump is provided with a single stop log that is used to isolate the compartments or outlet pipe if required. Both the balancing and outlet pipes is encased in a reinforced concrete surround where it passes under the embankment and below the floor of the reservoir.

The dividing wall between the two (2) compartments is constructed to the full non-overspill crest (NOC) level of the perimeter walls. The reservoir is therefore fitted with two spillways to discharge emergency flows. The purpose of the dividing wall is to allow for the reservoir to remain operational during maintenance operations in either compartment. Each spillway is sized to accommodate the design flood to prevent uncontrolled discharge from a single compartment when the other comportment is isolated for maintenance purposes. A vehicle access ramp is only provided to the inlet structure at the crest of the embankment to provide access for maintenance vehicles to clean the silt trap. The PCD is designed to be non-trafficable.

The PCD is lined with a Class C single composite liner in accordance with environmental regulations. The liner comprises a 1.5 mm thick HDPE Geomembrane (primary liner) and a 150 mm thick geocell

confinement layer filled with cement stabilised for protection of the high-density polyethylene (HDPE) geomembrane, shown in Figure 2-1. Further detail of the geocell filled with cement stabilised material and anchoring to concrete structures are shown in Appendix L, drawings KPSX-EP-16260-DRG-WW-DE-0103-01 and KPSX-EP-16260-DRG-WW-DE-0104-01. A herringbone subsoil drainage system under the liner is provided to control groundwater under the floor. The subsoil drainage system is also used for leak detection system in compliance with the NEMA Act. An Electric Leak Location Survey (ELLS) was done upon completion of the liner installation to identify possible leaks in the liner to be repaired.

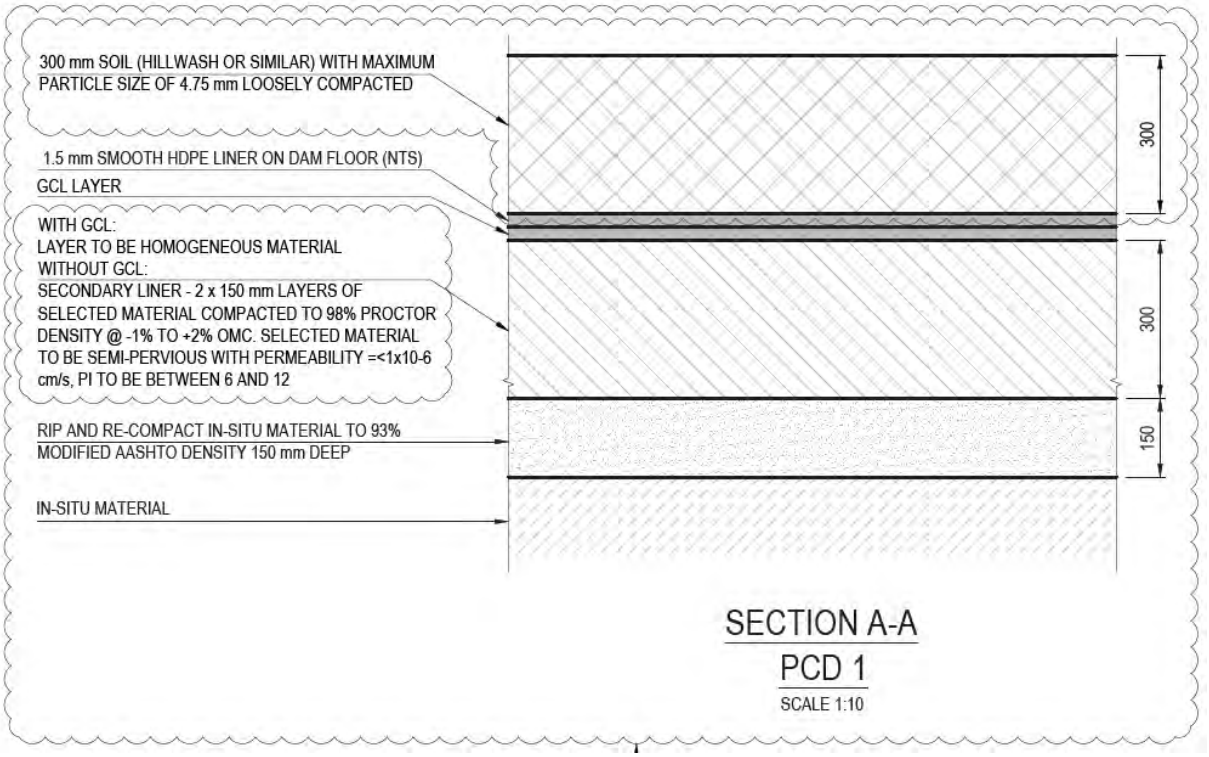


Figure 2-1: PCD 1 Class C single composite liner design for the dam basin (as per drawing KPSX-EP-16260-DRG-WW-DE-0103-01 in Appendix L)

The dam was designed by Aurecon Consulting Engineers with Mr AG Chemaly as the Approved Professional Person (APP). The main construction was completed in 2020 by Stefanutti Stocks Axsys Klipspruit Joint Venture.

The main features of KPSX Weltevreden PCD 1 are listed in the Table 2-1 below (the levels are given to mean sea level (MSL)).

Table 2-1: Main features of the dam

Feature or Parameter	Description and/or Detail(s)
Type of dam	Lined homogeneous earthfill
Dam Safety Office (DSO) Reference No.	12/2/B203/32
Owner	South32 Energy Coal Holdings South Africa (South Africa)
Designer	Aurecon

Feature or Parameter	Description and/or Detail(s)
Contractors	Stefanutti Stocks Axsys Klipspruit Joint Venture (PCD) Masibuyisane Joint Venture (Pump station) Enl Zest (Electrical and Instrumentation)
Completion Date	2020
Location	25° 58' 13" S & 29° 03' 54" E
Nearest Town	Ogies
Farm Name	Tweefontein No. 328 JS Portion 3, 4 and remainder
Purpose	Pollution Control Dam in terms of Regulation 704 of the NWA and process water
Classification	See DWS letter in Appendix B
Size Classification	Small
Hazard Potential Classification	Significant
Category Classification	II
River	None
Type of reservoir	Off channel storage dam on an unnamed watercourse of the Saalklap Spruit
Shape of reservoir	Rectangular in plan: Divided into two (2) rectangular compartments
Gross Storage Capacity	595 700 m^3 (2 x 297 850 m^3)
Nett Storage Capacity	595 700 m^3 (= 2 x 297 850 m^3)
Storage capacity of one (1) compartment when the other compartment is empty	297 850 m^3
Surface area at FSL	0.1164 km^2 (11.64 ha = 2 x 5.82 ha)
Total catchment area	0.1252 km^2 (12.52 ha = 2 x 6.26 ha). Taken as the surface area of the reservoir at where the upstream slope of the embankment meets NOC level, including that area of the dividing wall at NOC level that contributes to *'storm water'* runoff i.e. the half width of the dividing wall which is w/2 = (6.0 m/2) = 3 m times the NOC crest length of the dividing wall).
Mean Annual Precipitation (MAP)	720 mm

Feature or Parameter	Description and/or Detail(s)
Maximum wall height of PCD 1 (in terms of Section 117*(c)*(i) 'Definitions' in Chapter 12: 'Safety of Dams' in the National Water Act, 1998 (Act No 36,1998).	7.6 m (1 577.0 masl – 1549.4 masl)
Crest length of the dam wall (excluding length of the dividing wall between Compartment 1 and Compartment 2)	1436 m
Length of the dividing wall between Compartment 1 and Compartment 2	392 m
Wall volume	199 000 m^3
NOC level	Reduced Level (RL) 1 557.00 masl
FSL	1 556.00 masl
Total freeboard (i.e. NOC – FSL)	1.00 m
Maximum base width	62 m
Crest width (Perimeter wall)	4.0 m
Crest width (Dividing wall)	6.0 m
Upstream face slope	1V:3H
Downstream face slope	1V:2.5H
Upstream slope protection	150 mm high woven geocells (each geocell filled with cement stabilised soil)
Downstream slope protection	Topsoil and grass (hydroseeded)
Internal drainage (this is actually an under-drainage system below the dam lining system)	Herringbone drains comprising 100 mm diameter slotted pipes at the branches and 2 x 200 mm solid wall uPVC pipes for the central pipe. All slotted pipes will be surrounded by 19 mm single sized stone.
Foundation of the reservoir	Completely weathered to highly weathered, very closely jointed to medium jointed, soft to medium hard rock pyroxenite.
Type of spillway	Open channel. The PCD has two spillways due to the top of the dividing wall being the same level as NOC level.
Length of spillway return channel to watercourse	Length of spillway channel No. 1 = 129.0 m (South)
	Length of spillway channel No. 2 = 73.0 m (North)
Width of each spillway channel	5 m

Feature or Parameter	Description and/or Detail(s)
Spillway capacity	7.2 m^3/s
Design flow into each compartment	1.01 m^3/s
Flow into one (1) compartment when the other compartment is *'down or being cleaned'*	1.01 m^3/s
Maximum probable storm rainfall	108 mm/hr (this is equivalent to 1.82 m^3/s)
Recommended Design Flood (RDF) – inflow	1.01 m^3/s
Recommended Design Flood (RDF) – outflow	1.01 m^3/s ($Q_{out} \approx 1.00\ Q_{in}$)
Safety Evaluation Flood (SEF) – inflow	1.01 m^3/s + 1.82 m^3/s = 2.83 m^3/s
Safety Evaluation Flood (SEF) – outflow	2.83 m^3/s ($Q_{out} \approx 1.00\ Q_{in}$)
RDF water level (masl)	RL 1 556.27 (0.27 m above FSL)
SEF water level (masl)	RL 1 556.54 (0.54 m above FSL)
Non-overspill crest (NOC) level	RL 1 557.00 masl
Inlet works	The inlet works comprises a silt trap and inlet sump that overflows into a common inlet canal that connects to the individual inlet chutes of the compartments. Each compartment has a 2 m wide reinforced concrete baffled chute (USBR Basin IX) approximately 58 m long down the embankment. The chute discharges into a bucket 4.71 m x 2 m x 0.75 m deep. Flow into the individual compartments is controlled by two (2) 2.0 m wide by 1.5 m high channel mounted sluice gates installed in the inlet channels downstream of the silt trap and inlet sump. Flow into the reservoir is controlled at the various pump stations that discharge into the PCD. Water from the dewatering system and the Pit H storm water sump is discharged into the silt trap to reduce sedimentation in the PCD. The inlet sumps are located opposite the outlet sumps to minimize regions of stagnant water within the compartments.

Feature or Parameter	Description and/or Detail(s)
Outlet works	Each compartment has a reinforced concrete outlet structure partially placed inside the dividing wall (4.75 m x 2.6 m x 3.225 m deep) with a 600 mm diameter (DN) steel pipe that connects to a balancing sump, or tower, that is 2.74 m wide x 5.20 m long x 9.015 m high located in body of the dividing wall. A 500 mm diameter (DN) steel outlet pipe, controlled by a DN500 rising spindle gate valve, connects the balancing sump to the pump station directly downstream of the perimeter wall. Each outlet structure has one (1) heavy duty stainless steel trash, or debris, screen (2.770 m x 1.445 m) made up of 80 mm (deep) x 10 mm wide flat bars. The bars of the screen are spaced equally at approximately 35 mm in the 1.445 m direction and are supported at each end (only two sides) by a 100 mm x 100 mm x 10 mm stainless steel equal angle that has been cast into concrete.
Energy dissipation (outlet works)	A DN450 HDPE scour pipe, controlled by a DN400 rising spindle gate valve which discharges into an Impact Type Rectangular Stilling Chamber, which is approximately 110 m downstream of the PCD. The DN500 steel pipework from the outlet works reduce to a DN450 scour pipe which terminate at a single impact type rectangular stilling chamber which then discharges into the site storm water system north of the PCD.
Monitoring instruments	Ultrasonic water level recorder(s) connected by FOC to a SCADA system in the: (1) Main Control Room for the Mine situated at KPSX Operations Centre; and (2) Main Control of the Existing Klipspruit (KPS) Mine. Water level gauge plates which are fixed to the outside wall of the flight of steps, each side of the Balancing Structure leading from the NOC of the embankment downwards towards the trash/debris screens, shown in Figure 2-2. Settlement pegs on the NOC. Volumetric measurement of seepage at 'exit points' of the underdrainage drainage system (sub-soil drainage system).

