



**PRE-FEASIBILITY REPORT FOR THE
PROVISION OF CIVIL ENGINEERING SEWER SERVICES
FOR THE PROPOSED DEVELOPMENT OF
PROPERTIES IN CATO RIDGE FOR THE CATO RIDGE
DEVELOPMENT COMPANY**

JUNE 2023

K&T PROJECT REFERENCE: 20207/ SEWER 1

REVISION 4



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For and on behalf of	
Kantey & Timpler (Pty) Ltd	
Approved by:	Kevin Hohls
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Date:	15 June 2023

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1. EXECUTIVE SUMMARY

Kantey & Templer (PTY) LTD has been appointed by the Cato Ridge Development Company (CRDC) to compile a Pre-Feasibility Engineering Services Report in order to obtain preliminary approval from the service authorities for the proposed bulk service provision for the new Cato Ridge Development. This report documents the Proposed Bulk Sewer Infrastructure to Service the Development.

The greater Cato Ridge area has been considered for a number of years as a major metropolitan industrial growth node within eThekweni as well as fulfilling the role of “back of port” logistics along the N3 [SIP2] logistics corridor between Gauteng and Durban

The proposed development has been programmed to be implemented in 3 Phases which is indicated on the attached drawing in Annexure B

Due to the future road upgrades required and planned upgrade of the bulk trunk water and sewer lines by the eThekweni Municipality in 2031/2032 this proposed development will be unlocked in an incremental approach as follows:-

PHASE 1

Phase 1 is programmed to be unlocked within the next 18 months and will be phased in over the next 10 years as and when the demand arises which will be carried out as follows:-

- a) The lower section of Phase 1 along the R103 and up to the Assmang turnoff along Eddie Hagan to be phased in over the next 5 years.
- b) The upper section of Phase 1 from the Assmang Turn-off up to Macro Turn-off to be phased in over the next 5 to 10 years.

A Private Mini Waste Water Treatment works will need to be constructed for Phase 1 which will be constructed in 250 KL incremental modules as and when required

PHASE 2

It is proposed to develop Phase 2 into two sections which are as follows:-

- 1) The first section of Phase 2 will include up to the high point of the site which is approximately 400metres off the southern section of the Phase 2.
 - As there is sufficient water supply in the area it is proposed that this southern section of Phase 2 is developed in conjunction with Phase 1.
 - The first section of Phase 2 is programmed to be unlocked within the next 18 months and will be phased in over the next 10 years.
 - The Private Mini Wastewater Treatment Works does have sufficient capacity to accommodate this portion of Phase 2.
- 2) The second portion of Phase 2 will include the balance of the phase from the high point northwards and will only be unlocked after the service infrastructure has been completed in the Cato Ridge area.
 - This northern portion of Phase 2 will be implemented over the next 11 to 20 years.
 - The eThekweni Municipality is currently programming to upgrade the bulk water & bulk sewer reticulation in 2031/ 2032. It will not be economically viable to develop the northern portion of Phase 2 prior to the upgrade of the bulk water being carried out by Municipality.

- Based off the present eThekweni Municipality Water Demand spreadsheet on page 6 of this report the total theoretic water demand is estimated at 8,331 Ml/day. This includes for losses of 25%.
- The current water storage is 28 Ml/day which will accommodate the 1,96 Ml/day. The eThekweni Planning Department have also confirmed that the reservoir will be able to supply this water demand.

PHASE 3

There has been interest from the surrounding land owners to purchase land in close proximity to their existing properties and they will therefore be responsible to install their own services.

- The remaining land for development is relatively minor and has been considered within this report.
- Phase 3 will be implemented over the next 21 to 25 years.

2. INTRODUCTION

Kantey & Templer (PTY) LTD was appointed by the Cato Ridge Development Company (CRDC) to compile a Pre-Feasibility Engineering Services Report in order to obtain preliminary approval from the service authorities for the proposed bulk services provision for the new Cato Ridge Development in KwaZulu-Natal in support of the Environmental Impact Assessment Application update as per the Executive Summary. This report documents the findings of this assessment

2.1 Location & Access

- The proposed development is 351 hectares in extent and is located in Cato Ridge located on a greenfields site.
- The site locality plan is attached in Annexure A of this document.

2.2 Table 1: Phase 1, 2 & 3 co-ordinates

The development will have three (3) Phases. The co-ordinates (centre) of each Phase are as follows:

Table 1: Phase 1, 2 & 3 co-ordinates		
Phases	Y- CORDINATES	X- CORDINATES
Phase 1	+37 068	+3 289 114
Phase 2	+36 175	+3 286 829
Phase 3	+37 224	+3 290 057

Access to the development is via the R103 and Eddie Hagen Drive in Cato Ridge.

3. DEVELOPMENT PHASING

The Cato Ridge Development is divided into three (3) separate development phases.

- The timeframes above is dependent on a fluctuating economy, market trends and property demands which may change.

- The proposed development has been programmed to be implemented in 3 different Phases which is indicated on the attached Drawing No 20207-DS 02 Revision K in Annexure C.
- Due to the planned upgrade of the bulk trunk water lines & trunk sewer lines by the eThekweni Municipality in 2031/2032 this proposed development will be unlocked in an incremental approach as follows:-

3.1 Phase 1

Phase 1 is 131 Ha and is programmed to be unlocked within the next 18 months and will be phased in over the next 10 year period as and when the demand arises which will be carried out as follows:-

a) The lower section of Phase 1 along the R103 and up to the Assmang turnoff along Eddie Hagan is to be phased in over the next 5 years.

b) The upper section of Phase 1 from the Assmang Turn-off up to Macro Turn-off is to be phased in over the next 5 to 10 years.

Based off the present eThekweni Municipality Water Demand Spreadsheet below the total theoretic water demand is estimated at 8,331 ML/day, which includes adding for losses of 25%. This is indicated in Table 2 below:-

Table 2: eThekweni Municipality Water Demand spreadsheet

No.	No. of Housing Units	Dwelling Category	Level of Service (kl/d)	Daily Demand (kl/d) 2019	Daily Demand (kl/d) 2022	Add 25% losses (kl/day)	Peak Flow kl/day	Water Demand kl/day	Storage Capacity kl/48hrs
1	56	Formal Backyard House	1	56	58.558	73.1975	109.7962	73.19749	146.395
2	13	Formal Flats	1	13	13.5938	16.9923	25.48841	16.99227	33.98455
3	144	Formal Informal House	0.3	43.2	45.1733	56.4666	84.69995	56.46663	112.9333
4	664	Formal Standard House	1	664	694.33	867.913	1301.87	867.9131	1735.826
5	722	Informal Backyard House	0.3	216.6	226.494	283.117	424.6761	283.1174	566.2348
6	51	Informal Hostel	0.3	15.3	15.9989	19.9986	29.9979	19.9986	39.9972
7	5893	Informal House	0.3	1767.9	1848.65	2310.82	3466.228	2310.818	4621.637
8	2596	Informal Standard House	0.3	778.8	814.374	1017.97	1526.952	1017.968	2035.936
9	2	Rural Backyard House	0.3	0.6	0.62741	0.78426	1.176388	0.784259	1.568518
10	2678	Rural Cluster House	0.3	803.4	840.098	1050.12	1575.184	1050.123	2100.245
11	2869	Rural Cluster Standard House	0.3	860.7	900.015	1125.02	1687.529	1125.019	2250.038
12	6	Rural Hostel	0.3	1.8	1.88222	2.35278	3.529165	2.352776	4.705553
13	2675	Rural Informal House	0.3	802.5	839.157	1048.95	1573.419	1048.946	2097.892
14	1166	Rural Standard House	0.3	349.8	365.778	457.223	685.8343	457.2229	914.4457
Total	19535						12496.38	8330.92	KL/day
								8.33092	ML/day
		48 hour storage						16.66184	MI
		maximum storage						28MI	

As noted above the current storage is 28 MI/day which will accommodate the water demand of 1,96MI/day for Phase 1. The eThekweni Planning Department have also confirmed that the reservoir will be able to supply this water demand for Phase 1.

The Assmang Cato Ridge Manganese are currently planning to introduce the Reverse Osmosis Plant in July 2024, which is subject to change. This will further reduce the water demand by 32m³/hr or 0.77MI/day. The current consumption of the Assmang Cato Ridge Manganese plant correlates to approximately 31MI per month or 0.64 MI per day. The introduction of this plant will provide further surplus bulk water capacity to the area once commissioned.

A Private Waste Water Treatment works will need to be constructed for Phase 1 which will be constructed in 250 KL incremental modules as and when required.

Two proposed sewer collection sumps will be required for Phase 1 which will require a rising main to tie into the new proposed Municipal bulk sewer line. The sewer collection sump will be designed for 4 hour storage capacity which is the eThekweni Municipality norm. A standby generator and standby pump will be allowed for in the design.

3.2 Phase 2

The total proposed area for Phase 2 is 174 Ha with an estimated water demand of 2,4 MI/d.

It is proposed to develop Phase 2 into two sections which are as follows:-

- 1) The first section of Phase 2 will include up to the high point of the site which is approximately 400metres of the southern section of Phase 2.
 - As there is sufficient water supply in the area it is proposed that this southern section of Phase 2 is developed in conjunction with Phase 1.
 - The first section of Phase 2 is programmed to be unlocked within the next 18 months and will be phased in over the next 10 years
- 2) The second portion of Phase 2 will include the balance of Phase 2 from the high point northwards and will only be unlocked after the service infrastructure has been completed in the Cato Ridge area.
 - The northern portion of Phase 2 will be implemented over the next 11 to 20 years.
 - The eThekweni Municipality is currently programming to upgrade the bulk water & sewer reticulation in 2031/ 2032. It will not be economically viable to develop the northern portion of Phase 2 prior to the upgrade of the bulk water being carried out by Municipality.

One proposed sewer collection sump will be required for the second portion of Phase 2 which will require a rising main to tie into the new proposed Municipal bulk sewer line. The sewer collection sump will be designed for 4 hour storage capacity which is the eThekweni Municipality norm. A standby generator and standby pump will be allowed for in the design.

Water

The proposed Bulk Water Reticulation upgrade is as follows :-

- 1) The eThekweni Municipality are planning to construct a new 38MI in the vicinity of the existing 22,7MI Cato Ridge Reservoir. The new proposed 38MI reservoir will be the ultimate demand for the region which is dependent on the development uptake. The 38MI will only be required once the Cato Ridge supply zone is full developed. The time frames as to when this reservoir upgrade will take place are not available at this stage.

- 2) The bulk water pipeline is planned to be upgraded to Eddie Hagan Drive that will feed the Cato Ridge Reservoir.
- 3) The Upper Umkhomazi Dam Project falls under the DWS and Umngeni Municipality.
- 4) The construction date of the booster pump station is unknown as the land still has to be acquired and the design and implementation will only be completed once the land has been transferred.
 - When the booster pump station is constructed on the corner of the R103 and Eddie Hagan Drive it will increase the ultimate demand to approximately 40ML/day once the Umkomaas Dam is commissioned. This is presently scheduled to be constructed in 2030. However, this date is subject to change.
 - It will not be economically viable to develop the northern portion of Phase 2 prior to this bulk water & sewer infrastructure being carried out by Municipality which will be implemented over the next 11 to 20 years

3.3 Phase 3

The total proposed area of Phase 3 is 46 Ha. There has been interest from the surrounding land owners to purchase land in close proximity to their existing properties which may reduce the area required for bulk infrastructure. The proposed water demand reduction has not been considered in this report as the purchase of this land has not been finalised.

Phase 3 will be implemented over the next 21 to 25 years

One proposed sewer collection sumps will be required for Phase 3 which will require a rising main to tie into the new proposed Municipal bulk sewer line. The sewer collection sump will be designed for 4 hour storage capacity which is the eThekweni Municipality norm. A standby generator and standby pump will be allowed for in the design.

3.4 General

The proposed development is zoned as follows:-

- 1) Phase 1 & 2 are presently zoned "General Industry 2"
- 2) Phase 3 is presently zoned "Residential Small" holdings

The Bulk & Internal services will be designed according to accepted engineering specifications and principles as well as acceptable environmental requirements and specifications.

The following engineering services are proposed for the development of the area and are based on the following assumptions:-

- a) The level of service will cater for light industry logistics and warehouses, on the proposed development site.
- b) Where possible, the services will be designed to connect to the existing Municipal services and the roads will link to SANRAL & Department of Transport road network.
- c) The provision of infrastructure to the proposed development will be designed to ministerial norms and standards and generally in accordance with the "Guidelines for the Provisions of Engineering Services and Amenities in Residential Townships" (Red Book).

4. LAND USE AND DEMAND PARAMETERS

Table 3 below indicates the anticipated bulk land use for the Development.

<u>Table 3 Anticipated Bulk Developments</u>		
Phase	Warehouse Nett land area (HA)	Industrial Nett Land Area (HA)
Phase 1	60.305	60.305
Phase 2	74.015	74.015
Phase 3	19.31	19.31
TOTAL	153.63	153.63

Table 4 below indicates the water demand parameters used in the calculations for this report.

The figures for the design parameters of the Warehousing & Industrial buildings are extracted from the Red Book Water Supply Manual Section J.4 Design Considerations Table J.2 for the Recommended Unit Average Annual Daily Water Demands which is on page J.30. Please note that the worst case scenario has been used in the calculation in table 4 where the report allows for all the sites to be developed under industrial (ie 13KI//Ha/d).

<u>Table 4: Water Demands</u>							
Phase	Water Demand (AADD) (MI/d) Allowing for Industrial ONLY (13KI//Ha/d)	Total Average Daily Demand (MI/d) Includes 25% allowance for losses	Peak Demand (l/sec) (PF = 3.15)	Fire Flow (l/sec)	Domestic Storage For 48 hours (MI)	Fire Storage For 4 hours (MI)	Total Storage For 48 hours (MI)
Phase 1	1.57	1.96	71.46	50	3.92	0.72	
Phase 2	1.92	2.40	87.70	50	4.81		
Phase 3	0.50	0.63	22.88	50	1.26		
TOTAL	3.99	4.99	182.05	50	9.99	0.72	10.72

Please refer to the attached Water demands in the attached Annexure B for further details.

With regard to the Fire Flow each site will be responsible for installing their own fire-fighting infrastructure and storage tanks to comply with regulations. This will be a condition of the Sale

Agreement when the land is purchased. The fire flows listed below in the Red Book will therefore **not** be applicable:-

1) As per the Red Book on page 57, Table J. 17 it is considered that the warehousing & Industrial buildings will fall under Moderate Risk 1 which requires a total fire flow of 50 litres per second with a fire duration of 4 hours as per Table J. 18.

Table 4A indicates the sewer demand parameters used in the calculations for this report

Table 4A Sewer Demand Design Parameters	
Phase	Sewer Average Daily Demand (90% of water demand) (ML/d)
Phase 1	1.41
Phase 2	1.73
Phase 3	0.45
TOTAL	3.59

Please refer to the attached Drawing in Annexure C for further details of the water and sewer demands.

5. BULK INFRASTRUCTURE

5.1 Existing Infrastructure

Existing Roads

The present road network to the site and within the site is via the R103 and Eddie Hagan Road in Cato Ridge.

Existing Water

A meeting was held with the Water Operations Section on 08 December 2022 and the following feedback was provided:-

- 1) Point M is a custody meter point between the Umgeni Water and the eThekweni Municipality Reservoir.
- 2) A new booster pump station will be constructed on the corner of Eddie Hagan Drive and the R103. This will increase the ultimate demand to approximately 40ML/day which will only occur once the Umkomaas Dam is commissioned.
- 3) The Cato Ridge Reservoir is fed by a 600mm diameter water gravity supply which runs along the R103 and along Eddie Hagan Drive.
- 4) The Cato Ridge Reservoir is 22,7ML and is situated off Eddie Hagan Drive.
- 5) The Cato Ridge Reservoir reticulates water to:-
 - a) the Mgcwini and Inchanga area via a 200mm diameter pipeline.
 - b) The Kwaximba area via a separate 200mm diameter line.
- 6) A 600mm diameter bulk line from the Cato Ridge Reservoir feeds the Abattoir Reservoir.

7) The existing 13,5 ML Abattoir Reservoir is positioned off Eddie Hagen and reticulates into Drakensberg Street via a 450 diameter water pipeline.

8) The existing 800mm diameter water pipeline that runs along the R103 and Eddie Hagan Drive up to the Cato Ridge Reservoir has experienced leaks along the R103. This has resulted in the eThekweni Municipality abandoning a portion of the pipeline along the R103 and installing an end cap south of the R103/ Eddie Hagan Drive intersection.

From the end cap this section of 800mm diameter is presently only being used in the case of emergency if the 600mm diameter rising main is under repairs. There will be water supply issues up until the upper Umkhomazi Dam is commissioned.

The eThekweni Municipality has confirmed that there is sufficient water storage capacity to cater for the Priority Phase 1 water demand. However, the water capacity is dependent on the supply at Point M.

5.2 Existing Sewer

The current Cato Ridge Ponds are running at full capacity and cannot accommodate any new sewer connections for the proposed development.

6. PROPOSED BUILDING DEVELOPMENT

6.1 Cato Ridge Phased Development

Table 5 below indicates the three (3) Phases for the proposed development.

Table 5 Warehouse/ Industrial Net Land Area		
Phases	Warehouse Nett land area (HA)	Industrial Nett Land Area (HA)
Phase 1	60.305	60.305
Phase 2	74.015	74.015
Phase 3	19.31	19.31
TOTAL	153.63	153.63

Please refer to Paragraph 3. Development Phasing of this report which will provide details of Phase 1, Phase 2 & Phase 3 for the proposed development.

7. NEW INFRASTRUCTURE

7.1 Sewer

The new sewer infrastructure will be constructed as per paragraph 3 DEVELOPMENT PHASING on page 3 of this report. The following is required:-

7.1.1 Sewer piping

The new sewer piping sizes will vary from 160 diameter to 315 diameter which will all be uPVC class 34 pipes. The pipe sizing is indicated on the longitudinal sections.

7.1.2 Sewer Collection

Four proposed sewer collection sumps and pump stations, with rising mains to tie into the new proposed Municipal bulk sewer line are required as follows:-

Two for Phase 1
One for Phase 2
One for Phase 3

Each sewer collection sump will be designed for 96 hour storage capacity. A standby generator and standby pump will be allowed for in the design.

7.1.3 Management of the sewer effluent

The development will be phased in order to cater for sewer effluent.

After holding discussions with the eThekweni Municipality it is noted they are currently planning to connect the Cato Ridge area to the Hammarsdale wastewater treatment works in 2031/ 2032. The exact timing is still to be confirmed and will only proceed if the Cato Ridge area is developed.

No connection is possible to the existing Cato Ridge ponds as these are reportedly at full capacity.

In order for this development to proceed a sustainable solution for the disposal of the wastewater generated is required.

For the management of the sewer effluent the four options listed below have been investigated in order to unlock the development since there is no formalised Municipal bulk line to tie into for the development.

The following options present themselves:

a) Conservancy tanks

Although not considered sustainable due to high clearance costs conservancy tanks will only be implemented in the event of isolated pockets of land being sold within Priority Phase 1 & 2 which will be developed prior to the construction of the private waste water treatment works and installation of the bulk sewer line. This will only be applicable until the threshold through flow is reached to be licenced by end users. The conservancy tanks will be sealed and require emptying. Once the sewer trunk main has been connected then any conservancy tanks constructed will be abandoned as it will be more cost effective to connect directly to the bulk trunk main line.

A conservancy tank is a structure which is required for the collection of sewage material from human activities in areas where no existing municipal sewerage pipelines exist. The tank acts as a temporary holding area for the sewage. The sewage enters the conservancy tank from an inlet chamber. An interseptic trap allows one to monitor the liquid level of the main tank. The tank is connected to an outlet valve chamber via a uPVC outflow pipe. The valve chamber allows for the suction of the sewage off site for further treatment.

As such the conservancy tank must be sized to cater for onsite sewage outflows that allow for economical sewage collection for disposal off site. The design principle is to size a tank that will be economically feasible to construct whilst making sure that the tank is cleaned out on a regular schedule that is economically feasible to maintain in terms of cost of collection.

The local municipality requires that the conservancy tanks be sized to cater for a 4 day storage volume.

b) Connect to the existing Assmang Manganese Cato Ridge Sewer Treatment Works

The existing treatment works has a capacity of 240 kilolitres per day of which only 150 kilolitres per day is being utilised which provides a spare capacity of 90 kilolitres per day. Although existing surplus capacity exists this could potentially be increased further to a limited extent with upgrades of the system.

c) Utilise the existing Wastewater Treatment Works originally constructed for the abattoir

It is noted that the eThekweni Municipality will not support this approach and accordingly have not considered this option any further.

d) Construct a Private Mini Wastewater Treatment Works.

The eThekwini Municipality have produced a Guideline (Guideline 12) which is generally applied in cases where private wastewater plants are required. In general such plants are not accepted for anything other than wastewater emanating from residential areas. The treatment capacity of the works is also limited to a maximum of 2 Mld. The waste water treatment works would be constructed in 250 Kilolitre modules which would be upgraded on line as the demand increases

However, in this instance we understand that Metro will consider the construction and operation of a private wastewater treatment works since it will only be used to treat domestic wastewater and be operated on a temporary basis until the planned bulk infrastructure is provided to the area.

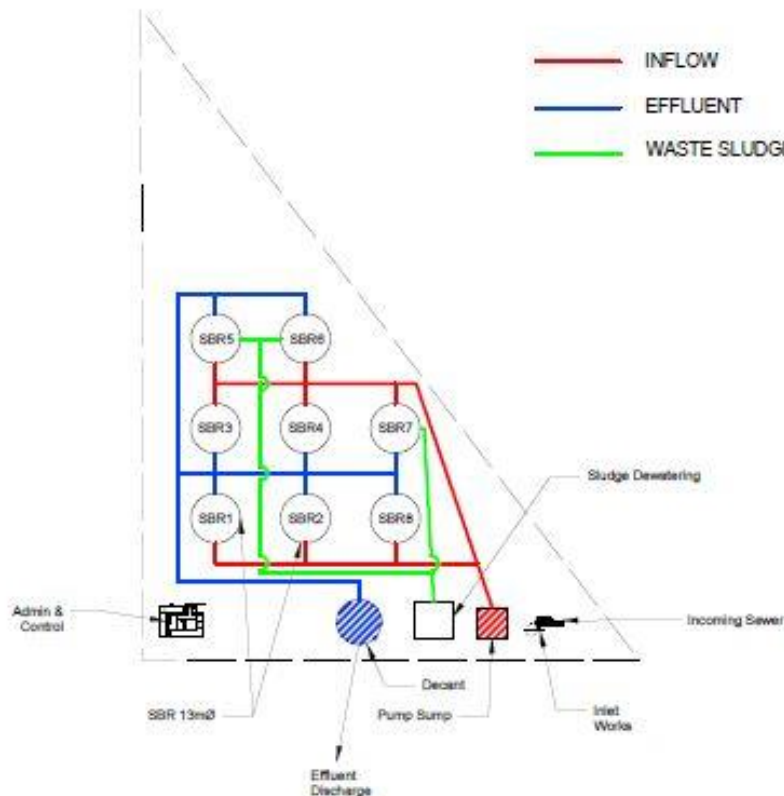
On the understanding that Metro will deviate from their guideline and allow the construction of a private wastewater treatment works with a capacity not exceeding 2 Mld, then this becomes an option worth serious consideration.

It is common cause that domestic wastewater is relatively easy to treat and that it facilitates the treatment of other wastes in admixture. The implication of this is that a large proportion of domestic sewage is required to treat wastewater containing less tractable substances. Because of this, it will be necessary to exclude (or limit) the quantity and quality of "trade effluents" entering the system and that very strict trade effluent discharge controls will have to be applied to protect the process in the works.

It is therefore proposed that Phase 1 and the southern portion of Phase 2, upto the high point of the project, be phased as and when the properties are sold, and the demand arises to connect to the mini waste water treatment works. This will be constructed in 250 KI modules as per the drawing indicated below. There will be a total of 8 modules which will not exceed 2MI as per the requirements by eThekweni Municipality. Details are listed below:-

7.2 Construction and Operation of a Private Mini Wastewater Treatment Works

If it is accepted that the ultimate capacity of the temporary works will be limited to 2 MI/d and also that the development of the project will be phased, then it would be logical to limit the capital expenditure works by building it in modules of 250 kilolitres as per the drawing below :-



250 KI MODULE
ULTIMATE SIZE 2MI Ø

7.3 PRELIMINARY DESIGN REPORT FOR MINI WASTEWATER TREATMENT WORKS

7.3.1 CONCEPT

The concept covered in this report is for the design and construction of a “mini wastewater treatment works” as opposed to a “package plant”.

The differences between the two are:

- A mini works has each unit process specifically designed and tailored to suit the unique circumstances applicable to the site and is not simply a catalogue selection from a standard range of models. This is especially important when considering the unique hydraulic and process requirements of specific works.
- The equipment supplied and installed in a mini works is of a generic nature and is specified on a performance basis by the designer. As such, it is possible for the equipment and the structures to be costed and selected on a conventional tender basis. This is due to the fact that the design is supplied by the designer who acts on behalf of the client and is not subject to “black box” technology or patented systems. Spares and service may thus be readily obtained directly from the local agent of the equipment in question and not necessarily from the original installer.
- Package plants, by definition are constructed off site, from catalogue designs which do not readily allow for variation between the various unit processes. This can lead to dangerous imbalances in certain circumstances. Naturally, these plants are designed to cater for size ranges and not necessarily specific to the actual needs of the site.

- Package plants are usually designed to produce an effluent complying with the General Limit Values of the Water Act and can be difficult to tailor for higher effluent standards (as in this case).
- In general, package plants are designed in low volume modules, often necessitating a multiplicity of units to cater for the design flows and loads. This leads to complexity of flow division, operation and maintenance.
- Package plants are often constructed of lightweight materials and some do not have the longevity required of a permanent works.

In general, the design concept adopted embodies the following principles:

- a) Each unit process is sized specifically for the requirements of this site
- b) The units process design factors into account the specific sewage characteristics
- c) The units are designed for economy of construction, longevity, ease of operation and economy of operation
- d) The units are designed using generic equipment, all of which may be supplied and installed by a number of suppliers and contractors.
- e) A minimum number of units are employed, simplifying flow balancing, operation and maintenance.
- f) In common with most commercial developments, the project is likely to be phased in stages that are developed as the market demand requires. This phasing will determine the module size and for the purposes of this report it is assumed that each module will be capable of treating 250 Kl/d. This results in a total of 8 modules to treat the ultimate capacity of 2 Mld. This is considered to be the minimum module size. For ease of operation, module sizes should be equal and in this instance, may be either 250 Kl/d, 500 Kl/d or 1 000 Kl/d
- g) In the past, eThekweni Metro has not permitted the construction and operation of private wastewater treatment works with a capacity in excess of 2 000 Kl/d. For this reason and coupled with the more stringent Water Licencing requirements for plant larger than 2 000 Kl/d, it is assumed that the maximum size of the plant will be 2 000 Kl/d
- h) It is further understood that the Hammarsdale WWTW (owned and operated by eThekweni Metro) is expected to be in a position to accept sewage from the Cato Ridge area within the next 10 years. For this reason, the works in question is considered to be of a temporary nature and wherever possible the process units will be constructed from reusable or resaleable material

7.4 DESIGN PARAMETERS

7.4.1 Potable Water Supply

Potable water is supplied to this area from Umgeni Water sources, via eThekweni Metro and is via a metered connection. This potable water is used for domestic purposes only and is not used to dilute sewage or added in significant amounts to the process. As can be seen from the mass balances, we expect a total of 2 kl of potable water to be used on the site for domestic and chemical make up purposes. This amounts to 0,1% of the wastewater flow.

7.4.2 Nature of the Sewage

The sewage entering this treatment works will be confined to domestic sewage only, no industrial effluent will be permitted to enter the system.

7.4.3 Flows

The design flows to this works are predicted to be as follows:

Average dry weather flow	2 000 Kl/d (23 l/s)
Peak factor	2.65
Peak dry weather flow	61 l/s
Peak wet weather flow	70 l/s

7.4.4 Load and Chemical Parameters (at full design flow)

Biological Oxygen Demand (BOD)	752 kg BOD/d (376 mg/l)
COD: BOD Ratio	2:1
Total Kjeldahl Nitrogen (TKN)	115 Kg/d (58 mg/l)
Suspended Solids (SS)	340 Kg/d
SS Concentration	170/l

7.4.5 Effluent Targets

The effluent quality targets assumed for this works is assumed to be the General Limit Values as laid down in the Water Act.

A minor portion of the final effluent will be reused on the site for wash down purposes and also in the mechanical screen spray bars. Should a use for second class water become apparent in the future, an effluent complying with the General Limit Values will provide a sound basis for reuse (or further treatment to a higher standard).

The works has been designed to produce an effluent complying with this requirement as reflected in the following table:-

Determinand	GLV Limits
pH	5.5 - 9.5
Conductivity (mS/m)	+ 70 max <150 max T
COD (mg/l)	<75
Ammonia as N (mg/l)	<6.0
Nitrate as N (mg/l)	15
Phosphate (mg/l)	<10
Suspended solids (mg/l)	<25
E.Coli (CFU/100 ml)	<1000

7.5 SITE CONSTRAINTS

7.5.1 Wetland Buffers

The allocated site is possibly constrained by wetland buffers and this will need clarification before detail design.

7.5.2 Development Potential

The developable area is reflected in Annexure C on Drawing No 20207-DS 02 Revision K. The sewage demand table reflects the following:

Priority	Sewage Generation (Kl/d)	Accumulative Sewage (Kl/d)
1	1 410	1 410
2	1 730	3 140
3	359	3 499

Previously, the Department of Water and Sanitation have resisted developments that produce sewage flows in excess of 80% of the design capacity of the treatment works. If such restrictions are applied, then it is apparent that the extent of development that will be allowed (using the temporary treatment works) will be such as to generate 1 600 Kl/d of sewage.

Therefore, Phase 1 and a portion of Phase 2 will be catered for with the construction of the Private Mini Wastewater Treatment Works.

7.6. PROCESS TRAINS (refer to process flow diagram and site layout drawing for details)

7.6.1 BNR Extended Aeration Activated Sludge by Sequencing Bioreactors

The process train for this option consists of:

- 1) Inlet works consisting:
 - Coarse hand raked bar screen
 - Fine hand raked bar screen (standby)
 - Fine mechanically raked bar screen
 - Screenings washing, dewatering and compaction
 - Vortex grit removal with air lift
 - Grit classifier
 - Flow measurement
- 2) Sequencing batch reactors consisting of circular steel tanks, HDPE lined, equipped with external venturi type aerators.
- 3) Reinforced concrete emergency storage / inlet pump station.
- 4) Disinfection by chlorination
- 5) Sludge wasting and disposal by mechanical means.
- 6) Siteworks, roads and fencing
- 7) A control building with ablutions
- 8) A second- class water supply for site washing and irrigation.
- 9) A standby diesel generating set.

7.7. MATERIALS BALANCE (at full design capacity)

7.7.1 Liquid Balance

Inputs

Raw sewage	1 996 500l/d
Potable water	2 000 l/d
Sodium hypochlorite solution	<u>1 500l/d</u>
Total	2 000 000 l/d

Outputs

Final effluent	1 998 500l/d
Liquid in sludge cake	<u>1 500 l/d</u>
Total	2 000 000 l/d

7.7.2 Solids Balance

Inputs

Screenings (0.008 m ³ /Mld)	0.016m ³ /d
Grit (0.034m ³ /Mld)	0.068m ³ /d
Activated sludge production	220 kg/d

Outputs

Screenings	0.016m ³ /d
Grit	0.068m ³ /d
Waste sludge	220/d

7.8. FUNCTIONAL DESIGN SPECIFICATION

The sewage arrives at the site and flows into the inlet works.

Inlet Works (IW)

A coarse hand raked screen is situated in the screen channel at the head of the inlet works. This screen has 40mm gaps and is designed to protect the fine screen from heavy foreign objects. This screen is cleared by hand and the screenings placed in a bin for later removal.

From the hand raked screen channel, the sewage flows to a further set of screens (duty / standby), placed in two parallel channels.

The flow to these channels is controlled by handstops.

The duty channel is equipped with a mechanically raked screen. This screen operates on a differential level basis to initiate the screening process. This is controlled by a level switch, monitoring the upstream sewage level in the screen channel.

The screenings from the mechanically raked screen are discharged into a screenings washer / compactor. This device washes organics from the screenings and these organics return to the sewage flow for further treatment. The washed screenings are compressed to reduce the water content and are then bagged for later removal. The bags are fitted and removed manually from the bagging device.

The standby channel is fitted with a hand raked screen. This screen is manually raked, and the screenings are placed in the screening's washer / compactor for disposal.

The exists to the screening channels are controlled by hand stops.

From the screenings channel, the screened sewage flow to the detritor. The flow to this detritor is controlled by hand stops.

The detritor settles grit contained in the sewage and this is removed via an airlift pump and flows to the grit classifier.

The airlift pump is powered by air from an air blower and this is manually controlled.

The detritor is equipped with a rotating paddle driven by an electric motor and gearbox. This paddle keeps organics in suspension during periods of low flow and is operated manually.

The detritor is also fitted with a high-pressure water lance which is fed with high pressure water from the second-class water system. This lance is manually controlled and is used to break up any dense accumulation of grit in the hopper of the detritor.

The grit classifier removes any remaining organics from the grit and returns these to the system for treatment. The cleaned grit is elevated by a screw conveyor and discharged into a grit hopper for later disposal. The classifier is manually operated.

From the detritor, the screened, degritted sewage enters the delivery pipe to the recycle / feed pump station which is fitted with the inlet flow recorder (FR1) where the instantaneous flow rate and accumulated flow rates are measured and recorded by the flow recorder.

Feed Pump Station

The sewage enters the feed pump station.

The sump is equipped with a submersible mixer to keep solids in suspension and ensure homogeneity of contents.

The mixers are manually operated.

Sequencing Batch Reactors

The treatment process is explained below. Each of the SBR's will operate independently of each other, running a full batch treatment from start to finish before receiving any additional wastewater flow. The batch treatment volume, tank sizes and cycle time has been designed to ensure that each SBR will operate out of phase with the others and one tank will always be ready to accept sewage when the buffer storage in the recycle / feed sump reaches high level.

Flow into the tanks will be controlled by actuated valves and flow out of the tanks by actuated valves. These are actuated via signals from the PLC.

Manually operated valves are provided upstream of the actuated valves to facilitate fine tuning and maintenance.

Stage 1 – Fill

The treatment cycle starts at time $T=0$. It is assumed that the SBR has recently completed a treatment cycle so the volume is at low level, inlet valve and decant valve are closed and that the aerators are either off or in mixing mode.

When the duty feed pump starts, the actuator fitted to the inlet valve opens and the SBR starts to fill. The aerator continues to operate in mixing mode.

When the level indicator in the SBR reads HIGH the feed pump stops and the inlet valve is closed.

Stage 2 – Aeration

The treatment cycle is now at time $T=+1$ hour. SBR1 is at high level and inlet and decant valves are closed. The venturi aerator starts and commences the four hour aeration period. At this stage the SBR is operating as a conventional aeration tank. During the aeration cycle it is possible to use the aerator in a mixing mode for a selected period.

Stage 3- Settlement

The treatment cycle is now at time $T=+5$ hours. The aeration / mixing cycle is now complete and the auto timer switches off the venturi aerator. Inlet and decant valves remain closed. At this stage the SBR is operating as a settlement tank to allow separation of solid and liquid phases.

Stage 4 – Decant

The treatment cycle is now at time $T=+6$ hours. During the preceding hour, the sludge has settled to the lower part of the SBR (importantly to below the level of the decant bellmouth) and clear treated effluent occupies the upper portion of the tank. The auto timer sends a signal to the actuator controlling the decant valve which opens. Simultaneously, the sodium hypochlorite dosing pump starts and runs

until the decant valve closes. The level in the SBR starts to drop and treated effluent flows from the tank until the level recorded by reads LOW at which time the decant valve closes.

At the end of the decant stage the treatment cycle is complete and time is now at T= +7 hours. SBR is now ready to restart at stage 1, once sufficient wastewater has been collected in the sump of the feed / recycle pump station.

Chlorine Dosing

Sodium hypochlorite is dosed into the decant tank during the decant cycle to disinfect the effluent. This is done by sodium hypochlorite dosing pumps (duty / standby) interlocked with the decant valve operating cycle.

Waste Activated Sludge System

Excess activated sludge is wasted from the independent sequencing batch reactors when required. This is achieved by the manual operation of the waste activated sludge outlet valve on the SBR and

then the waste activated sludge in admixture with the polyelectrolyte flows by gravity to the thin sludge holding tank.

The mechanical dewatering system is operated when the thin sludge holding tank is full and this system operates automatically, controlled by a PLC. The dewatered sludge is deposited into a skip for later removal. The filtrate from the dewatering process is returned to the feed pump station for further processing.

Final Effluent Flow Recorder

A final effluent flow recorder is provided to record instantaneous flow and total flow released to the environment.

7.9. WORKS RATING AND STAFFING REQUIREMENTS

7.9.1 Works Rating

Water and wastewater treatment works are subject to rating by DWS as laid down by the regulations published in the Government Gazette (Regulation No R 2834 dated 27 December 1985).

In terms of this, we are of the opinion that this works will be rated as a Class C works.

7.9.2 Staffing Requirements

The same regulations define the staffing requirements for each class of works.

In the case of a Class C works, the requirements are:

- 1 x Trainee
- 2 x Class I operators
- 1 x Class II operator
- 1 x Class IV person as supervisor
- 1 x Class V person to carry out weekly inspections

7.10. MANAGEMENT SYSTEMS

7.10.1 Water Services Provider

The sewage treatment works is managed by a grouping of the contributors, which body is a designated water services provider, in terms of an agreement with eThekweni Municipality. All of the functions and responsibilities of a water services provided are the responsibility of this group.

7.10.2 Description and Hierarchy of Operating Staff

The hierarchy of the operating staff is as follows:

- Water Services Provider Responsible Person
- Plant operator
- Works staff

These persons are supported by :

- Consulting Chemical Engineer
- Consulting Design Engineer
- SANAS accredited laboratory
- Mechanical and electrical service provider
- Sludge, screening and grit removal service providers.

7.10.3 Availability of Mechanical Maintenance Staff

The Water Service Provider has a term contract with a service provider for routine mechanical maintenance and breakdown interventions on the plant.

7.10.4 Availability of Electrical Maintenance Staff

The Water Service Provider has a term contract with a service provider for routine electrical maintenance and breakdown interventions on the plant.

7.10.5 Availability of Process Control Staff and Process Consultants

The Water Services Provider has a term contract with a firm of Consulting Engineers to provide this assistance to the staff employed.

7.10.6 Drainage By Laws

A set of drainage by laws is in place and is administered by the Water Services Provider, in conjunction with the Consulting Engineers.

7.11. IS THE WASTE TREATMENT PROCESS THE BEST OPTION

It is contended that the treatment process employed is the best option in this case for the following reasons:

- The ability to produce the required effluent standard
- The ease of constructing the plant in a modular fashion
- The small footprint of the plant
- The absence of fly breeding and odours applicable to this process
- The production of a mineralised, stable sludge within the process by aerobic means
- The ability of the process to denitrify and reduce nitrates as well as to recover alkalinity lost in the process.

7.12. IS THE BEST TECHNOLOGY IN USE

It is contended that the best technology is in use as all items of equipment employed are generic and may thus be replaced at any stage with similar equipment, without being beholden to any one original equipment suppliers.

7.13. WHAT ARE THE ALTERNATIVE OPTIONS FOR SEWAGE TREATMENT

Alternative options for treatment and disposal are:

- Biological filtration
- Rotating biological contactors
- Submerged fixed film reactors.

7.14. WHY WAS THIS OPTION CHOSEN

This option was chosen for the following reasons:

- Effluent quality produced
- Ease of extension
- Small footprint
- Low nuisance
- Ease of removal when main drainage connection is available.

7.15. OPERATIONAL MANAGEMENT PLAN

7.15.1 What are the Chances of System Failure

System failure can be attributed to the following causes:

- Mechanical breakdown
- Electrical breakdown
- Electrical outage
- Process poisoning
- Operator actions

In the event of a mechanical breakdown, all essential items of equipment are provided with a standby to assume duty in the event of a failure.

Similarly, all electrical switchgear (excepting the transformer) is duplicated with the mechanical plant.

In the event of an electrical outage, the plant is provided with a diesel driven standby generator.

Process poisoning can occur if poisons find their way into the sewer system. This is unlikely as the system is for domestic sewage only and not for industrial effluents. Diligent application of the drainage by laws will also mitigate against this.

If the operation of the works is not diligent, then process failure can result. The Water Services Provider has an obligation to ensure that all routine and intervention actions are carried out by the operational staff.

Overall, the chances of a significant system failure are seen as being low.

7.15.2 What are the Implications of Such a Failure

The implications of such failure will be the loss of final effluent quality. This will result in an additional load being placed on the purification capacity of the adjacent wetland. If this capacity is ever exceeded, then pollution and nuisance will result.

7.15.3 What Safety Factors Have Been Used

As described earlier in this report, the following safety factors have been used:

- Conservative design criteria
- Generic equipment employed that can be replaced at short notice
- Domestic sewage only to be treated
- Professional process advice and monitoring
- Preventative maintenance of plant and equipment
- Standby equipment provided

7.15.4 What are the Management and Maintenance Plans

The day- to- day management of the works rests with the Water Service Provider who manages and guides the following;

- Finance and budgets
- Personnel and training plans
- Process and monitoring plans
- Mechanical and electrical maintenance plans

-
- Applications for new connections
 - Compliance planning

7.15.5 Availability of Standby / Spare Equipment

All mechanical and electrical equipment is provided in a duty / standby configuration.

A standby generator is provided.

All equipment is generic and spares are readily available.

7.15.6 What are the Accident and Emergency Plans

In the event of an accident, first aid is available from Administration / Control building on the plant. First aid facilities are provided at this point.

Emergency services are available from various service providers in the vicinity.

Emergency breakdowns are handled by the contracted maintenance service providers.

Process emergencies are handled by the Consulting Engineers.

7.15.7 What Plans are there to Minimise the Pollution Hazard / Potential

Daily plant inspections by operating and supervisory staff.

Weekly plant inspections by maintenance service providers.

Monthly plant inspections by Consulting Engineers.

7.15.8 Are there Alarm Systems in All Pump Stations?

Alarm systems are provided.

7.15.9 Are there Notification Procedures for Downstream Users

These are in place.

7.15.10 Wastewater Risk Abatement Plan

7.15.10.1 Introduction

The primary objective of collection and wastewater treatment is to ensure that the effluent discharged to the environment does not pose unacceptable risks to the human health and the ecosystem.

Wastewater Treatment Works operate 24/7, 365 days of the year and there is limited control over the quantity and quality of the incoming raw wastewater.

The environment in which the Wastewater Treatment Works (WWTW) operates is aggressive and corrosive. More importantly the discharge of substandard effluent quality or untreated wastewater degrades the receiving water catchments and poses significant risks to public health and the environment.

To mitigate potential risks, a risk mitigation plan has been developed and this is detailed in this document.

To ensure that the objectives are achieved these points are committed to:

- ☐ Responsible stewardship and a high standard of plant management;
- ☐ Meeting the requirements of relevant legislation pertaining to the operation and maintenance of the Wastewater Treatment Works;
- ☐ Preventing pollution by implementing the Best Practical Environment Option at all times;

☐ ☐ Educating and motivating employees to conduct their work activities in an environmentally responsible manner;

☐ ☐ Staying abreast of the latest wastewater treatment technology;

☐ ☐ Improving efficiency with regard to energy consumption;

☐ ☐ Minimising the use of hazardous substances and strict control of the use of those that are necessary;

☐ ☐ Promoting the re-use of treated effluent;

☐ ☐ Implementing an environmental management system.

☐ ☐ Communicating this policy to relevant stakeholders.

In addition, it is committed to ensuring that a 10 year Master Plan for capital financing of its replacement, refurbishment and upgrading of the Works is implemented.

7.15.11 Contingency Plan

ASSMANG CATO RIDGE WASTEWATER TREATMENT WORKS: CONTINGENCY PLAN –“WHAT IF” SCENARIO

LOCATION	PROBLEM	EFFECT	ACTION	CONTACT
Inlet works screens	Mechanical or electrical failure of one unit	Screen blocks up.	Open penstock to second hand raked screen..	Maintenance staff to effect repairs.
Inlet works grit removal unit	Mechanical or electrical failure of unit.	Grit will accumulate in failed unit. No adverse effect of operation in short term. In long term possible carryover of grit into reactor.	By-pass unit.	Maintenance staff to effect repairs.
Inlet pump station	Pump Failure	Level rises in sump	Stand-by pump operates automatically. High level alarm.	Maintenance staff to effect repairs
Activated sludge aerators	Mechanical or electrical failure of units.	Each reactor has 2 aerators. Reduction in aeration capacity would lead to decreased nitrification.	Install standby aerator from store	Maintenance staff to effect repairs.
Chlorination system	Mechanical or electrical failure	No disinfection of final effluent..	Start stand-by disinfection pump.	Maintenance staff to effect repairs.
Control valves	Mechanical or electrical failure of 1 unit	Lack of “cycle” of the module.	Disable automatic valve and operate manually.	Maintenance staff to effect repairs.

Sludge dewatering system.	Mechanical or electrical failure.	Build up of suspended solids in the activated sludge reactor. Could become a problem after 1 week depending on loading.	Effect repairs.	Maintenance staff to effect repairs.
General power failure	All electrical Equipment stops.	Potential lack of treatment. A standby generator has been installed on site and this operates automatically on mains failure.	Determine reason for outage. Ensure standby has sufficient fuel for operation.	Electrical maintenance to determine if problem is on site or is external. If latter contact the electricity supply authority and stress need to restore power as soon as possible

7.16. DISPOSAL OF SOLID WASTE AND SLUDGES

7.16.1 Description of Solid Waste

Solid waste emanating from this works will be:

- Washed grit from the inlet works
- Washed and bagged screenings from the mechanical screen
- Dewatered waste activated sludge.

7.16.2 Quantity

The screenings output is calculated as 0,016 m³/d or 10kg/d or 3 650 kg/annum
The waste activated sludge output is 120kg dry solids / day or 44t per annum

7.16.3 Analyses of Sludges

On operation, sludge classification will be undertaken and results will be submitted to DWS

7.16.4 Classification of Sludges

No classification of sludge is as yet available.

7.16.5 Method of Disposal

The waste sludge is taken to a designated eThekwin Metro works for final disposal.

7.16.6 Description of Contract for Removal of Sludges

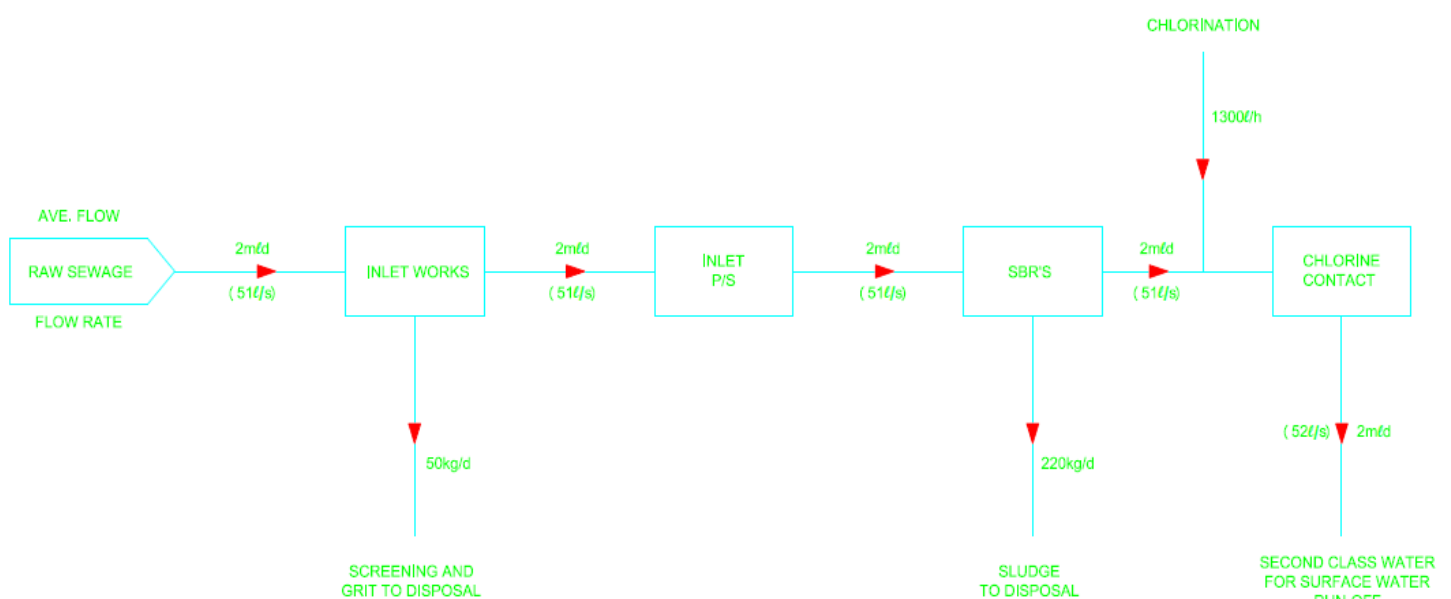
A service provider is contracted to transport the waste sludge to the designated eThekwin Metro works.

7.17. METRO APPROVAL

eThekwin Metro have, in the past, applied Guideline 12 as a means of controlling the design, construction and operation of privately owned wastewater treatment works. *Inter alia* this guideline demands the following:

- a) Sewage shall only be from residential areas with a maximum of 20% being generated by commercial sources. Clearly, this development does not fall within the appropriate category and relief will have to be sought from this requirement
- b) The works shall be designed by an experienced professional who shall be responsible for overseeing operation and maintenance for a period of 5 years after commissioning
- c) The works shall be monitored monthly with reporting to EWS. Analyses to be undertaken by a SANAS accredited laboratory.
- d) Application to construct and operate such a works shall be made to EWS in due form.
- e) A guarantee amounting to 250% (2,5 times) the cost of the works (including VAT and Professional fees) shall be lodged with EWS on commissioning of the plant. The duration of this guarantee is for 5 years and is refundable if the works performance is satisfactory. If the works performance is unsatisfactory, then the guarantee monies may be used for rectification.

CATO RIDGE PROCESS FLOW DIAGRAM



CATO RIDGE PROCESS FLOW DIAGRAM

7.18 Planning Construction

In the planning for the design phase, cognizance is taken of the following reference documents:-

- 1) Red Book - Guidelines for Human Settlement Planning and Design
- 2) SANS 1200 – Standardized Specification for Civil Engineering Construction
- 3) Local Municipal Standards

7.19 Environmental sensitive Area

There are 6 specific areas in the table below which describe the storm water runoff and sewer crossing that discharge within the watercourse that require a Method Statement:-

Point Number	Description	Watercourse
1	Stormwater discharge point , plus stormwater pipeline	S6
2	Stormwater discharge point , plus stormwater pipeline	S11
3	Effluent Discharge Point	Within R3 drainage line
4	Stormwater discharge point , plus stormwater pipeline	R3 and R4 drainage line and within the 33m drainage buffer
5	Stormwater discharge point , plus stormwater pipeline	R2 and drainage buffer
6	Stormwater discharge point , plus stormwater pipeline	R2 Drainage line

The 6 specific areas are indicated in blocks on the attached Master Layout of the Water Uses associated with the project which is attached in Annexure D.

Stormwater Outlets

Where the stormwater outlets discharge into the drainage line or wetland buffer they will be managed with the construction of a headwall with dissipater blocks, a gabion structure to dissipate the flow and erosion protection measures. This is highlighted in more detail in the Method Statement for Construction Activities for the Proposed Development of Properties in Cato Ridge. Please refer to Annexure E for details.

Sewer Outlet

There is one sewer outlet that requires a method statement as it discharges within the R3 drainage line. The flow rate is only around 52 litres/second and will be managed in the similar manner as the stormwater outlets with the construction of a headwall with dissipater blocks and a gabion structure with suitable stone pitching and erosion protection measures where required. Please refer to Annexure H for details. A 300mm diameter sewer outlet pipe will discharge from the Private Mini Wastewater Treatment Works into the drainage line.

As indicated above the storm water runoff and sewer will be discharged via 6 outlets into the watercourses or wetland buffer. Where possible, these discharge points will be further managed with the construction of swales that will retain, sink and spread the storm water runoff. This construction work will be undertaken within the wetland buffer and drainage lines.

Please refer to G for the delineated wetlands and low impact mixed use combined watercourses.

7.20 Method Statement for Construction Activities

Please refer to Annexure E for the Method Statement for Construction Activities for the Proposed Development of Properties in Cato Ridge

8. CONCLUSION

The Development is achievable with the proposed upgrades as referred to in the report which is summarised as follow:-

Phase 1

Phase 1 is programmed to be unlocked within the next 18 months and will be phased in over the next 10 year period as and when the demand arises

Phase 2

It is proposed to develop Priority Phase 2 into two sections which are as follows:-

1) The first section of Phase 2 will include up to the high point of the site which is approximately 400metres off the southern section of Phase 2.

The southern section of Phase 2 is to be developed in conjunction with Phase 1.

The first section of Phase 2 is programmed to be unlocked within the next 18 months and will be phased in over the next 10 years

The second portion of Phase 2 will include the balance of Phase 2 from the high point northwards and will only be unlocked after the service infrastructure has been completed in the Cato Ridge area.

The northern portion of Phase 2 will be implemented over the next 11 to 20 years.

Phase 3

Phase 3 will be implemented over the next 21 to 25 years

In addition, the Sewer Design Engineer will be appointed to design, oversee the construction and commission the extensions to the proposed private wastewater treatment works. He will also monitor performance and maintenance for a period of 5 years after commissioning.

KANTEY AND TEMPLER CONSULTING ENGINEERS



KEVIN HOHLS
Pr. Eng. 20060264
ASSOCIATE DIRECTOR

ANNEXURE A

Site Locality Plan

LOCALITY SKETCH

(N.T.S.)



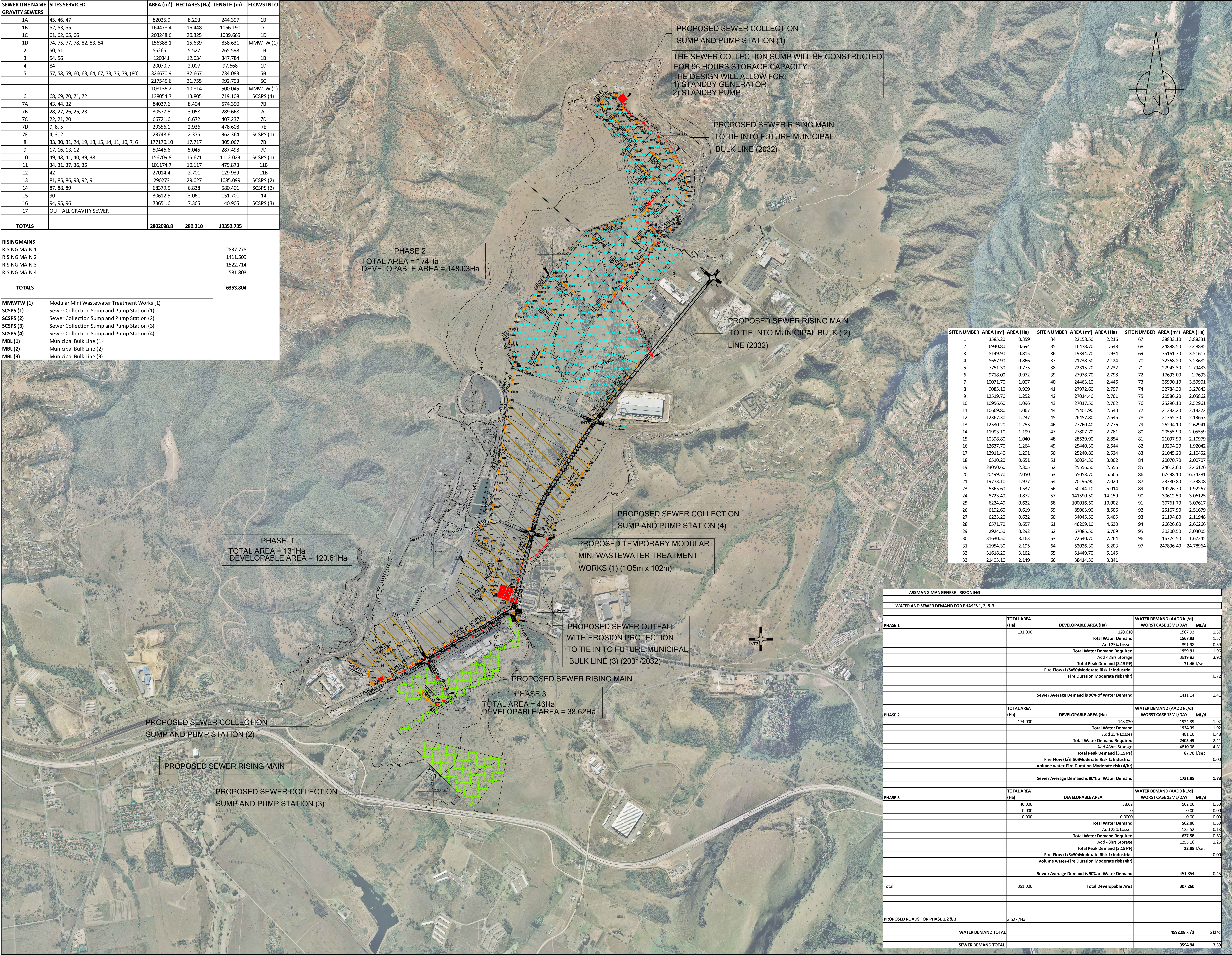
ANNEXURE B

Sewer Drawing With Orthophoto

SEWER LINE NAME	SITES SERVICED	AREA (m²)	HECTARES (Ha)	LENGTH (m)	FLOWS INTO:
GRAVITY SEWERS					
1A	45, 46, 47	82025.9	8.203	244.397	1B
1B	52, 53, 55	164478.4	16.448	1166.190	1C
1C	61, 62, 65, 66	203248.6	20.325	1039.665	1D
1D	74, 75, 77, 78, 82, 83, 84	156388.1	15.639	858.631	MMWWTW (1)
2	50, 51	55265.1	5.527	265.598	1B
3	54, 56	120341	12.034	347.784	1B
4	84	20070.7	2.007	97.668	1D
5	57, 58, 59, 60, 63, 64, 67, 73, 76, 79, (80)	326670.9	32.667	734.083	5B
		217545.6	21.755	992.793	5C
		108136.2	10.814	500.045	MMWWTW (1)
6	68, 69, 70, 71, 72	138054.7	13.805	719.108	SCSPS (4)
7A	43, 44, 32	84037.6	8.404	574.390	7B
7B	28, 27, 26, 25, 23	30577.5	3.058	289.668	7C
7C	22, 21, 20	66721.6	6.672	407.237	7D
7D	9, 8, 5	29356.1	2.936	478.608	7E
7E	4, 3, 2	23748.6	2.375	362.364	SCSPS (1)
8	33, 30, 31, 24, 19, 18, 15, 14, 11, 10, 7, 6	177170.10	17.717	305.067	7B
9	17, 16, 13, 12	50446.6	5.045	287.498	7D
10	49, 48, 41, 40, 39, 38	156709.8	15.671	1112.023	SCSPS (1)
11	34, 31, 37, 36, 35	101174.7	10.117	479.873	11B
12	42	27014.4	2.701	129.939	11B
13	81, 85, 86, 93, 92, 91	290273	29.027	1085.099	SCSPS (2)
14	87, 88, 89	68379.5	6.838	580.401	SCSPS (2)
15	90	30612.5	3.061	151.701	14
16	94, 95, 96	73651.6	7.365	140.905	SCSPS (3)
17	OUTFALL GRAVITY SEWER				
TOTALS		2802098.8	280.210	13350.735	

RISING MAINS		
RISING MAIN 1		2837.778
RISING MAIN 2		1411.509
RISING MAIN 3		1522.714
RISING MAIN 4		581.803
TOTALS		6353.804

MMWWTW (1)	Modular Mini Wastewater Treatment Works (1)
SCSPS (1)	Sewer Collection Sump and Pump Station (1)
SCSPS (2)	Sewer Collection Sump and Pump Station (2)
SCSPS (3)	Sewer Collection Sump and Pump Station (3)
SCSPS (4)	Sewer Collection Sump and Pump Station (4)
MBL (1)	Municipal Bulk Line (1)
MBL (2)	Municipal Bulk Line (2)
MBL (3)	Municipal Bulk Line (3)



SITE NUMBER	AREA (m²)	AREA (Ha)	SITE NUMBER	AREA (m²)	AREA (Ha)	SITE NUMBER	AREA (m²)	AREA (Ha)
1	3585.20	0.359	34	22158.50	2.216	67	38833.10	3.88331
2	6940.80	0.694	35	16478.70	1.648	68	24888.50	2.48885
3	8149.90	0.815	36	19344.70	1.934	69	35161.70	3.51617
4	8657.90	0.866	37	21238.50	2.124	70	32368.20	3.23682
5	7751.30	0.775	38	22315.20	2.232	71	27943.30	2.79433
6	9718.00	0.972	39	27978.70	2.798	72	17693.00	1.7693
7	10071.70	1.007	40	24463.10	2.446	73	35990.10	3.59901
8	9085.10	0.909	41	27972.60	2.797	74	32784.30	3.27843
9	12519.70	1.252	42	27014.40	2.701	75	20586.20	2.05862
10	10956.60	1.096	43	27017.50	2.702	76	25296.10	2.52961
11	10669.80	1.067	44	25401.90	2.540	77	21332.20	2.13322
12	12367.30	1.237	45	26457.80	2.646	78	21365.30	2.13653
13	12530.20	1.253	46	27760.40	2.776	79	26294.10	2.62941
14	11993.10	1.199	47	27807.70	2.781	80	20555.90	2.05559
15	10398.80	1.040	48	28539.90	2.854	81	21097.90	2.10979
16	12637.70	1.264	49	25440.30	2.544	82	19204.20	1.92042
17	12911.40	1.291	50	25240.80	2.524	83	21045.20	2.10452
18	6510.20	0.651	51	30024.30	3.002	84	20070.70	2.00707
19	23050.60	2.305	52	25556.50	2.556	85	24612.60	2.46126
20	20499.70	2.050	53	55053.70	5.505	86	167438.10	16.74381
21	19773.10	1.977	54	70196.90	7.020	87	23380.80	2.33808
23	5365.60	0.537	56	50144.10	5.014	89	19226.70	1.92267
24	8723.40	0.872	57	141590.50	14.159	90	30612.50	3.06125
25	6224.40	0.622	58	100016.50	10.002	91	30761.70	3.07617
26	6192.60	0.619	59	85063.90	8.506	92	25167.90	2.51679
27	6223.20	0.622	60	54045.50	5.405	93	21194.80	2.11948
28	6571.70	0.657	61	46299.10	4.630	94	26626.60	2.66266
29	2924.50	0.292	62	67085.50	6.709	95	30300.50	3.03005
30	31630.50	3.163	63	72640.70	7.264	96	16724.50	1.67245
31	21954.30	2.195	64	50206.30	5.203	97	247896.40	24.78964
32	31618.20	3.162	65	51449.70	5.145			
33	21493.10	2.149	66	38414.30	3.841			

ASSMANG MANGENESE - REZONING					
WATER AND SEWER DEMAND FOR PHASES 1, 2, & 3					
PHASE 1	TOTAL AREA (Ha)	DEVELOPABLE AREA (Ha)	WATER DEMAND (AADD KL/d)		ML/d
			WORST CASE 13ML/DAY		
	131.000		120.610	1567.93	1.57
			Total Water Demand	1567.93	1.57
			Add 25% Losses	391.98	0.39
			Total Water Demand Required	1959.91	1.96
			Add 48hrs Storage	3919.82	3.92
			Total Peak Demand (3.15 PF)	71.46	0.72
			Fire Flow (L/S=50)Moderate Risk 1: Industrial		
			Fire Duration Moderate risk (4hr)		
			Sewer Average Demand is 90% of Water Demand	1411.14	1.41
PHASE 2	TOTAL AREA (Ha)	DEVELOPABLE AREA (Ha)	WATER DEMAND (AADD KL/d)		ML/d
			WORST CASE 13ML/DAY		
	174.000		148.030	1924.39	1.92
			Total Water Demand	1924.39	1.92
			Add 25% Losses	481.10	0.48
			Total Water Demand Required	2405.49	2.41
			Add 48hrs Storage	4810.98	4.81
			Total Peak Demand (3.15 PF)	87.70	0.88
			Fire Flow (L/S=50)Moderate Risk 1: Industrial		
			Volume water-Fire Duration Moderate risk (4hr)		
			Sewer Average Demand is 90% of Water Demand	1731.95	1.73
PHASE 3	TOTAL AREA (Ha)	DEVELOPABLE AREA	WATER DEMAND (AADD KL/d)		ML/d
			WORST CASE 13ML/DAY		
	46.000	38.62	502.06	502.06	0.50
	0.000	0	0.00	0.00	0.00
	0.000	0.0000	0.00	0.00	0.00
			Total Water Demand	502.06	0.50
			Add 25% Losses	125.52	0.13
			Total Water Demand Required	627.58	0.63
			Add 48hrs Storage	1255.16	1.26
			Total Peak Demand (3.15 PF)	22.88	0.23
			Fire Flow (L/S=50)Moderate Risk 1: Industrial		
			Volume water-Fire Duration Moderate risk (4hr)		
			Sewer Average Demand is 90% of Water Demand	451.854	0.45
Total	351.000	Total Developable Area	307.260		
PROPOSED ROADS FOR PHASE 1,2 & 3					
	3,527 /Ha				
WATER DEMAND TOTAL			4992.98 kl/d	5 kl/d	
SEWER DEMAND TOTAL			3594.94	3.59	