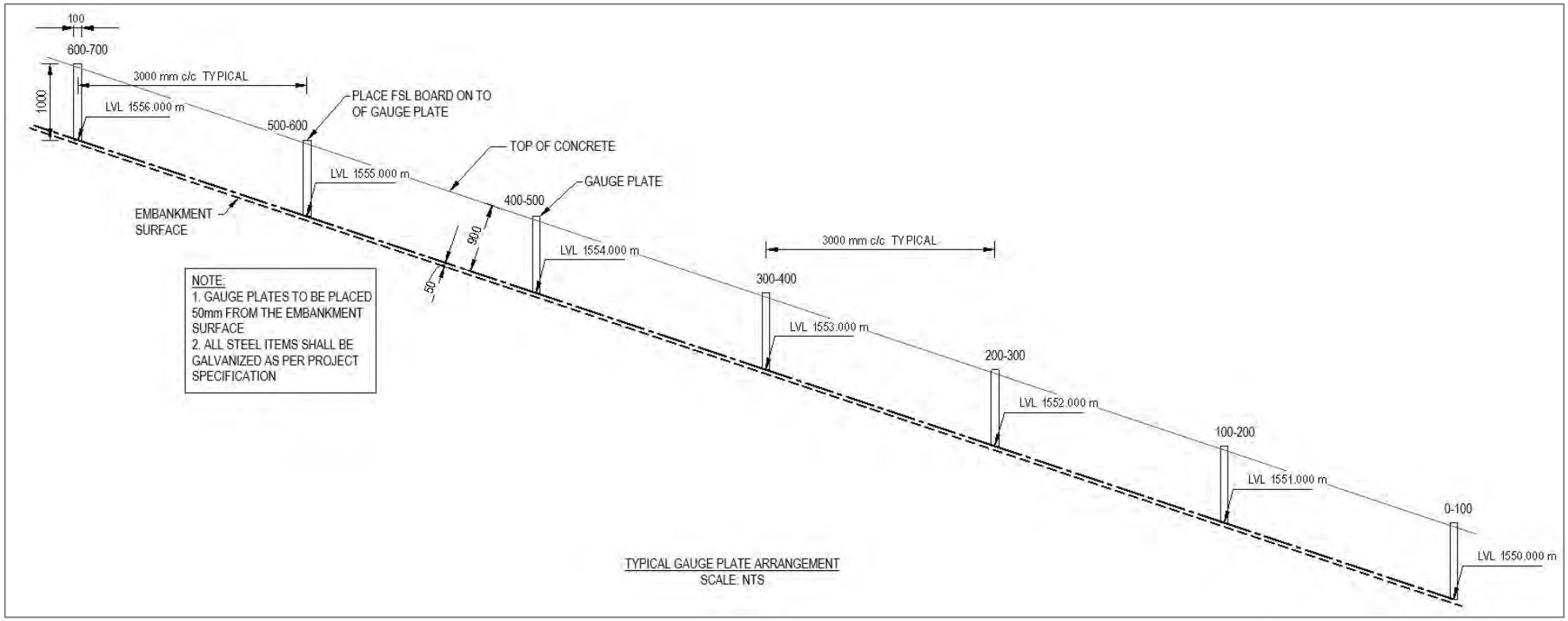


Figure 2-2: Water level gauge plate installation on the outside wall on each flight of steps at the balancing structure

3 Routine inspections

3.1 Scope

The dam must be inspected at intervals as described below for evidence of development of unusual conditions. Any condition which may affect the safety of the dam should be reported to the Director-General of the Department of Human Settlements, Water and Sanitation.

During the first filling of the dam, inspections must be carried out as follows:

a) with the dam empty,
b) with the water level at half of full supply level, and
c) with the water level at full supply level.

Thereafter routine inspections should be carried out quarterly for the first year, biannually for years two and three and thereafter at yearly intervals. Unusual conditions are described in Section 4 and should be inspected at intervals as suggested.

A detailed dam safety evaluation inspection, as required by the National Water Act, 1998 (Act 36 of 1998) must be performed by an approved professional person at intervals of not more than five years after the initial safety inspection. The Department of Human Settlements, Water and Sanitation will inform the owner when the next inspection is due.

A routine inspection check list for the dam is included in Appendix A as a form for recording observations. The comment column on this form should be completed or where space is limited, detailed information should be supplied on separate sheets. The form should be signed by the observer and owner of the dam. Changes in conditions from one routine inspection to the next should be monitored or rectified as necessary. The components of the dam that should be included in the routine inspections are discussed below.

3.2 Embankment

The slopes of the embankment must be inspected to detect any signs of seepage, cracking, movement, erosion or animal burrows. Vegetation on the slopes should be kept short and all trees must be removed when still young.

The extent of damp patches that appear on the downstream face must be marked with pegs so that changes in the affected area can be monitored. The appearance of seepage water must be carefully watched, and the clarity noted to determine if soil particles are being carried in the water. The position relative to the crest and distance along the crest must be recorded.

The position, width and length of cracks must also be marked and recorded. Relative movement of the crack must be measured by placing pegs on either side of the crack to monitor vertical and horizontal displacement.

The condition of the HDPE liner system on the upstream face of the embankment should be visually evaluated. Positions where there are exposed portions of the liner should be recorded along with any holes or tears in the liner system. The anchor system should be monitored for any possible defects.

The location and extent of wave or weather erosion should be noted. The slope protection on the upstream face should be inspected to detect any signs of movement or loss.

Appearance of ant's nests and other animal holes should be recorded.

3.3 Spillway

The face and invert of the spillway channels entrance should be inspected for cracks. The position, width and length of cracks must be marked and recorded.

Erosion of the spillway channels should be noted and the need for repair considered.

The condition of the rip-rap lining of the spillway channels should be inspected and repaired or replaced where necessary.

3.4 Downstream toe

A strip 5 m wide measured from the downstream toe, should have its vegetation cut short and be carefully inspected for the appearance of seepage water. The appearance of seepage water, cracks or any movement and the position thereof must be observed and noted.

3.5 Inlet works

The condition of the inlet pipes should be inspected for any signs of corrosion or leakage (where possible). The sluice gates should be operated at every inspection to ensure that they are functioning correctly

3.6 Outlet works

The condition of the outlet pipe and valves (including the scour pipe and valve) should be inspected for any signs of corrosion or leakage (where possible). The butterfly valve and scour valve should be operated at every inspection to ensure that they are functioning correctly.

The chain blocks and stoplogs should be operated when possible to ensure that they are functioning correctly.

The screens of the outlet structure inlets should be inspected when they are exposed.

3.7 Dam Basin

The condition of the HDPE liner system on the basin of each compartment should be visually evaluated when possible. Positions where there are exposed portions of the liner should be recorded along with any holes or tears in the liner system.

Any signs of uplift of the HDPE liner from the basin shall be recorded

3.8 Monitoring

The two parameters used for long term monitoring is settlement of the embankments using installed settlement beacons along the crest of the embankment, and the performance of the HDPE liner through the leak detection sumps of the PCD.

3.8.1 Settlement Beacons

Settlement beacons have been installed on the non-overspill crest (NOC) of PCD 1 at approximately 75 m centres (see positions on Drawing No KPSX-EP-16260-DRG-WW-LY-0201-01 in APPENDIX J). The beacons must be surveyed every quarter of the first year after construction and then yearly for the next two years, and thereafter after every five years. Refer to the form included in APPENDIX A.

3.8.2 Seepage

Two leak detection sumps have been incorporated with the subsoil drainage network underneath the lined floor of the dam. The subsoil network of each compartment drains to its own leak detection sump. The sumps are located on the downstream side of the eastern embankment along the centreline of each compartment. Refer to the form included in APPENDIX A.

4 Unusual conditions

Changes in conditions from one routine inspection to the next should be carefully noted. If conditions that may affect the safety of the dam arise, expert advice should be called in as suggested below.

Unusual conditions that should be carefully noted are described below:

a) Instabilities indicated by cracks, slips, sags and bulges in the slopes and/or movements in the crest of the dam and reservoir basin slopes should be noted and new seepage water discharge points observed on a weekly basis. The location and dimensions of movement or seepage should be determined, photographed and pegged to mark the position.

b) The occurrence and slow development of any of the following at the dam surface should be inspected on a daily basis. The location and dimensions of movement or seepage should be determined, photographed and pegged to mark the position.

   i. Turbid seepage water.

   ii. Transverse and longitudinal cracks with opening widths larger than 5 mm, or cracks longer than 1 m.

   iii. Observable displacement across a longitudinal crack.

   iv. Ground movement of more than 100 mm between two inspections.

   v. Concentrated settlement less than 25 m^2 in area.

   vi. Settlement of the dam crest below the design level.

   vii. Concentrated seepage discharges at new locations with flows larger than 0.2 ℓ/s.

   viii. Leakage through or along the outlet pipe or any pipes through the embankment i.e. those of the sub-soil drainage system.

c) If any of the circumstances described in section b) develop suddenly then they must be inspected from twice a day up to hourly. Observations as described must be taken and the reservoir level must be lowered. A professional dam engineer must be consulted for advice.

5 Maintenance of the dam

5.1 Embankment

Shallow rooted vegetation on the downstream slope of the embankment must be kept cut to less than 1 m above the ground so that unusual conditions can be easily observed.

The faces of the embankment should be kept clear of trees. Ant's nests and animal holes should be removed as they could create leakage paths.

Erosion of the dam slopes should be repaired as soon as possible. The upstream face liner protection of the embankment should be repaired if severe wave benching occurs.

5.2 Spillway

The spillway channels, particularly the sections lined with rip-rap, must be kept clean and free of all undesirable vegetation like trees and bushes. Other vegetation must be kept shorter than 300 mm.

Erosion of the rip-rap lined spillway channels should be monitored, and where necessary be repaired as soon as possible. Rockfill may be required to repair severe erosion on section.

5.3 Downstream toe

Vegetation in the 5 m wide strip downstream of the toe of the dam should be kept cut to less than 300 mm above ground to enable easy access and so that any unusual conditions can be observed.

5.4 Inlet works

It is recommended that the sluice gates are cycled once a month, in order to prevent the gates from seizing. The sluice gates should be inspected at least twice per year, with general maintenance activities carried out. Remove the cover tube, examine the spindle threads, remove all dirt build-up and lubricate the threads with all-purpose grease. The operating gearboxes are generally 'sealed for life', however they may require a light greasing occasionally. Lower and raise the gate fully. Check gate closure and adjust the stop collar if required. Inspect the seals for damage and deterioration and replace where necessary.

Technical details of the sluice gates are included in APPENDIX I.

5.5 Outlet works

The outlet valves should be opened and shut at least four times per year, lubricated and adjusted as necessary and seals or packing replaced where necessary. Technical details of the valves are included in APPENDIX I.

A general inspection of the stoplogs shall be carried out on a monthly basis. The stoplogs shall be removed from their docked positions. Inspect the gate for corrosion damage and repair the areas where possible. Inspect for a build-up of scale or dry mud. If any build-up is noticed it must be cleaned off with a high-pressure washer. Inspect side guides for deep scoring marks which could indicate obstructions on the guides, guides must then be inspected, and obstructions cleared, if left unattended it could cause the gate to jam. Move the storage bars in and out to ensure they move freely.

Twice a year, a thorough inspection of the stoplogs shall be carried out. The gate must be visually inspected for rust, cracks or mechanical damage to paint. Rust shall be sanded down, and the area repainted immediately. Any cracks found must be immediately reported to the engineer and under no circumstances should the gate be used until the damage has been assessed. Check rubber seals for integrity and cracks, if the rubber is badly damaged seals must be replaced. The gate must be washed with a high-pressure cleaner at least once every six months when not in regular use.

The frames, seals and screens of the outlet structure should be cleaned whenever they are exposed. Maintenance should be done as required.

5.5.1 Maintenance on the pump station isolating valve

Should the pump station isolating valve need to be removed to perform additional maintenance, the following procedure should be followed:

1. Lower the stop log to the outlet pipe in the balancing chamber
2. Scour the outlet pipe through either the scour pipeline or pump station
3. Remove the dismantling joint downstream of the pump station isolating valve
4. Remove the pump station isolating valve and re-install the valve after the required maintenance has been performed
5. Ensure that the scour valve is closed
6. Fill and pressurize the outlet pipeline to the water level pressure in the dam through a flange attached downstream of the pump station isolating valve
7. Once the pressure is approximately equal to that of the dam water level, close the pump station isolating valve
8. Remove the flange used to fill and pressure the outlet pipeline and re-install the dismantling joint, opening the pump station isolating valve once complete
9. Raise the stoplog in the balancing structure and resume normal operating conditions

5.5.2 Maintenance on the scour valve

Should the scour valve need to be removed to perform additional maintenance, the following procedure should be followed:

1. Lower the stop log to the outlet pipe in the balancing chamber
2. Scour the outlet pipe through either the scour pipeline or pump station
3. Remove the dismantling joint downstream of the scour valve
4. Remove the scour valve and re-install the valve after the required maintenance has been performed
5. Ensure that the pump station isolating valve is closed
6. Fill and pressurize the outlet pipeline to the water level pressure in the dam through a flange attached downstream of the scour valve
7. Once the pressure is approximately equal to that of the dam water level, close the scour valve
8. Remove the flange used to fill and pressure the outlet pipeline and re-install the dismantling joint
9. Raise the stoplog in the balancing structure and resume normal operating conditions

5.6 Dam Basin

The dam basin of each compartment of PCD 1 should be inspected whenever they are exposed. When the water that is returned to PCD 1 from either of the leak detection sumps becomes abnormally high compared to normal operating conditions, the affected compartment shall be emptied and inspected to locate the leak.

To conduct maintenance on the dam basin, either one of the compartments of PCD 1 can be isolated. The procedure to isolate a compartment of PCD 1 is describe below:

1. To empty a compartment for maintenance, the stoplog in the balancing chamber opposite the chosen compartment should be lowered
2. The water in the compartment shall be pumped out of the compartment through the pump station
3. Lower the stoplog of the compartment that requires maintenance / an inspection
4. Open the stoplog of the compartment not being maintained for PCD 1 to continue operations
5. Following maintenance on the basin, the compartment may be filled again
6. Once the water level in each compartment is approximately equal, the stoplog may be raised

5.7 Access

The access road to the dam and silt trap must be maintained to ensure easy access at all times.

6 Operating procedures

Water will be pumped into PCD 1 from numerous pump stations including pump stations from PCD 2, PCD 4, Pit BD dewatering system (future), Pit H dewatering system and Pit H storm water sump.

Silt traps are provided directly upstream of PCD 4 and PCD 2. Water being pumped from these two dams will not be routes through the silt trap of PCD 1; therefore, the dam inlet comprises a separate inlet chamber and silt trap. Both these structures are controlled by a sharp crested weir that spills into a common inlet channel (2.00 m wide x 1.50 m high) that connects the inlet structure to the dam inlet spillways. Two sluice gates are installed in the inlet channel on either side of the inlet works that can be used to isolate the individual compartments.

The inlet into each compartment comprises a 2.00 m wide inlet spillway (baffled chute) that is connected to the inlet channel downstream of the sluice gates. The spillways were designed as a baffled chute to protect the lining system of the PCD in accordance with procedures set out in the USBR publication 'Design of Small Dams', 1987. The capacity of the inlet works is designed to accommodate the maximum inflow combinations from the various pump stations. The design capacity of the inlet works is shown in Table 6-1.