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REFERENCE DRAWING



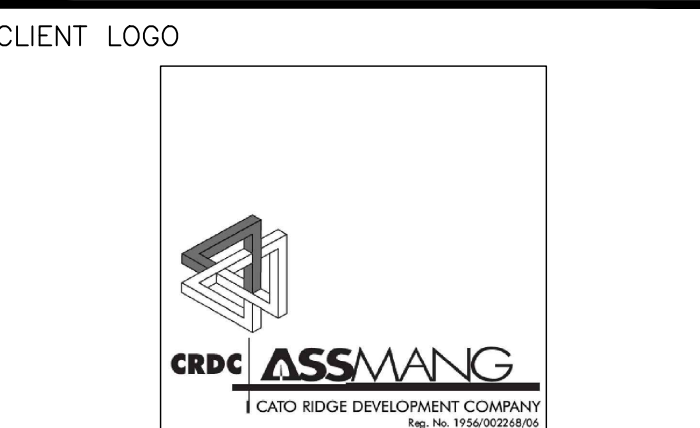
	PHASE 1
	PHASE 2
	PHASE 3

PROPOSED SEWER RISING MAIN
PROPOSED GRAVITY SEWER

K	WATER & SEWER DEMAND TABLE	SKM	KH	24/05/23
J	SEWER PIPE SIZES & SEWER MANHOLES NAMES ADDED.	SKM	KH	16/05/23
I	WATER AND SEWER DEMAND TABLE AMENDED. SEWER PIPE SIZES ADDED.	SKM	KH	04/04/23
H	WATER AND SEWER DEMAND TABLE AMENDED.	SKM	KH	03/02/23
G	SEWER LAYOUT REVISED	SKM	KH	03/02/23
F	SEWER LAYOUT REVISED	SKM	KH	23/01/23
E	SEWER LAYOUT REVISED	SKM	KH	01/11/22
D	SEWER LAYOUT REVISED	SKM	KH	25/10/22
C	SEWER LAYOUT AMENDED	SKM	KH	05/10/22
B	TOWN PLANNING LAYOUT & ROAD LAYOUT CHANGES-FOR DISCUSSION	SKM	KH	29/09/22
A	ISSUED FOR DISCUSSION	ZC	KH	02/08/22
REV	DESCRIPTION	DR	APP	DATE

DESIGNED	INITIALS	SIGN	DATE
	RK		
DRAWN	SKM		
PROJECT ENG.	KH		
APPROVED			

K&T
KANTY & TEMPLER
CONSULTING ENGINEERS
Engineering African Development
PO BOX 290 HILTON SOUTH AFRICA 3245 TEL +27 33 347 5453



CLIENT
CATO RIDGE DEVELOPMENT COMPANY(Pty) Ltd
PROJECT
CATO RIDGE PHASED DEVELOPMENT

TITLE
PROPOSED SEWER LAYOUT

SCALE : 1:10000
DRAWING No. 20207-DS-01
REV K
KTY-geo-A01.dwg (SCALE) A0 SHEET

ANNEXURE C

Sewer Layout Drawing with water & sewer demands

SEWER LINE NAME	SITES SERVICED	AREA (m²)	HECTARES (Ha)	LENGTH (m)	FLOWS INTO:
GRAVITY SEWERS					
1A	45, 46, 47	82025.9	8.203	244.397	1B
1B	52, 53, 55	164478.4	16.448	1166.190	1C
1C	61, 62, 65, 66	203248.6	20.325	1039.665	1D
1D	74, 75, 77, 78, 82, 83, 84	156388.1	15.639	858.631	MMWTW (1)
2	50, 51	55265.1	5.527	265.598	1B
3	54, 56	120341	12.034	347.784	1B
4	84	20070.7	2.007	97.668	1D
5	57, 58, 59, 60, 63, 64, 67, 73, 76, 79, (80)	326670.9	32.667	734.083	5B
		217545.6	21.755	992.793	5C
		108136.2	10.814	500.045	MMWTW (1)
6	68, 69, 70, 71, 72	138054.7	13.805	719.108	SCSPS (4)
7A	43, 44, 32	84037.6	8.404	574.390	7B
7B	28, 27, 26, 25, 23	30577.5	3.058	289.668	7C
7C	22, 21, 20	66721.6	6.672	407.237	7D
7D	9, 8, 5	29356.1	2.936	478.608	7E
7E	4, 3, 2	23748.6	2.375	362.364	SCSPS (1)
8	33, 30, 31, 24, 19, 18, 15, 14, 11, 10, 7, 6	177170.10	17.717	305.067	7B
9	17, 16, 13, 12	50446.6	5.045	287.498	7D
10	49, 48, 41, 40, 39, 38	156709.8	15.671	1112.023	SCSPS (1)
11	34, 31, 37, 36, 35	101174.7	10.117	479.873	11B
12	42	27014.4	2.701	129.939	11B
13	81, 85, 86, 93, 92, 91	290273	29.027	1085.099	SCSPS (2)
14	87, 88, 89	68379.5	6.838	580.401	SCSPS (2)
15	90	30612.5	3.061	151.701	14
16	94, 95, 96	73651.6	7.365	140.905	SCSPS (3)
17	OUTFALL GRAVITY SEWER				
TOTALS		2802098.8	280.210	13350.735	

RISING MAINS		
RISING MAIN 1		2837.778
RISING MAIN 2		1411.509
RISING MAIN 3		1522.714
RISING MAIN 4		581.803
TOTALS		6353.804

MMWTW (1)	Modular Mini Wastewater Treatment Works (1)
SCSPS (1)	Sewer Collection Sump and Pump Station (1)
SCSPS (2)	Sewer Collection Sump and Pump Station (2)
SCSPS (3)	Sewer Collection Sump and Pump Station (3)
SCSPS (4)	Sewer Collection Sump and Pump Station (4)
MBL (1)	Municipal Bulk Line (1)
MBL (2)	Municipal Bulk Line (2)
MBL (3)	Municipal Bulk Line (3)

ASSMANG MANGENISE - REZONING					
WATER AND SEWER DEMAND FOR PHASES 1, 2, & 3					
PHASE 1	TOTAL AREA (Ha)	DEVELOPABLE AREA (Ha)	WATER DEMAND (AADD KL/d)		
			WORST CASE 13ML/DAY	ML/d	
	131.000	120.610	1567.93	1.57	
		Total Water Demand	1567.93	1.57	
		Add 25% Losses	391.98	0.39	
		Total Water Demand Required	1959.91	1.96	
		Add 48hrs Storage	3919.82	3.92	
		Total Peak Demand (3.15 PF)	7146.1	l/sec	
		Fire Flow (L/S=50)Moderate Risk 1: Industrial			
		Fire Duration Moderate risk (4hr)		0.72	
		Sewer Average Demand is 90% of Water Demand	1411.14	1.41	
PHASE 2	TOTAL AREA (Ha)	DEVELOPABLE AREA (Ha)	WATER DEMAND (AADD KL/d)		
			WORST CASE 13ML/DAY	ML/d	
	174.000	148.030	1924.39	1.92	
		Total Water Demand	1924.39	1.92	
		Add 25% Losses	481.10	0.48	
		Total Water Demand Required	2405.49	2.41	
		Add 48hrs Storage	4810.98	4.81	
		Total Peak Demand (3.15 PF)	87.70	l/sec	
		Fire Flow (L/S=50)Moderate Risk 1: Industrial		0.00	
		Volume water-Fire Duration Moderate risk (4hr)			
		Sewer Average Demand is 90% of Water Demand	1731.95	1.73	
PHASE 3	TOTAL AREA (Ha)	DEVELOPABLE AREA	WATER DEMAND (AADD KL/d)		
			WORST CASE 13ML/DAY	ML/d	
	46.000	38.62	502.06	0.50	
	0.000	0	0.00	0.00	
	0.000	0.000	0.00	0.00	
		Total Water Demand	502.06	0.50	
		Add 25% Losses	125.52	0.13	
		Total Water Demand Required	627.58	0.63	
		Add 48hrs Storage	1255.16	1.26	
		Total Peak Demand (3.15 PF)	22.88	l/sec	
		Fire Flow (L/S=50)Moderate Risk 1: Industrial		0.00	
		Volume water-Fire Duration Moderate risk (4hr)			
		Sewer Average Demand is 90% of Water Demand	451.854	0.45	
Total	351.000	Total Developable Area	307.260		
PROPOSED ROADS FOR PHASE 1, 2 & 3					
	3.527 /Ha				
WATER DEMAND TOTAL			4992.98 kl/d	5 kl/d	
SEWER DEMAND TOTAL			3594.94	3.59	



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REFERENCE DRAWING

PHASE 1

PHASE 2

PHASE 3

PROPOSED SEWER RISING MAIN

PROPOSED GRAVITY SEWER

K	WATER & SEWER DEMAND TABLE	SKM	KH	24/05/23
J	SEWER PIPE SIZES & SEWER	SKM <td>KH <td>16/05/23</td> </td>	KH <td>16/05/23</td>	16/05/23
	MANHOLE NAMES ADDED			
I	WATER AND SEWER DEMAND TABLE	SKM <td>KH <td>04/04/23</td> </td>	KH <td>04/04/23</td>	04/04/23
	AMENDED, SEWER PIPE SIZES ADDED			
H	WATER AND SEWER DEMAND TABLE	SKM <td>KH <td>03/02/23</td> </td>	KH <td>03/02/23</td>	03/02/23
	AMENDED			
G	SEWER LAYOUT REVISED	SKM <td>KH <td>03/02/23</td> </td>	KH <td>03/02/23</td>	03/02/23
F	SEWER LAYOUT REVISED	SKM <td>KH <td>23/01/23</td> </td>	KH <td>23/01/23</td>	23/01/23
E	SEWER LAYOUT REVISED	SKM <td>KH <td>01/11/22</td> </td>	KH <td>01/11/22</td>	01/11/22
D	SEWER LAYOUT REVISED	SKM <td>KH <td>25/10/22</td> </td>	KH <td>25/10/22</td>	25/10/22
C	SEWER LAYOUT AMENDED	SKM <td>KH <td>05/10/22</td> </td>	KH <td>05/10/22</td>	05/10/22
B	TOWN PLANNING LAYOUT & ROAD	SKM <td>KH <td>29/09/22</td> </td>	KH <td>29/09/22</td>	29/09/22
A	ISSUED FOR DISCUSSION	ZC	KH <td>02/08/22</td>	02/08/22

REV	D E S C R I P T I O N	DR.	APP.	DATE
		INITIALS	SIGN	DATE
DESIGNED		RK		
DRAWN		SKM		
PROJECT ENG.		KH		
APPROVED				

Engineering African Development

PO BOX 290 HILTON SOUTH AFRICA 3245 TEL +27 33 347 5453

CLIENT LOGO

CLIENT

CATO RIDGE DEVELOPMENT COMPANY(Pty) Ltd

PROJECT

CATO RIDGE PHASED DEVELOPMENT

TITLE

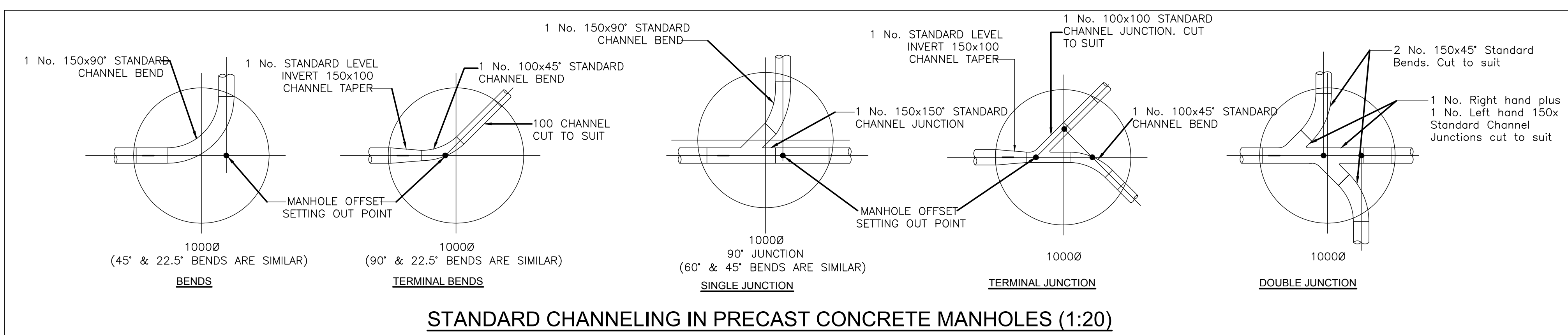
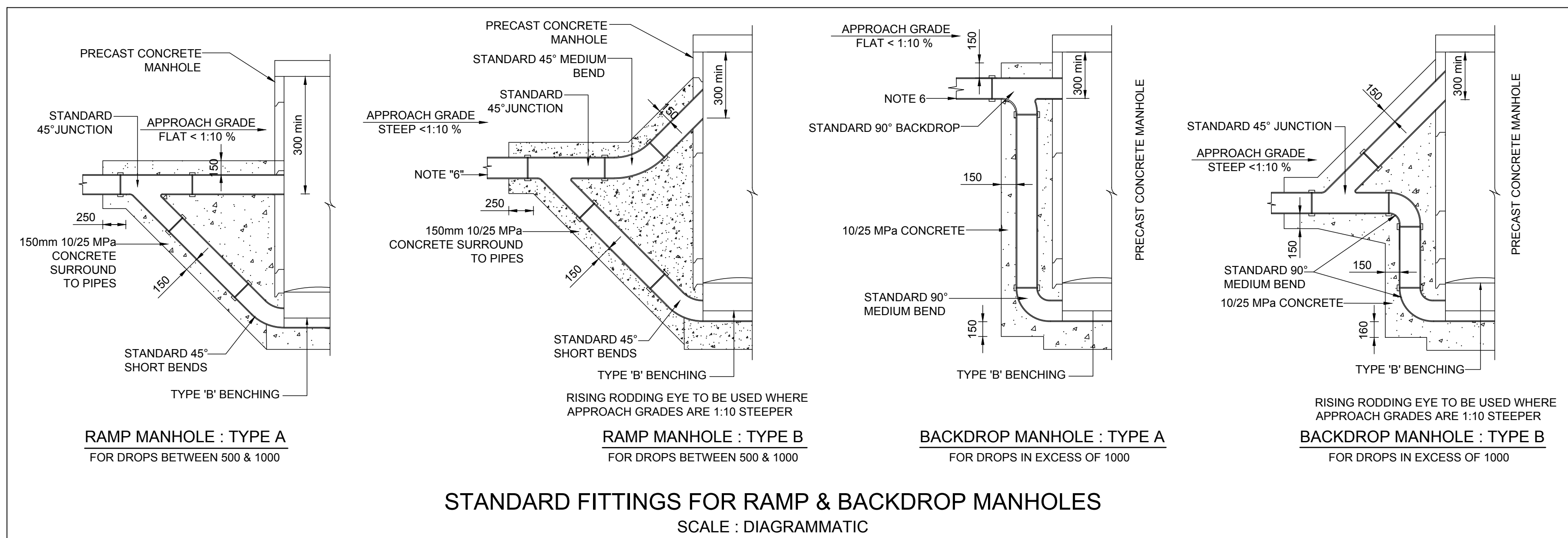
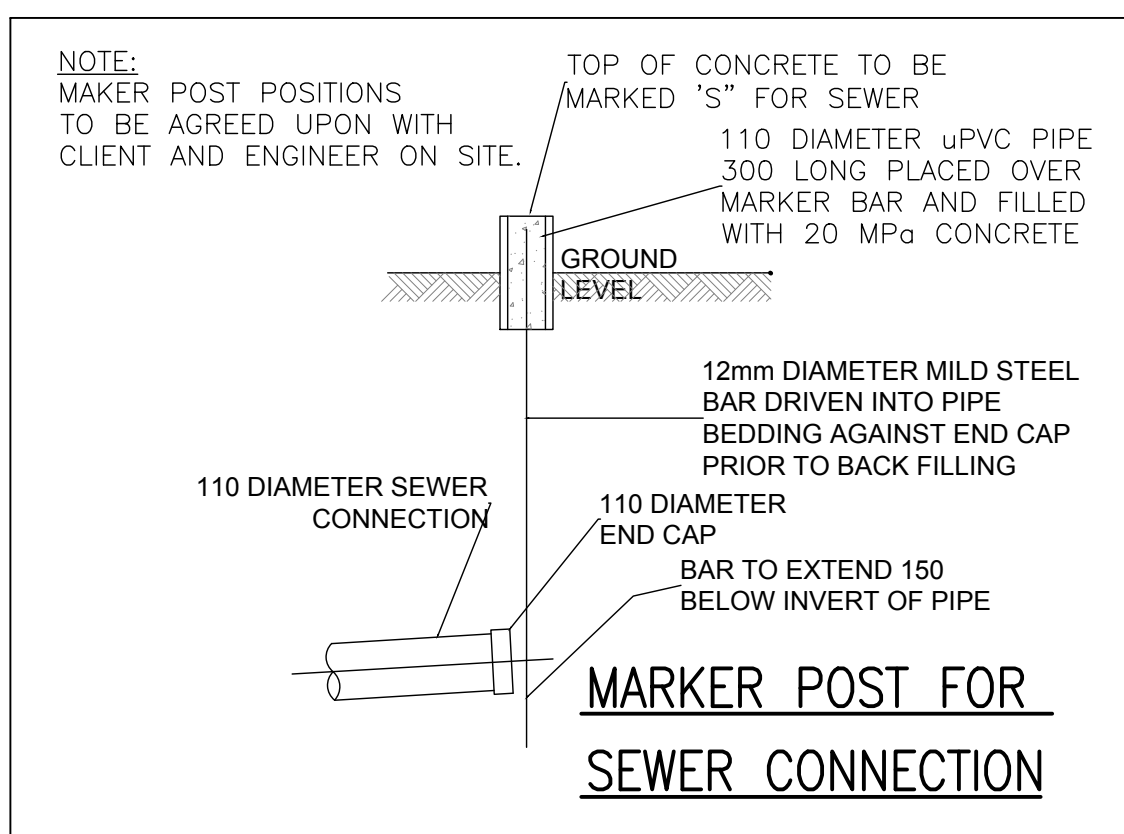
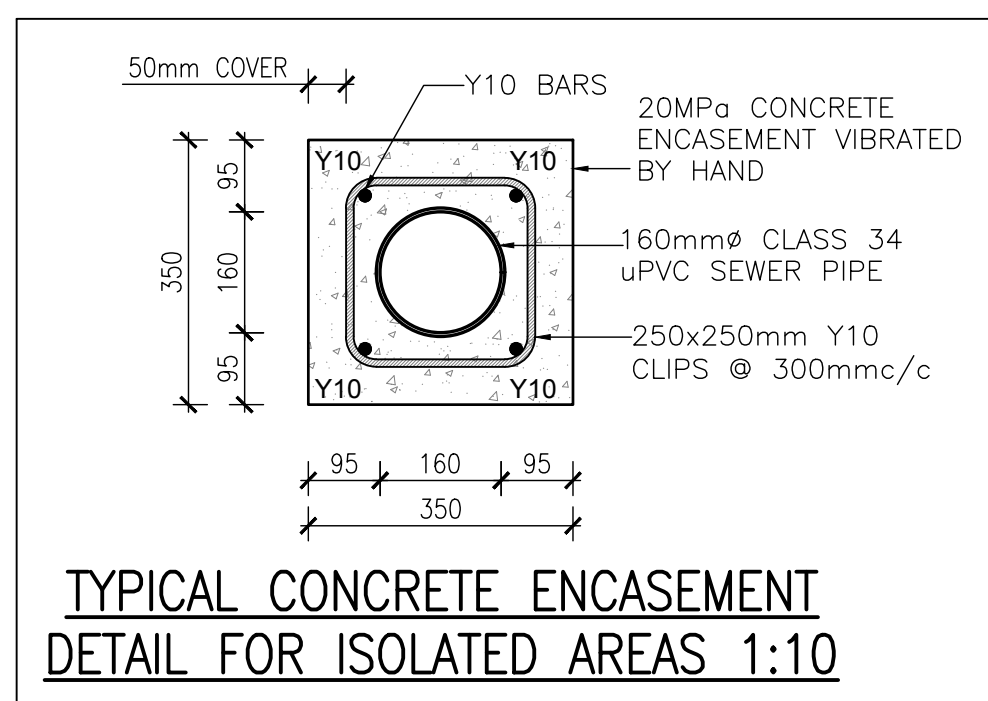
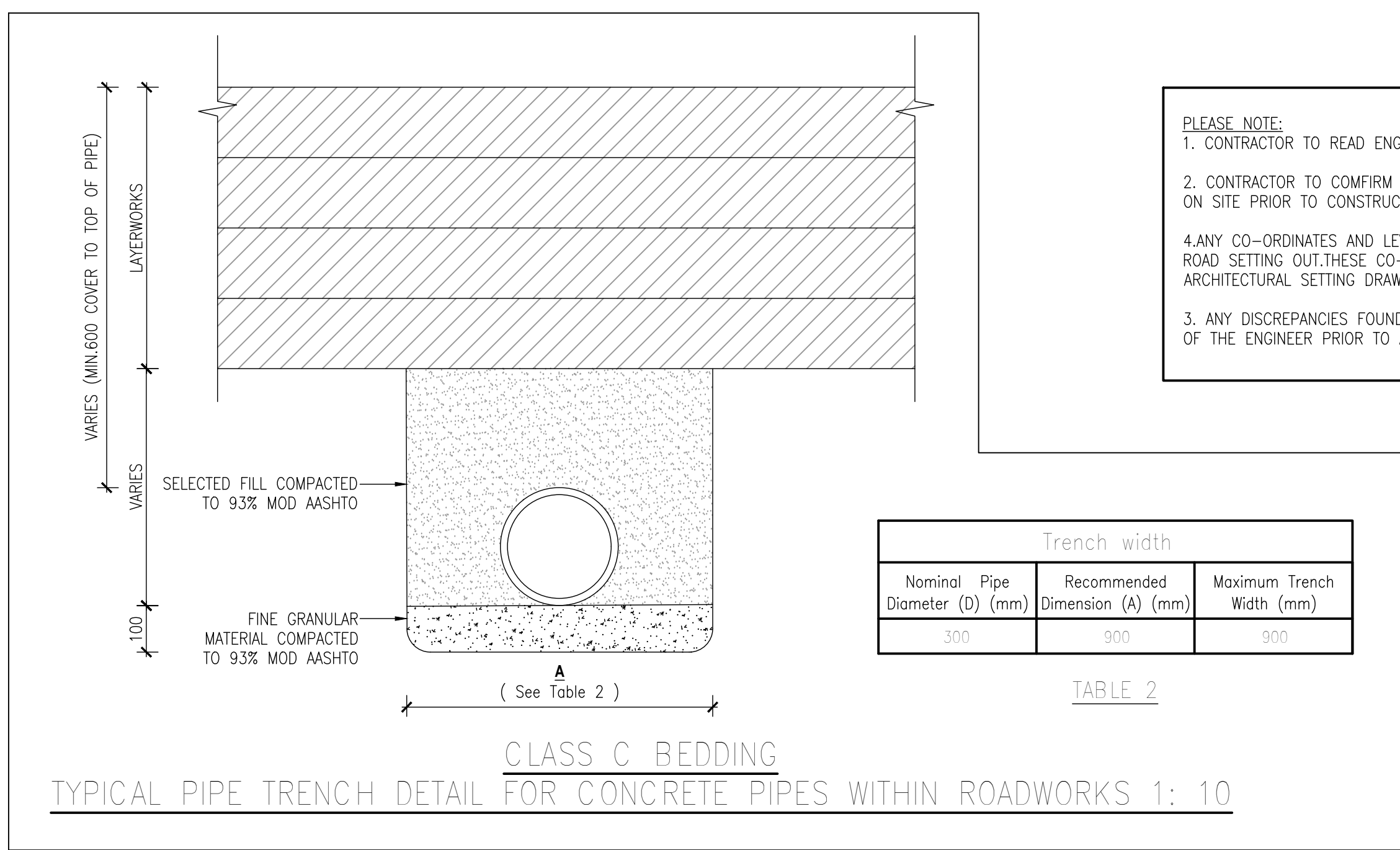
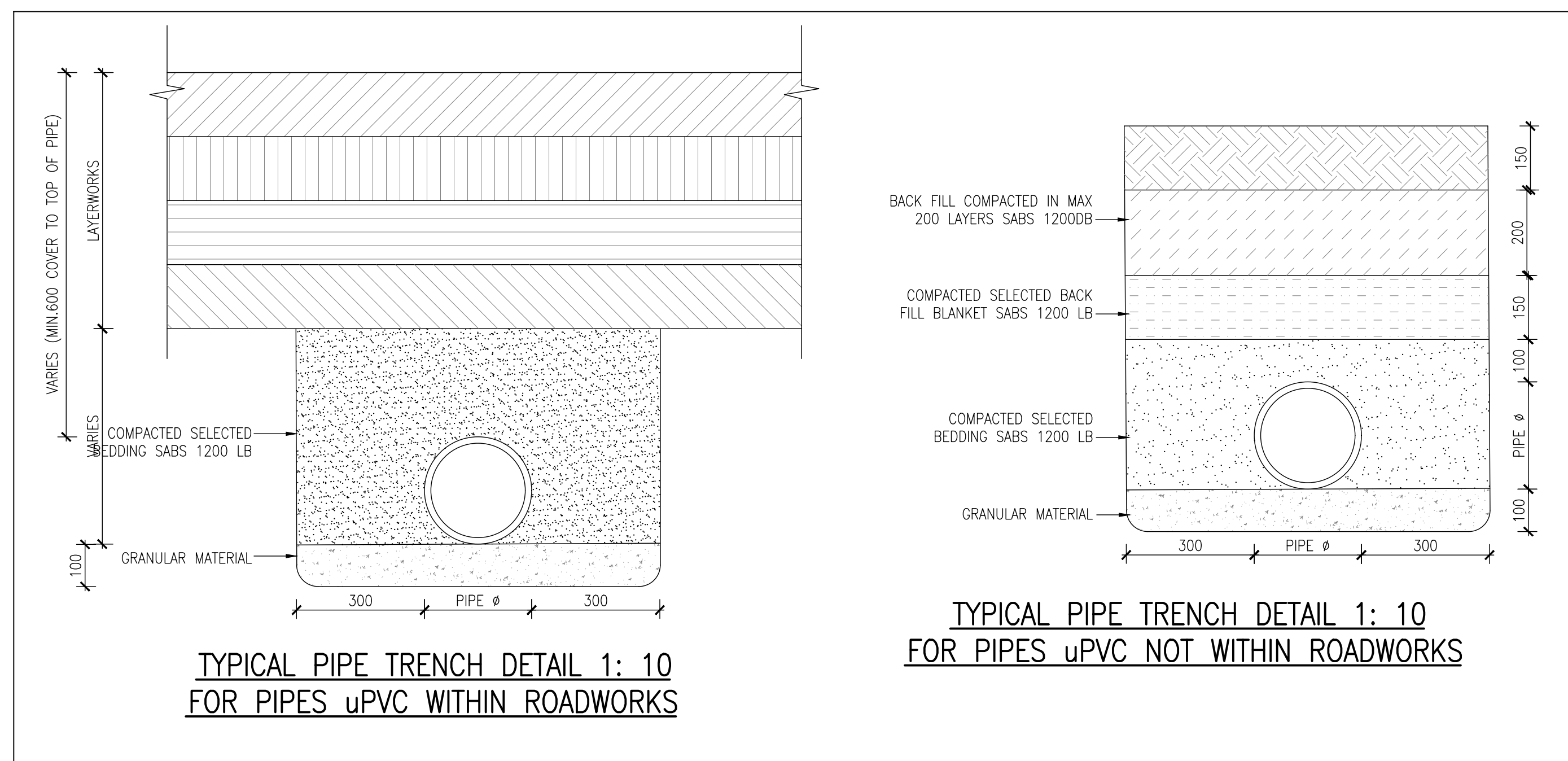
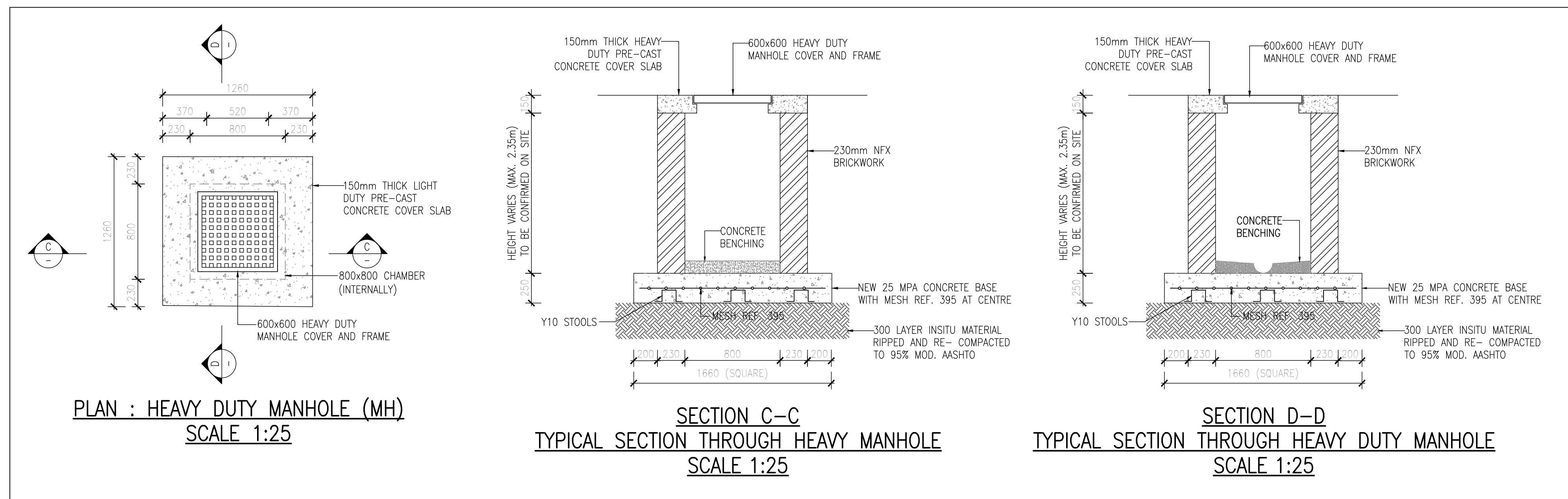
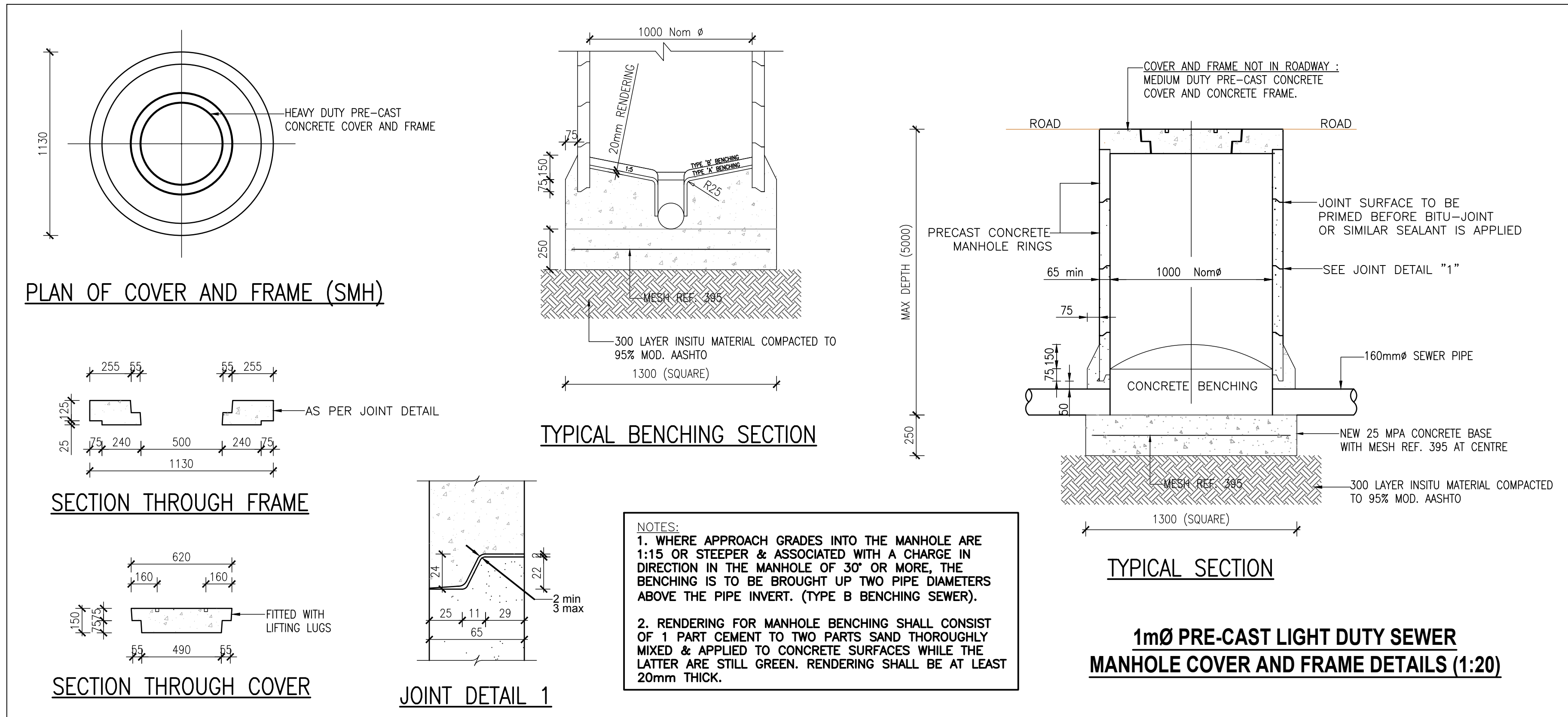
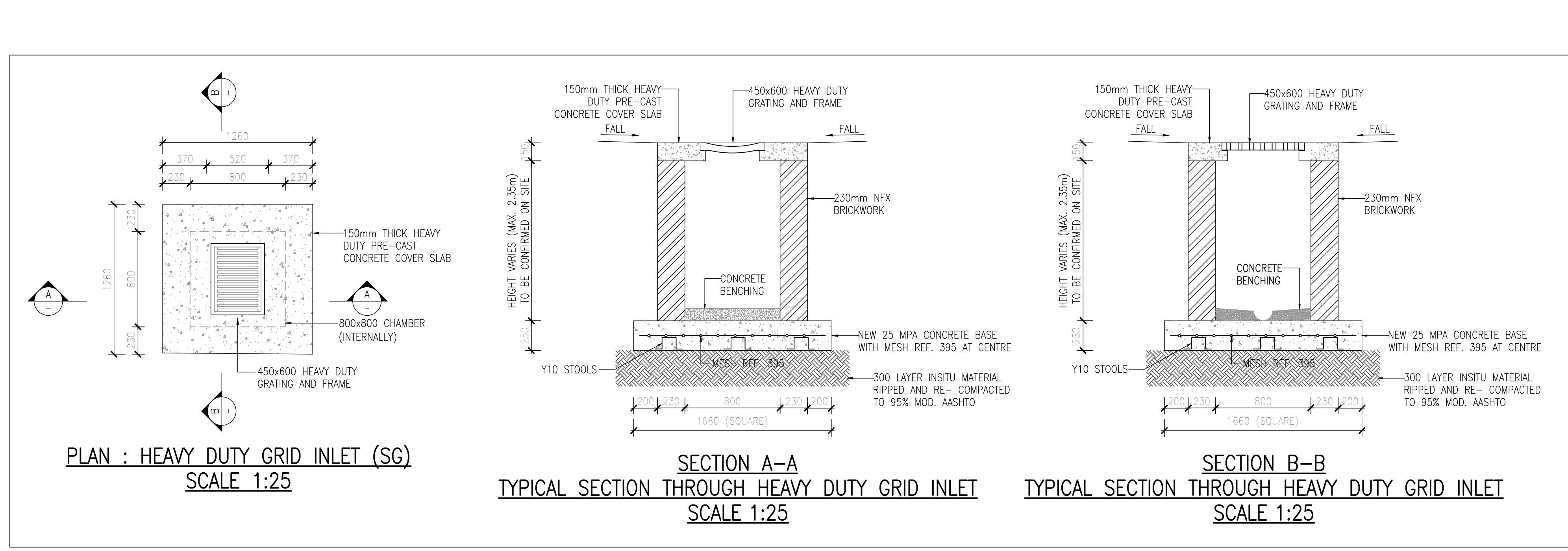
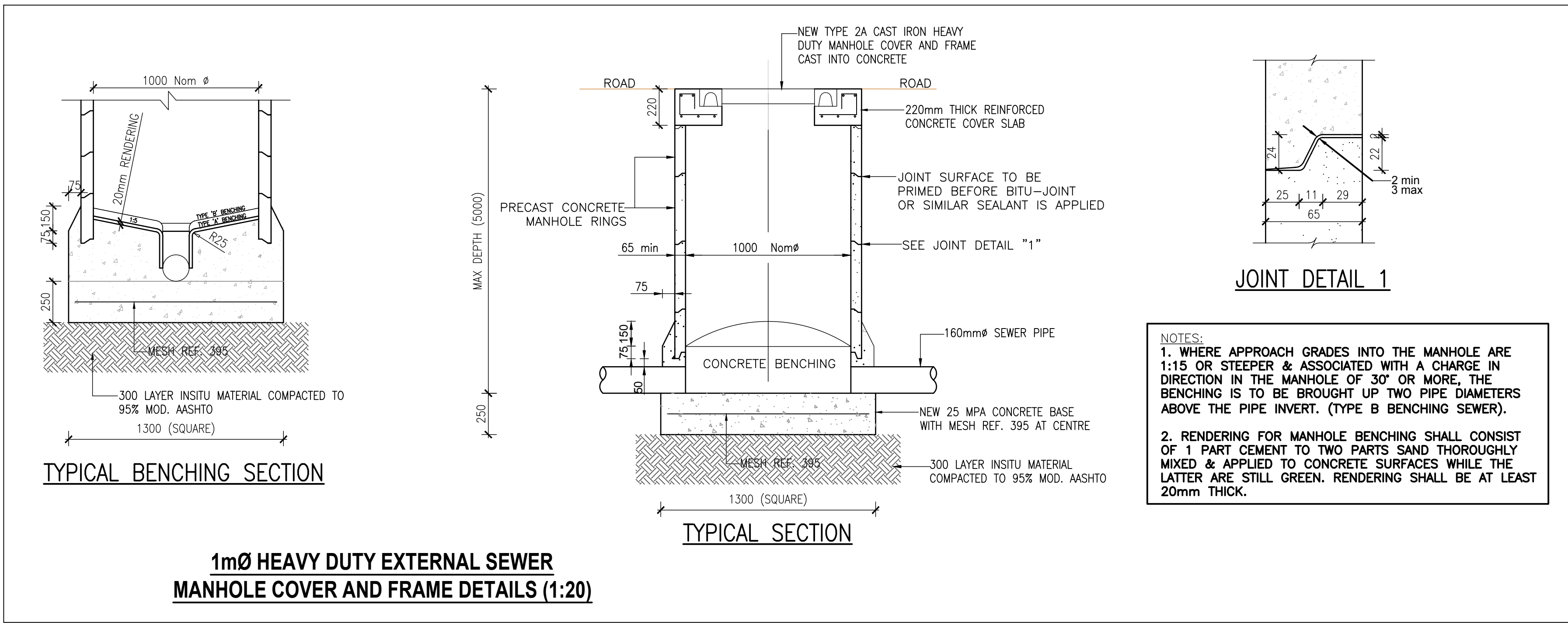
PROPOSED SEWER LAYOUT

SCALE : 1:10000

DRAWING No. 20207-DS-02

REV K

K1-0010-A01.dwg (SCALE) NO SHEET



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REFERENCE DRAWING			

REV	DESCRIPTION	DR	APP	DATE
A	ISSUED FOR INFORMATION	SKM	KH	03/05/23

DESIGNED	INITIALS	SIGN	DATE
DRAWN			
PROJECT ENG.			
APPROVED			

K&T
KANTEY & TEMPLER
CONSULTING ENGINEERS
Engineering African Development
PO BOX 290 HILTON SOUTH AFRICA 3245 TEL +27 33 347 5453

CLIENT LOGO

ASSMANG
1 CAD-BASED SURVEYING COMPANY
No. 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100

CLIENT
CATO RIDGE DEVELOPMENT COMPANY(Pty) Ltd

PROJECT
CATO RIDGE PHASED DEVELOPMENT

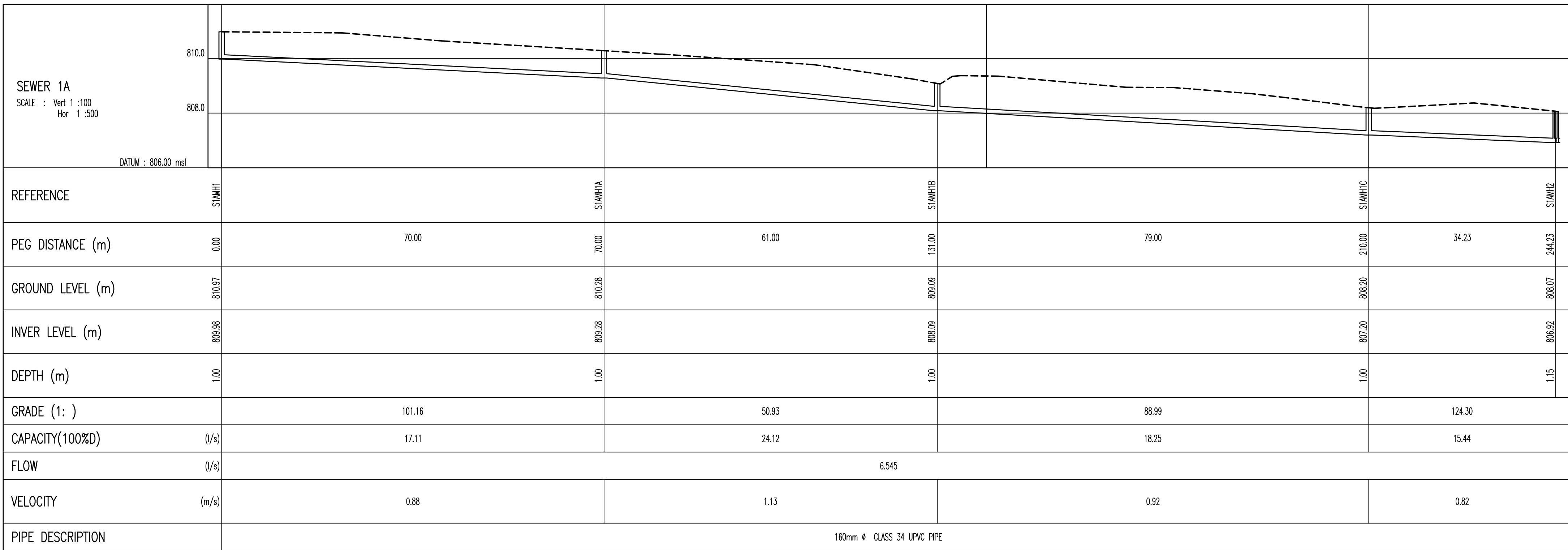
TITLE
SEWER STANDARD DETAILS

SCALE : AS SHOWN

DRAWING No. 20207-CS 01

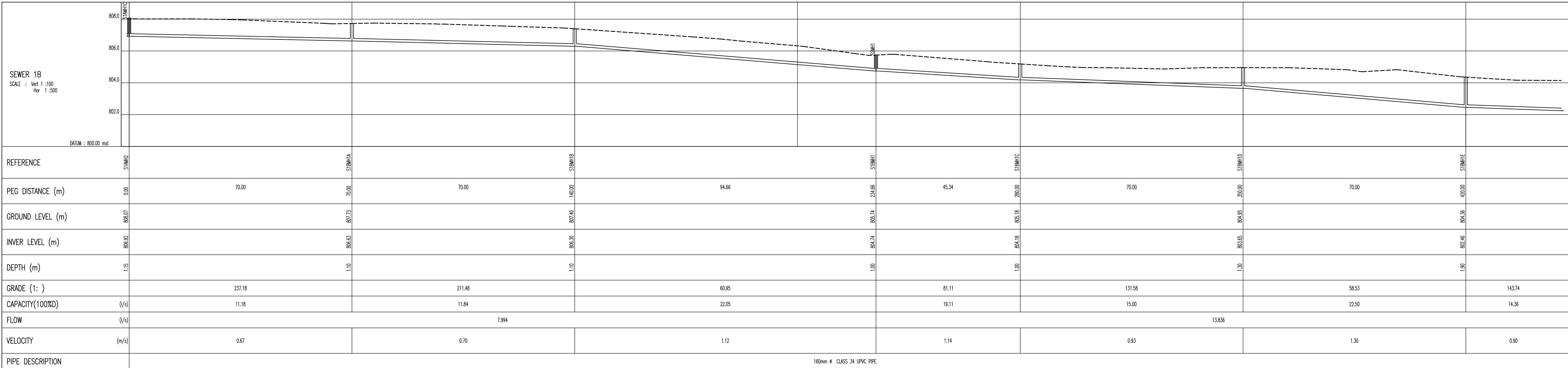
ANNEXURE D

Sewer Longitudinal Drawings



Reference		Pipe lengths (m)	Horiz.	Slope
ST10M1	- ST10M1A	70.000	70.003	
ST10M1A	- ST10M1B	61.000	61.012	
ST10M1B	- ST10M1C	79.000	79.005	
ST10M1C	- ST10M2	34.228	34.229	

Reference		Pipe design data					
		Y	X	IL in	IL out	D in	D out
ST10M1		36308.987	3286821.575	809.975	809.975	1.000	1.000
ST10M1A		36364.192	3286777.282	809.283	809.283	1.000	1.000
ST10M1B		36411.427	3286738.084	808.285	808.285	1.000	1.000
ST10M1C		36472.801	3286688.696	807.198	807.198	1.000	1.000
ST10M2		36488.997	3286666.907	806.922	806.922	1.146	1.146

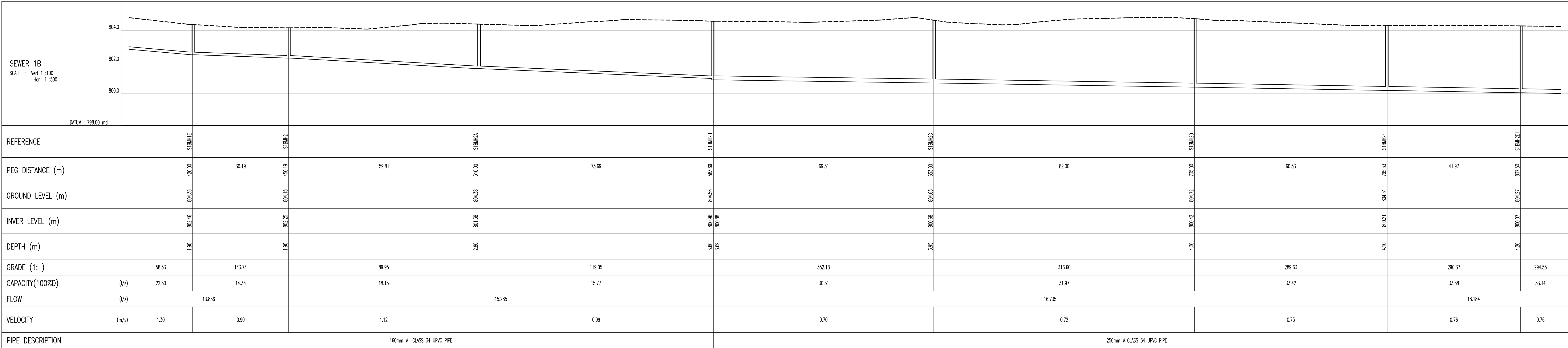


Reference		Pipe lengths (m)		Horiz.	Slope
ST10M2	- ST10M1A	70.000	70.001		
ST10M1A	- ST10M1B	70.000	70.001		
ST10M1B	- ST10M1C	94.662	94.675		
ST10M1C	- ST10M1D	45.341	45.341		
ST10M1D	- ST10M1E	70.000	70.002		
ST10M1E	- ST10M2	70.000	70.000		

Reference		Pipe design data					
		Y	X	IL in	IL out	D in	D out
ST10M2		36498.997	3286666.907	806.922	806.922	1.146	1.146
ST10M1A		36543.847	3286720.651	806.627	806.627	1.100	1.100
ST10M1B		36598.697	3286774.396	806.296	806.296	1.100	1.100
ST10M1C		36649.349	3286827.075	804.743	804.743	1.000	1.000
ST10M1D		36718.398	3286881.885	804.184	804.184	1.000	1.000
ST10M1E		36723.148	3286935.629	803.662	803.662	1.300	1.300
ST10M2		36768.098	3286989.374	802.456	802.456	1.900	1.900

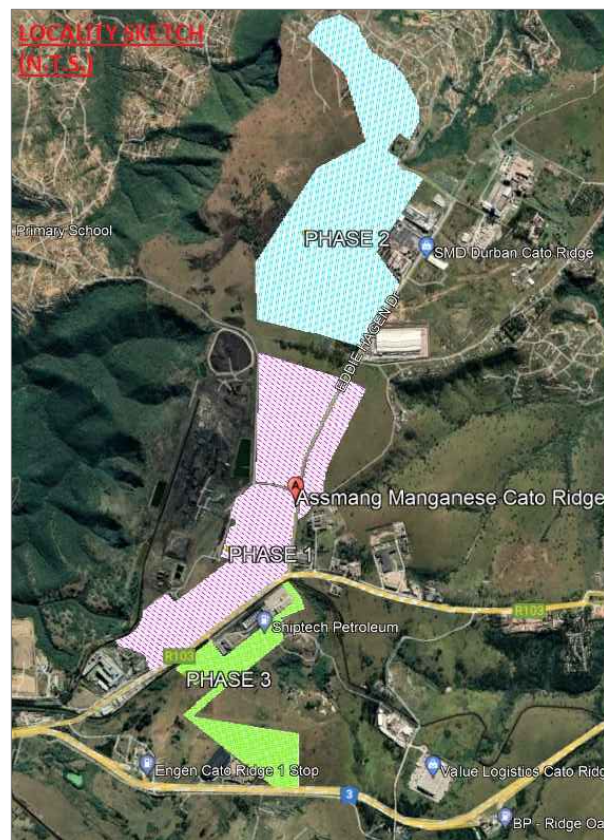
Reference		Pipe lengths (m)		Horiz.	Slope
ST10M1E	- ST10M2	30.185	30.186		
ST10M2	- ST10M2A	58.815	58.819		
ST10M2A	- ST10M2B	73.690	73.693		
ST10M2B	- ST10M2C	69.310	69.310		
ST10M2C	- ST10M2D	82.000	82.000		
ST10M2D	- ST10M2E	60.533	60.533		
ST10M2E	- ST10M2F	41.967	41.967		
ST10M2F	- ST10M2G	40.198	40.198		

Reference		Pipe design data					
		Y	X	IL in	IL out	D in	D out
ST10M1E		36768.098	3286989.374	802.456	802.456	1.900	1.900
ST10M2		36787.438	3287012.549	802.246	802.246	1.900	1.900
ST10M2A		36823.167	3287060.521	801.581	801.581	2.800	2.800
ST10M2B		36867.183	3287119.621	800.962	800.976	3.600	3.686
ST10M2C		36867.892	3287188.300	800.679	800.679	3.950	3.950
ST10M2D		36846.813	3287269.553	800.420	800.420	4.300	4.300
ST10M2E		36838.664	3287329.535	800.211	800.211	4.100	4.100
ST10M2F		36830.695	3287371.481	800.066	800.066	4.200	4.200



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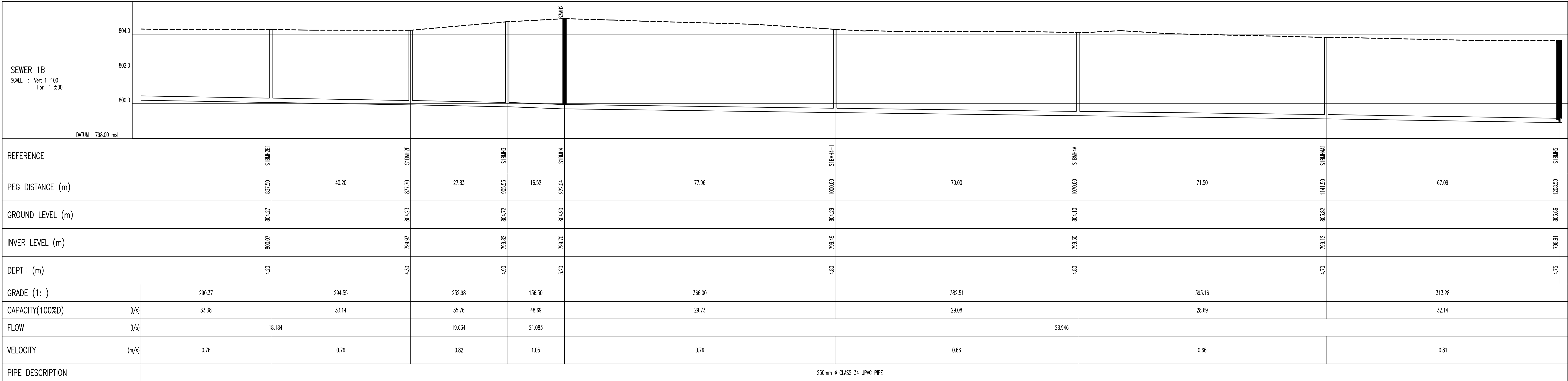
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TITLE
SEWER
LONGITUDINAL SECTIONS
SHEET 1 OF 15

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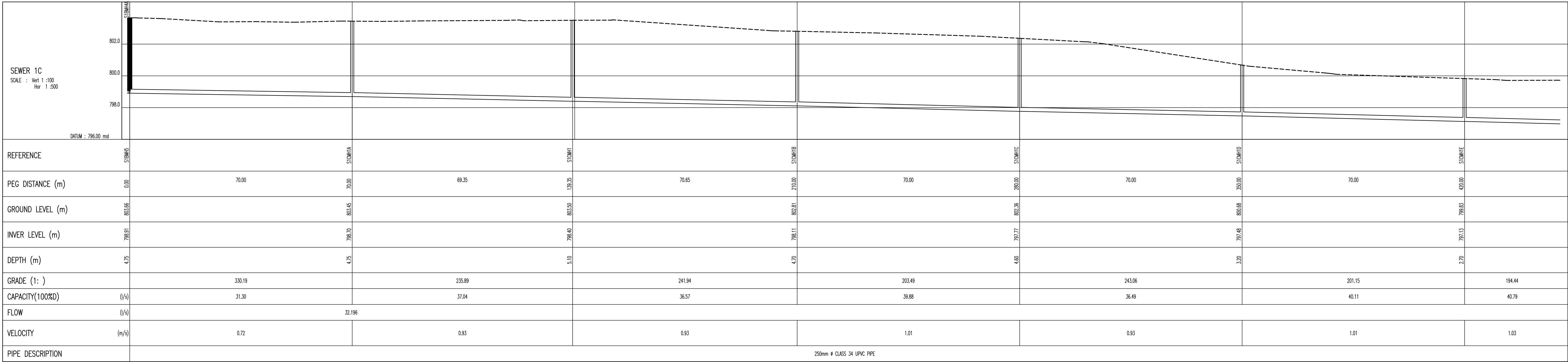
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Pipe lengths (m)		
Reference	Horiz.	Slope
S1BMA2E1 - S1BMA2F	40.198	40.198
S1BMA2F - S1BMA3	27.828	27.828
S1BMA3 - S1BMA4	16.516	16.517
S1BMA4 - S1BMA4-1	77.957	77.958
S1BMA4-1 - S1BMA4	70.000	
S1BMA4 - S1BMA41	71.500	
S1BMA41 - S1BMA5	67.086	67.086

Pipe design data.		
Reference	Y	X
S1BMA2E1	36839.995	3287371.481
S1BMA2F	36841.270	3287411.659
S1BMA3	36816.690	3287424.630
S1BMA4	36807.510	3287438.387
S1BMA4-1	36824.621	3287514.443
S1BMA4	36839.995	3287562.137
S1BMA41	36855.878	3287652.493
S1BMA5	36870.403	3287717.943

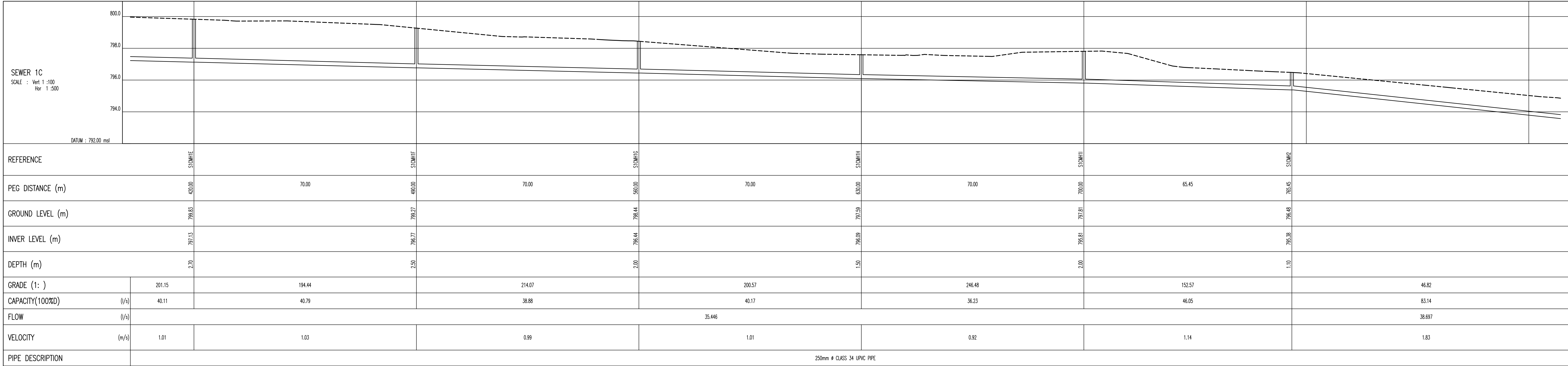


Pipe lengths (m)		
Reference	Horiz.	Slope
S1CMA5 - S1CMA1A	70.000	70.000
S1CMA1A - S1CMA1B	69.353	69.354
S1CMA1B - S1CMA1C	70.667	70.668
S1CMA1C - S1CMA1D	70.000	70.001
S1CMA1D - S1CMA1E	70.000	70.001
S1CMA1E - S1CMA1F	70.000	70.001

Pipe design data.		
Reference	Y	X
S1CMA5	36870.403	3287717.943
S1CMA1A	36878.328	3287787.493
S1CMA1B	36886.190	3287856.400
S1CMA1C	36896.128	3287926.343
S1CMA1D	36895.884	3287995.646
S1CMA1E	36915.841	3288064.948
S1CMA1F	36925.697	3288134.251

Pipe lengths (m)		
Reference	Horiz.	Slope
S1CMA1E - S1CMA1F	70.000	70.001
S1CMA1F - S1CMA1G	70.000	70.001
S1CMA1G - S1CMA1H	70.000	70.001
S1CMA1H - S1CMA1I	70.000	70.001
S1CMA1I - S1CMA1J	65.454	65.455
S1CMA1J - S1CMA1K	197.992	198.037

Pipe design data.		
Reference	Y	X
S1CMA1E	36925.697	3288134.251
S1CMA1F	36935.554	3288203.553
S1CMA1G	36945.410	3288272.856
S1CMA1H	36955.267	3288342.159
S1CMA1I	36965.124	3288411.461
S1CMA1J	36974.980	3288476.263



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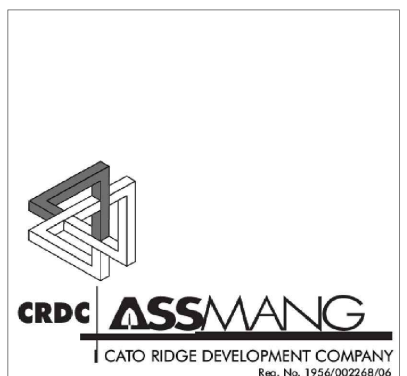
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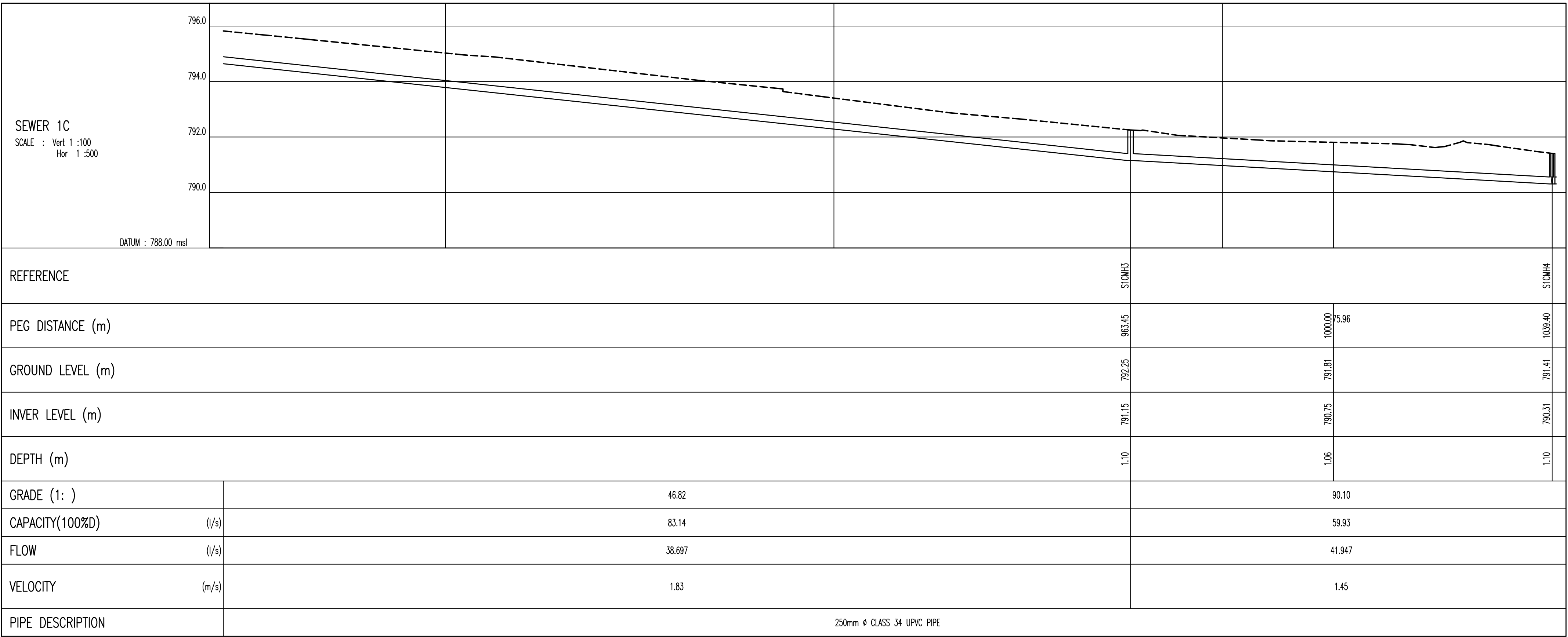
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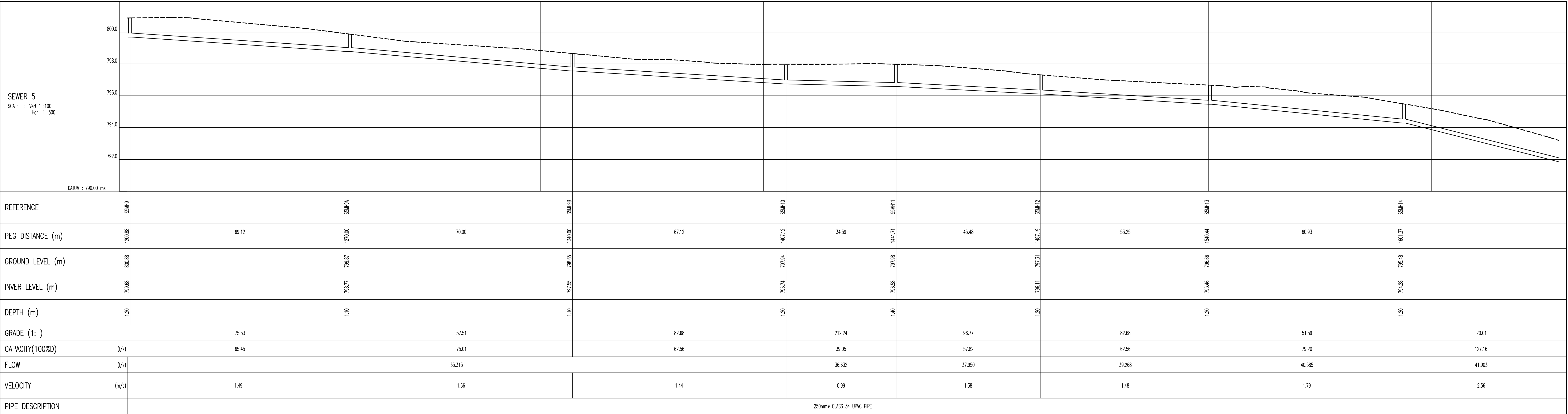
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SHEET 2 OF 15

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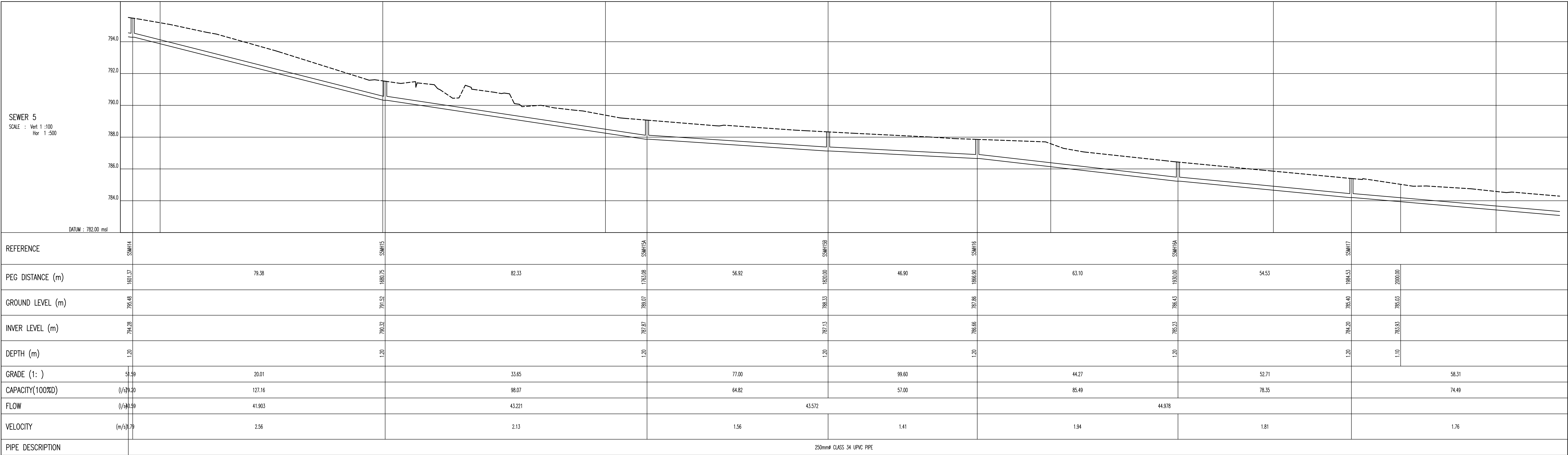
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Pipe lengths (m)			
Reference		Horiz.	Slope
SSMH9	-	SSMH9A	69.12
SSMH9A	-	SSMH9B	70.00
SSMH9B	-	SSMH10	67.12
SSMH10	-	SSMH11	34.59
SSMH11	-	SSMH12	45.48
SSMH12	-	SSMH13	53.25
SSMH13	-	SSMH14	60.940
SSMH14	-	SSMH15	79.382