Table 6-1: Inflow into PCD 1

Inflow	Inflow Number	Number Design Capacity (m^3/s)	Maximum Pump Capacity (m^3/s)
From PCD 4 to PCD 1	1	0.542	0.580
From PCD 2 to PCD 1	2	0.200	0.233
From Pit H Storm Water Sump to PCD 1	3	0.059	0.059
From Pit H Dewatering system	4	0.110	0.138
Total inflow through silt trap	3 + 4		0.197*
Total inflow through inlet chamber	1 + 2		0.813*
Total Dam Inlet Capacity	1 + 2 + 3 + 4		1.010

* The pit dewatering system of Pit BD is routed through PCD 4 into PCD 1. In future the dewatering system of the pit will pump directly into PCD 1 as the mining pit progresses in a Western direction past PCD 1. The dewatering system will then also discharge into the silt trap. The silt trap was therefore designed for a through flow of 0.777 m^3/s.

The outlet works from each compartment comprises a bottom outlet sump with a steel grating, which discharges into a DN600 steel balancing pipe. The balancing pipes from each compartment are concrete encased and connect to a central balancing sump that is situated inside the 6 m wide dividing wall. A DN600 concrete encased steel outlet pipe, aligned with the axis of the dividing wall, connects the balancing sump to an isolation and scour valve chamber near the embankment toe.

The outlet pipework then enters the PCD 1 pump station immediately downstream of the PCD and to the rectangular impact stilling chamber used to scour and/or empty the dam. From the pump station water is pumped to various demand nodes, reservoirs and dams in the larger water system of the project. The balancing sump is provided with three stop log slots, with two stop logs installed (1100 mm wide by 1000 mm high) that are used to isolate the compartments or outlet pipe if required.

The steel balancing pipes and steel outlet pipes are encased in reinforced concrete where they pass under the embankment and below the floor of the reservoir.

Each compartment of the reservoir can be drained through a DN450 scour pipe. The DN450 scour branches off from the DN600 outlet pipe in the isolation valve chamber and then discharges into an impact type scour chamber. Flow from the scour chamber is then discharged into a scour outlet channel. Both of PCD 1's compartments can be drawn down individually or simultaneously through the scour outlet. Should the scour outlet not be available, PCD 1 can also be scoured through the pump station or water pumped to any of the various 'demand nodes' (see **Section 6.2**).

The number of days needed to draw down the water level from full supply level (FSL) to different levels with no inflow is indicated in Table 6-2.

Table 6-2: Drawdown time for various reservoir levels

Percentage of full supply level depth	Water level in the reservoir	Days to empty one (1) compartment	Days to empty two (2) compartments
90%	1555.48	0.7	1.4
80%	1554.95	1.4	2.9
70%	1554.40	2.2	4.4
60%	1553.83	3.1	6.1
50%	1553.23	4.0	8.0
40%	1552.62	5.0	10.0
30%	1551.98	6.2	12.4
20%	1551.32	7.5	14.9
10%	1550.64	8.4	16.9

The draw down curves for a single and both compartments are shown in Figure 6-1. The gross storage capacity for a single and both compartments of PCD 1, i.e. with the non-recoverable water (dead storage), is shown in Figure 6-2, with the nett storage capacity of PCD 1, i.e. recoverable water available for usage, shown in Figure 6-3. The surface area curves for a single and both compartments are shown in Figure 6-4.

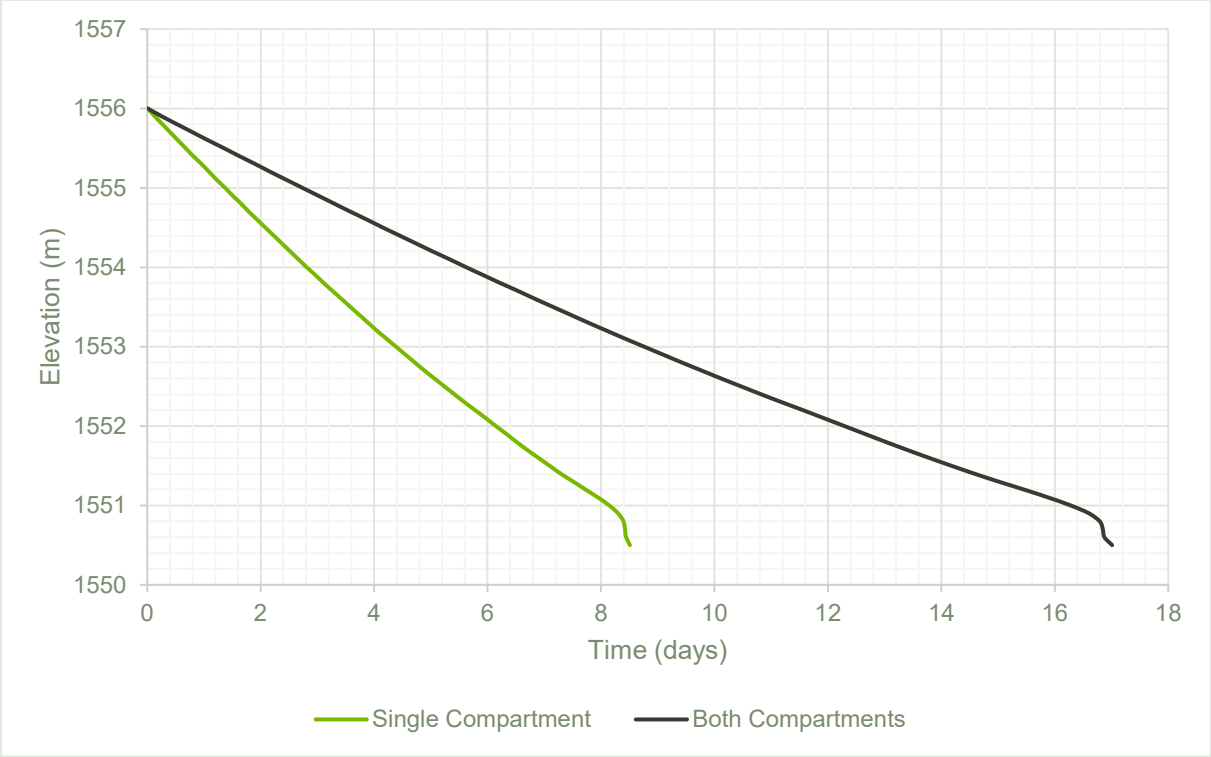


Figure 6-1: Draw down curves for PCD 1

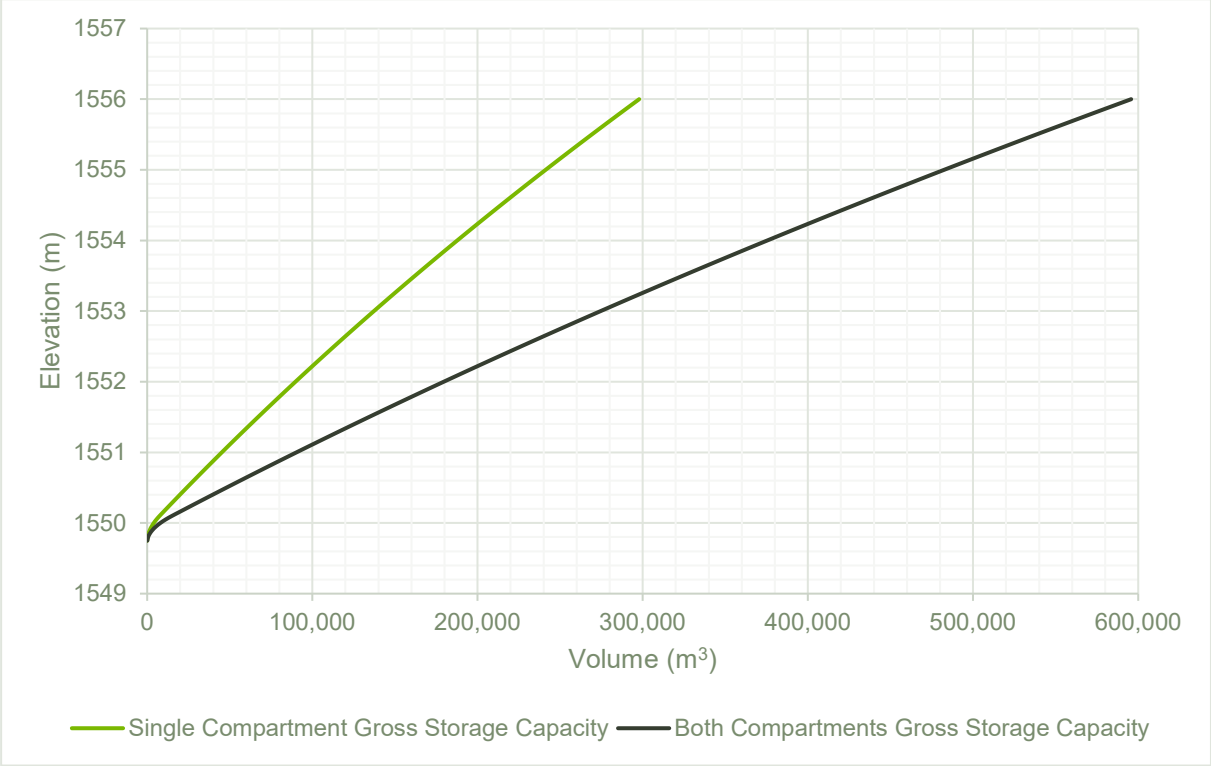


Figure 6-2: PCD 1 Gross storage capacity curves

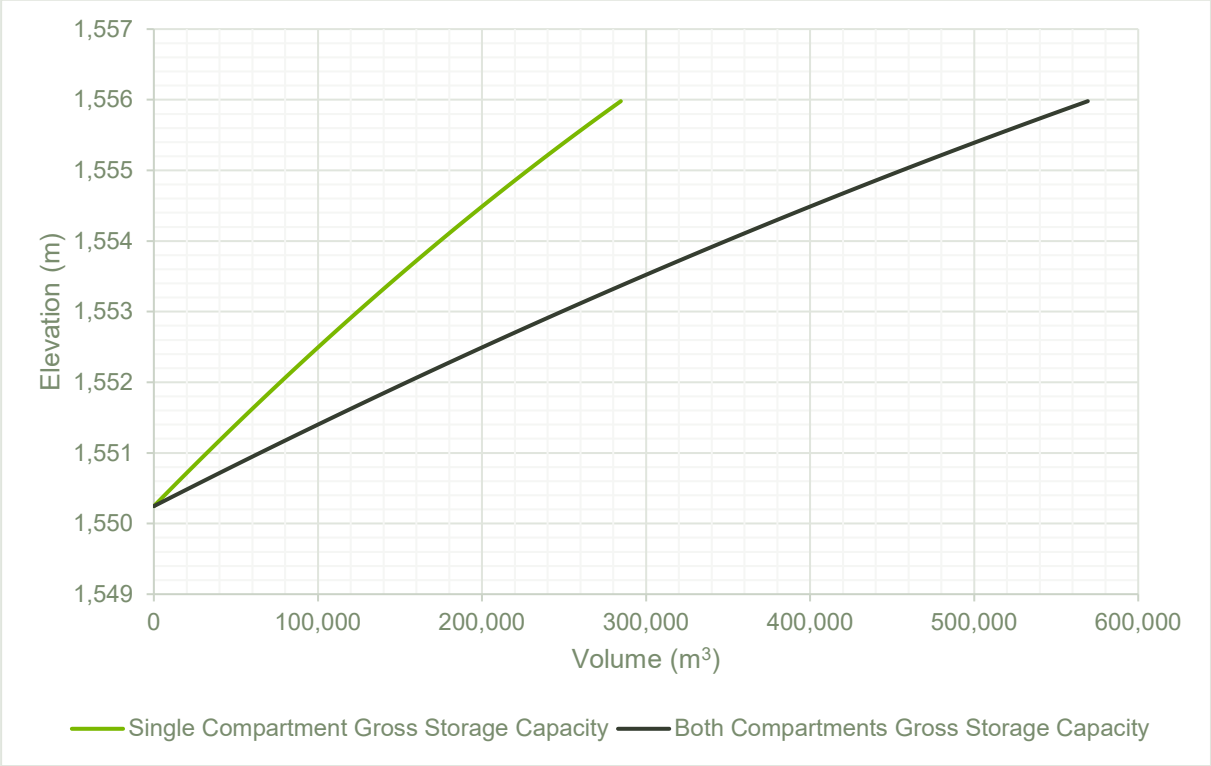


Figure 6-3: PCD 1 Nett storage capacity curves

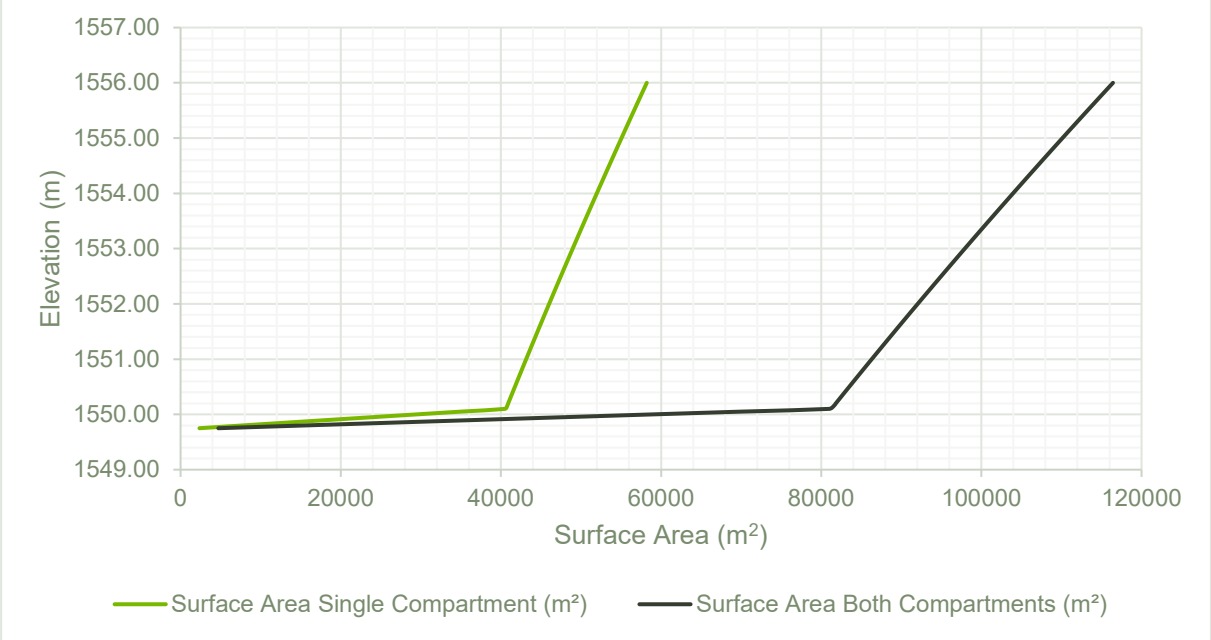


Figure 6-4: PCD 1 Surface area curves

6.1 Process Description

PCD 1 has a storage volume of 595 700 m³. Water pumped from Pit BD will go to PCD 1 (via PCD 4) or it will be pumped to PCD 2 as the mine plan progresses. Water will also be pumped from Pit H to PCD 1 in future.