Pipe design data.							
Reference	Y	X	L in	L out	D in	D out	
SSMH9	36492.872	3283382.552	799.685	799.685	1.200	1.200	
SSMH9A	36530.827	3284443.444	798.770	798.770	1.100	1.100	
SSMH9B	36568.867	328499.076	797.553	797.553	1.100	1.100	
SSMH10	36605.530	328655.293	796.741	796.741	1.200	1.200	
SSMH11	36623.373	3288594.810	796.578	796.578	1.400	1.400	
SSMH12	36639.405	3289627.427	796.108	796.108	1.200	1.200	
SSMH13	36682.978	3289978.511	795.464	795.464	1.200	1.200	
SSMH14	36671.774	3288736.888	794.283	794.283	1.200	1.200	



Pipe lengths (m)			
Reference		Horiz.	Slope
SSMH14	-	SSMH15	79.382
SSMH15	-	SSMH15A	82.328
SSMH15A	-	SSMH15B	56.920
SSMH15B	-	SSMH16	46.904
SSMH16	-	SSMH16A	63.098
SSMH16A	-	SSMH17	54.544
SSMH17	-	SSMH17A	75.466

Pipe design data.							
Reference	Y	X	L in	L out	D in	D out	
SSMH14	36671.774	3288736.888	794.283	794.283	1.200	1.200	
SSMH15	36690.772	3288813.963	790.316	790.316	1.200	1.200	
SSMH15A	36710.530	3288863.885	787.869	787.869	1.200	1.200	
SSMH15B	36724.191	3288946.141	787.130	787.130	1.200	1.200	
SSMH16	36735.447	3288994.672	786.659	786.659	1.200	1.200	
SSMH16A	36750.853	3289055.881	785.234	785.234	1.200	1.200	
SSMH17	36764.169	3289108.744	784.199	784.199	1.200	1.200	

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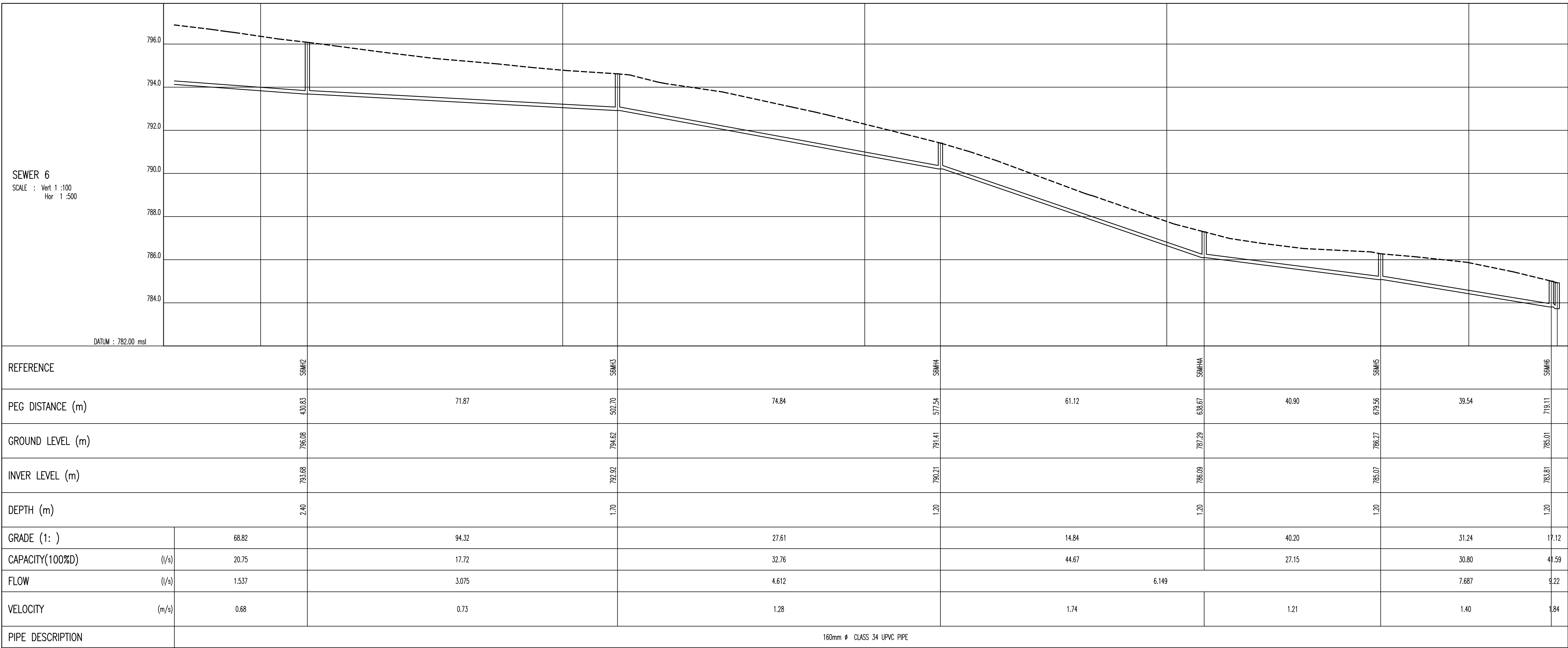
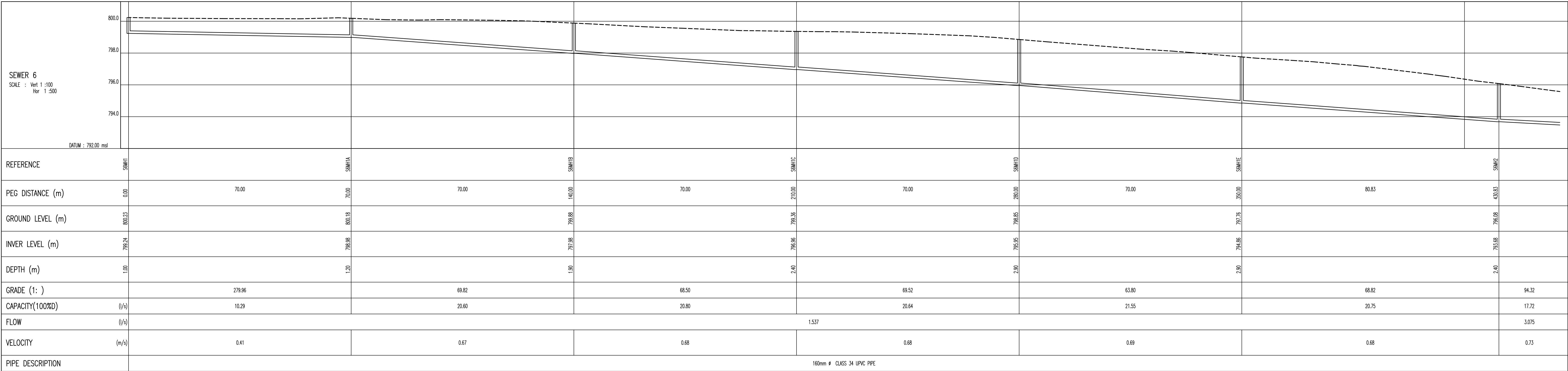
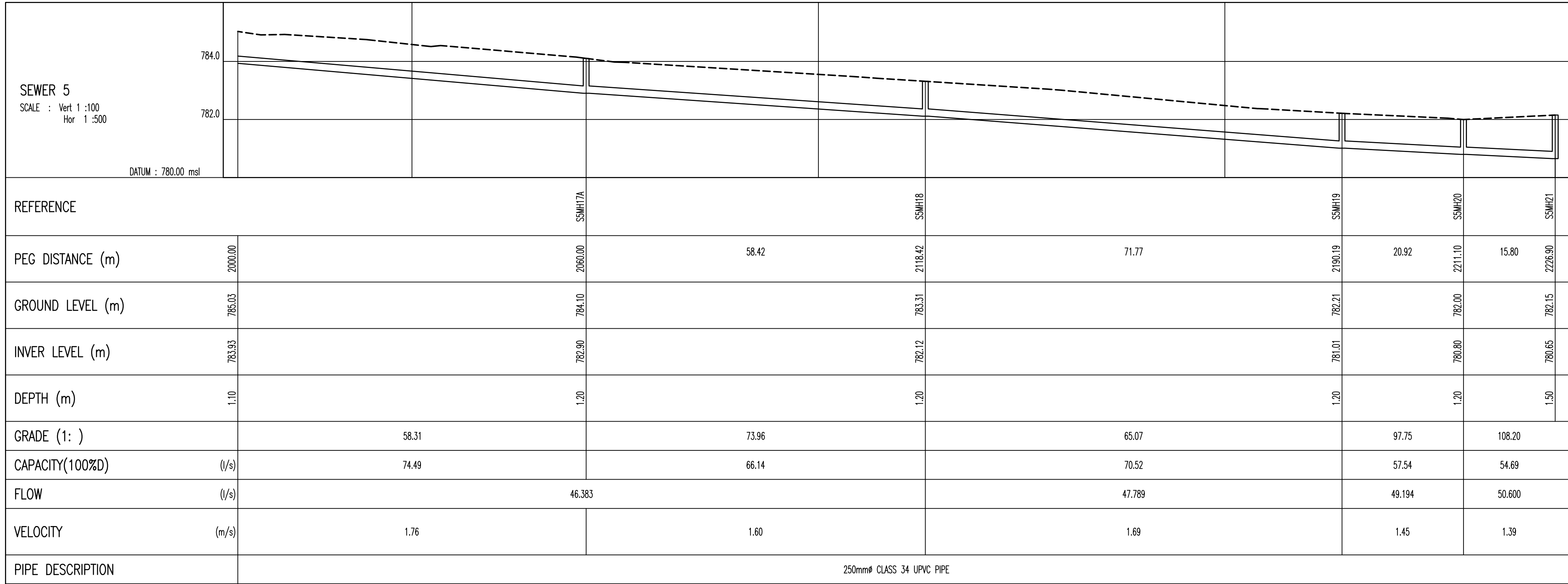
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SHEET 6 OF 15

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Reference	Pipe lengths (m)	Horiz.	Slope
SMWH17A - SMWH18	58.417	58.422	
SMWH18 - SMWH19	71.769	71.778	
SMWH19 - SMWH20	20.919	20.919	
SMWH20 - SMWH21	15.796	15.797	

Reference	Y	Pipe design data. X	IL in	IL out	D in	D out
SMWH17A	36785.122	3389181.343	782.905	782.905	1.200	1.200
SMWH18	36801.341	3389237.363	782.115	782.115	1.200	1.200
SMWH19	36816.672	3389306.480	781.012	781.012	1.200	1.200
SMWH20	36827.002	3389336.417	780.789	780.789	1.200	1.200
SMWH21	36842.058	3389321.637	780.652	780.652	1.500	1.500

Reference	Pipe lengths (m)	Horiz.	Slope
SMWH1 - SMWH1A	70.000	70.000	
SMWH1A - SMWH1B	70.000	70.007	
SMWH1B - SMWH1C	70.000	70.007	
SMWH1C - SMWH1D	70.000	70.007	
SMWH1D - SMWH1E	70.000	70.009	
SMWH1E - SMWH2	80.827	80.836	
SMWH2 - SMWH3	71.873	71.877	

Reference	Y	Pipe design data. X	IL in	IL out	D in	D out
SMWH1	36195.872	3388256.615	799.235	799.235	1.000	1.000
SMWH1A	36234.780	3388314.913	798.885	798.885	1.200	1.200
SMWH1B	36273.588	3388373.131	797.982	797.982	1.900	1.900
SMWH1C	36312.395	3388431.388	796.960	796.960	2.400	2.400
SMWH1D	36351.203	3388489.646	795.954	795.954	2.900	2.900
SMWH1E	36390.011	3388547.904	794.856	794.856	2.900	2.900
SMWH2	36434.821	3388615.173	793.682	793.682	2.400	2.400

Reference	Pipe lengths (m)	Horiz.	Slope
SMWH2 - SMWH3	71.873	71.877	
SMWH3 - SMWH4	74.841	74.850	
SMWH4 - SMWH5	61.124	61.263	
SMWH5 - SMWH6	40.899	40.910	
SMWH6 - SMWH7	35.544	35.564	
SMWH7 - SMWH8	1.357	1.389	

Reference	Y	Pipe design data. X	IL in	IL out	D in	D out
SMWH2	36434.821	3388615.173	793.682	793.682	2.400	2.400
SMWH3	36467.628	3388678.887	792.800	792.800	1.700	1.700
SMWH4	36494.844	3388748.800	790.209	790.209	1.200	1.200
SMWH5	36508.061	3388808.479	786.091	786.091	1.200	1.200
SMWH6	36515.904	3388864.406	785.074	785.074	1.200	1.200
SMWH7	36538.781	3388881.320	783.808	783.808	1.200	1.200
SMWH8	36559.082	3388962.704	783.727	783.727	1.200	1.200

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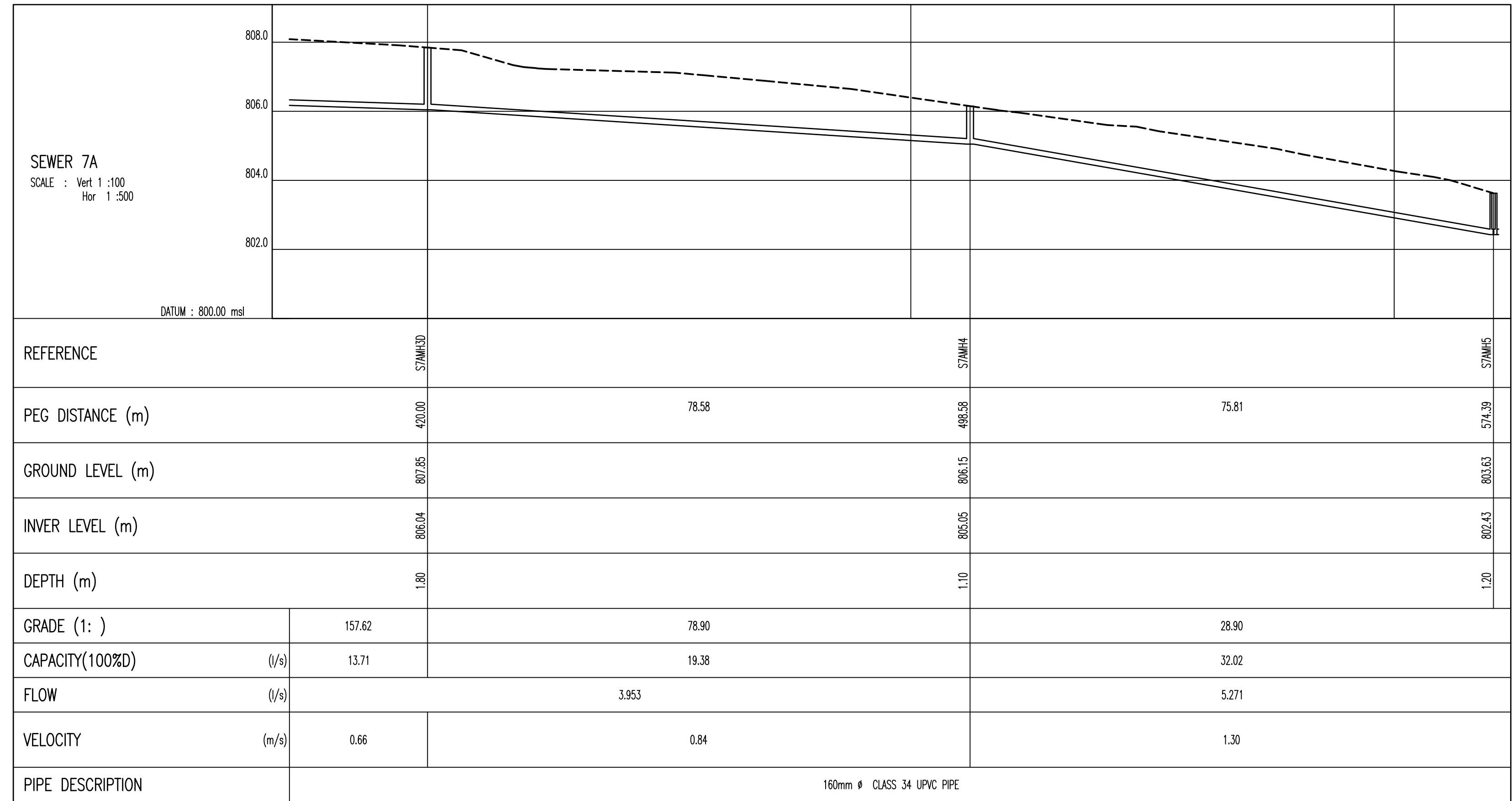
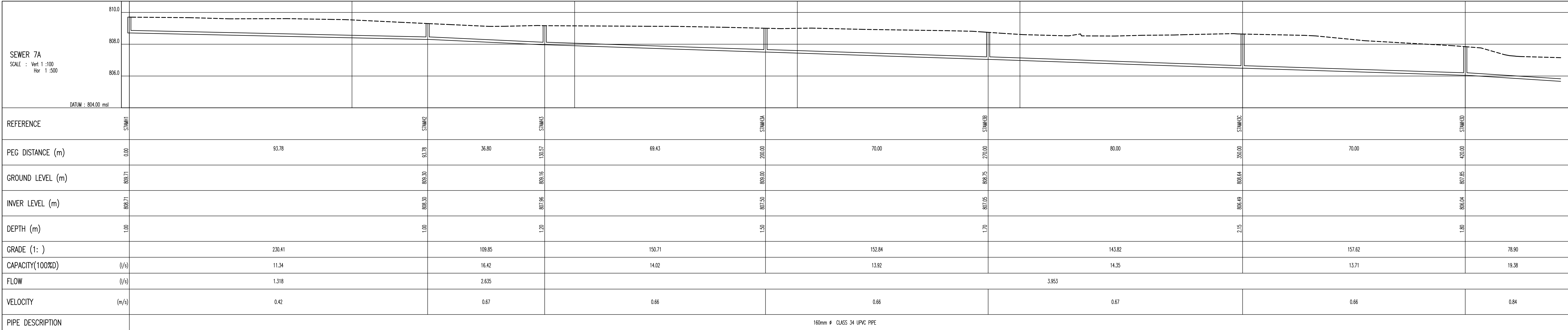
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LONGITUDINAL SECTIONS
SHEET 7 OF 15

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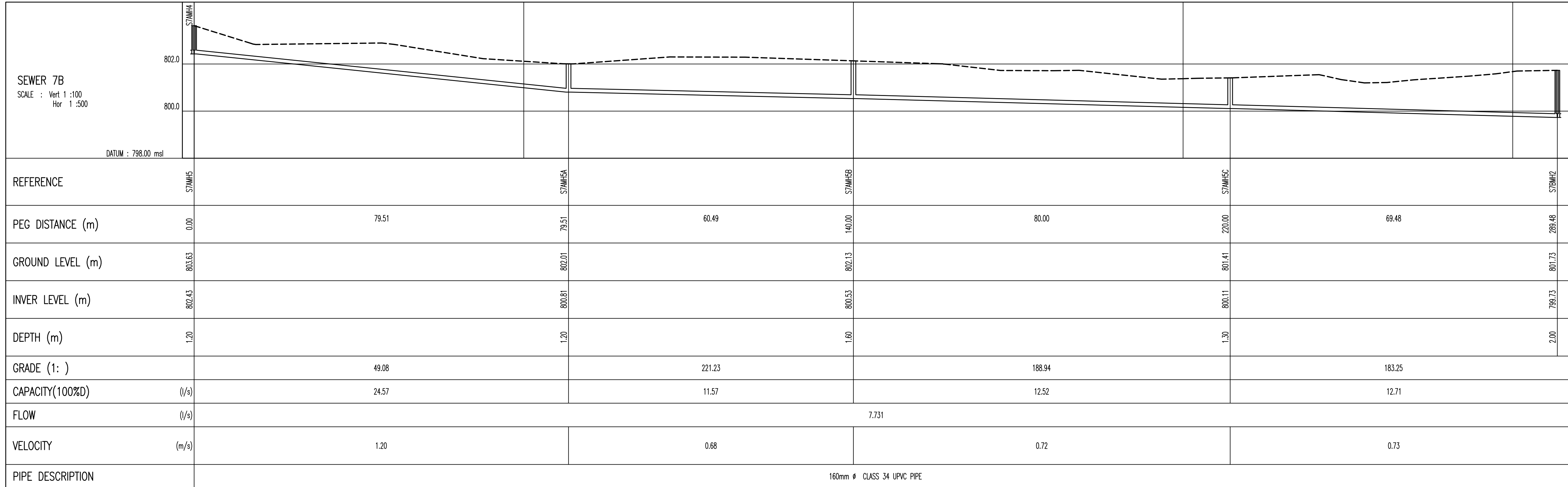


Reference	Pipe lengths (m)		
	Horiz.	Slope	
STAMH1 - STAMH2	93.76	93.777	
STAMH2 - STAMH3	36.799	36.800	
STAMH3 - STAMH4	69.435	69.437	
STAMH4 - STAMH5	70.000	70.001	
STAMH5 - STAMH6	80.000	80.002	
STAMH6 - STAMH7	70.000	70.001	
STAMH7 - STAMH8	78.902	78.908	

Reference	Pipe design data.						
	Y	X	IL in	IL out	D in	D out	
STAMH1	36121.713	3286399.230	806.706	806.706	1.000	1.000	
STAMH2	36194.343	3286339.910	806.299	806.299	1.000	1.000	
STAMH3	36177.086	3286311.489	807.864	807.864	1.200	1.200	
STAMH4	36106.025	3286287.128	807.503	807.503	1.500	1.500	
STAMH5	36040.446	3286262.645	807.245	807.245	1.700	1.700	
STAMH6	35995.469	3286244.665	806.489	806.489	2.150	2.150	
STAMH7	35899.920	3286210.183	806.045	806.045	1.800	1.800	

Reference	Pipe lengths (m)		
	Horiz.	Slope	
STAMH3 - STAMH4	78.582	78.588	
STAMH4 - STAMH5	73.808	73.854	

Reference	Pipe design data.						
	Y	X	IL in	IL out	D in	D out	
STAMH3	35899.920	3286210.183	806.045	806.045	1.800	1.800	
STAMH4	35806.301	3286182.899	805.049	805.049	1.100	1.100	
STAMH5	35751.447	3286170.709	802.426	802.426	1.200	1.200	



Reference	Pipe lengths (m)		
	Horiz.	Slope	
STAMH5 - STAMH6	79.507	79.504	
STAMH6 - STAMH7	60.493	60.494	
STAMH7 - STAMH8	80.000	80.001	
STAMH8 - STAMH9	69.478	69.479	

Reference	Pipe design data.						
	Y	X	IL in	IL out	D in	D out	
STAMH5	35751.447	3286170.709	802.426	802.426	1.200	1.200	
STAMH6	35687.147	3286112.633	800.806	800.806	1.200	1.200	
STAMH7	35655.833	3286080.445	800.533	800.533	1.600	1.600	
STAMH8	35601.196	3286010.008	800.109	800.109	1.300	1.300	
STAMH9	35553.746	3285959.258	799.730	799.730	2.000	2.000	

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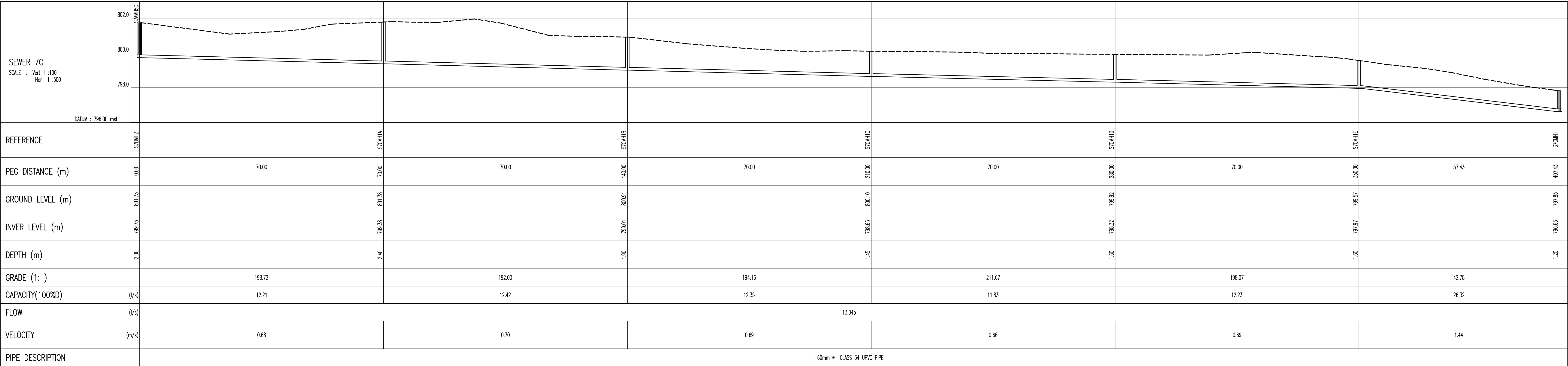
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SHEET 8 OF 15

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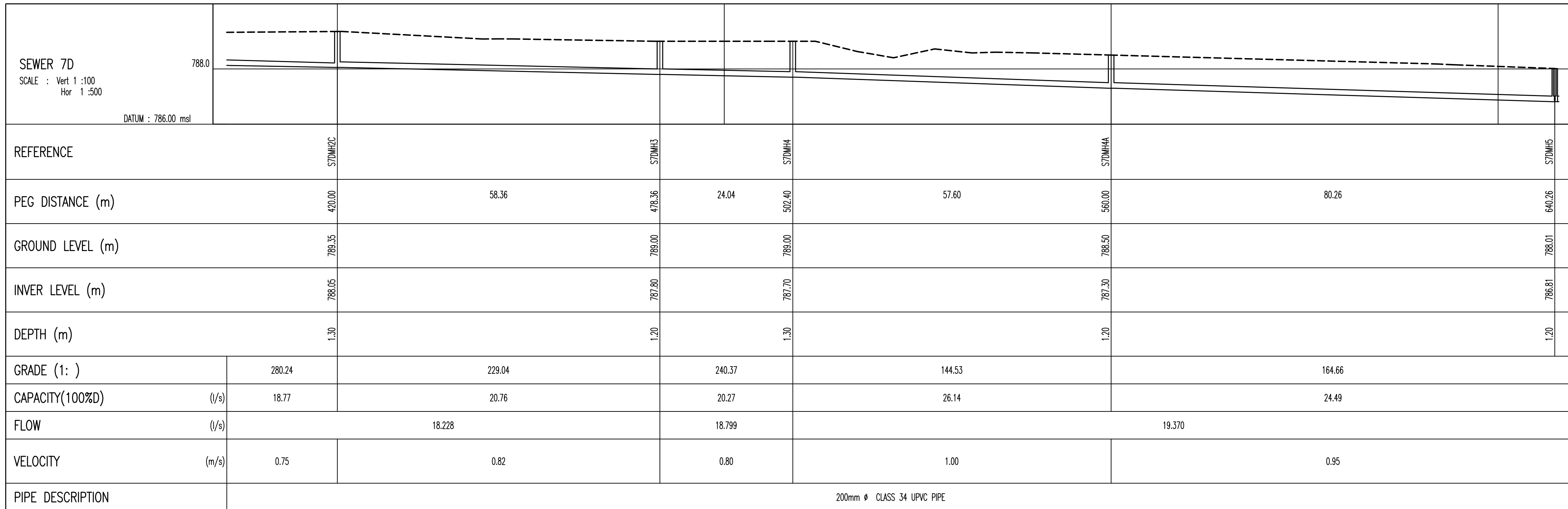
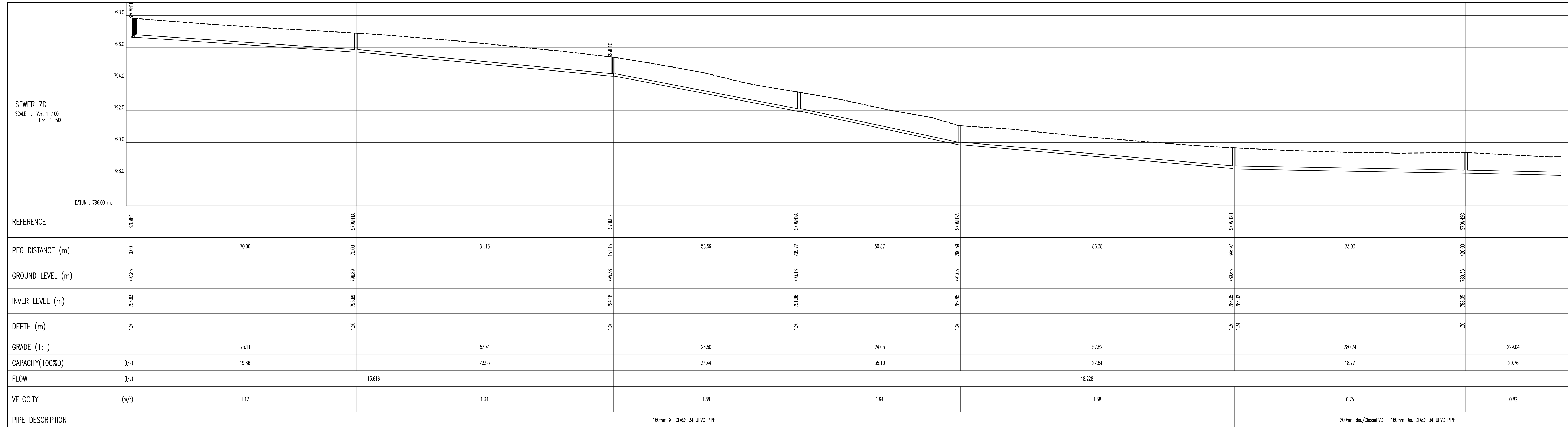
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Reference	Pipe lengths (m)	Horiz.	Slope
STW42	- STW44	70.00	70.001
STW44	- STW48	70.00	70.001
STW48	- STW50	70.00	70.001
STW50	- STW52	70.00	70.001
STW52	- STW54	70.00	70.001
STW54	- STW56	57.428	57.444

Reference	Y	Pipe design data.	X	L in	L out	D in	D out
STW42	35553.746	3285959.259	799.730	799.730	2.000	2.000	
STW44	35604.775	3285911.541	799.378	799.378	2.400	2.400	
STW48	35655.804	3285863.423	799.013	799.013	1.900	1.900	
STW50	35706.832	3285815.506	798.653	798.653	1.400	1.400	
STW52	35757.861	3285767.589	798.322	798.322	1.600	1.600	
STW54	35808.890	3285719.672	797.969	797.969	1.600	1.600	
STW56	35859.754	3285680.300	798.628	798.628	1.200	1.200	



Reference	Pipe lengths (m)	Horiz.	Slope
STW41	- STW44	70.000	70.006
STW44	- STW48	81.137	81.141
STW48	- STW50	58.592	58.634
STW50	- STW52	50.874	50.918
STW52	- STW54	86.376	86.389
STW54	- STW56	73.031	73.031
STW56	- STW58	58.361	58.361

Reference	Y	X	L in	L out	D in	D out
STW41	35800.754	3285680.360	796.626	796.626	1.200	1.200
STW44	35850.558	3285638.694	795.694	795.694	1.200	1.200
STW48	35748.859	3285588.750	794.175	794.175	1.200	1.200
STW50	35792.454	3285539.603	791.964	791.964	1.200	1.200
STW52	35830.305	3285485.617	789.949	789.949	1.200	1.200
STW54	35884.573	3285437.901	788.354	788.354	1.300	1.338
STW56	35948.911	3285389.107	788.055	788.055	1.300	1.300

Reference	Pipe lengths (m)	Horiz.	Slope
STW42	- STW45	58.361	58.361
STW45	- STW48	24.037	24.038
STW48	- STW50	57.602	57.603
STW50	- STW52	80.260	80.262

Reference	Y	X	L in	L out	D in	D out
STW42	35948.911	3285389.107	788.055	788.055	1.300	1.300
STW45	35990.334	3285352.114	787.800	787.800	1.200	1.200
STW48	36004.592	3285329.437	787.700	787.700	1.300	1.300
STW50	36047.102	3285290.567	787.301	787.301	1.200	1.200
STW52	36106.133	3285236.406	786.814	786.814	1.200	1.200

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A	FOR INFORMATION			15/05/23

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	SKM		
PROJECT ENG.	INITIALS	SIGN	DATE
	KH		
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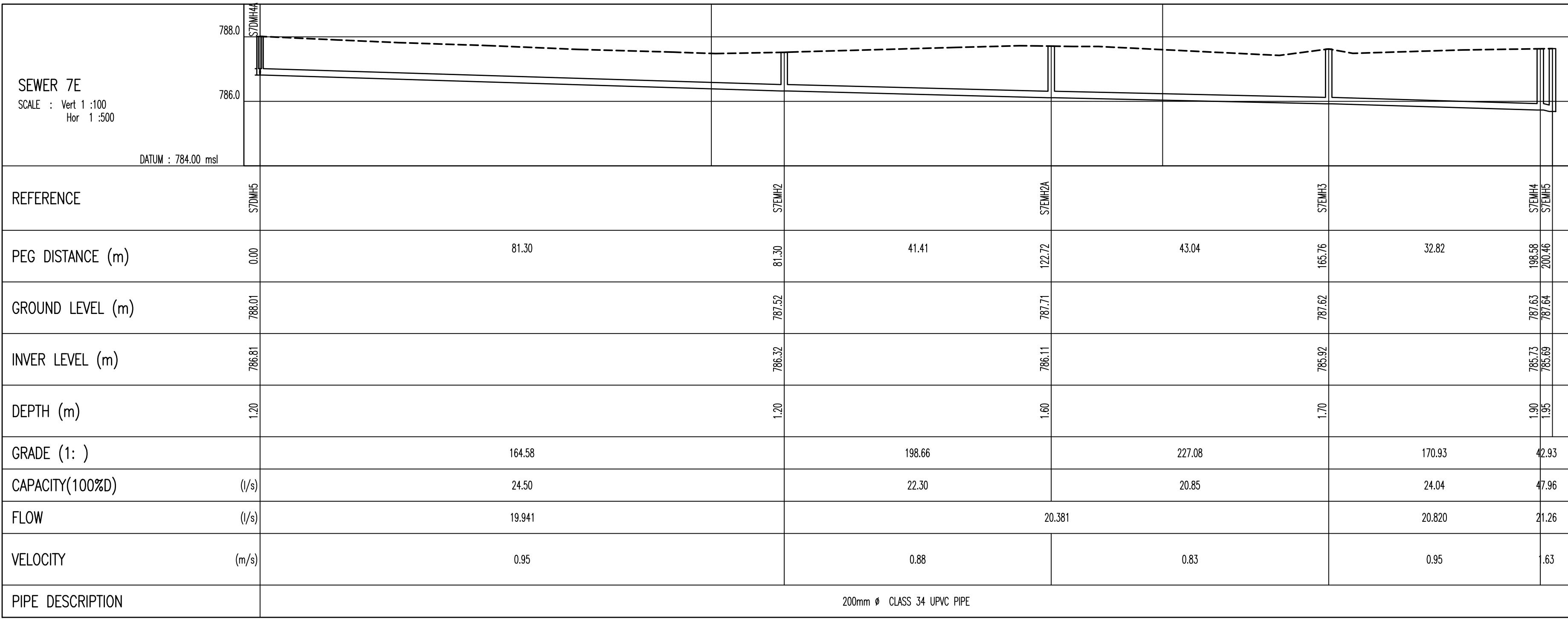
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PHASED DEVELOPMENT

TITLE
SEWER
LONGITUDINAL SECTIONS
SHEET 9 OF 15

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DRAWING No. 20207-DS-11

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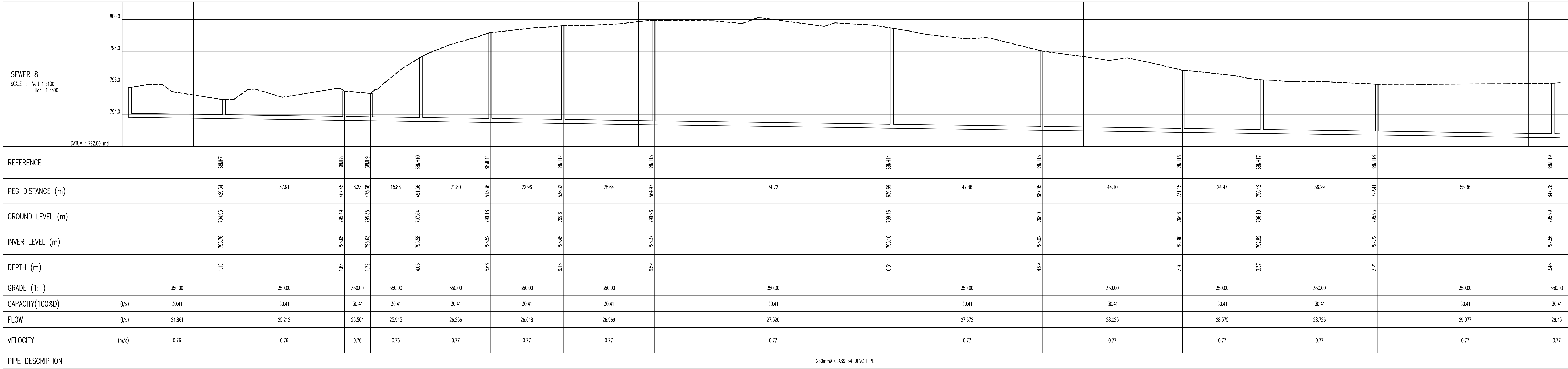
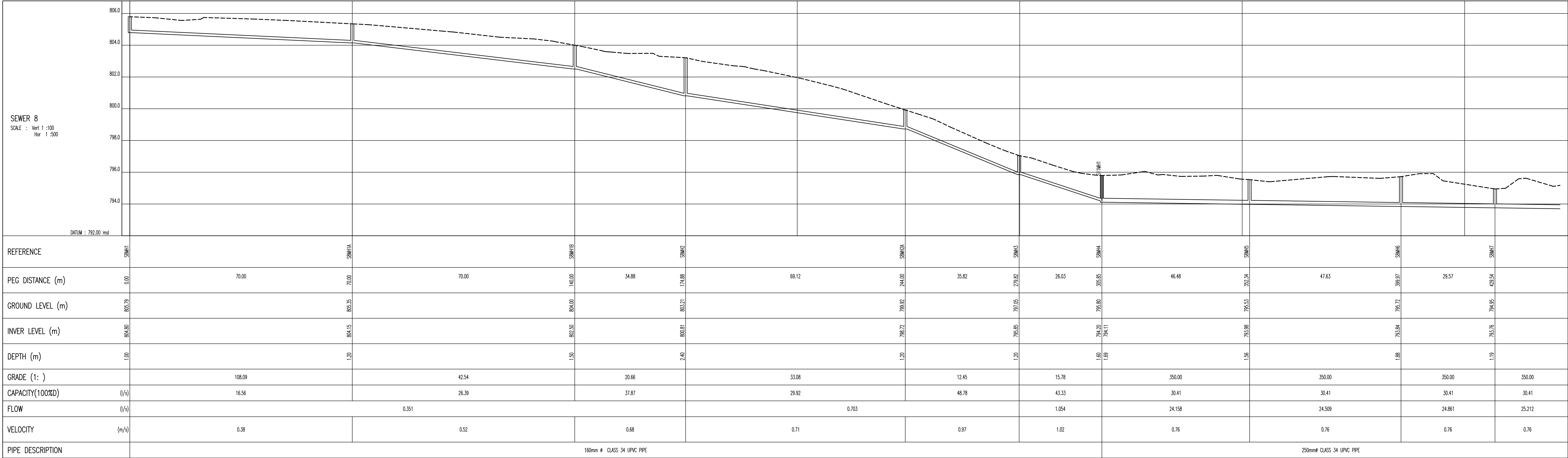
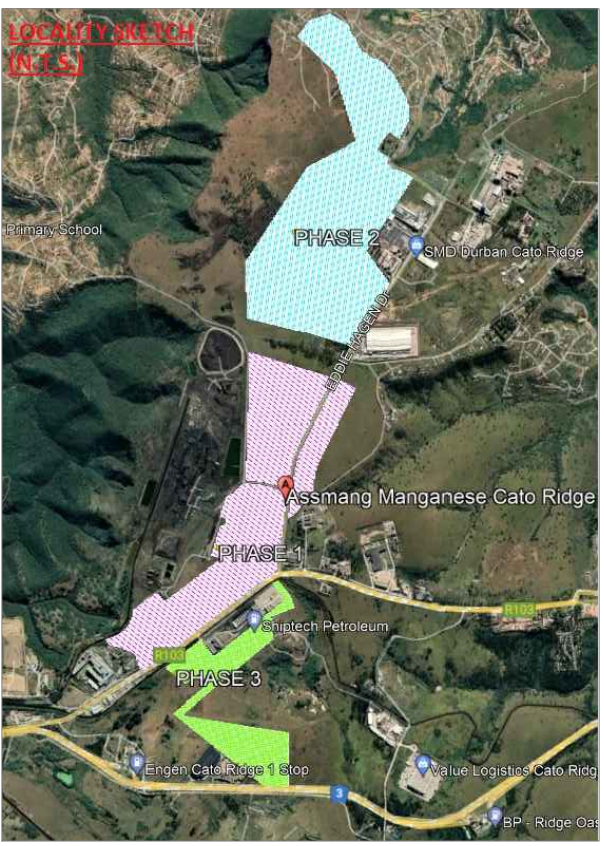


Reference	Pipe lengths (m)		Horiz.	Slope
	STW045	STW046		
STW045	81.305	81.306		
STW046	41.414	41.415		
STW047	43.038	43.039		
STW048	32.818	32.819		
STW049	1.889	1.890		

Reference	Pipe design data.		IL in	IL out	D in	D out
	Y	X				
STW045	35106.333	3285236.406	786.814	786.814	1.200	1.200
STW046	36054.801	3285173.518	786.320	786.320	1.200	1.200
STW047	36074.427	3285164.283	786.112	786.112	1.600	1.600
STW048	35972.470	3285154.707	785.522	785.522	1.700	1.700
STW049	35953.278	3285181.328	785.730	785.730	1.900	1.900
STW050	35952.173	3285182.880	785.686	785.686	1.950	1.950

Reference	Pipe lengths (m)		Horiz.	Slope
	STW011	STW012		
STW011	70.000	70.003		
STW012	34.881	34.882		
STW013	68.119	68.121		
STW014	35.819	35.824		
STW015	26.534	26.537		
STW016	46.485	46.485		
STW017	47.629	47.629		
STW018	29.571	29.571		
STW019	37.913	37.913		

Reference	Pipe design data.		IL in	IL out	D in	D out
	Y	X				
STW01	35807.276	3286399.560	804.795	804.795	1.000	1.000
STW02	35702.783	3286345.586	804.147	804.147	1.200	1.200
STW03	35718.130	3286291.611	802.502	802.502	1.500	1.500
STW04	35695.919	3286264.716	800.813	800.813	2.400	2.400
STW05	35645.172	3286311.859	798.724	798.724	1.200	1.200
STW06	35619.177	3286336.289	795.847	795.847	1.200	1.200
STW07	35594.404	3286328.283	794.197	794.197	1.600	1.600
STW08	35554.008	3286335.134	793.678	793.678	1.556	1.556
STW09	35511.070	3286284.680	793.842	793.842	1.880	1.880
STW10	35488.045	3286268.928	793.737	793.737	1.190	1.190



Reference	Pipe lengths (m)		Horiz.	Slope
	STW021	STW022		
STW021	37.913	37.913		
STW022	467.65	467.65		
STW023	8.23	8.23		
STW024	15.882	15.882		
STW025	21.796	21.796		
STW026	22.961	22.961		
STW027	28.645	28.645		

Reference	Pipe lengths (m)		Horiz.	Slope
	STW028	STW029		
STW028	74.722	74.722		
STW029	47.364	47.364		
STW030	44.095	44.095		
STW031	24.969	24.969		
STW032	36.294	36.294		
STW033	55.364	55.364		
STW034	43.311	43.312		

Reference	Pipe design data.		IL in	IL out	D in	D out
	Y	X				
STW021	35486.045	3286268.926	793.757	793.757	1.190	1.190
STW022	35486.045	3286268.926	793.757	793.757	1.190	1.190
STW023	35486.045	3286268.926	793.757	793.757	1.190	1.190
STW024	35486.045	3286268.926	793.757	793.757	1.190	1.190
STW025	35486.045	3286268.926	793.757	793.757	1.190	1.190
STW026	35486.045	3286268.926	793.757	793.757	1.190	1.190
STW027	35486.045	3286268.926	793.757	793.757	1.190	1.190
STW028	35486.045	3286268.926	793.757	793.757	1.190	1.190
STW029	35486.045	3286268.926	793.757	793.757	1.190	1.190
STW030	35486.045	3286268.926	793.757	793.757	1.190	1.190

Reference	Pipe design data.		IL in	IL out	D in	D out
	Y	X				
STW031	35440.248	3286148.037	793.370	793.370	6.588	6.588
STW032	35419.174	3286096.611	793.157	793.157	6.307	6.307
STW033	35391.962	3286041.844	793.022	793.022	4.992	4.992
STW034	35375.254	3286007.037	792.896	792.896	3.912	3.912
STW035	35371.228	3285982.395	792.824	792.824	3.370	3.370
STW036	35371.387	3285946.101	792.721	792.721	3.205	3.205
STW037	35376.644	3285900.887	792.562	792.562	3.432	3.432

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SKM	SKM		
DRAWN	INITIALS	SIGN	DATE
SKM	SKM		
PROJECT ENG.	INITIALS	SIGN	DATE
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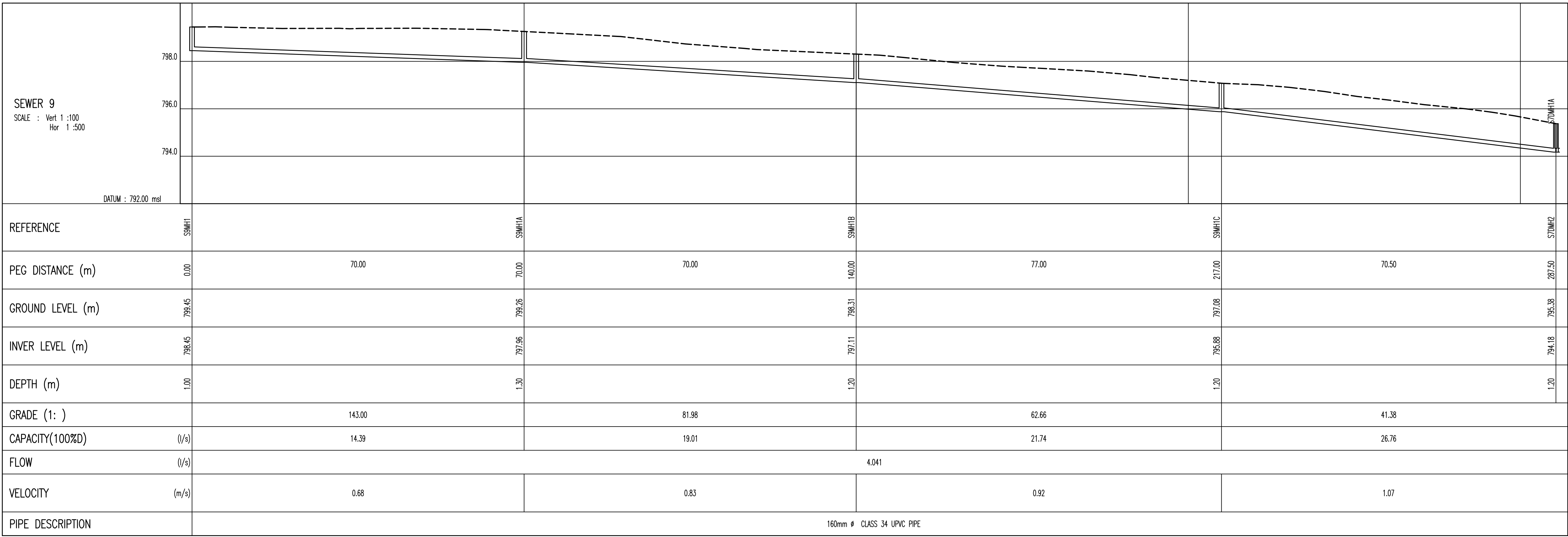


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TITLE
SEWER
LONGITUDINAL SECTIONS
SHEET 10 OF 15

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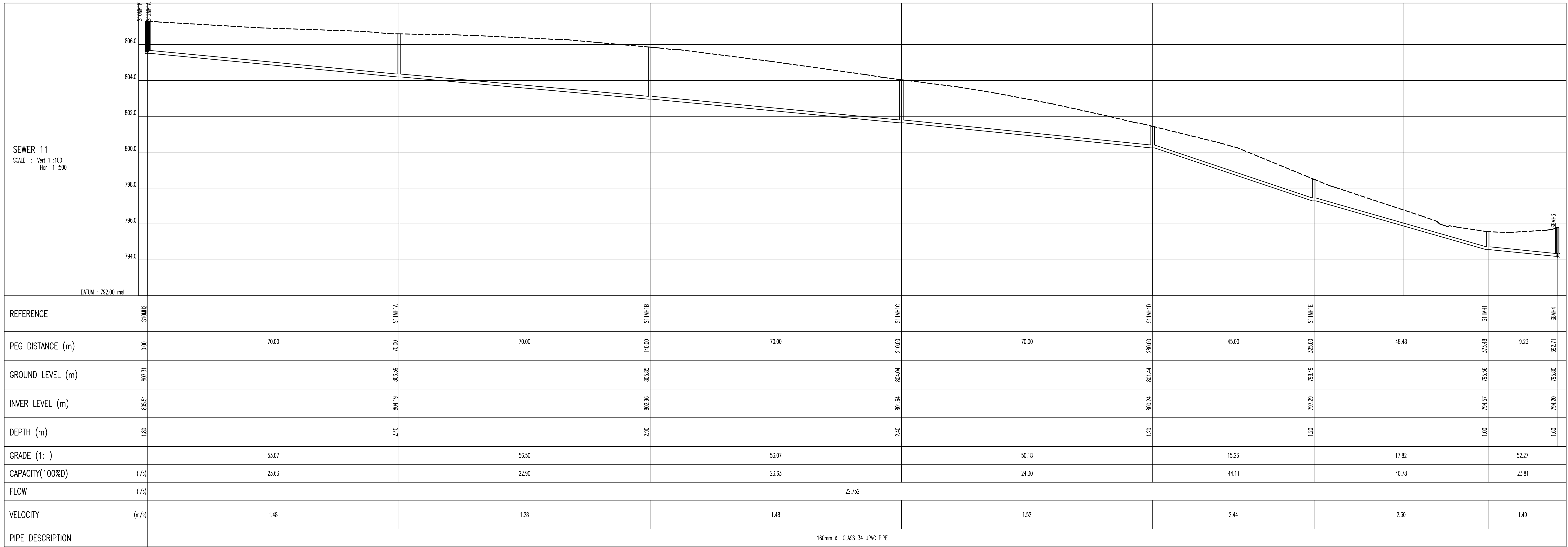
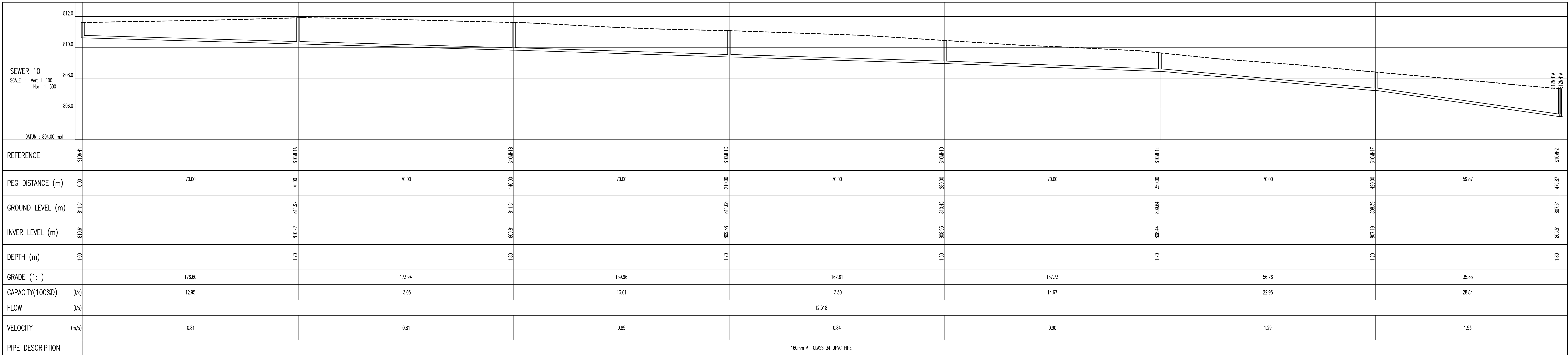


Reference	Pipe lengths (m)	
	Horiz.	Slope
ST0M1A	70.000	70.002
ST0M1B	70.000	70.005
ST0M1C	70.000	77.010
ST0M1D	70.499	70.519

Reference	Pipe design data.					
	Y	X	IL in	IL out	D in	D out
ST0M1A	35536.429	328762.474	798.451	798.451	1.000	1.000
ST0M1B	35688.151	3285715.306	797.961	797.961	1.300	1.300
ST0M1C	35639.874	3285668.138	797.108	797.108	1.200	1.200
ST0M1D	35686.768	3285618.254	795.879	795.879	1.200	1.200
ST0M1E	35748.659	3285596.720	794.175	794.175	1.200	1.200

Reference	Pipe lengths (m)	
	Horiz.	Slope
ST0M1A	70.000	70.001
ST0M1B	70.000	70.001
ST0M1C	70.000	70.001
ST0M1D	70.000	70.002
ST0M1E	70.000	70.011
ST0M1F	59.674	59.698

Reference	Pipe design data.					
	Y	X	IL in	IL out	D in	D out
ST0M1A	36137.104	3287006.838	810.613	810.613	1.000	1.000
ST0M1B	36092.666	3286952.752	810.217	810.217	1.700	1.700
ST0M1C	36048.228	3286898.667	808.814	808.814	1.800	1.800
ST0M1D	36053.790	3286844.581	808.377	808.377	1.700	1.700
ST0M1E	35959.352	3286790.495	808.946	808.946	1.500	1.500
ST0M1F	35914.914	3286736.410	808.438	808.438	1.200	1.200
ST0M1G	35870.476	3286682.324	807.194	807.194	1.200	1.200
ST0M1H	35832.466	3286636.062	805.513	805.513	1.800	1.800



Reference	Pipe lengths (m)	
	Horiz.	Slope
ST0M1A	70.000	70.012
ST0M1B	70.000	70.011
ST0M1C	70.000	70.012
ST0M1D	45.000	45.093
ST0M1E	48.478	48.554
ST0M1F	19.224	19.238

Reference	Pipe design data.					
	Y	X	IL in	IL out	D in	D out
ST0M1A	35632.466	3286636.062	805.513	805.513	1.800	1.800
ST0M1B	35788.028	3286581.976	804.194	804.194	2.400	2.400
ST0M1C	35743.590	3286527.890	802.855	802.855	2.900	2.900
ST0M1D	35699.152	3286473.805	801.536	801.536	2.400	2.400
ST0M1E	35654.714	3286419.719	800.241	800.241	1.200	1.200
ST0M1F	35626.147	3286364.630	797.296	797.296	1.200	1.200
ST0M1G	35595.372	3286307.483	794.465	794.465	1.000	1.000
ST0M1H	35564.404	3286258.283	794.197	794.197	1.600	1.600

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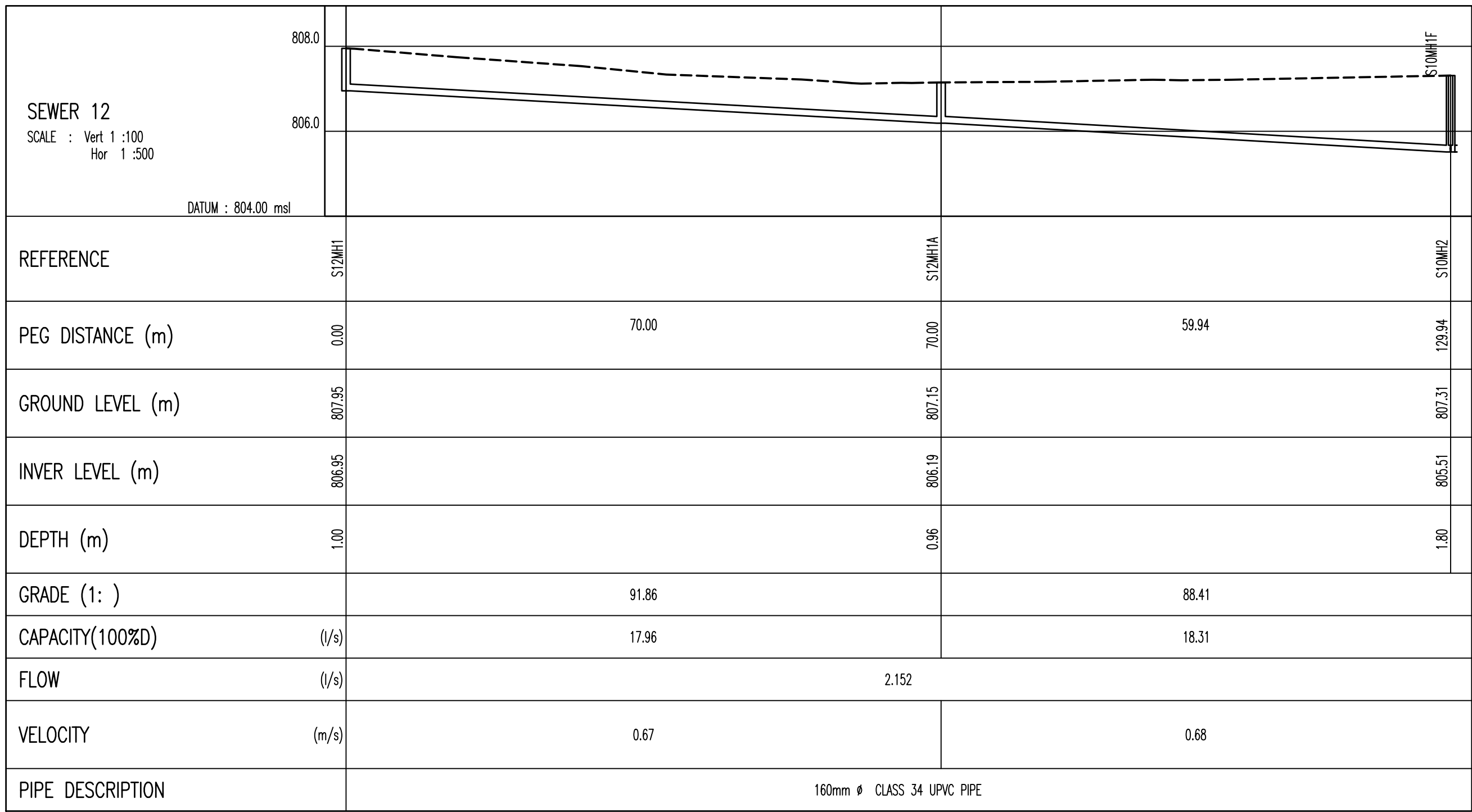
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SHEET 12 OF 15

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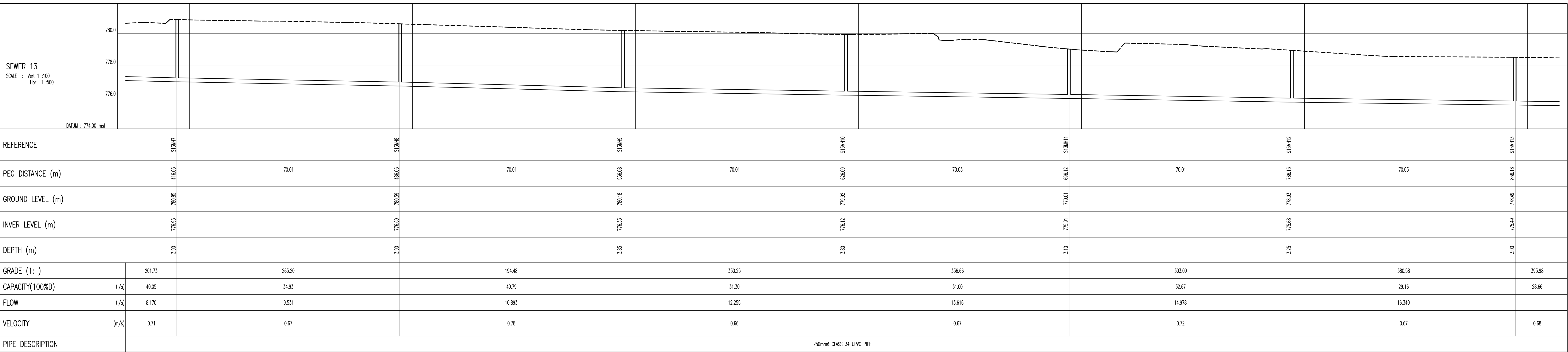
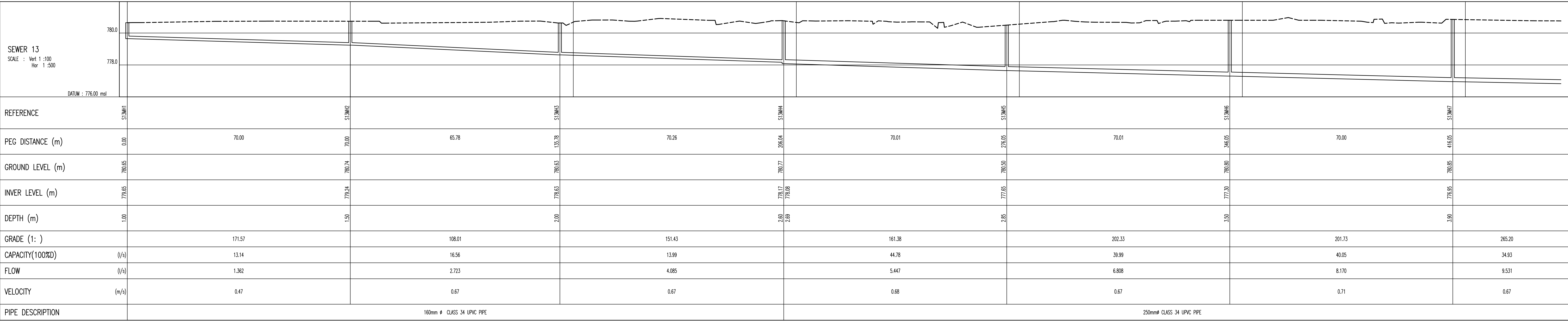
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A



Pipe lengths (m)			
Reference	Horiz.	Slope	
S12WH1 - S12WH1A	70.000	70.004	
S12WH1A - S12WH2	59.839	59.945	

Pipe design data.						
Reference	Y	X	IL in	IL out	D in	D out
S12WH1	25933.293	3289554.088	806.953	806.953	1.000	1.000
S12WH1A	25870.676	3289598.253	806.191	806.191	0.960	0.960
S12WH2	25832.466	3289636.062	805.513	805.513	1.800	1.800



Pipe lengths (m)			
Reference	Horiz.	Slope	
S13WH1 - S13WH1A	70.012	70.012	
S13WH1A - S13WH2	70.014	70.015	
S13WH2 - S13WH3	70.013	70.014	
S13WH3 - S13WH4	70.026	70.026	
S13WH4 - S13WH5	70.014	70.015	
S13WH5 - S13WH6	70.027	70.027	
S13WH6 - S13WH7	73.843	73.843	

Pipe design data.						
Reference	Y	X	IL in	IL out	D in	D out
S13WH1	25933.293	3289554.088	806.953	806.953	1.000	1.000
S13WH1A	25870.676	3289598.253	806.191	806.191	0.960	0.960
S13WH2	25832.466	3289636.062	805.513	805.513	1.800	1.800

Pipe lengths (m)			
Reference	Horiz.	Slope	
S13WH1 - S13WH2	70.000	70.001	
S13WH2 - S13WH3	65.779	65.782	
S13WH3 - S13WH4	70.261	70.263	
S13WH4 - S13WH5	70.005	70.006	
S13WH5 - S13WH6	70.005	70.006	
S13WH6 - S13WH7	69.999	70.000	
S13WH7 - S13WH8	70.012	70.012	

Pipe design data.						
Reference	Y	X	IL in	IL out	D in	D out
S13WH1	25933.293	3289554.088	806.953	806.953	1.000	1.000
S13WH1A	25870.676	3289598.253	806.191	806.191	0.960	0.960
S13WH2	25832.466	3289636.062	805.513	805.513	1.800	1.800

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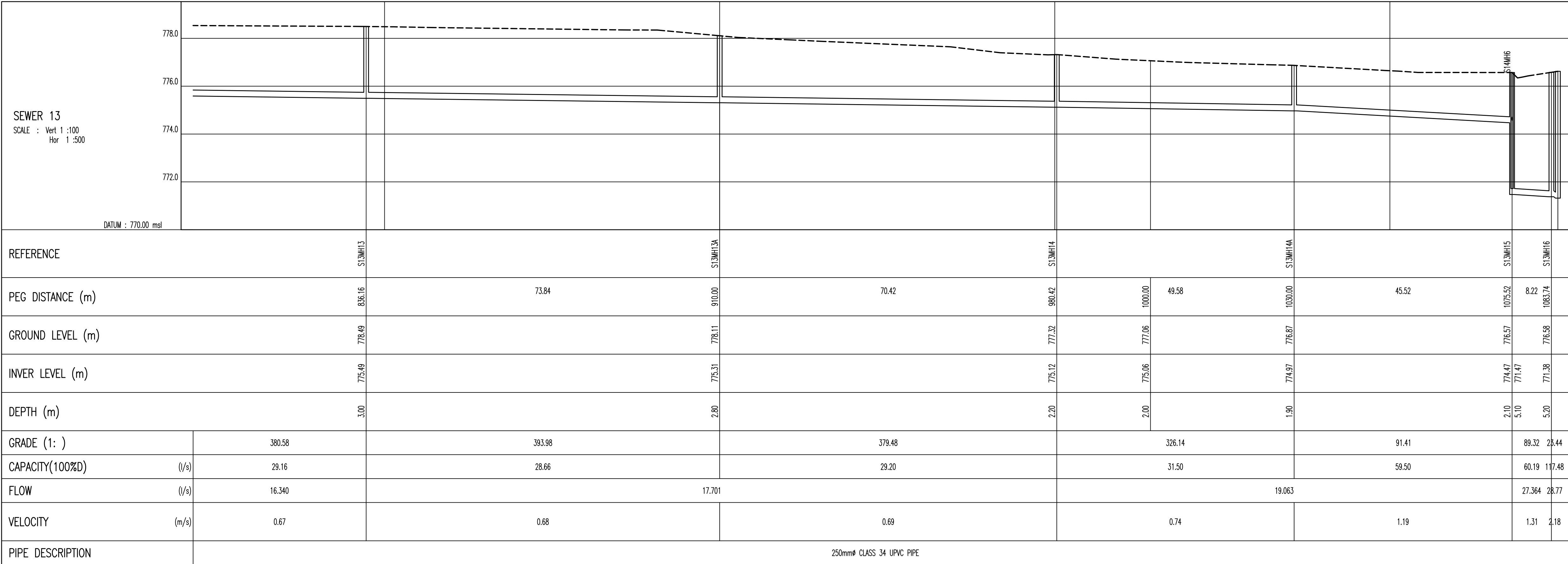