PCD 2 has a storage volume of 80 000 m^3. Water will be pumped from the Pit BD to PCD 2 in future according to the mine plan. PCD 2 will pump to PCD 1 when the volume in PCD 2 becomes bigger than the total amount of dead storage in the PCD and if PCD 1 has sufficient capacity.

PCD 1 will pump to KPS buffer dam if it is necessary to supply plant water as well as supply raw water demand via the raw water tank. The KPS Buffer Dam provides additional storage capacity to the PCD 1 system. PCD 1 directly supplies a filling point (Filling Point 2), shown in Figure 6-5, which is used for dust suppression. If a case arises where PCD 1 overflows that amount of volume will spill into PCD 2.

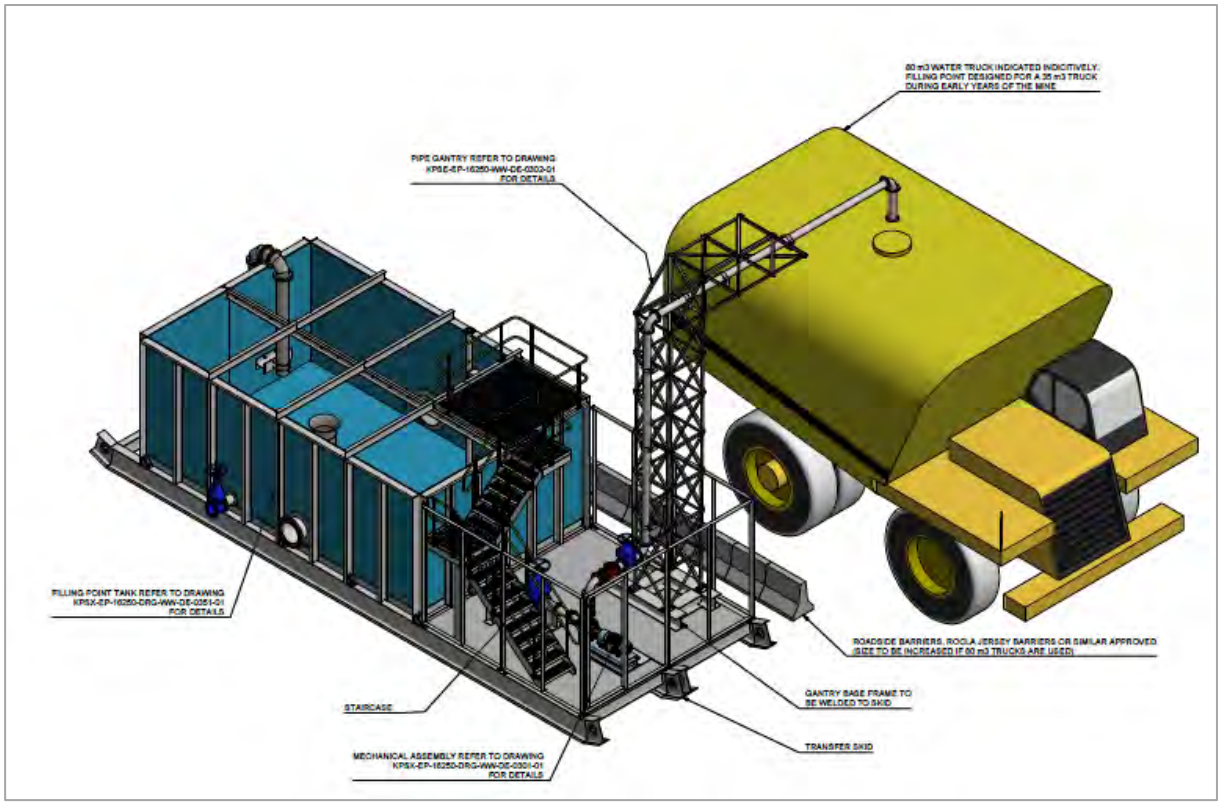


Figure 6-5: Filling point used to refill trucks for dust suppression

i) PCD 1 will receive water as follows:

- PCD 4 transfer the dewatering water of Pit BD to PCD 1 if the operational volume in PCD 4 is exceeded (must maintain the storm water capacity in the dam)
- PCD 2 transfers storm water to PCD 1 (if there is water in the PCD it will be pumped to PCD 1 unless PCD 1 is full i.e. the volume of water stored is 100%.
- Pit H dewatering system pumps to PCD 1 if PCD 1 < 90% of total storage capacity.

ii) PCD 1 has three pump systems with three separate pipelines:

- 1 duty pump without a standby pump to filling point 2
- 1 duty pump and 1 standby pump to raw water reservoir
- 1 duty pump and 1 standby pump to KPS Buffer Dam

iii) All pipelines out of the pump station have flow meters.

PCD 1 can transfer water to PCD 4 via a take-off on the raw water reservoir supply pipeline. This is a manual operational procedure as this will not be a normal operational procedure. It can be automated in future by including two actuated valves.

The PCD has two leak detection/subsoil drainage sumps with sump pumps that pump the water collected by the subsoil drainage system back into the PCD (1 per compartment). The pumps are normal, small submersible pumps with integral level switches.

6.2 Operating Description

During normal operating conditions, the pumps operate in auto mode and will be rotated between standby pump and duty pump automatically. The pumps will start and stop based on the levels of Filling Point 2, the Raw Water Reservoir, KPS Buffer Dam and PCD 4 (future)

Table 6-3: PCD 1 pump description

Pump Number	Description / System
GP211	1 Duty pump Pumps from PCD 1 to Filling Point Tank 2 via 1 pipeline
GP212A and GP212B	1 Duty pump and 1 standby pump Pumps from PCD 1 to the Raw Water Reservoir via 1 pipeline
GP213A and P213B	1 Duty pump and 1 standby pump Pumps from PCD 1 to KPS Buffer Dam via 1 pipeline

Table 6-4: PCD 1 Stop and start levels for pump operation and other important levels for operation of the PCD

Level		Description
HH:	1555.950 m	Warn operator that PCD 1 will spill
H5:	1555.750 m	Stop pumps from PCD 2 (Future)
H4:	1555.500 m	Stop pumps form PCD 4 and Pit H Storm Water Sump
H3:	1552.800 m	Water to be transferred to KPS Buffer Dam, Pumps to KPS Buffer Dam will start on H3 and stop on H2, pumps to Raw Water Reservoir and Filling Point can also run in this area. Volume between H3 and H4 – All pumps in PCD 1 pump station can run, transfer to KPS must be on and PCD 4 or PCD 2 can still pump to PCD 1
H2:	1550.950 m	Volume allocated for Filling Point and Raw Water Reservoir
H1:	1550.700 m	Volume allocated to supply the Filling Point. If level > H1 pump can start, pump will stop on L
L:	1550.400 m	Stop pump supplying the Filling Point
LL:	1550.235 m	Safety interlock

6.3 Description of Operation – When no Power is Available

Normal operating conditions of PCD 1 is dependent on a constant supply of electric power to the pump station, leak detection chambers and level monitoring systems within the dam. In the unlikely event of a power failure or a prolonged power outage, PCD 1 can be operated by hand. The procedure is described below:

a) Levels of each compartment should be noted on the gauge plates at the time of the power outage

b) It should be noted if a compartment of PCD 1 or the outlet pipe has been isolated by means of a stop log. The stop log should be raised if possible.

c) The condition of the sluice gates should be noted, i.e. both channels are open or if a compartment is isolated at the inlet channel. Both channels should be open if possible

d) The pump station isolation valve shall remain open

e) The level of the PCD shall be monitored daily

f) The levels of each leak detection chamber shall be monitored daily

g) Should PCD 1 spill, the scour valve may be opened to assist in lowering the level of PCD 1

6.4 Description of Operation – Operating a Single Compartment

The normal operation of PCD 1 is the use of both compartments, with the dam water level balancing through the balancing structure. Should the dam be required to operate only with a single compartment, the following procedure should be followed:

a) Lower the sluice gate in the inlet structure to block off all flow to the compartment to take out of service

b) If the compartment has water prior to taking it out of service, the stoplog for the opposite compartment should be lowered in the balancing structure

c) The compartment shall then be emptied by pumping through the pump station

d) Once the compartment has been emptied, lower the stoplog in the balancing structure to isolate the compartment to be taken out of service

e) Raise the stoplog in the balancing structure that isolated the compartment that will be kept in service

Once the compartment is ready to be placed back in service, the following:

a) Raise the sluice gate in the inlet structure, allowing water to flow into the compartment

b) Once the water level in the previously out of service compartment is approximately equal to that of the other compartment, raise the stoplog in the balancing chamber to return the dam to normal operating conditions

6.5 Maintenance

For pump or motor maintenance purposes the pump is selected to *'maintenance mode'* and isolation valves on both the suction and discharge sides of the pump closed (refer to the O&M manual for the PCD 1 pump station / integrated O&M manual for KPSX Extension).

These O&M manuals are mentioned for completeness but are not specifically required for dam safety purposes.

Hand operated scour valves are provided at low points along the pipeline to drain sections of the pipeline as required.

6.6 Component and Measurement Requirements

The equipment installed on the pipelines from PCD 1 to the various delivery points to measure the water flow is shown in Table 6-5.

Table 6-5: PCD 1 component and measurement requirements

Line / Equipment Description	Measured Value
Filling Point 2 flow meter	Volumetric flow, instantaneous and totalised
Raw Water Reservoir flow meter	Volumetric flow, instantaneous and totalised
KPS Buffer Dam flow meter	Volumetric flow, instantaneous and totalised

6.7 Identification of Control Parameters

The summarized control parameters for PCD 1 is shown in Table 6-6.

Table 6-6: PCD 1 identification of control parameters

Description	Control Range
Filling Point 2 tank	Maintain the tank level between the high- and low-level control limits.
Raw Water Reservoir	Maintain the tank level between the high- and low-level control limits if PCD 3 and PCD is low.
KPS Buffer Dam	Maintain the PCD 1 dam level between the high- and low-level control limits.

6.8 Alarms and Protection Interlocks

The alarms and protection interlocks for PCD 1 are shown in Table 6-7. Values that are noted as TBD (to be determined) shall be confirmed during commissioning of the pump station at PCD 1 and updated at a later date.

Table 6-7: PCD 1 alarms and Protection Interlocks

Description	Measured Variable	High/ Low	Value	Action
PCD 1	Level	LL	TBD	Protection Interlock, trip pumps
PCD 1	Level	HH	TBD	Notify control room operator to prevent over filling
PCD 1	Level	LL > HH	TBD	Refer to Table 6-4: PCD 1 Levels
Pump GP211 flow switch	Flow	L	N/A	Protection Interlock, trip to protect against dry run and dead head protection

Description	Measured Variable	High/ Low	Value	Action
Pump GP212A flow switch	Flow	L	N/A	Protection Interlock, trip to protect against dry run and dead head protection
Pump GP212B flow switch	Flow	L	N/A	Protection Interlock, trip to protect against dry run and dead head protection
Pump GP213A flow switch	Flow	L	N/A	Protection Interlock, trip to protect against dry run and dead head protection
Pump GP213B flow switch	Flow	L	N/A	Protection Interlock, trip to protect against dry run and dead head protection
Pump GP211 suction isolation valve position closed	Position	Close	N/A	Protection Interlock, trip to protect against dry run protection
Pump GP212A suction isolation valve position closed	Position	Close	N/A	Protection Interlock, trip to protect against dry run protection
Pump GP212B suction isolation valve position closed	Position	Close	N/A	Protection Interlock, trip to protect against dry run protection
Pump GP213A suction isolation valve position closed	Position	Close	N/A	Protection Interlock, trip to protect against dry run protection
Pump GP213B suction isolation valve position closed	Position	Close	N/A	Protection Interlock, trip to protect against dry run protection
Pump GP211 discharge pressure	Pressure	H	TBD	Protection Interlock, trip to protect against dead head
Pump GP212A/B discharge pressure	Pressure	H	TBD	Protection Interlock, trip to protect against dead head
Pump GP213A/B discharge pressure	Pressure	H	TBD	Protection Interlock, trip to protect against dead head

7 Dam break analysis

PCD 1 is an off-channel reservoir and the risk of a dam break flood occurring due to overtopping of the non-overspill crest is considered negligible due to the small catchment area.

The probable failure scenarios are a piping failure through the HDPE lining system of embankment or a sudden embankment collapse.

The dam break analysis carried out on PCD 1 indicated no risk for loss of life as there are no inhabitants below the dam. Two structures were identified downstream of the dam, a small farm dam with an approximate height of 1.5 m and a retention pond, approximate height of 4.0 m.

Two farm roads were identified, the first being 1.4 km downstream of the dam. The second is a roadway that crosses the crest of the above-mentioned retention pond, 4.0 km downstream of the dam.

The dam break analysis indicated that, should a failure occur, the break would cover an area of approximately 217 526 m^2 within a 2.5 km downstream reach of the dam, spilling 571 931 m^3 of water. The dam break flood lines are shown on drawing KPSX-EP-16260-DRG-WW-LY-0011-01 in Appendix D.

8 Emergency Preparedness Plan

This Emergency Preparedness Plan (EPP) must be implemented as necessary by the owner who should also maintain it and keep it up to date. Note that this is not an emergency evacuation plan. The owner's representative and the designated disaster management authority are responsible for warning and evacuation in the affected areas as necessary

8.1 Threatened area

As described in Section 7, a dam break analysis was carried out for PCD 1 showing the threatened area which is contained within the mining property of the owner. The dam break flood lines are shown on drawing KPSX-EP-16260-DRG-WW-LY-0011-01 in Appendix D.

8.2 Emergency Planning

All role players (as discussed in Section 8.4) which may need to respond to any hazard occurrence in the surrounding area must be prepared for a quick and effective response in the event of a dam failure occurrence.

In the pro-active phase of disaster risk management, preparedness is defined as per the sections below.

8.2.1 Education and training

The role players (as discussed in Section 8.4) and the public directly implicated must be made aware of the emergency procedures discussed in Section 8.3.

8.2.2 Engineering and technical

The required inspection, operation and maintenance of the dam is discussed in Section 3 to 6 of this report. It is the owner's responsibility to ensure that the responsible role players (as discussed in Section 8.4) are acquainted with this report and that the necessary resources are provided to implement the required activities.

8.2.3 Emergency preparedness

The operator of the dam must be well acquainted with this report. The operator must know what procedures to follow in any emergency situation with guidance from this report as well as more detailed evacuation plans which are not set out in this report.

It is good practice to have the following items available to the operator of the dam for monitoring and emergency preparedness:

- O&M manual (this report)
- Pegs
- Paint
- Radio / cellphone
- Camera
- Lighting

- Generator
- Loud hailer
- Valve key
- Valve chamber keys
- Pump station key
- Warning signs
- Warning flags
- Personal Protection Equipment (PPE)
- Emergency contact details

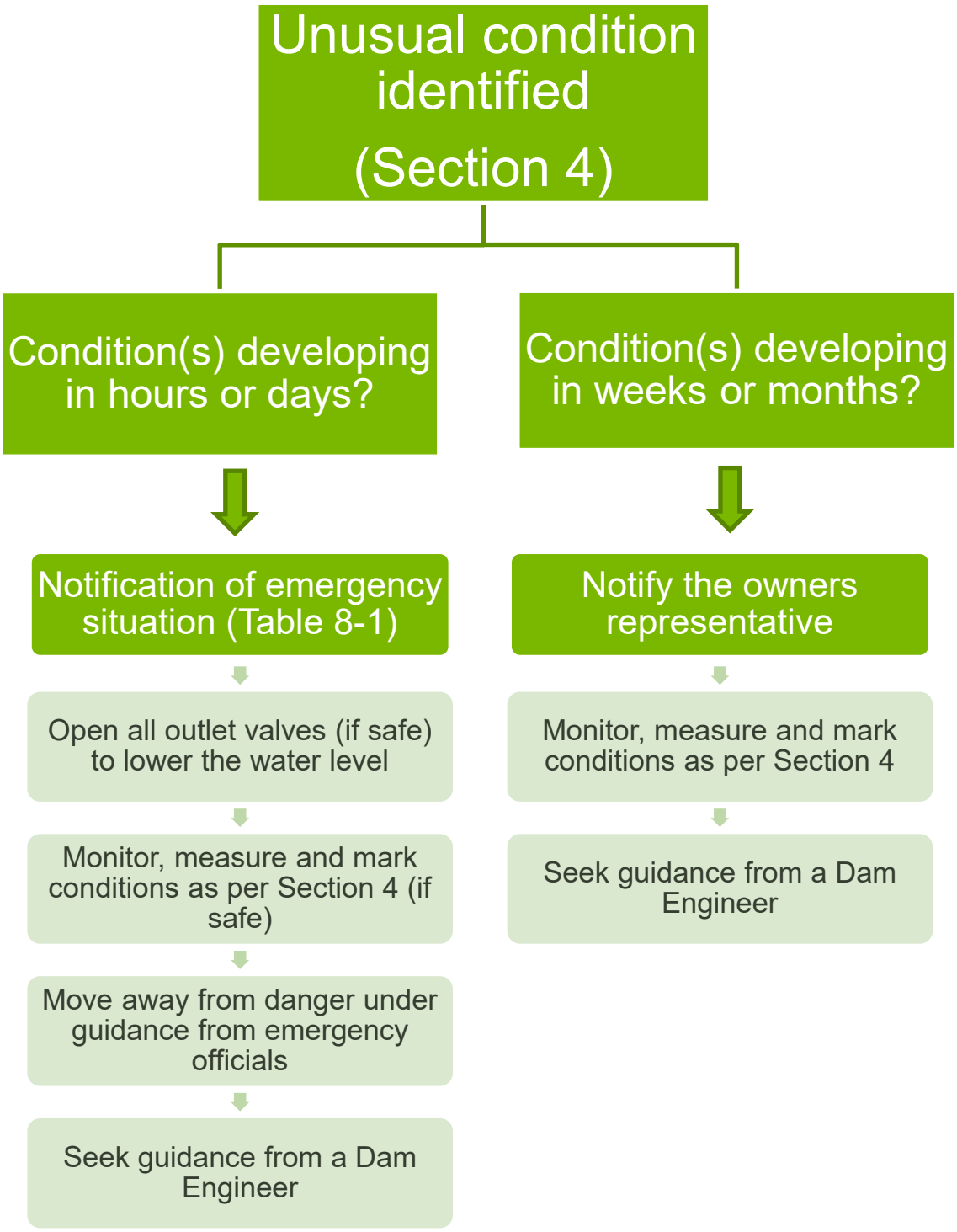
Keys to the security gates of the perimeter fence around the dam should be kept in a central location at the control room such that they can be accessed quickly during an emergency. Refer to Section 8.4 for contact details.

8.3 Emergency procedures

Conditions that indicate a potential emergency situation are described in Section 4, especially if the conditions arise rapidly (over several hours or days). If deemed necessary or if the unusual condition develops suddenly, all steps should be taken to drain the dam or lower the water level, by opening all valves or syphoning water.

It is the responsibility of the operator to assess the severity. The severity is indicated by the time of development of the unusual condition (Section 4).

8.3.1 Assess the severity



8.3.2 Notification procedures

The following procedures should be followed in the event of an emergency situation, in order:

1. Call the KPS Control Room who will notify Disaster Risk Management and emergency response units.
2. Warn the Owners of properties and Authorities of roads downstream of the dam of the emergency situation.
3. Warn and inform anybody who might be downstream of the dam at the time of the emergency situation.
4. Notify the owner of the dam.
5. Seek expert advice from an experienced dam engineer (see 8.3.3 below).
6. The Director-General of the Department of Human Settlements, Water and Sanitation (in the person of the Director: Dam Safety Regulation Chief: Dam Safety Office, telephone 012 - 338 7500) should immediately be notified as soon as a condition affecting the safety of the dam is identified, and a written report on the nature, extent and causes of the condition and the steps taken to improve the safety of the dam should be submitted to the Director-General within 30 days.

IN CASE OF EMERGENCY NOTIFY THE PARTIES ACCORDING TO STEPS 1 - 5 ON THE FOLLOWING PAGE

8.3.3 Expert advice

If the dam owner decides that a potential emergency situation is developing, expert advice in managing the dam through the event may be obtained from the following persons or institutions:

- The Approved Professional Person (APP) previously involved with the dam (if possible)
- Any suitably experienced dam engineer
- Dam Safety Office (DSO) of the Directorate: Dam Safety Regulation of the Department of Human Settlements, Water and Sanitation (DHSWS)

Contact details are provided in Section 8.4.

Table 8-1: Emergency Notification Protocol

ORDER OF NOTIFICATION

	OPREATOR PROTOCOL	ADDITIONAL ACTIVIY AND INFORMATION
1	**Notification of Possible Emergency Situation to KPS Control Room** **Who:** Notifier: Public/Operator Notification to: KPS Control Room **How:** Dial: 013 643 3911	Control Room notifies emergency services. Control Room notifies Disaster Management Unit. Disaster Management Unit to follow the relevant emergency response protocols.
2	**Notification of Possible Emergency Situation to Property Owners** **Who:** Notifier: Public/Operator/Emergency services/Disaster Management Unit Notification to: Property owners **How:** Identify properties and infrastructure and go from door to door to warn and notify those affected. The Disaster Management Unit and local emergency services must advise and assist.	Inform/notify the following: ▪ All people downstream of the dam. ▪ Properties located adjacent to the dam break flood line.
3	**Notification of Possible Emergency Situation to Public** **Who:** Notifier: Public/Operator/Emergency services/Disaster Management Unit Notification to: Public **How:** Identify any person downstream of the dam and verbally notify said person(s) of emergency situation.	Public to stay calm and wait for emergency services to arrive. In the case where the danger is imminent the Disaster Management Unit and emergency services will inform all persons to evacuate the area in immediate danger.
4	**Notification of Possible Emergency Situation to Owners representative** **Who:** Notifier: Operator Notification to: Owners representative **How:** Contact and inform the relevant person/institution as set out in **Section 8.4**	The owners representative needs to assess the situation and ensure: ▪ The Disaster Management Unit is aware and in control of the emergency situation. ▪ The staff at the pump station and downstream infrastructure is aware of the situation. ▪ An observer is sent to the dam to monitor the situation on site. ▪ All outlet valves are opened to drain the dam. ▪ A dam engineer is contacted to provide expert advice.
5	**Notification of Possible Emergency Situation to a Dam Engineer** **Who:** Notifier: Owners representative Notification to: Specialist Dam Engineer **How:** Contact and inform the Dam Engineer who carried out the latest dam safety evaluation OR Contact and inform any suitably experienced dam engineer.	

8.4 Names and addresses of relevant persons/institutions

The persons and institutions that are responsible for the dam or should be contacted in the event of an emergency with their contact details are listed below. Note that these details and persons may change from time to time and it is the responsibility of the dam owner that this list is updated to reflect any changes.

Operations Manager: KPSX Weltevreden PCD 1	
Name:	TT Mathebula
Cell phone:	N/A
Telephone:	013 653 5151
Responsibility:	Evaluate gravity of emergency situation and, where appropriate, notify emergency response personnel (Emalahleni Disaster Management Unit, Road Traffic Inspectorate and SA Police).
Manager: Emalahleni District Municipality Disaster Management Unit	
Name:	AV Mlangeni
Cell phone:	N/A
Telephone:	013 690 6444 013 690 6222
Responsibility:	Co-ordinate Disaster Management Unit staff to patrol water course below dam to warn local communities to stay away from river banks.
Commanding Officer- SA Police Service, Phola	
Name:	Colonel Matlala
Cell phone:	079 495 3917
Telephone:	013 643 8605
Responsibility:	To monitor local Ogies / Phola community and control any dangerous situation arising To send patrol cars to downstream crossings of the Grootspruit watercourse to be on standby close to the road for vehicular and pedestrian traffic.

Commanding Officer - SA Police Service, Ogies	
Name:	Captain Mabena
Cell phone:	N/A
Telephone:	013 643 8402
Responsibility:	To monitor local Ogies / Phola community and control any dangerous situation arising To send patrol cars to downstream crossings of the Grootspruit watercourse to be on standby close to the road for vehicular and pedestrian traffic.
Ward Councillor – Local Community	
Name:	ML Mofokeng
Cell phone:	078 408 3878
Telephone:	013 690 6333
Responsibility:	Assist local authorities with communications to the residents
KPS Control Room	
Name:	KPS Control Room
Cell phone:	N/A
Telephone:	013 643 3911
Responsibility:	Assist local authorities and the owner with resources to respond to the emergency

Appendices

Appendix A
Routine Inspection Check List for KPSX Weltevreden Pollution Control Dam 1

Date of inspection: ……..... Water level on gauge plate ……..m

Full Supply Level = 6.3 m on gauge plate

Item	Inspection	Comment*
1.	**DOWNSTREAM FACE OF DAM**	
1.1	**Appearance of seepage water:**	
	Position(s)	
	Estimate of flow	
	Clarity of water	
1.2	**Appearance of damp patches:**	
	Position(s)	
	Area of patch	
1.3	**Appearance of settlement:**	
	Position(s)	
	Surface area	
	Maximum depth below normal slope	
1.4	**Appearance of bulges:**	
	Position(s)	
	Surface area	
	Maximum height above normal slope	
1.5	**Appearance of cracks:**	
	Position(s)	
	Direction #	
	Length	
	Width	
	Vertical displacement	
1.6	**Condition of vegetation:**	
	Grass	
	Removal of trees	
1.7	**Appearance of erosion**	
1.8	**Other**	
1.9	**General condition**	

Item	Inspection	Comment*
2.	**UPSTREAM FACE OF DAM**	
2.1	**Condition of slope protection:**	
	Condition of stabilised infill	
	Condition of geocells	
	Wash out of geocell(s)	
	Position(s)	
	Length	
	Width	
2.2	**Condition of HDPE liner**	
	Exposed Liner	
	Position(s)	
	Length	
	Width	
	Hole in liner	
	Position(s)	
	Length	
	Width	
	Tear in liner	
	Position(s)	
	Length	
	Width	
2.3	**Appearance of settlement:**	
	Position(s)	
	Surface area	
	Maximum depth below normal slope	
2.4	**Appearance of cracks:**	
	Position(s)	
	Direction #	
	Length	
	Width	
	Vertical displacement	
2.5	**Appearance of erosion/wave benching**	
2.6	**Other**	
2.7	**General condition**	