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SEWER LONGITUDINAL SECTIONS SHEET 13 OF 15

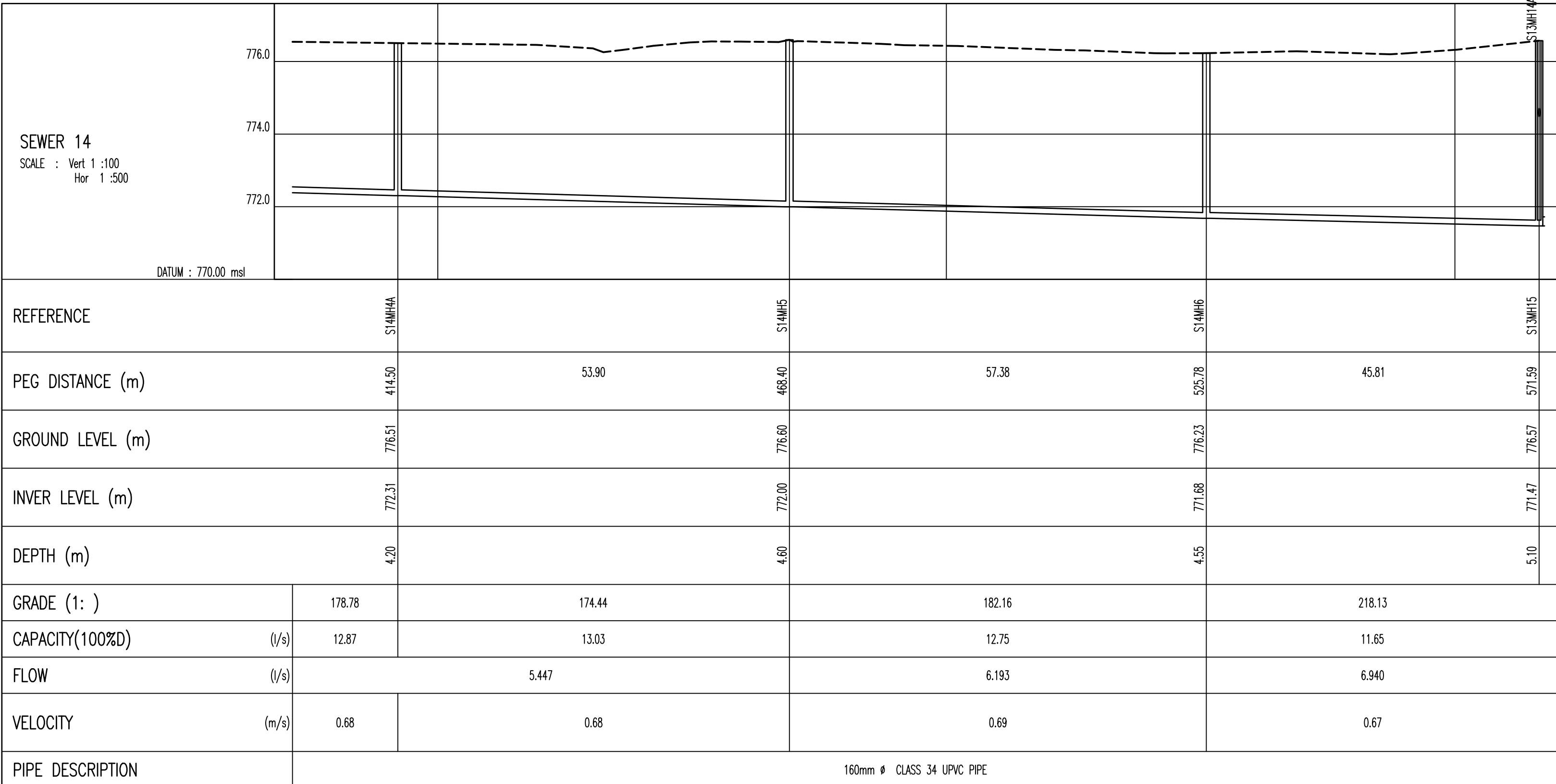
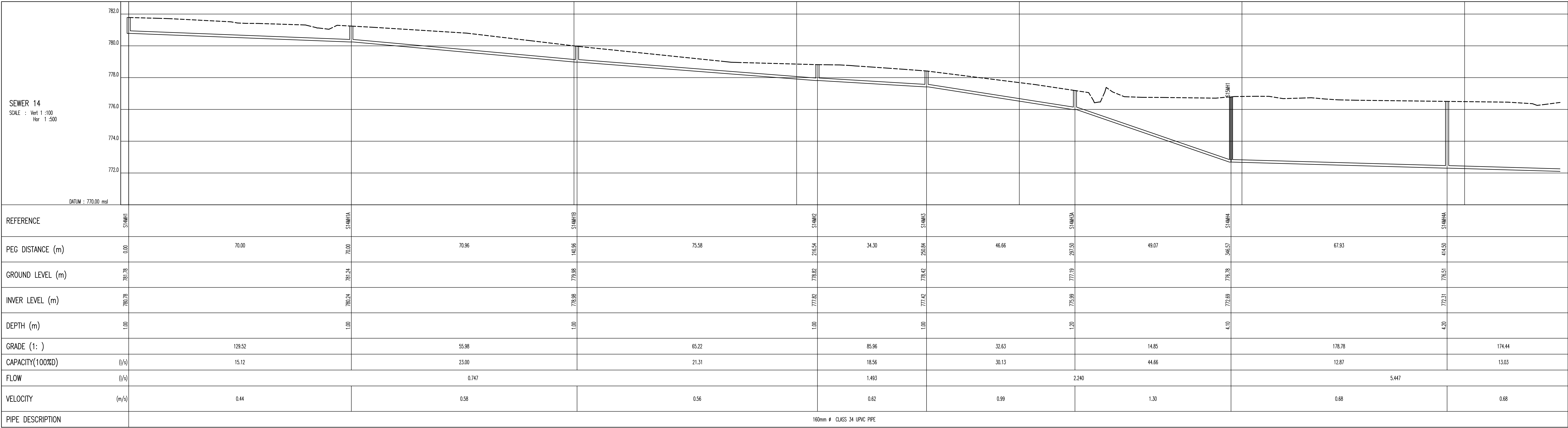
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Reference	Pipe lengths (m)	
	Horiz.	Slope
S13MH13	- S13MH13A	73.843
S13MH13A	- S13MH14	70.421
S13MH14	- S13MH14A	49.579
S13MH14A	- S13MH15	45.523
S13MH15	- S13MH16	8.217
S13MH16	- S13MH17	1.360

Reference	Pipe design data.					
	Y	X	IL in	IL out	D in	D out
S13MH13	37718.614	3289960.124	775.494	775.494	3.000	3.000
S13MH13A	37781.593	3289968.678	775.307	775.307	2.800	2.800
S13MH14	37841.654	3290035.445	775.121	775.121	2.200	2.200
S13MH14A	37885.684	3290058.237	774.969	774.969	1.900	1.900
S13MH15	37926.111	3290079.164	774.471	771.471	2.100	5.100
S13MH16	37929.675	3290071.760	771.379	771.379	5.200	5.200
S13MH17	37930.265	3290070.535	771.321	771.321	5.300	5.300



Reference	Pipe lengths (m)	
	Horiz.	Slope
S14MH4	- S14MH5	53.903
S14MH5	- S14MH6	57.381
S14MH6	- S14MH15	45.807

Reference	Pipe design data.					
	Y	X	IL in	IL out	D in	D out
S14MH4	38034.010	3290057.602	772.305	772.305	4.200	4.200
S14MH5	38034.241	3290110.613	771.996	771.996	4.600	4.600
S14MH6	37968.840	3290095.671	771.681	771.681	4.500	4.500
S14MH15	37926.111	3290079.164	771.471	771.471	5.100	5.100

Reference	Pipe lengths (m)	
	Horiz.	Slope
S14MH1	- S14MH1A	70.000
S14MH1A	- S14MH1B	70.959
S14MH1B	- S14MH2	75.585
S14MH2	- S14MH3	34.297
S14MH3	- S14MH3A	46.659
S14MH3A	- S14MH4	49.085
S14MH4	- S14MH4A	67.835
S14MH4A	- S14MH5	53.903

Reference	Pipe design data.					
	Y	X	IL in	IL out	D in	D out
S14MH1	37808.161	3289772.716	780.784	780.784	1.000	1.000
S14MH1A	37870.438	3289805.556	782.244	782.244	1.000	1.000
S14MH1B	37932.554	3289840.859	778.976	778.976	1.000	1.000
S14MH2	37968.720	3289877.399	777.817	777.817	1.000	1.000
S14MH3	37993.085	3289911.232	777.418	777.418	1.000	1.000
S14MH3A	38019.040	3289950.072	775.988	775.988	1.200	1.200
S14MH4	38046.323	3289980.793	772.685	772.685	4.100	4.100
S14MH4A	38034.010	3290057.602	772.305	772.305	4.200	4.200

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CLIENT LOGO



CLIENT
CATO RIDGE DEVELOPMENT COMPANY (Pty) Ltd
PROJECT
CATO RIDGE PHASED DEVELOPMENT

TITLE
SEWER LONGITUDINAL SECTIONS SHEET 14 OF 15

SCALE : AS SHOWN

DRAWING No. 20207-DS-16

REV
A

ANNEXURE E

WULA Application Information



INFORMATION SUPPLIED
TO WULA SPECIALIST TO
ASSIST IN COMPLETION
OF THE WULA.

**(ASSMANG DEVELOPMENT:
CATO RIDGE)**



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1. WULA Aide Memoire Used as a Reference

“Aide memoire for the preparation of a water quality management report to support the application for licences for sewage treatment works in terms of the requirements of the National Water Act, 1998 (ACT 36 of 1998)”

“The aide memoire provides a list of items to be considered when drawing up a WQMR”

This section of the report provides technical details of the plant to assist the WULA Specialist in drawing up the required WQMR and is not a detailed or comprehensive compilation of all of the peripheral information required in the submission.

Part 1: Administrative Information and Brief Project Description

By Specialist.

Part 2: Description of the Environment (for orientation and first order screening)

By Specialist.

Part 3: Water Supply

3.1 Water Use

3.1.1 Sources of Water

Potable Water Supply

Potable water is supplied to this area from Umgeni Water sources, via eThekweni Metro and is via a metered connection. This potable water is used for domestic purposes only and is not used to dilute sewage or added in significant amounts to the process. As can be seen from the mass balances, we expect a total of 2 kl of potable water to be used on the site for domestic and chemical make-up purposes. This amounts to 0,1% of the wastewater flow.

3.1.2 Yearly Usage Patterns

3.1.3 Yearly Water Use

3.1.4 Water Rights

By Specialist.

Part 4: Description of Reticulation System

4.1 Percentage of the Area that is Unsewered

0%.

4.2 Percentage of the Area that is Sewered

100%.

4.2.1 What Type of Network will be installed

Standard reticulation.

4.2.2 Location of Sewers

Sewers will be located as shown on the attached drawings, generally within road reserves and in some cases, within servitudes through sub- divided erven.

4.3 Nature of Sewage

4.3.1 Sewage Flow Predictions and Hydraulic Loading

The design flows to this works are predicted to be as follows:

Average dry weather flow	2 000 Kld (23 l/s)
Peak factor	2.65
Peak dry weather flow	61 l/s
Peak wet weather flow	70 l/s

4.3.2 Industrial Component

No industrial effluents.

The sewage entering this treatment works will be confined to domestic sewage only, no industrial effluent will be permitted to enter the system.

4.4 Hydraulic and Organic Loading

Hydraulic loading as 4.3.1 above.

Organic Loading

Load and Chemical Parameters (at full design flow)

Chemical Oxygen Demand (COD)	1 504 kg COD/d (752 mg/l)
Biological Oxygen Demand (BOD)	752 kg BOD/d (376 mg/l)
COD: BOD Ratio	2:1
Total Kjeldahl Nitrogen (TKN)	115 Kg/d (58 mg/l)
Suspended Solids (SS)	340 Kg/d
SS Concentration	170/l

Part 5: Description of Sewage Treatment Works and Classification

5.1 Inlet Works

An inlet works consisting of the following unit processes will be constructed:

- Coarse hand raked bar screen
- Fine hand raked bar screen (standby)
- Fine mechanically raked bar screen
- Screenings washing, dewatering and compaction
- Vortex grit removal with air lift
- Grit classifier
- Flow measurement

5.2 Primary Sedimentation Tanks

Not applicable.

5.3 Septic Tanks

Not applicable

5.4 Biological Filtration Systems

Not applicable

5.5 Activated Sludge Systems

5.5.1 Type of System and Basic Design Information

BNR Extended Aeration Activated Sludge by Sequencing batch reactors, consisting of steel tanks, HDPE lined, with external venturi aerators.

Design details of the system are as follows:

Parameter	Data 500 kl/d Module
Flow and Basics Per Reactor	
Flow Capacity (kl/d)	500
Number of Reactors	2
Cycles per Day (per Reactor)	2
Selected BOD (mg/l)	375
Selected TKN (mg/l)	83
Selected settling Time (hr)	1.3
Selected Decant Time (hr)	1.0
Volume per Cycle (kl)	125
BOD per Hour (kg/h) (per Day)	10.8 (188)
TKN per Hour (kg/h)	2.4
Peak Flow Factor (Peak wet Weather Factor)	3.19 (1.25)
PDWF (PWWF) (l/s)	36.9 (51.4)
Load & Oxygenation Per Reactor	
Mixed Liquor OC (per Reactor) (kg/h)	23.7
Clean Water OC (Site) (kg/h)	46.7
Turbine Surface Aerator Power per Reactor (kW) (kWh/d)	26 (200)
Venturi Recirculation Aerator Power (kW) (kWh/d)	21 (160)
Dimensional Data Per Reactor	
Bottom Water Volume @ 3700 mg/l MLSS (m ³)	283
Selected Bottom water Depth (m) (@ 4 m Top Water Depth)	2.1 (4.0)
Area (m ²)	133
Top Water Volume (Decant Depth) (m)	533 (1.9)
Wall Height with 0.5 m Freeboard (m)	4.5
Circular Tank Diameter (m) (Square Side Length)	13 (11.5 x 11.5)

5.5.2 Method of Operation

The sewage arrives at the site and flows into the inlet works.

Inlet Works (IW)

A coarse hand raked screen is situated in the screen channel at the head of the inlet works. This screen has 40mm gaps and is designed to protect the fine screen from heavy foreign objects. This screen is cleared by hand and the screenings placed in a bin for later removal.

From the hand raked screen channel, the sewage flows to a further set of screens (duty / standby), placed in two parallel channels.

The flow to these channels is controlled by handstops.

The duty channel is equipped with a mechanically raked screen. This screen operates on a differential level basis to initiate the screening process. This is controlled by a level switch, monitoring the upstream sewage level in the screen channel.

The screenings from the mechanically raked screen are discharged into a screenings washer / compactor. This device washes organics from the screenings and these organics return to the sewage flow for further treatment.

The washed screenings are compressed to reduce the water content and are then bagged for later removal. The bags are fitted and removed manually from the bagging device.

The standby channel is fitted with a hand raked screen. This screen is manually raked, and the screenings are placed in the screening's washer / compactor for disposal.

The exists to the screening channels are controlled by hand stops.

From the screenings channel, the screened sewage flow to the detritor. The flow to this detritor is controlled by hand stops.

The detritor settles grit contained in the sewage and this is removed via an airlift pump and flows to the grit classifier

The airlift pump is powered by air from an air blower and this is manually controlled.

The detritor is equipped with a rotating paddle driven by an electric motor and gearbox. This paddle keeps organics in suspension during periods of low flow and is operated manually.

The detritor is also fitted with a high-pressure water lance which is fed with high pressure water from the second-class water system. This lance is manually

controlled and is used to break up any dense accumulation of grit in the hopper of the detritor.

The grit classifier removes any remaining organics from the grit and returns these to the system for treatment. The cleaned grit is elevated by a screw conveyor and discharged into a grit hopper for later disposal. The classifier is manually operated.

From the detritor, the screened, degritted sewage enters the delivery pipe to the recycle / feed pump station which is fitted with the inlet flow recorder (FR1) where the instantaneous flow rate and accumulated flow rates are measured and recorded by the flow recorder.

Feed Pump Station

The sewage enters the feed pump station.

The sump is equipped with a submersible mixer to keep solids in suspension and ensure homogeneity of contents.

The mixers are manually operated.

Sequencing Batch Reactors

The treatment process is explained below. Each of the SBR's will operate independently of each other, running a full batch treatment from start to finish before receiving any additional wastewater flow. The batch treatment volume, tank sizes and cycle time has been designed to ensure that each SBR will operate out of phase with the others and one tank will always be ready to accept sewage when the buffer storage in the recycle / feed sump reaches high level. Flow into the tanks will be controlled by actuated valves and flow out of the tanks by actuated valves. These are actuated via signals from the PLC. Manually operated valves are provided upstream of the actuated valves to facilitate fine tuning and maintenance.

Stage 1 – Fill

The treatment cycle starts at time $T=0$. It is assumed that the SBR has recently completed a treatment cycle so the volume is at low level, inlet valve and decant valve are closed and that the aerators are either off or in mixing mode.

When the duty feed pump starts, the actuator fitted to the inlet valve opens and the SBR starts to fill. The aerator continues to operate in mixing mode.

When the level indicator in the SBR reads HIGH the feed pump stops and the inlet valve is closed.

Stage 2 – Aeration

The treatment cycle is now at time $T=+1$ hour. SBR1 is at high level and inlet and decant valves are closed. The venturi aerator starts and commences the four hour aeration period. At this stage the SBR is operating as a conventional aeration tank. During the aeration cycle it is possible to use the aerator in a mixing mode for a selected period.

Stage 3- Settlement

The treatment cycle is now at time $T = +5$ hours. The aeration / mixing cycle is now complete and the auto timer switches off the venturi aerator Inlet and decant valves remain closed. At this stage the SBR is operating as a settlement tank to allow separation of solid and liquid phases.

Stage 4 – Decant

The treatment cycle is now at time $T = +6$ hours. During the preceding hour, the sludge has settled to the lower part of the SBR (importantly to below the level of the decant bellmouth) and clear treated effluent occupies the upper portion of the tank. The auto timer sends a signal to the actuator controlling the decant valve which opens. Simultaneously, the sodium hypochlorite dosing pump starts and runs until the decant valve closes. The level in the SBR starts to drop and treated effluent flows from the tank until the level recorded by reads LOW at which time the decant valve closes.

At the end of the decant stage the treatment cycle is complete and time is now at $T = +7$ hours. SBR is now ready to restart at stage 1, once sufficient wastewater has been collected in the sump of the feed / recycle pump station.

Chlorine Dosing

Sodium hypochlorite is dosed into the decant tank during the decant cycle to disinfect the effluent. This is done by sodium hypochlorite dosing pumps (duty / standby) interlocked with the decant valve operating cycle.

Final Effluent Flow Recorder

A final effluent flow recorder is provided to record instantaneous flow and total flow released to the environment.

5.6 Humus Tanks or Secondary Sedimentation Tanks

Not applicable

5.7 Sludge Handling

5.7.1 Daily Quantity of Wet Sludge

Estimated sludge quantities at design load are:

Waste Solids – Sludge Dewatering Ultimate	
Waste Sludge per day (Whole Plant – 4 Reactors) (kg/d)	220
Solids mass/hour (4 h/d)	55
Thickening and Dewatering Press - Daily Duty Time (h)	4

Linear Screen Feed Rate (m ³ /h)	16.2 (say 20)
Screw Press @ 3% TS Feed Rate (m ³ /h)	2.0

5.7.2 Treatment of Surplus Activated Sludge

Excess activated sludge is wasted from the independent sequencing batch reactors when required. This is achieved by the manual operation of the waste activated sludge outlet valve on the SBR and then the waste activated sludge in admixture with the polyelectrolyte flows by gravity to the thin sludge holding tank.

The mechanical dewatering system is operated when the thin sludge holding tank is full and this system operates automatically, controlled by a PLC. The dewatered sludge is deposited into a skip for later removal.

5.7.3 Relative Digester Capacity

Not applicable.

5.7.4 Total Digester Capacity

Not applicable.

5.7.5 Supernatant Disposal

Not applicable.

5.7.6 Land Disposal

Not applicable.

5.7.7 Sludge Drying Beds

Not applicable.

5.7.8 Sludge Drying Beds

Not applicable.

5.7.9 Sludge Drainage Liquors

The filtrate from the dewatering process is returned to the feed pump station for further processing.

5.7.10 Other Means for Dealing with Sludge

Not applicable.

5.7.11 Final Disposal of Dried Sludge

Conveyance to municipal wastewater treatment works.

5.8 Oxidation Pond System

Not applicable.

5.9 Tertiary Treatment

5.9.1 Micromesh Screens

Not applicable.

5.9.2 Rapid Gravity Sand Filters

Not applicable.

5.9.3 Slow Sand Filters

Not applicable.

5.9.4 Hamlin Filters

Not applicable.

5.9.5 Reed Bed Systems

Not applicable.

5.9.6 Maturation Pond Systems

Not applicable.

5.9.7 Phosphorous Removal

Phosphorous may be removed by dosing ferric chloride into the SBR and precipitating phosphate with the waste activated sludge.

5.9.8 Disinfection of Final Effluent

Disinfection - Ultimate	
Decant Tank Storage Volume (2 Cycles) (m ³)	200
Chlorine (Sodium Hypochlorite) per day (kg)	200 (1 500)
Volume Hypochlorite per day (Per hour – $8 \times 1.5 = 12$ hours) (l)	1 300 (110)

5.10 Classification of Works and Operators

5.10.1 Works Rating

Water and wastewater treatment works are subject to rating by DWS as laid down by the regulations published in the Government Gazette (Regulation No R 2834 dated 27 December 1985).

In terms of this, we are of the opinion that this works will be rated as a Class C works.

5.10.2 Are All Operators Classified

When employed, operators will be classified according to:

In the case of a Class C works, the requirements are:

1 x	Trainee
2 x	Class I operators
1 x	Class II operator
1 x	Class IV person as supervisor
1 x	Class V person to carry out weekly inspections

5.11 Fencing Around the Works

The works will be fully enclosed by an alarmed security fence.

Part 6: Water and Materials Balance Diagram

See attached diagrams

Part 7: management Systems and Pollution Prevention Methods

7.1 Hierarchy of Operating Staff

Water Services Provider

The sewage treatment works is managed by a grouping of the contributors, which body is a designated water services provider, in terms of an agreement with eThekweni Municipality.

All of the functions and responsibilities of a water services provided are the responsibility of this group.

Description and Hierarchy of Operating Staff

The hierarchy of the operating staff is as follows:

- Water Services Provider Responsible Person
- Plant operator
- Works staff

These persons are supported by :

- Consulting Chemical Engineer
- Consulting Design Engineer
- SANAS accredited laboratory
- Mechanical and electrical service provider
- Sludge, screening and grit removal service providers.

7.2 Availability of Mechanical Maintenance Staff

The Water Service Provider has a term contract with a service provider for routine mechanical maintenance and breakdown interventions on the plant.

7.3 Availability of Electrical Maintenance Staff

The Water Service Provider has a term contract with a service provider for routine electrical maintenance and breakdown interventions on the plant.

7.4 Availability of process Control Staff and/or Process Consultants

The Water Services Provider has a term contract with a firm of Consulting Engineers to provide this assistance to the staff employed

7.5 Are there a Set of Drainage By-Laws in Place

These will be promulgated for the development, in due course.

7.6 Technology

7.6.1 Is the Waste Treatment Process the Best Option

It is contended that the treatment process employed is the best option in this case for the following reasons:

- The ability to produce the required effluent standard
- The ease of constructing the plant in a modular fashion
- The small footprint of the plant
- The absence of fly breeding and odours applicable to this process
- The production of a mineralised, stable sludge within the process by aerobic means
- The ability of the process to denitrify and reduce nitrates as well as to recover alkalinity lost in the process.

7.6.2 Is the Disposal Practice the Best Option

Yes, a good quality effluent returned to the environment for the benefit of other users.

7.6.3 Is the best Available Technology in Use

It is contended that the best technology is in use as all items of equipment employed are generic and may thus be replaced at any stage with similar equipment, without being beholden to any one original equipment suppliers.

7.6.4 What are the Alternative Options of Treatment

Alternative options for treatment and disposal are:

- Biological filtration
- Rotating biological contactors
- Submerged fixed film reactors.

7.6.5 Why was the Proposed Option Chosen

This option was chosen for the following reasons:

- Effluent quality produced
- Ease of extension
- Small footprint
- Low nuisance
- Ease of removal when main drainage connection is available.

7.7 WQ Operational Management Plan

7.7.1 What are the Chances of a System Failure

System failure can be attributed to the following causes:

- Mechanical breakdown **Low**
- Electrical breakdown **Low**
- Electrical outage **High**
- Process poisoning **Low**
- Operator actions **Low**

In the event of a mechanical breakdown, all essential items of equipment are provided with a standby to assume duty in the event of a failure.

Similarly, all electrical switchgear (excepting the transformer) is duplicated with the mechanical plant.

In the event of an electrical outage, the plant is provided with a diesel driven standby generator.

Process poisoning can occur if poisons find their way into the sewer system.

This is unlikely as the system is for domestic sewage only and not for industrial effluents. Diligent application of the drainage by laws will also mitigate against this.

If the operation of the works is not diligent, then process failure can result. The Water Services Provider has an obligation to ensure that all routine and intervention actions are carried out by the operational staff.

Overall, the chances of a significant system failure are seen as being low.

7.7.2 What are the Implications of Such a Failure

The implications of such failure will be the loss of final effluent quality. This will result in an additional load being placed on the purification capacity of the adjacent wetland. If this capacity is ever exceeded, then pollution and nuisance will result.

7.7.3 What Safety Factors Have Been Used.

As described earlier in this report, the following safety factors have been used:

- Conservative design criteria
- Generic equipment employed that can be replaced at short notice
- Domestic sewage only to be treated
- Professional process advice and monitoring
- Preventative maintenance of plant and equipment
- Standby equipment provided

7.7.4 What are the Management and Maintenance Plans

The day- to- day management of the works rests with the Water Service Provider who manages and guides the following;

- Finance and budgets
- Personnel and training plans
- Process and monitoring plans
- Mechanical and electrical maintenance plans
- Applications for new connections
- Compliance planning

7.7.5 Availability of Standby/Spare Equipment

All mechanical and electrical equipment is provided in a duty / standby configuration.

A standby generator is provided.

All equipment is generic and spares are readily available.

7.7.6 What are the Accident and Emergency Action Plans

In the event of an accident, first aid is available from Administration / Control building on the plant. First aid facilities are provided at this point.

Emergency services are available from various service providers in the vicinity.

Emergency breakdowns are handled by the contracted maintenance service providers.

Process emergencies are handled by the Consulting Engineers.

7.7.7 What Plans are there to Minimise the Pollution Hazard

Daily plant inspections by operating and supervisory staff.

Weekly plant inspections by maintenance service providers.

Monthly plant inspections by Consulting Engineers.

7.7.8 What Monitoring and Auditing Systems do you Have

Alarms on all control panels to detect and report trips.

Daily checks on chlorination levels.

Monthly audit samples for GLV compliance.

7.7.9 Are There Alarms Systems in Place at All Pump Stations

Alarm systems are provided.

7.7.10 Are there Notification Procedures for all Downstream Users

These are in place.

Part 8: Disposal of Solid Waste and Sludges

8.1 Description of Solid Waste

8.1.1 Solid Waste

Solid waste emanating from this works will be:

- Washed grit from the inlet works
- Washed and bagged screenings from the mechanical screen
- Dewatered waste activated sludge.

Quantity

The grit output is calculated to be	0.068 m ³ /d or 95 kg/d or 35t/annum
The screenings output is calculated as	0,016 m ³ /d or 10kg/d or 3 650 kg/annum

8.1.2 Analysis of Solid Waste

The solid waste is expected to comprise 91% grit and 9% screenings (by mass).

8.2 Description of Sludges

This plant will produce a highly mineralised waste activated sludge, dewatered to approximately 15% dry solids.

The waste activated sludge output is	120kg dry solids / day or 44t per annum
--------------------------------------	---

8.2.1 Analyses of Sludges

On operation, sludge samples will be analysed and results will be submitted to DWS.

8.2.2 Classification of Sludges

On operation, the sludge analyses will be used to classify the sludge.

8.2.3 Disposal to Ponds / Lagoons

Not applicable

8.2.4 Land Disposal

The waste sludge is taken to a designated eThekwini Metro works for final disposal.

8.2.5 Description of Contracts for Removal of Sludges

A service provider is contracted to transport the waste sludge to the designated eThekwini Metro works.

Part 9: Final Waste Disposal Evaluation

9.1 Quantity

The discharge will take place for 365 days per year.	
At full design the quantity expected to be disposed is	2 000 m ³ /day
The average daily flow is expected to be	1 600 m ³ /d
The maximum daily flow is expected to be	2 000 m ³ /d
The average annual flow is expected to be	584 000 m ³ /a
The peak annual flow is expected to be	730 000 m ³ /a

9.2 Land Disposal – Ponds or Dams

Not applicable.

9.3 Land Disposal - Irrigation Areas

Not applicable.

9.4 Disposal to Groundwater

9.5 Disposal to Surface Water

9.5.1 Quantity of Waste

730 000 m³/a.

9.5.2 Annual Discharge Pattern

Evenly spread over the entire year.

9.5.3 Name of Minor River Catchment

By WULA Specialist.

Area of Catchment

By WULA Specialist.

Mean monthly run off

By WULA Specialist.

Quality of River Upstream

By WULA Specialist.

9.5.4 Waste Quality Analyses

The waste is expected to comply with the following:

Determinand	GLV Limits
pH	5.5 - 9.5
Conductivity (mS/m)	+ 70 max <150 max T
COD (mg/l)	<75
Ammonia as N (mg/l)	<6.0
Nitrate as N (mg/l)	15
Phosphate (mg/l)	<10
Suspended solids (mg/l)	<25
E.Coli (CFU/100 ml)	<1000

9.5.5 Established Use of the River

By WULA Specialist.

9.5.6 Establish the Applicable WQ Criteria – 9.5.14

By WULA Specialist.

9.6 Discharge to Lagoon and Estuary

Not Applicable.

9.7 Discharge to Sea

Not applicable.

9.8 Disposal by Evaporation

Not Applicable.

9.9 Municipal or Private Waste Purification Plant

By WULA Specialist.

Part 10: Recommendation from Other Interested Parties

By WULA Specialist.

Part 11: Conclusion

By WULA Specialist.

Part 12: Reference and Supporting Documentation

By WULA Specialist.