3.	EMBANKMENT CREST			
3.1	**Monitoring of settlement (annual only)**		**Benchmark level = ...masl**	
	Settle Beacon	Initial level (masl)	Present level (masl)	Vertical movement (mm)
	PCD 1-SB01			
	PCD 1-SB02			
	PCD 1-SB03			
	PCD 1-SB04			
	PCD 1-SB05			
	PCD 1-SB06			
	PCD 1-SB07			
	PCD 1-SB08			
	PCD 1-SB10			
	PCD 1-SB09			
	PCD 1-SB10			
	PCD 1-SB11			
	PCD 1-SB12			
	PCD 1-SB13			
	PCD 1-SB14			
	PCD 1-SB15			
	PCD 1-SB16			
	PCD 1-SB17			
	PCD 1-SB18			
	PCD 1-SB19			
	PCD 1-SB20			

Item	Inspection	Comment*
3.2	**Appearance of settlement:**	
	Position(s)	
	Surface area	
3.3	**Appearance of cracks:**	
	Position(s)	
	Direction #	
	Length	
	Width	
	Depth	
	Distance between transverse cracks	
3.4	**Other**	
3.5	**General condition**	

Item	Inspection	Comment*
4.	**SPILLWAYS**	
4.1	**Appearance of erosion**	
4.2	**Vegetation in channel**	
4.3	**Blockages in channel**	
4.4	**Condition of rip-rap**	
4.5	**Other**	
4.6	**General condition**	
5.	**LEAK DETECTION SUMPS**	
5.1	**Monitoring of seepage water:**	
	Chamber No	Estimated flow (ℓ/s)
	Leak Detection Sump A	
	Leak Detection Sump B	
5.2	**Monitoring of water quality**	
	Clarity of water	
	Contaminant(s)	
5.3	**Open and close valves**	
5.4	**Leakage at pipe surround**	
5.5	**Leakage through closed valves**	
5.6	**Damage or corrosion**	
5.7	**Other**	
5.8	**General condition**	
6	**DOWNSTREAM TOE**	
6.1	**Appearance of seepage water:**	
	Position(s)	
	Estimate of flow	
	Clarity of water	
6.2	**Appearance of settlement or movement:**	
	Position(s)	
	Surface area	
	Maximum depth below normal slope	
6.3	**Other**	
6.4	**General condition**	

Item	Inspection	Comment*
7	**INLET WORKS**	
7.1	**Open and close sluice gates**	
7.2	**Leakage around sluice gates**	
7.3	**Condition of access stairs**	
7.4	**Leakage at inlet pipes**	
7.5	**Silt build up depth**	
7.6	**Damage or corrosion**	
7.7	**Other**	
7.8	**General condition**	
8	**OUTLET WORKS**	
8.1	**Lift and lower stoplogs**	
8.2	**Condition of screens**	
8.3	**Condition of staircases**	
8.4	**Leakage at pipe surround**	
8.5	**Leakage through closed valves**	
8.6	**Open and close valves**	
8.7	**Damage or corrosion**	
8.8	**Other**	
8.9	**General condition**	
9.	**BASIN**	
9.1	**Condition of HDPE Liner**	
	Exposed Liner	
	Position(s)	
	Length	
	Width	
	Hole in liner	
	Position(s)	
	Length	
	Width	
	Tear in liner	
	Position(s)	
	Length	
	Width	
9.2	**Other**	
9.3	**General condition**	

* Give description of observations of each component of the dam by commenting on the different items, e.g. good, poor, none, what action should be taken and any further applicable comment.

Photographs of a particular condition are useful and provide much more information than a description.

\# Cracks parallel to the crest of the dam = longitudinal
Cracks perpendicular to crest of the dam = transverse

_____	_____
Signature of the Observer	**Signature of the Owner or the Owner's representative who is responsible for PCD 1.**
_____	_____
Date	**Date**

Appendix B
Classification of KPSX Weltevreden PCD1

Letter from the Dam Safety Office (DSO) of the Directorate: Dam Safety Regulation of the Department of Water and Sanitation

water & sanitation

Department:
Water and Sanitation
REPUBLIC OF SOUTH AFRICA

185 Francis Baard Street, Pretoria, 0002 / Private BagX313, Pretoria, 0001

Ms HM Groenewald
(012) 336 8553
12/2/B203/32

Director South32 Coal Holdings (PTY) LTD PO Box 61820 **MARSHALLTOWN** **2107**	Mr Josua Bekker Klipspuit Colliery Private Bag x15 **LERAATSFONTEIN** **1038**

Attention: Mr Josua Bekker, Klipspruit Colliery, josua.bekker@south32.net

Sir

CLASSIFICATION OF A DAM WITH A SAFETY RISK IN TERMS OF CHAPTER 12 OF THE NATIONAL WATER ACT, 1998 (ACT 36 OF 1998), READ WITH REGULATIONS 2 AND 3 OF THE REGULATIONS PUBLISHED IN GOVERNMENT NOTICE R.139 OF 24 FEBRUARY 2012: PROPOSED KPSX WELTEVREDEN PCD 1 DAM ON PORTION 3 AND 4 OF THE FARM TWEEFONTEIN 328 JS AND THE REMAINDER OF THE FARM TWEEFONTEIN 328 JS, DISTRICT OF EMALAHLENI

A. APPLICATION

Receipt is acknowledged of the documentation listed below as received under the cover letter with reference KPSX-EP-16260-LET-WW-001, dated 20 June 2017, from Mr AG Chemaly of the firm Aurecon South Africa (Pty) Ltd on your behalf:

1.1 Application for Classification of a Proposed New Dam (KPSX Weltevreden PCD 1) Form DW692E (document reference KPSX-EP-16260-FRM-WW-0001),
1.2 Drawing No. KPSX-EP-16260-DRW-WW-LY-GA-0011-01 KPSX WELTEVREDEN PCD 1 Locality plan;
1.3 Drawing No. KPSX-EP-16260-DRG-WW-LY-0011-01 KPSX WELTEVREDEN PCD 1 dam break assessment; and
1.4 Licence for water uses listed and described in Licence No. 03/B11F/ACGIJ/4740 (File No. 27/2/B203/332) dated 24 October 2016.

B. CLASSIFICATION

1. The classification of proposed KPSX Weltevreden PCD 1 Dam is as follows:

Vertical wall height Storage capacity	7,3 metres 595 700 cubic metres
Size classification Hazard potential rating Category	Small Significant II

2. The classification is based on available information. If you have any information on the basis of which you feel the classification is incorrect, you should submit a substantiated application in writing for its revision.

C. REQUIREMENTS FOR CONSTRUCTING A DAM WITH A SAFETY RISK

1. In terms of Regulation 4(1), no person who intends to construct a dam with a safety risk, *or enlarge, alter or repair an existing dam* with a safety risk, may begin any construction work, before he or she is in possession of a **licence to construct**, enlarge, alter or repair, issued by the Director-General. The procedure to obtain a licence is explained below:

1.1 acquire the **services** of an approved professional person to design the proposed project and to draw up plans and specifications for it. **An application in this regard has already been received from *Mr AG Chemaly* and he is approved for the task.**

1.2 apply on an official application form (DW695E) for a licence to **construct**, by submitting to the Director-General a proposed design complying with acceptable dam engineering practices and criteria as set out in Regulation 10 to 14.

2. In terms of Regulation 4(2) you have to obtain a water use licence before the dam safety licence to construct/alter/enlarge could be issued. **A copy of the water use licence has been received.**

3. In terms of section 120 of the National Water Act, 1998, the dam must be registered at the Dam Safety Office of this Department within 120 days of the date on which the dam becomes capable of containing, storing or impounding water. Form DW693E must be completed and submitted to the Dam Safety Office for this purpose.

D. THIS LETTER SHALL NOT BE CONSTRUED AS CONFERRING EXEMPTION FROM COMPLIANCE WITH THE FOLLOWING:

1. The required licence or entitlement to water use in terms of chapter 4 of the National Water Act, 1998 or recognition of an existing lawful use.

2. The provisions and regulations of the National Environmental Management Act, 1998 (Act No. 107 of 1998) regarding control over activities which may have a detrimental effect on the environment.

Yours faithfully

HMGroenewald

Letter signed by: Ms HM Groenewald
Designation: Assistant Director: Dam Safety Regulation
Date: 27/07/2017

Copy to:
(i) Chief Director: Mpumalanga
(ii) Mr Waldo Bezuidenhout, South32 Project Manager, PO Box 61820, Marshalltown, 2107. E-mail Waldo.Bezuidenhout@south32.net
(iii) Mr Jan Roos, South32 CSA Project Development, Private Bag X15, Leraatsfontein, 1038. E-mail Jan.Roos@south32.net
(iv) Ms Eldoreen van der Wath, South32 KPS – Transition to Operations Manager, Private Bag X15, Leraatsfontein, 1038. E-mail Van der Wath, Eldoreen.VanDerWath@south32.net
(v) Mr V Wentzel, KPSX Water Lead, Aurecon South Africa (Pty) Ltd, PO Box 74381, Lynnwood Ridge, 0040. Victor.Wentzel@aurecongroup.com
(vi) Mr A.G. Chemaly, Specialist Engineer: Dams, Aurecon South Africa (Pty) Ltd, PO Box 74381, Lynnwood Ridge, 0040. E-mail Alan.Chemaly@aurecongroup.com
(vii) Mr S Herholdt, Aurecon Project Manager, Aurecon South Africa (Pty) Ltd, PO Box 74381, Lynnwood Ridge, 0040. E-mail Stephen.Herholdt@aurecongroup.com
(viii) Mr R Gilau, Aurecon Engineering Manager, Aurecon South Africa (Pty) Ltd, PO Box 74381, Lynnwood Ridge, 0040. E-mail Ruan.Gilau@aurecongroup.com
(ix) Ms E. Pretorius, Aurecon Document Controller (Gauteng Resources and Manufacturing), Aurecon South Africa (Pty) Ltd, PO Box 74381, Lynnwood Ridge, 0040. E-mail Ernette.Pretorius@aurecongroup.com

Appendix C
KPSX Weltevreden Pollution Control Dam 1
Locality Map

Appendix D
KPSX Weltevreden Pollution Control Dam 1 Dam Break Analysis

Appendix E

KPSX Pollution Control Dam 1 Gross Capacity Table

Percentage of full supply level depth	Water level (masl)	Capacity of one (1) Compartment (m^3)	Capacity of two (2) Compartments (m^3)	Percentage of full supply level depth	Water level (masl)	Capacity of one (1) Compartment (m^3)	Capacity of two (2) Compartments (m^3)
100%	1,556.00	297,850	595,700	75%	1,554.68	223,398	446,797
99%	1,555.95	294,886	589,771	74%	1,554.62	220,420	440,839
98%	1,555.89	291,907	583,814	73%	1,554.57	217,441	434,882
97%	1,555.83	288,928	577,857	72%	1,554.51	214,462	428,925
96%	1,555.78	285,950	571,900	71%	1,554.46	211,484	422,967
95%	1,555.73	282,971	565,942	70%	1,554.40	208,505	417,010
94%	1,555.68	279,993	559,985	69%	1,554.34	205,526	411,053
93%	1,555.63	277,014	554,028	68%	1,554.29	202,548	405,096
92%	1,555.58	274,035	548,070	67%	1,554.23	199,569	399,138
91%	1,555.53	271,057	542,113	66%	1,554.17	196,590	393,181
90%	1,555.48	268,078	536,156	65%	1,554.12	193,612	387,224
89%	1,555.42	265,099	530,199	64%	1,554.06	190,633	381,266
88%	1,555.37	262,121	524,241	63%	1,554.00	187,655	375,309
87%	1,555.32	259,142	518,284	62%	1,553.94	184,676	369,352
86%	1,555.27	256,163	512,327	61%	1,553.89	181,697	363,395
85%	1,555.21	253,185	506,369	60%	1,553.83	178,719	357,437
84%	1,555.16	250,206	500,412	59%	1,553.77	175,740	351,480
83%	1,555.11	247,227	494,455	58%	1,553.71	172,761	345,523
82%	1,555.06	244,249	488,498	57%	1,553.65	169,783	339,565
81%	1,555.00	241,270	482,540	56%	1,553.59	166,804	333,608
80%	1,554.95	238,291	476,583	55%	1,553.53	163,825	327,651
79%	1,554.89	235,313	470,626	54%	1,553.47	160,847	321,694
78%	1,554.84	232,334	464,668	53%	1,553.41	157,868	315,736
77%	1,554.79	229,356	458,711	52%	1,553.35	154,889	309,779
76%	1,554.73	226,377	452,754	51%	1,553.29	151,911	303,822