Part 13: Confidential Material

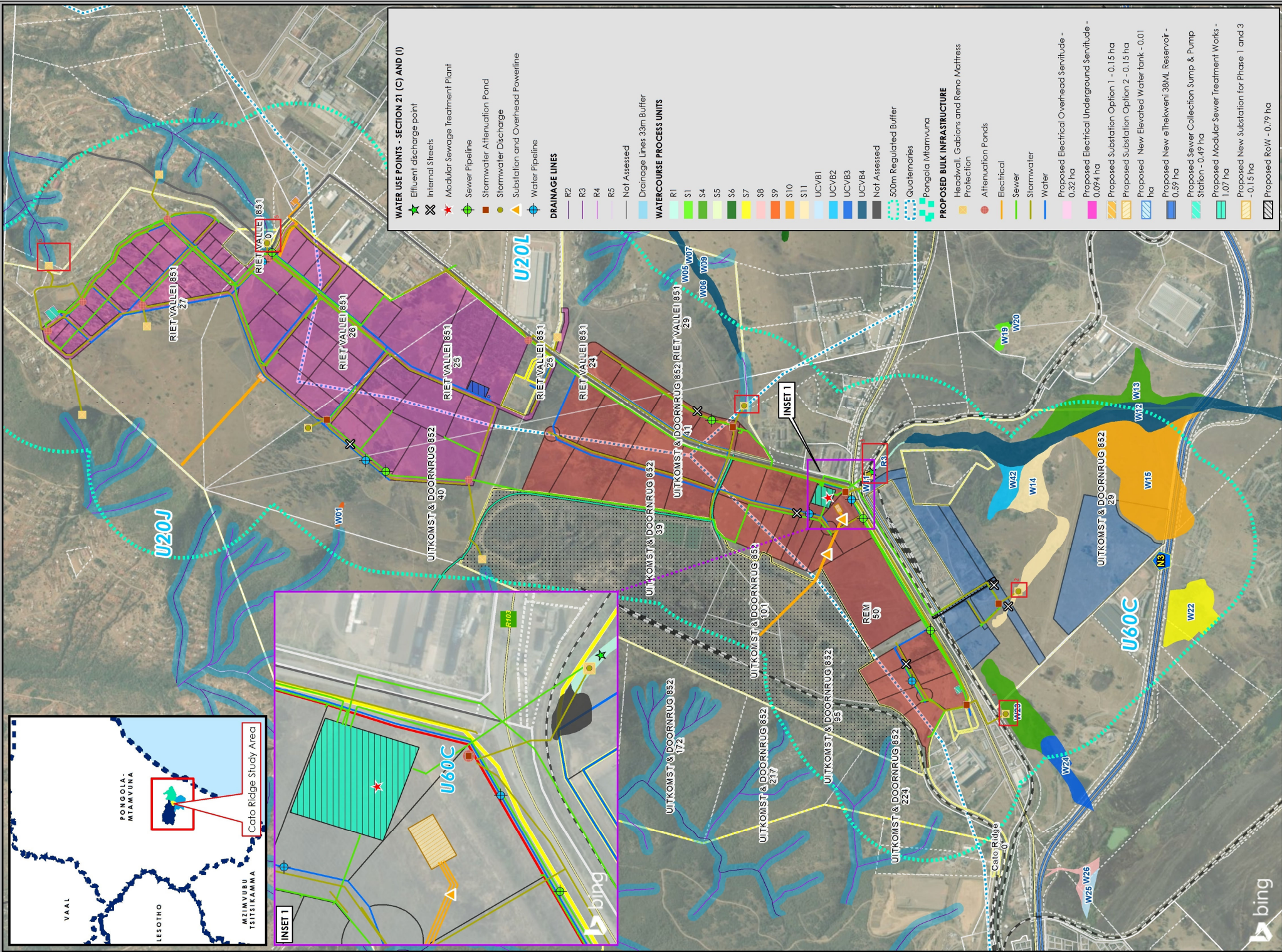
By WULA Specialist.

Part 14: Declaration

By WULA Specialist.

ANNEXURE F

Master Layout of the Water Uses associated with the project



ANNEXURE G

Method Statement for Construction Activities for the Proposed Development of Properties in Cato Ridge



**METHOD STATEMENT FOR CONSTRUCTION ACTIVITIES
FOR THE PROPOSED DEVELOPMENT OF PROPERTIES IN
CATO RIDGE
FOR THE CATO RIDGE DEVELOPMENT COMPANY**

MAY 2023

K&T PROJECT REFERENCE: 20207/ M1

REVISION 0



Details of this report

Client Name	CATO RIDGE DEVELOPMENT COMPANY
Document Title	METHOD STATEMENT FOR CONSTRUCTION ACTIVITIES FOR THE PROPOSED DEVELOPMENT OF PROPERTIES IN CATO RIDGE FOR THE CATO RIDGE DEVELOPMENT COMPANY
K&T Project Reference	20207/M1
File Name	20207-PMB/M/1
Prepared by	R. Keppler

Report Revision Record

Revision	Date	Description
0	24/05/2023	Issued for Review

This report has been prepared by Kantey & Templer (Pty) Ltd, with all reasonable skill, care and diligence within the terms of the Contract with the client, incorporating our General Terms and Conditions of Business and taking account of the resources devoted to it by agreement with the client.

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For and on behalf of

Kantey & Templer (Pty) Ltd

Approved by: Kevin Hohls

Signed:



Position: Professional Engineer

Date: 24 May 2023

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METHOD STATEMENT FOR CONSTRUCTION ACTIVITIES FOR THE PROPOSED DEVELOPMENT OF PROPERTIES IN CATO RIDGE FOR THE CATO RIDGE DEVELOPMENT COMPANY

1. Introduction

Kantey & Templer (PTY) LTD was appointed by the Cato Ridge Development Company (CRDC) to compile a Pre-Feasibility Engineering Services Report in order to obtain preliminary approval from the service authorities for the proposed bulk services provision for the new Cato Ridge Development in KwaZulu-Natal in support of the Environmental Impact Assessment Application.

The proposed Industrial & Warehouse Development in Cato Ridge is situated on a 351 Ha greenfields site which will be completed in 3 phases as follows:-

PHASE 1

Phase 1 is programmed to be unlocked within the next 18 months and will be phased in over the next 10 year period as and when the demand arises.

PHASE 2

Phase 2 will be implemented over the next 10 to 20 years

PHASE 3

Phase 3 will be implemented over the next 20 to 25 years

This report will provide Technical information on the proposed project, with a Method Statement that is triggered due to the construction activities for the 6 No specific areas, where the stormwater runoff and sewer crossings discharge outlets falls within a watercourse.

2. Location & Access

The site locality plan is attached in Annexure A of this document.
The co-ordinates (centre) of each of the 3 Phases are as follows:

Phases	Y- CORDINATES	X- CORDINATES
Phase 1	+37 068	+3 289 114
Phase 2	+36 175	+3 286 829
Phase 3	+37 224	+3 290 057

Access to the development is via the R103 and Eddie Hagen Road

3. Scope of Works

Please refer to the attached drawing in Annexure C for the stormwater layout drawing 20207-DSW 01
Revision I

The table below indicates the three Phases for the proposed development.

Phases	Warehouse Bulk (HA)	Industrial Bulk (HA)
Phase 1	60.305	60.305
Phase 2	74.015	74.015
Phase 3	19.31	19.31
TOTAL	153.63	153.63

The scope of works for the services will include the construction of:-

- 1) Roads
- 2) Water reticulation, which includes an elevated tank
- 3) Sewer reticulation which includes a rising main
- 4) 4 x Sewer collection sumps with pump stations
- 5) Mini Wasterwater Treatment Works
- 6) Roads
- 7) Stormwater reticulation
- 8) Stormwater attenuation ponds
- 9) Electrical which includes a substation, overhead lines and underground lines
- 10) Warehousing & Industrial.

This technical note covers the design and construction considerations and parameters for the construction activities for The Proposed Development of Properties in Cato Ridge for the Cato Ridge Development Company.

In the Project Development certain construction activities will have an impact on the wetlands and these items are covered as Construction Methodology activities within the Project Area.

There are 6 specific areas in the table below which describe the storm water runoff and sewer crossing that discharge within the watercourse that require a Method Statement:-

Point Number	Description	Watercourse
1	Stormwater discharge point , plus stormwater pipeline	S6
2	Stormwater discharge point , plus stormwater pipeline	S11
3	Effluent Discharge Point	Within R3 drainage line
4	Stormwater discharge point , plus stormwater pipeline	R3 and R4 drainage line and within the 33m drainage buffer
5	Stormwater discharge point , plus stormwater pipeline	R2 and drainage buffer
6	Stormwater discharge point , plus stormwater pipeline	R2 Drainage line

The 6 specific areas are indicated in blocks on the attached Master Layout of the Water Uses associated with the project which is attached in Annexure C.

Stormwater Outlets

Where the stormwater outlets flow into the drainage line or wetland buffer they will be managed with the construction of a headwall with dissipater blocks, a gabion structure to dissipate the flow and erosion protection measures which are highlighted in more detail in this report.

Ponds 5, 9, 10, 11 & 12 flow into the drainage line or wetland buffer area. Please refer to Annexure D for the proposed throttling and outlet pipe sizes.

Sewer Outlet

There is one sewer outlet which is from the Mini Wastewater Treatment Works that requires a method statement as it falls within the R3 drainage line. The flow rate is only around 52 litres/second and will be managed in the same manner as the stormwater outlets with the construction of a headwall with dissipater blocks and a gabion structure with suitable stone pitching and erosion protection measures where required.

As indicated above the storm water runoff and sewer will be discharged via 6 outlets into the watercourses or wetland buffer and, where possible, will be further managed with the construction of swales that will retain, sink and spread the storm water runoff. This construction work would be undertaken within the wetland buffer and drainage lines.

4. Planning Construction

In the planning for the design phase, cognizance is taken of the following reference documents:

1. Red Book – Guidelines for Human Settlement Planning and Design;
2. SABS 1200 – Standardized Specification for Civil Engineering Construction; and
3. Local municipal standards.

Due to the environmental sensitivity the impact on water quality, potential flooding and erosion needs to be considered in the planning phase. The planning would consider:

The proposed stormwater design concept for the proposed development in Cato Ridge must comply to all Environmental and eThekweni Municipality requirements and specifications.

The traditional design of storm water drainage systems collects and confines storm water runoff as rapidly as possible to a suitable location where it can be discharged. This traditional design can however result in drainage and flooding problems downstream unless erosion protection measures are implemented.

The road network stormwater management system is designed to accommodate both the 351 hectare development footprints and the actual roads.

4.1 Objective

The objective of a storm water management plan should be to manage the storm water resources of the collective watersheds to:

- Prevent erosion and flood damage
- Preserve the natural and beneficial functions of the natural drainage system
- Preserve and enhance storm water quality.
- The storm water management strategy will be to collect all surface runoff, pass it through an attenuation/ detention system before discharging the water into the natural drainage systems.
- The storm water drainage network system will be kept separate from the waste water.

4.2 Stormwater Design

The stormwater management principles applied to the proposed Cato Ridge development to accommodate the stormwater run-off is separated into two sections which are as follows:-

4.2.1 All developable Erf/ Sites to be responsible for their own stormwater design and attenuation infrastructure.

A standard condition will be incorporated in all Purchase or Rental Agreements for each erf/stand that the Developer/ Landowner/ Tenant will be responsible to submit a stormwater management plan to the eThekweni Municipality for approval.

This shall include:-

- a stormwater design to attenuate the infrastructure into attenuation ponds or attenuation within the hardstands/ parking area. Other local on-site attenuation may be considered which includes grass-lined drains and swales, storm water infiltration systems undulations, landscaping etc. The attenuation area will be designed for a 1 in 50 year event.
- A throttling manhole will be designed and sized accordingly at the attenuation outlet to cater for the pre and post stormwater flows.
- stormwater reticulation pipelines, channels, energy dissipation measures etc.
- Erosion protection where required.
- Details of the stormwater discharge tie into point into the bulk Municipal road stormwater system
- All internal stormwater pipes will be gravity reticulated via the sub-catchments across the site.

4.2.2 Roads Stormwater

The bulk stormwater has been designed for a minimum 1 in 50 year event.

Storm water from the roads and surface channels will be collected through inlets and piped across or parallel to the roads, within the road reserve, to points where the water will be discharged into attenuation ponds, in an efficient, safe and environmental acceptable manner. Please refer to drawing no 20207-DSW 01 Revision I in Annexure B for details of the stormwater reticulation system and proposed attenuation ponds.

Each attenuation pond will be designed accordingly and constructed with throttling manholes at the outlets to restrict the outlet flow in the event of a heavy storm. The design will cater for the pre and post development stormwater flows from the roads prior to discharging into the valleys and low lying areas.

The attenuation ponds will be dry and will only be a temporary storage in the event of heavy rainfall. The discharge from the attenuation pond will be restricted by the throttling manhole.

The velocity and energy of the stormwater discharge will be reduced when entering the stormwater attenuation ponds due to:-

- 1) the volume of the pond which must be vegetated.
- 2) dissipator blocks at the inlet headwall.
- 3) Gabion baskets/ rip rap at the inlet to prevent erosion.

At discharge points :-

- 1) Grass lined open drains will be installed which will assist in retaining sediment and reduce the velocity of the flows.
- 2) Where applicable concrete channels or concrete pipes will be installed from the attenuation pond outlets which will be directed within the existing road network to avoid further impact on the environment. This will reduce the registration of servitudes through tribal authority areas. Road Servitudes will be registered where required in remaining disturbed areas.
- 3) The drains and stormwater pipe network will prevent flooding of houses and reduce the safety risk within the area.
- 4) Where there are no structures or erf/stands the outlet will discharge directly onto the site with erosion protection where deemed necessary.

- 5) The design measures incorporated will take measures into account to reduce the impact on disturbing the biodiversity in the area. Where possible, stormwater discharge points will be directed to follow areas that have already been disturbed by the existing road footprint.
- 6) Where possible, the stormwater will discharge into an open area to allow water to dissipate before entering into the river systems.

The standards for the storm water infrastructure to be installed with the proposed road development can be summarised as follows:

- Flood occurrence interval : 50 years
- Pipe Material : Concrete
- Pipe class : Minimum 75D in road reserve and 100D at road crossings.
The developer will be responsible for their own stormwater within the sites to be developed
- Pipe diameters : minimum 450φmm diameter within the road reserve and discharging from the road reserve. The developer will be responsible for their own stormwater within the sites to be developed
- Bedding : Class C
- Inlets : Manhole
- Junctions : Points of deflections on pipelines
- V-drains : Concrete lined open channels
- Cut-off drains : Grass lined channels and berms

4.2.3 Erosion Protection

The following recommendations are suggested:

1. It is essential that appropriate erosion control measures need to be taken into consideration at the various storm water discharge points located throughout the site to limit erosion on the receiving environment e.g. at headwalls and culverts.
2. Steep water courses may require additional protection from erosion through the use of lined channels, controlled drops etc. in order to dissipate flow energy.
3. Road intersections should be designed to prevent localised flooding.
4. The storm water system must be kept separate from the wastewater (sewer) drainage system.
5. Suitable erosion protection measures will be installed at all discharge points. At each attenuation pond dissipator blocks with a gabion retaining structure (see attached detail in Annexure E) will be constructed after each throttling manhole/headwall outlet to reduce the stormwater velocity at the outlet which will reduce erosion.
6. For the design of the swale the philosophy of "Slow it, Spread it and Sink it" will be followed so that the velocity of the stormwater runoff is slowed down and spread laterally to mitigate erosion while sink it will assist in recharge of ground water.
7. Appropriate and adequate protection of the banks will be incorporated into the design.
8. Swales will be designed to accommodate both dry conditions and storm flow conditions.
9. For high intensity, the water will overtop the berm and suitable bank protection in the form of vegetation will be implemented to prevent erosion during these events.
10. Headwall details will be as per the eThekweni Municipality or Department of Transport standard specifications depending on which is applicable.
11. Suitable stone pitching and/or reno-mattress and gabion protection structure will be constructed to obviate any erosion that may be prone to occur at these points.
12. A sediment fence will be erected on the wetland buffer boundary to demarcate the edge of the wetland buffer. In addition, this fence will intercept and detain small amounts of sediment from disturbed areas during construction operations and reduce runoff velocity down a slope.

5. Construction Methodology

5.1 The typical construction sequence is summarized hereunder:

- The engineer in consultation with the Environmental Assessment Practitioner / Environmental Control Officer will confirm the nature of the drainage line being considered and ensure adequate control measures are allowed for in the drawings, tender and site instructions.
- Appointed contractor to submit a Method Statement for the construction activities for review and approval by appointed Safety Agent, Environmental Assessment Practitioner / Environmental Control Officer and Engineer
- Site Handover and briefing meeting with the contractor to highlight environmental sensitivity and confirm construction methods.
- Regular meetings and inspections from Environmental Assessment Practitioner / Environmental Control Officer and Engineer to confirm agreed method statement is being followed.
- Before final handover, inspections and snag list are compiled to ensure all necessary protection has been undertaken as per engineers design.

5.2 Typical general measures that should be implemented are

- The area of disturbance should be kept to a minimum to allow clearing of the construction right of way, excavation, layer works, construct works, backfill, to restore the construction right of way. This should not exceed the construction footprint width and must be kept to a minimum, for the wetland;
- Construction should be immediately followed by rehabilitation;
- Soil surfaces should not be left open for lengthy periods to prevent erosion;
- Sods must be stored and placed back immediately after trenches have been backfilled;
- Where possible, construction should take place during the dry season;
- Weather forecasts from the South African Weather Bureau of up to three days in advance must be monitored on a daily basis to avoid exposing soil or building works during a storm event. Appropriate action must be taken in advance to protect construction works should a storm event be forecasted;
- Appropriate erosion and sediment control measures should be implemented;
- Sediment barriers should be constructed across the entire construction site where necessary to prevent sediment flow into the wetland;
- Vegetation and soil should be retained in position for as long as possible, and should only be removed immediately ahead of construction / earthworks in any specific area;
- Remove only the vegetation where essential for the continuation of construction of services. On completion of the construction work, the site will be contoured to ensure free flow of runoff and to prevent ponding of water. Drainage will be controlled to ensure that runoff from the site will not culminate in off - site pollution or result in damage to properties downstream of any storm water discharge.
- During final design stages erosion protection will be designed to comply to Municipal & Department of Transport standards. Special precautions will be carried out to ensure that a designed storm water discharge route is approved to prevent erosion or flooding in the valleys and low lying areas which also have residential houses in areas.
- The attenuation ponds are a temporary storage facility and will only fill up in the event of heavy rainfall event.

5.3 Typical Plant and Resources required:

- Excavators;
- TLB;
- Dozer;

- Bob Cat;
- Tipper trucks for the delivery of bedding material and road fill material to be placed over the pipes;
- Small Compaction equipment for pipe bedding and restricted fill around the pipe culvert;
- Heavy compaction equipment for compaction of the bulk fill for roads and hardstands;
- Equipment for the construction of the brick headwalls as detailed;
- Equipment and labour for the positioning and packing of gabion and reno-mattress baskets or stone pitching, as appropriate and as agreed with the Environmental Assessment Practitioner / Environmental Control Officer, to control and obviate any erosion;
- Light equipment and labour to dress backfill, topsoil and re-vegetate all exposed areas.

5.4 Construction Methods:

- Remove topsoil and stockpile for later use.
- Excavate trench for pipe or culvert to the design level
- Construct storm water diversion berms where required.
- Place temporary diversion pipe if required to divert water
- Place bedding, lay pipes, place and compact selected fill over the pipeline.
- Backfill to specification.
- Construction of gabions
- Construction of headwalls
- Construction of swales
- Dress backfill, topsoil and re-vegetate all exposed areas.
- Stockpiles of construction materials must be clearly separated from soil stockpiles in order to limit any contamination of soils.
- The stockpiles may only be placed within demarcated stockpile areas, which must fall within the demarcated construction area. The contractor should avoid stockpiling materials in vegetated areas that will not be cleared. The slope and height of stockpiles must be limited to 2 m to avoid collapse.
- Stockpiled soils are to be kept free of weeds and are not to be compacted. The stockpiled soil must be kept moist using some form of spray irrigation on a regular basis as appropriate and according to weather conditions.

5.5 Storage

- No construction materials may be stored or disposed of within the delineated wetland or within the buffer zone of 30 m from the wetland.
- No concrete batching may take place within the delineated wetland or within the buffer zone of 30 m from the wetland.
- No refuelling may take place within the delineated wetland or within the buffer zone of 30 m from the wetland.
- Contamination of the soil and groundwater by construction liquid waste should be prevented by using drip trays or appropriate containment receptacles and bunding. Appropriate containment receptacles and bunding. Construction liquid waste, including toxic liquid waste, should be stored in leak-proof containers and taken to the closest authorised waste and recycling centre.

5.6 Rehabilitation

In areas where construction activities have been completed and no further disturbance is anticipated, rehabilitation and re-vegetation should commence as soon as possible.

- Profile the banks over the disturbed areas to an acceptable slope and replace topsoil;
- Plant indigenous sedge and grass material from the adjacent areas;

- Water plants thoroughly immediately after planting and continue to water every three days in the absence of more than 10 mm of rainfall until plants are established;
- Re-vegetation of disturbed areas must be undertaken with indigenous species and in accordance with the instructions issued by the Environmental Control Officer;
- Replanting activities should be undertaken at the end of the dry season (middle to end September) to ensure optimal conditions for germination and rapid vegetation establishment;
- Should plants not successfully establish within two growing seasons after the first planting, new plant material should be provided;
- Any weed or alien species that germinates during the contract period should be cleared by hand before flowering;
- Any erosion channels developed during the construction period should be appropriately backfilled (and compacted where relevant) and the areas restored to a condition similar to the condition before the construction erosion occurred.

6. Maintenance

- After construction the temporary sediment fence to be removed and replaced with a permanent fence;
- Fence to be regularly checked and maintain to ensure functionality;
- All storm water pipes and outlets to be checked for blockages;
- Swale to be checked to ensure no sediment and silts collect in the trench;
- All litter to be removed from storm water systems including swale and that no general waste is dumped in the wetlands;
- Lined and sealed VIPs to be fitted with an effluent overflow, the wet sludge can be removed by ordinary vacuum tankers. These tankers are the same as those used for emptying septic tanks.

7. Conclusion

All design and construction work will be carried out in accordance with the relevant construction specifications and in compliance with the Construction Health and Safety Specifications as well as the Construction Environmental Management Programme.

KANTEY AND TEMPLER CONSULTING ENGINEERS



KEVIN HOHLS
Pr. Eng. 20060264
ASSOCIATE DIRECTOR

ANNEXURE A
Site Locality Plan

ANNEXURE B
Stormwater Layout Drawing

ANNEXURE C

Master Layout of the Water Uses associated with the project

ANNEXURE D
Throttling Pipe sizes and outlet pipe sizes

ANNEXURE E
Stormwater Gabion Structure & Standard Details

ANNEXURE H

Gabion Structure Detail & Standard Details

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BUILDING PLAN NO.:

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REV	DESCRIPTION	DR.	APP.	DATE
		INITIALS	SIGN	DATE
DESIGNED		RK		
DRAWN		SKM		
PROJECT ENG.		KH		
APPROVED				

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CLIENT LOGO



CLIENT

**CATO RIDGE
DEVELOPMENT COMPANY(Pty) Ltd**

PROJECT

**CATO RIDGE
PHASED DEVELOPMENT**

TITLE

**HEADWALL AND
GABION BASKET
DETAILS AT OUTLET
SEWER**

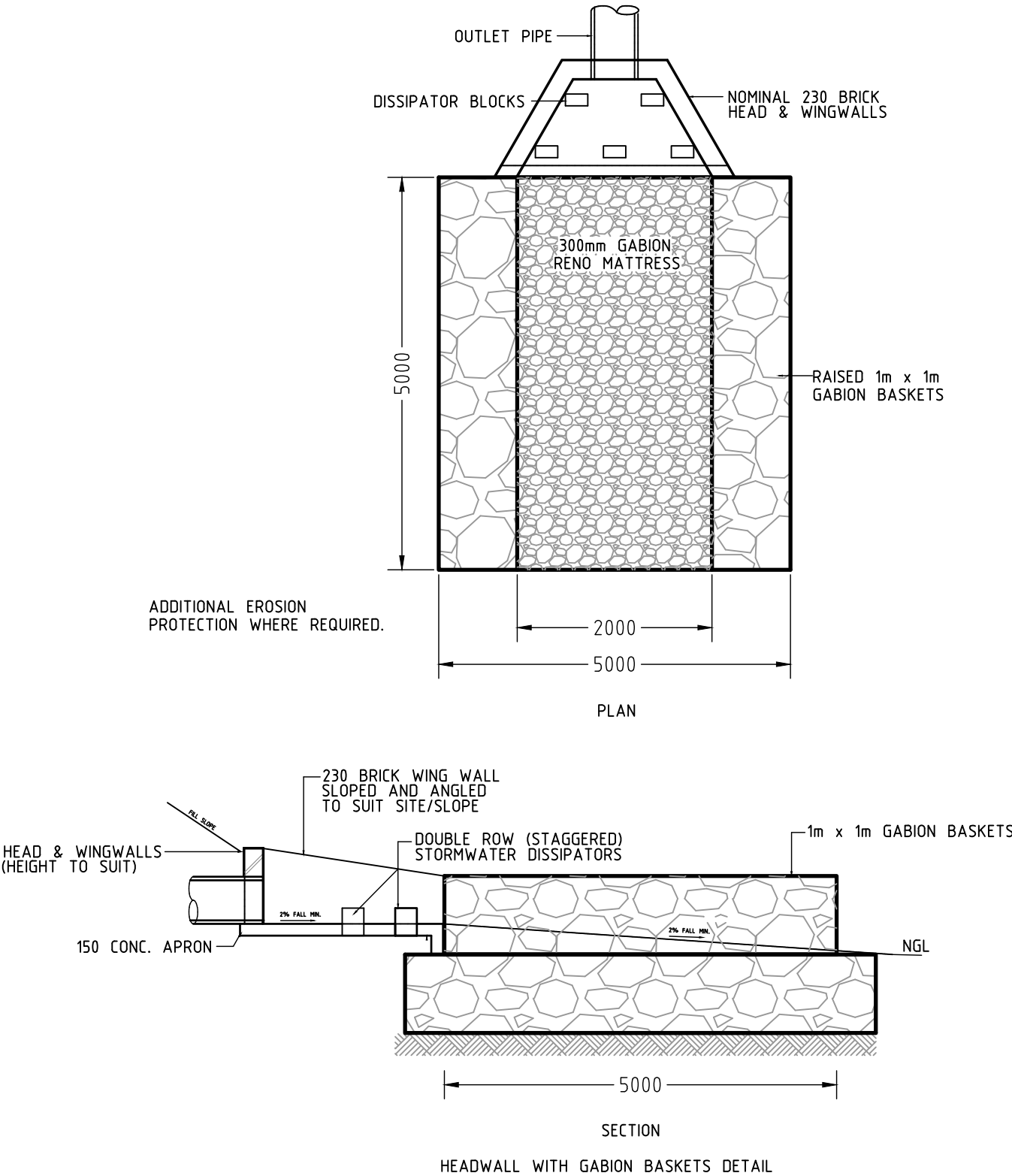
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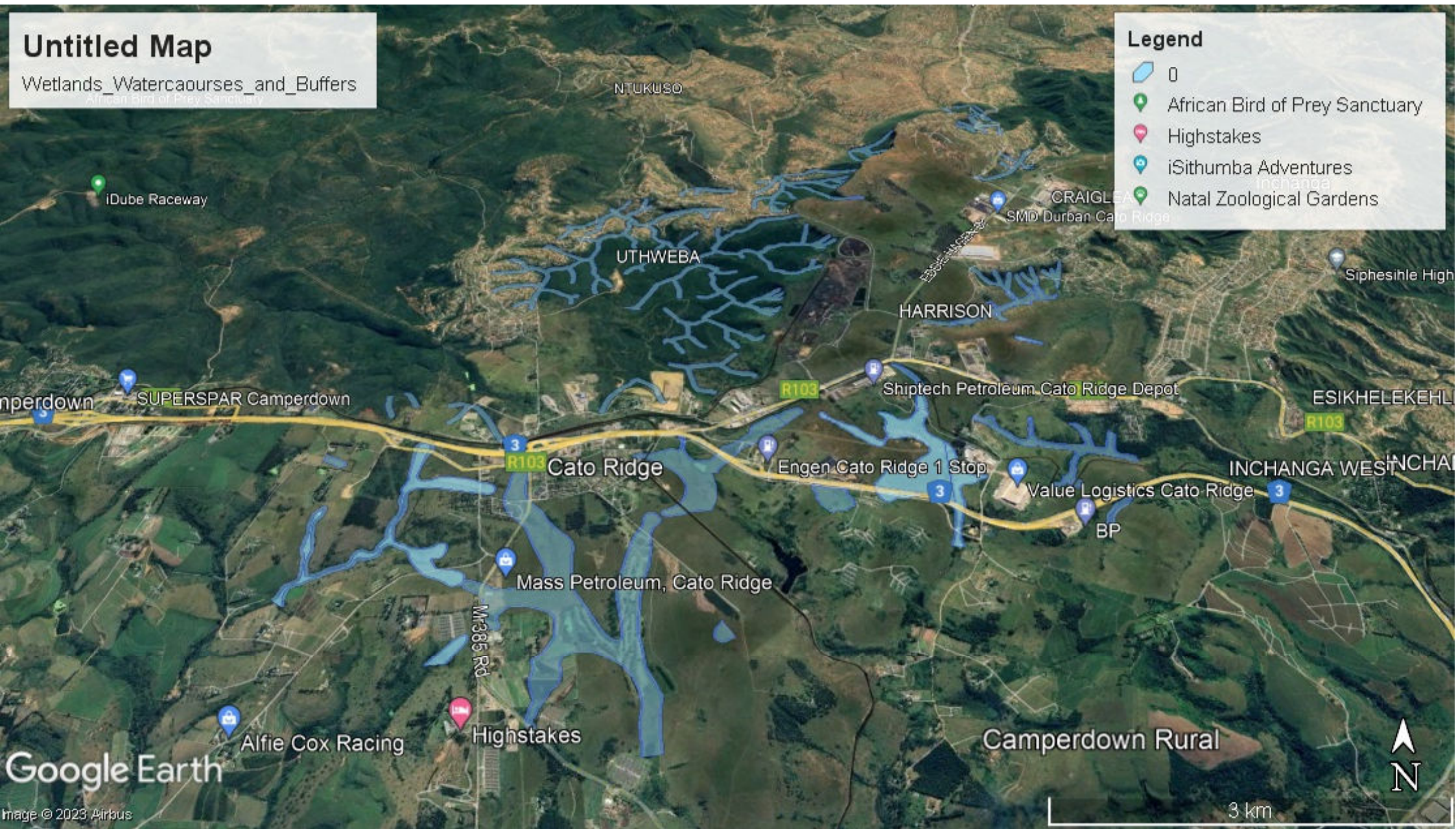


ANNEXURE I

Delineated wetlands and low impact mixed use combined watercourses

Untitled Map

Wetlands_Watercourses_and_Buffers

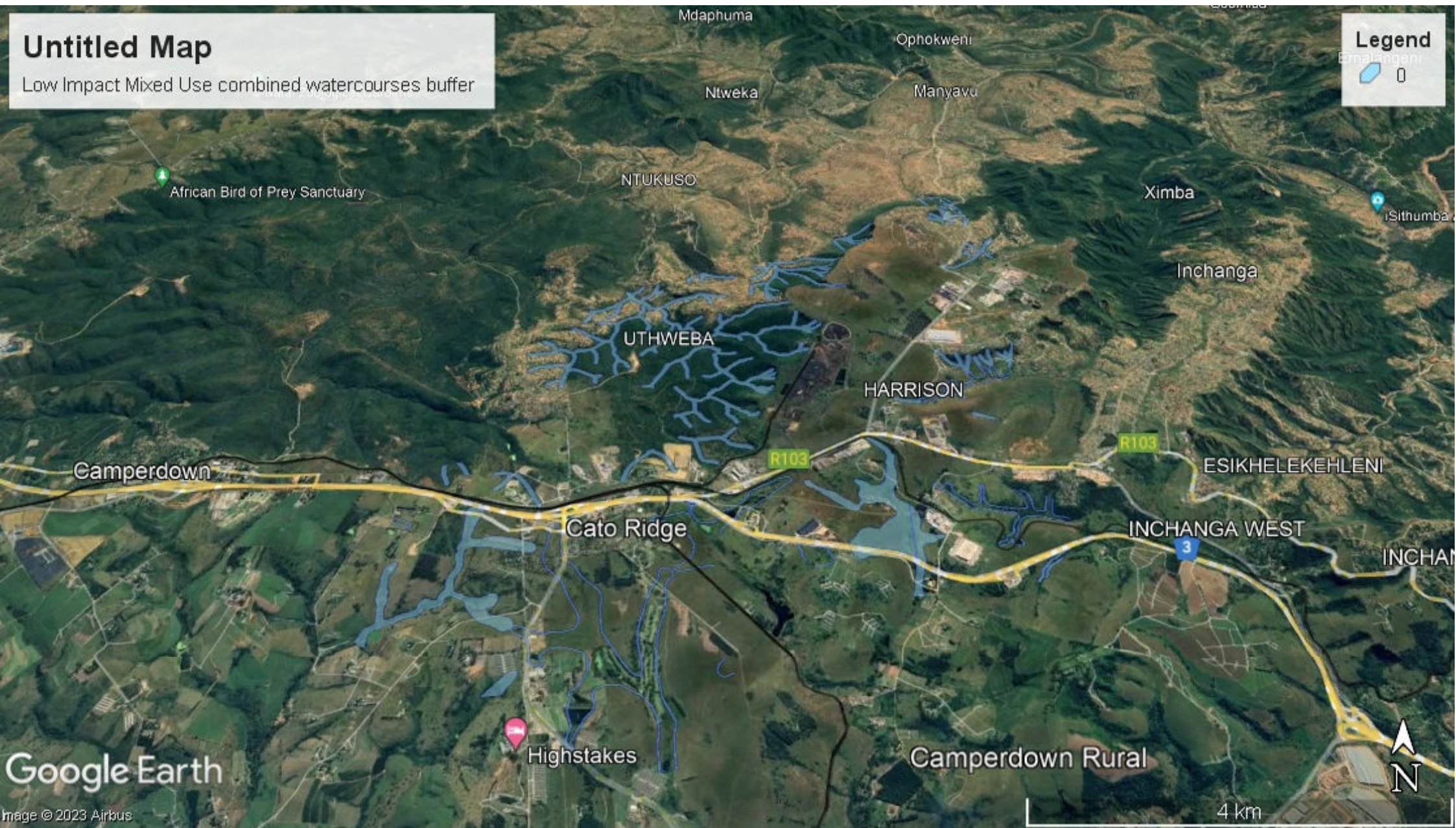


Untitled Map

Low Impact Mixed Use combined watercourses buffer

Legend

Emalingeni 0



Google Earth

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