Percentage of full supply level depth	Water level (masl)	Capacity of one (1) Compartment (m^3)	Capacity of two (2) Compartments (m^3)	Percentage of full supply level depth	Water level (masl)	Capacity of one (1) Compartment (m^3)	Capacity of two (2) Compartments (m^3)
50%	1,553.23	148,932	297,864	25%	1,551.65	74,466	148,932
49%	1,553.17	145,954	291,907	24%	1,551.59	71,487	142,975
48%	1,553.11	142,975	285,950	23%	1,551.52	68,509	137,018
47%	1,553.05	139,996	279,993	22%	1,551.45	65,530	131,060
46%	1,552.99	137,018	274,035	21%	1,551.39	62,552	125,103
45%	1,552.93	134,039	268,078	20%	1,551.32	59,573	119,146
44%	1,552.87	131,060	262,121	19%	1,551.25	56,594	113,188
43%	1,552.81	128,082	256,163	18%	1,551.18	53,616	107,231
42%	1,552.74	125,103	250,206	17%	1,551.12	50,637	101,274
41%	1,552.68	122,124	244,249	16%	1,551.05	47,658	95,317
40%	1,552.62	119,146	238,291	15%	1,550.98	44,680	89,359
39%	1,552.56	116,167	232,334	14%	1,550.91	41,701	83,402
38%	1,552.49	113,188	226,377	13%	1,550.84	38,722	77,445
37%	1,552.43	110,210	220,420	12%	1,550.77	35,744	71,487
36%	1,552.37	107,231	214,462	11%	1,550.70	32,765	65,530
35%	1,552.30	104,253	208,505	10%	1,550.64	29,786	59,573
34%	1,552.24	101,274	202,548	9%	1,550.57	26,808	53,616
33%	1,552.17	98,295	196,590	8%	1,550.50	23,829	47,658
32%	1,552.11	95,317	190,633	7%	1,550.43	20,851	41,701
31%	1,552.04	92,338	184,676	6%	1,550.42	17,872	35,744
30%	1,551.98	89,359	178,719	5%	1,550.28	14,893	29,786
29%	1,551.91	86,381	172,761	4%	1,550.20	11,915	23,829
28%	1,551.85	83,402	166,804	3%	1,550.14	8,936	17,872
27%	1,551.78	80,423	160,847	2%	1,550.08	5,957	11,915
26%	1,551.72	77,445	154,889	1%	1,549.96	2,979	5,957

**1549.750 masl is the lowest level available for the gross storage capacity of the dam*

Appendix F

KPSX Pollution Control Dam 1 Nett Capacity Table

Percentage of full supply level depth	Water level (masl)	Capacity of one (1) Compartment (m^3)	Capacity of two (2) Compartments (m^3)	Percentage of full supply level depth	Water level (masl)	Capacity of one (1) Compartment (m^3)	Capacity of two (2) Compartments (m^3)
100%	1,556.00	284,639	569,279	75%	1,554.74	213,480	426,959
99%	1,555.95	281,793	563,586	74%	1,554.69	210,633	421,266
98%	1,555.89	278,947	557,893	73%	1,554.63	207,787	415,573
97%	1,555.84	276,100	552,200	72%	1,554.58	204,940	409,881
96%	1,555.79	273,254	546,508	71%	1,554.53	202,094	404,188
95%	1,555.74	270,407	540,815	70%	1,554.47	199,248	398,495
94%	1,555.69	267,561	535,122	69%	1,554.42	196,401	392,802
93%	1,555.64	264,715	529,429	68%	1,554.37	193,555	387,110
92%	1,555.60	261,868	523,736	67%	1,554.31	190,708	381,417
91%	1,555.55	259,022	518,044	66%	1,554.26	187,862	375,724
90%	1,555.50	256,175	512,351	65%	1,554.21	185,016	370,031
89%	1,555.45	253,329	506,658	64%	1,554.15	182,169	364,338
88%	1,555.40	250,483	500,965	63%	1,554.10	179,323	358,646
87%	1,555.35	247,636	495,273	62%	1,554.04	176,476	352,953
86%	1,555.30	244,790	489,580	61%	1,553.99	173,630	347,260
85%	1,555.25	241,943	483,887	60%	1,553.93	170,784	341,567
84%	1,555.20	239,097	478,194	59%	1,553.88	167,937	335,874
83%	1,555.15	236,251	472,501	58%	1,553.82	165,091	330,182
82%	1,555.10	233,404	466,809	57%	1,553.76	162,244	324,489
81%	1,555.05	230,558	461,116	56%	1,553.71	159,398	318,796
80%	1,555.00	227,711	455,423	55%	1,553.65	156,552	313,103
79%	1,554.94	224,865	449,730	54%	1,553.60	153,705	307,411
78%	1,554.89	222,019	444,037	53%	1,553.54	150,859	301,718
77%	1,554.84	219,172	438,345	52%	1,553.48	148,012	296,025
76%	1,554.79	216,326	432,652	51%	1,553.43	145,166	290,332

Percentage of full supply level depth	Water level (masl)	Capacity of one (1) Compartment (m^3)	Capacity of two (2) Compartments (m^3)	Percentage of full supply level depth	Water level (masl)	Capacity of one (1) Compartment (m^3)	Capacity of two (2) Compartments (m^3)
50%	1,553.37	142,320	284,639	25%	1,551.87	71,160	142,320
49%	1,553.31	139,473	278,947	24%	1,551.81	68,313	136,627
48%	1,553.25	136,627	273,254	23%	1,551.75	65,467	130,934
47%	1,553.20	133,781	267,561	22%	1,551.68	62,621	125,241
46%	1,553.14	130,934	261,868	21%	1,551.62	59,774	119,549
45%	1,553.08	128,088	256,175	20%	1,551.56	56,928	113,856
44%	1,553.02	125,241	250,483	19%	1,551.49	54,081	108,163
43%	1,552.96	122,395	244,790	18%	1,551.43	51,235	102,470
42%	1,552.90	119,549	239,097	17%	1,551.36	48,389	96,777
41%	1,552.84	116,702	233,404	16%	1,551.30	45,542	91,085
40%	1,552.78	113,856	227,711	15%	1,551.24	42,696	85,392
39%	1,552.72	111,009	222,019	14%	1,551.17	39,850	79,699
38%	1,552.67	108,163	216,326	13%	1,551.11	37,003	74,006
37%	1,552.61	105,317	210,633	12%	1,551.04	34,157	68,313
36%	1,552.55	102,470	204,940	11%	1,550.98	31,310	62,621
35%	1,552.48	99,624	199,248	10%	1,550.91	28,464	56,928
34%	1,552.42	96,777	193,555	9%	1,550.85	25,618	51,235
33%	1,552.36	93,931	187,862	8%	1,550.78	22,771	45,542
32%	1,552.30	91,085	182,169	7%	1,550.71	19,925	39,850
31%	1,552.24	88,238	176,476	6%	1,550.65	17,078	34,157
30%	1,552.18	85,392	170,784	5%	1,550.58	14,232	28,464
29%	1,552.12	82,545	165,091	4%	1,550.51	11,386	22,771
28%	1,552.06	79,699	159,398	3%	1,550.45	8,539	17,078
27%	1,552.00	76,853	153,705	2%	1,550.38	5,693	11,386
26%	1,551.93	74,006	148,012	1%	1,550.31	2,846	5,693

**1550.235 masl is the lowest level available for the nett storage capacity of the dam*

Appendix G

KPSX Pollution Control Dam 1 Surface Area Table

Percentage of full supply level depth	Water level (masl)	Surface Area of one (1) Compartment (m^2)	Surface Area of two (2) Compartments (m^2)	Percentage of full supply level depth	Water level (masl)	Surface Area of one (1) Compartment (m^2)	Surface Area of two (2) Compartments (m^2)
100%	1,556.00	58,216	116,432	75%	1,554.68	43,662	87,324
99%	1,555.95	57,634	115,268	74%	1,554.62	43,080	86,160
98%	1,555.89	57,052	114,103	73%	1,554.57	42,498	84,995
97%	1,555.83	56,470	112,939	72%	1,554.51	41,916	83,831
96%	1,555.78	55,887	111,775	71%	1,554.46	41,333	82,667
95%	1,555.73	55,305	110,610	70%	1,554.40	40,751	81,502
94%	1,555.68	54,723	109,446	69%	1,554.34	40,169	80,338
93%	1,555.63	54,141	108,282	68%	1,554.29	39,587	79,174
92%	1,555.58	53,559	107,117	67%	1,554.23	39,005	78,009
91%	1,555.53	52,977	105,953	66%	1,554.17	38,423	76,845
90%	1,555.48	52,394	104,789	65%	1,554.12	37,840	75,681
89%	1,555.42	51,812	103,624	64%	1,554.06	37,258	74,516
88%	1,555.37	51,230	102,460	63%	1,554.00	36,676	73,352
87%	1,555.32	50,648	101,296	62%	1,553.94	36,094	72,188
86%	1,555.27	50,066	100,132	61%	1,553.89	35,512	71,024
85%	1,555.21	49,484	98,967	60%	1,553.83	34,930	69,859
84%	1,555.16	48,901	97,803	59%	1,553.77	34,347	68,695
83%	1,555.11	48,319	96,639	58%	1,553.71	33,765	67,531
82%	1,555.06	47,737	95,474	57%	1,553.65	33,183	66,366
81%	1,555.00	47,155	94,310	56%	1,553.59	32,601	65,202
80%	1,554.95	46,573	93,146	55%	1,553.53	32,019	64,038
79%	1,554.89	45,991	91,981	54%	1,553.47	31,437	62,873
78%	1,554.84	45,408	90,817	53%	1,553.41	30,854	61,709
77%	1,554.79	44,826	89,653	52%	1,553.35	30,272	60,545
76%	1,554.73	44,244	88,488	51%	1,553.29	29,690	59,380

Percentage of full supply level depth	Water level (masl)	Surface Area of one (1) Compartment (m^2)	Surface Area of two (2) Compartments (m^2)	Percentage of full supply level depth	Water level (masl)	Surface Area of one (1) Compartment (m^2)	Surface Area of two (2) Compartments (m^2)
50%	1,553.23	29,108	58,216	25%	1,551.65	14,554	29,108
49%	1,553.17	28,526	57,052	24%	1,551.59	13,972	27,944
48%	1,553.11	27,944	55,887	23%	1,551.52	13,390	26,779
47%	1,553.05	27,362	54,723	22%	1,551.45	12,808	25,615
46%	1,552.99	26,779	53,559	21%	1,551.39	12,225	24,451
45%	1,552.93	26,197	52,394	20%	1,551.32	11,643	23,286
44%	1,552.87	25,615	51,230	19%	1,551.25	11,061	22,122
43%	1,552.81	25,033	50,066	18%	1,551.18	10,479	20,958
42%	1,552.74	24,451	48,901	17%	1,551.12	9,897	19,793
41%	1,552.68	23,869	47,737	16%	1,551.05	9,315	18,629
40%	1,552.62	23,286	46,573	15%	1,550.98	8,732	17,465
39%	1,552.56	22,704	45,408	14%	1,550.91	8,150	16,300
38%	1,552.49	22,122	44,244	13%	1,550.84	7,568	15,136
37%	1,552.43	21,540	43,080	12%	1,550.77	6,986	13,972
36%	1,552.37	20,958	41,916	11%	1,550.70	6,404	12,808
35%	1,552.30	20,376	40,751	10%	1,550.64	5,822	11,643
34%	1,552.24	19,793	39,587	9%	1,550.57	5,239	10,479
33%	1,552.17	19,211	38,423	8%	1,550.50	4,657	9,315
32%	1,552.11	18,629	37,258	7%	1,550.43	4,075	8,150
31%	1,552.04	18,047	36,094	6%	1,550.42	3,493	6,986
30%	1,551.98	17,465	34,930	5%	1,550.28	2,911	5,822
29%	1,551.91	16,883	33,765	4%	1,550.20	2,329	4,657
28%	1,551.85	16,300	32,601	3%	1,550.14	1,746	3,493
27%	1,551.78	15,718	31,437	2%	1,550.08	1,164	2,329
26%	1,551.72	15,136	30,272	1%	1,549.96	582	1,164

**1549.750 masl is the empty level for the surface area of the dam*

Appendix H

KPSX Weltevreden Pollution Control Dam 1 Draw Down Table

Table H-1: Draw down table for single compartment

Percentage of full supply level depth	Water level (masl)	Draw down time for one compartment (days)	Draw down time for one compartment (hours)	Percentage of full supply level depth	Water level (masl)	Draw down time for one compartment (days)	Draw down time for one compartment (hours)
100%	1556.00	0.000	0.00	77%	1555.95	1.677	40.25
99%	1555.30	0.083	2.00	76%	1555.85	1.740	41.75
98%	1554.60	0.146	3.50	75%	1555.80	1.833	44.00
97%	1553.90	0.219	5.25	74%	1555.75	1.896	45.50
96%	1553.25	0.281	6.75	73%	1555.70	1.990	47.75
95%	1552.55	0.354	8.50	72%	1555.65	2.063	49.50
94%	1551.85	0.417	10.00	71%	1555.60	2.146	51.50
93%	1551.15	0.490	11.75	70%	1555.55	2.219	53.25
92%	1550.45	0.563	13.50	69%	1555.50	2.302	55.25
91%	1549.75	0.625	15.00	68%	1555.45	2.396	57.50
90%	1549.10	0.698	16.75	67%	1555.35	2.469	59.25
89%	1549.10	0.781	18.75	66%	1555.30	2.552	61.25
88%	1549.10	0.844	20.25	65%	1555.25	2.646	63.50
87%	1549.15	0.917	22.00	64%	1555.20	2.719	65.25
86%	1549.15	0.990	23.75	63%	1555.15	2.802	67.25
85%	1549.15	1.073	25.75	62%	1555.10	2.896	69.50
84%	1556.30	1.135	27.25	61%	1555.05	2.990	71.75
83%	1556.25	1.208	29.00	60%	1554.95	3.073	73.75
82%	1556.20	1.292	31.00	59%	1554.90	3.156	75.75
81%	1556.15	1.365	32.75	58%	1554.85	3.250	78.00
80%	1556.10	1.427	34.25	57%	1554.80	3.333	80.00
79%	1556.05	1.521	36.50	56%	1554.75	3.427	82.25
78%	1556.00	1.583	38.00	55%	1554.65	3.521	84.50

Percentage of full supply level depth	Water level (masl)	Draw down time for one compartment (days)	Draw down time for one compartment (hours)	Percentage of full supply level depth	Water level (masl)	Draw down time for one compartment (days)	Draw down time for one compartment (hours)
54%	1554.60	3.615	86.75	29%	1553.05	6.302	151.25
53%	1554.55	3.708	89.00	28%	1553.00	6.417	154.00
52%	1554.50	3.802	91.25	27%	1552.95	6.542	157.00
51%	1554.45	3.906	93.75	26%	1552.85	6.656	159.75
50%	1554.35	4.000	96.00	25%	1552.80	6.781	162.75
49%	1554.30	4.094	98.25	24%	1552.75	6.906	165.75
48%	1554.25	4.188	100.50	23%	1552.65	7.042	169.00
47%	1554.20	4.292	103.00	22%	1552.60	7.177	172.25
46%	1554.15	4.385	105.25	21%	1552.55	7.302	175.25
45%	1554.05	4.500	108.00	20%	1552.45	7.458	179.00
44%	1554.00	4.604	110.50	19%	1552.40	7.615	182.75
43%	1553.95	4.708	113.00	18%	1552.35	7.740	185.75
42%	1553.90	4.813	115.50	17%	1552.25	7.896	189.50
41%	1553.80	4.906	117.75	16%	1552.20	8.031	192.75
40%	1553.75	5.031	120.75	15%	1552.15	8.167	196.00
39%	1553.70	5.135	123.25	14%	1552.05	8.281	198.75
38%	1553.65	5.240	125.75	13%	1552.00	8.354	200.50
37%	1553.55	5.354	128.50	12%	1551.90	8.396	201.50
36%	1553.50	5.479	131.50	11%	1551.85	8.417	202.00
35%	1553.45	5.583	134.00	10%	1551.80	8.427	202.25
34%	1553.40	5.698	136.75	9%	1551.70	8.438	202.50
33%	1553.30	5.823	139.75	8%	1551.65	8.500	204.00
32%	1553.25	5.938	142.50	7%	1551.60	8.510	204.25
31%	1553.20	6.063	145.50	6%	1551.50	8.510	204.25
30%	1553.10	6.177	148.25	5%	1551.45	8.510	204.25

Table H-2: Draw down table for both compartments

Percentage of full supply level depth	Water level (masl)	Draw down time for two compartments (days)	Draw down time for two compartments (hours)	Percentage of full supply level depth	Water level (masl)	Draw down time for two compartments (days)	Draw down time for two compartments (hours)
100%	1556.00	0.000	0.00	77%	1555.95	3.354	80.50
99%	1555.30	0.167	4.00	76%	1555.85	3.490	83.75
98%	1554.60	0.302	7.25	75%	1555.80	3.667	88.00
97%	1553.90	0.438	10.50	74%	1555.75	3.802	91.25
96%	1553.25	0.573	13.75	73%	1555.70	3.979	95.50
95%	1552.55	0.708	17.00	72%	1555.65	4.125	99.00
94%	1551.85	0.844	20.25	71%	1555.60	4.292	103.00
93%	1551.15	0.990	23.75	70%	1555.55	4.438	106.50
92%	1550.45	1.125	27.00	69%	1555.50	4.615	110.75
91%	1549.75	1.260	30.25	68%	1555.45	4.792	115.00
90%	1549.10	1.396	33.50	67%	1555.35	4.938	118.50
89%	1549.10	1.563	37.50	66%	1555.30	5.115	122.75
88%	1549.10	1.698	40.75	65%	1555.25	5.292	127.00
87%	1549.15	1.833	44.00	64%	1555.20	5.438	130.50
86%	1549.15	1.979	47.50	63%	1555.15	5.615	134.75
85%	1549.15	2.146	51.50	62%	1555.10	5.802	139.25
84%	1556.30	2.281	54.75	61%	1555.05	5.979	143.50
83%	1556.25	2.417	58.00	60%	1554.95	6.156	147.75
82%	1556.20	2.583	62.00	59%	1554.90	6.313	151.50
81%	1556.15	2.729	65.50	58%	1554.85	6.500	156.00
80%	1556.10	2.865	68.75	57%	1554.80	6.677	160.25
79%	1556.05	3.042	73.00	56%	1554.75	6.865	164.75
78%	1556.00	3.177	76.25	55%	1554.65	7.052	169.25

Percentage of full supply level depth	Water level (masl)	Draw down time for one compartment (days)	Draw down time for one compartment (hours)	Percentage of full supply level depth	Water level (masl)	Draw down time for one compartment (days)	Draw down time for one compartment (hours)
54%	1554.60	7.240	173.75	29%	1553.05	12.615	302.75
53%	1554.55	7.427	178.25	28%	1553.00	12.833	308.00
52%	1554.50	7.615	182.75	27%	1552.95	13.083	314.00
51%	1554.45	7.802	187.25	26%	1552.85	13.313	319.50
50%	1554.35	8.000	192.00	25%	1552.80	13.573	325.75
49%	1554.30	8.188	196.50	24%	1552.75	13.813	331.50
48%	1554.25	8.385	201.25	23%	1552.65	14.083	338.00
47%	1554.20	8.583	206.00	22%	1552.60	14.365	344.75
46%	1554.15	8.781	210.75	21%	1552.55	14.615	350.75
45%	1554.05	9.010	216.25	20%	1552.45	14.917	358.00
44%	1554.00	9.208	221.00	19%	1552.40	15.229	365.50
43%	1553.95	9.417	226.00	18%	1552.35	15.490	371.75
42%	1553.90	9.625	231.00	17%	1552.25	15.792	379.00
41%	1553.80	9.823	235.75	16%	1552.20	16.073	385.75
40%	1553.75	10.073	241.75	15%	1552.15	16.344	392.25
39%	1553.70	10.281	246.75	14%	1552.05	16.563	397.50
38%	1553.65	10.490	251.75	13%	1552.00	16.708	401.00
37%	1553.55	10.708	257.00	12%	1551.90	16.802	403.25
36%	1553.50	10.958	263.00	11%	1551.85	16.833	404.00
35%	1553.45	11.177	268.25	10%	1551.80	16.854	404.50
34%	1553.40	11.396	273.50	9%	1551.70	16.885	405.25
33%	1553.30	11.656	279.75	8%	1551.65	17.000	408.00
32%	1553.25	11.875	285.00	7%	1551.60	17.010	408.25
31%	1553.20	12.135	291.25	6%	1551.50	17.010	408.25
30%	1553.10	12.354	296.50	5%	1551.45	17.010	408.25

Appendix I
Mechanical Data Sheets – Selected

Appendix J
Instrumentation Data Sheets – Selected

Appendix K
List of Drawings

LIST OF DRAWINGS	
DRAWING NUMBER	**TITLE**
(1) KPSX-EP-16260-DRG-WW-GA-0201-01	PCD 1 INFRASTRUCTURE GENERAL ARRANGEMENT
(2) KPSX-EP-16260-DRG-WW-LY-0201-01	PCD 1 FINAL EMBANKMENT SETTING OUT DETAILS (ALSO A – A, B – B, C – C AND D – D FOR GEOLOGICAL CROSS SECTIONS)
(3) KPSX-EP-16260-DRG-WW-SE-0210-01	PCD 1 GEOLOGICAL CROSS SECTIONS (1)
(4) KPSX-EP-16260-DRG-WW-SE-0210-02	PCD 1 GEOLOGICAL CROSS SECTIONS (2)
(5) KPSX-EP-16260-DRG-WW-LY-0203-01	PCD 1 BULK EARTHWORKS EMBANKMENT SECTIONS LAYOUT
(6) KPSX-EP-16260-DRG-WW-SE-0202-01	PCD 1 EMBANKMENT SECTIONS AND DETAILS (1 OF 3)
(7) KPSX-EP-16260-DRG-WW-SE-0202-02	PCD 1 EMBANKMENT SECTIONS AND DETAILS (2 OF 3)
(8) KPSX-EP-16260-DRG-WW-SE-0202-03	PCD 1 EMBANKMENT SECTIONS AND DETAILS (3 OF 3)
(9) KPSX-EP-16260-DRG-WW-DE-0102-01	TYPICAL DETAIL: TYPICAL EMBANKMENT DETAIL (1 OF 2)
(10) KPSX-EP-16260-DRG-WW-DE-0102-02	TYPICAL DETAIL: TYPICAL EMBANKMENT DETAIL (2 OF 2)
(11) KPSX-EP-16260-DRG-WW-DE-0103-01	TYPICAL DETAIL: LINING DETAIL
(12) KPSX-EP-16260-DRG-WW-DE-0104-01	TYPICAL DETAIL: LINER FIXING DETAIL
(13) KPSX-EP-16260-DRG-WW-GA-0221-01	PCD 1 SILT TRAP AND INLET CANAL (GENERAL ARRANGEMENT)
(14) KPSX-EP-16260-DRG-WW-GA-0221-02	PCD 1 DAM INLET (GENERAL ARRANGEMENT)
(15) KPSX-EP-16260-DRG-WW-DE-0222-01	PCD 1 SILT TRAP AND INLET CANAL (LAYOUT AND SECTIONS)
(16) KPSX-EP-16260-DRG-WW-DE-0222-02	PCD 1 SILT TRAP AND INLET CANAL (SECTIONS AND DETAILS)
(17) KPSX-EP-16260-DRG-WW-DE-0222-03	PCD 1 SILT TRAP AND INLET CANAL (SECTIONS AND DETAILS)
(18) KPSX-EP-16260-DRG-WW-DE-0221-01	PCD 1 DAM INLET (LAYOUT AND SECTIONS) – 1
(19) KPSX-EP-16260-DRG-WW-DE-0221-02	PCD 1 DAM INLET (LAYOUT AND SECTIONS) – 2
(20) KPSX-EP-16260-DRG-WW-LY-0223-01	PCD 1 SPILLWAY LAYOUT AND SECTIONS
(21) KPSX-EP-16260-DRG-WW-DE-0261-01	PCD 1 EMERGENCY SPILLWAY 1 (LAYOUT AND SECTIONS)
(22) KPSX-EP-16260-DRG-WW-DE-0262-01	PCD 1 EMERGENCY SPILLWAY 2 (LAYOUT AND SECTIONS)

LIST OF DRAWINGS	
DRAWING NUMBER	**TITLE**
(23) KPSX-EP-16260-DRG-WW-LY-0224-01	PCD 1 OUTLET WORKS LAYOUT, SECTIONS AND SETTING OUT DETAILS
(24) KPSX-EP-16260-DRG-WW-DE-0119-01	PCD DAM OUTLET STRUCTURE (STRUCTURE DETAILS)
(25) KPSX-EP-16260-DRG-WW-DE-0120-01	PCDS: DAM OUTLET STRUCTURE SCREEN DETAIL
(26) KPSX-EP-16260-DRG-WW-DE-0281-01	PCD 1 OUTLET – LAYOUT SECTIONS AND DETAILS (1 OF 5)
(27) KPSX-EP-16260-DRG-WW-DE-0281-02	PCD 1 OUTLET – LAYOUT SECTIONS AND DETAILS (2 OF 5)
(28) KPSX-EP-16260-DRG-WW-DE-0281-03	PCD 1 OUTLET – LAYOUT SECTIONS AND DETAILS (3 OF 5)
(29) KPSX-EP-16260-DRG-WW-DE-0281-04	PCD 1 OUTLET – LAYOUT SECTIONS AND DETAILS (4 OF 5)
(30) KPSX-EP-16260-DRG-WW-DE-0281-04	PCD 1 OUTLET – LAYOUT SECTIONS AND DETAILS (5 OF 5)
(31) KPSX-EP-16260-DRG-WW-DE-0118-01	DETAILS OF EMBEDDED ITEMS FOR STOPLOG(S)
(32) KPSX-EP-16260-DRG-WW-DE-0118-03	PCD 1 STOPLOG DETAILS
(33) KPSX-EP-16260-DRG-WW-DE-0117-01	PCD 1 BALANCING CHAMBER - GANTRY DETAILS
(34) KPSX-EP-16260-DRG-WW-DE-0282-01	PCD 1: PCD ACCESS STAIRCASE LAYOUT AND DETAILS (1 OF 2)
(35) KPSX-EP-16260-DRG-WW-DE-0282-02	PCD 1: PCD ACCESS STAIRCASE LAYOUT AND DETAILS (2 OF 2)
(36) KPSX-EP-16260-DRG-WW-DE-0283-01	PCD 1 SCOUR VALVE CHAMBER CIVIL DETAILS
(37) KPSX-EP-16260-DRG-WW-DE-0284-01	PCD 1 SCOUR VALVE CHAMBER MECHANICAL DETAILS
(38) KPSX-EP-16260-DRG-WW-DE-0285-01	PCD 1 SCOUR CHAMBER CIVIL AND MECHANICAL DETAILS
(39) KPSX-EP-16200-DRG-WW-DE-0113-01	BURGLAR BARS (i.e. Safety screen at exit of the Scour Chamber)
(40) KPSX-EP-16260-DRG-WW-LY-0202-01	PCD1 SUBSOIL DRAINAGE AND LEAK DETECTION (SUBSOIL DRAINAGE LAYOUT)
(41) KPSX-EP-16260-DRG-WW-DE-0101-01	POLLUTION CONTROL DAMS: TYPICAL DETAIL SUBSOIL DRAINAGE
(42) KPSX-EP-16260-DRG-WW-LY-0222-01	PCD1 LEAK DETECTION SUMP AND PIPELINE: LAYOUT, SECTIONS AND SETTING OUT DETAILS
(43) KPSX-EP-16260-DRG-WW-DE-0271-01	PCD 1 LEAK DETECTION SUMP 1 (PLANS, SECTIONS AND ELEVATIONS)
(44) KPSX-EP-16260-DRG-WW-DE-0272-01	PCD 1 LEAK DETECTION SUMP 2 (PLANS, SECTIONS AND ELEVATIONS)
(45) KPSX-EP-16260-DRG-WW-LY-0204-01	PCD 1 STORMWATER DRAINAGE: SITE DRAINAGE LAYOUT
(46) KPSX-EP-16260-DRG-WW-DE-0106-01	PCD TYPICAL JOINT DETAILS (CONCRETE WALLS AND SLABS)
(47) KPSX-EP-16260-DRG-WW-DE-0105-01	TYPICAL DETAILS: BENCH MARKS AND SETTLEMENT BEACONS

Appendix L
Drawings

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