

**STUDY ON AUGMENTATION OF  
WATER SUPPLY AND SANITATION  
FOR  
THE GOA STATE  
IN THE REPUBLIC OF INDIA**

**Volume VI  
Drawings**

November 2006

**JAPAN INTERNATIONAL COOPERATION AGENCY**

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**NIHON SUIDO CONSULTANTS CO., LTD.  
and  
NJS CONSULTANTS CO., LTD.**

<b>GE</b>
<b>JR</b>
<b>06-069</b>

## **PREFACE**

In response to a request made by the Government of Republic of India, the Government of Japan decided to conduct the Study on Augmentation of Water Supply and Sanitation for the Goa State in the Republic of India and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to India a study team headed by Mr. Takemasa MAMIYA of Nihon Suido Consultants Co., Ltd. between March 2005 and October 2006. The study team was composed of members from Nihon Suido Consultants Co., Ltd. and NJS Consultants Co., Ltd. JICA also established an Advisory Committee headed by Mr. Yoshiki OMURA, Senior Advisor, Institute for International Cooperation JICA, which, from time to time during the course of the study, provided specialist advice on technical aspects of the study.

The team held discussions with the officials concerned of the Government of the Republic of India and conducted field surveys at the study area. Upon returning to Japan, the team conducted further studies and prepared present report.

I hope that this report will contribute to the promotion of this project and to the enhancement of friendly relationship between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of India and Government of Goa for their close cooperation extended to the team.

November, 2006

Ariyuki MATSUMOTO  
Vice-President  
Japan International Cooperation Agency

November, 2006

Mr. Ariyuki MATSUMOTO  
Vice-President  
Japan International Cooperation Agency

## **Letter of Transmittal**

Dear Sir,

We are pleased to submit to you this Final Report on the Study on Augmentation of Water Supply and Sanitation for the Goa State in the Republic of India. This report incorporates the views and suggestions of the authorities concerned of the Government of Japan, including your Agency. It also includes the comments made on the Draft Final Report by Public Works Department of the Government of Goa and Ministry of Urban Development of the Government of the Republic of India and other government agencies concerned of the Republic of India.

The Final Report comprises a total of six volumes as listed below.

Volume I	: Executive Summary
Volume II	: Main Report: Master Plan
Volume III	: Main Report: Feasibility Study
Volume IV	: Annex for Master Plan
Volume V	: Annex for Feasibility Study
Volume VI	: Drawings

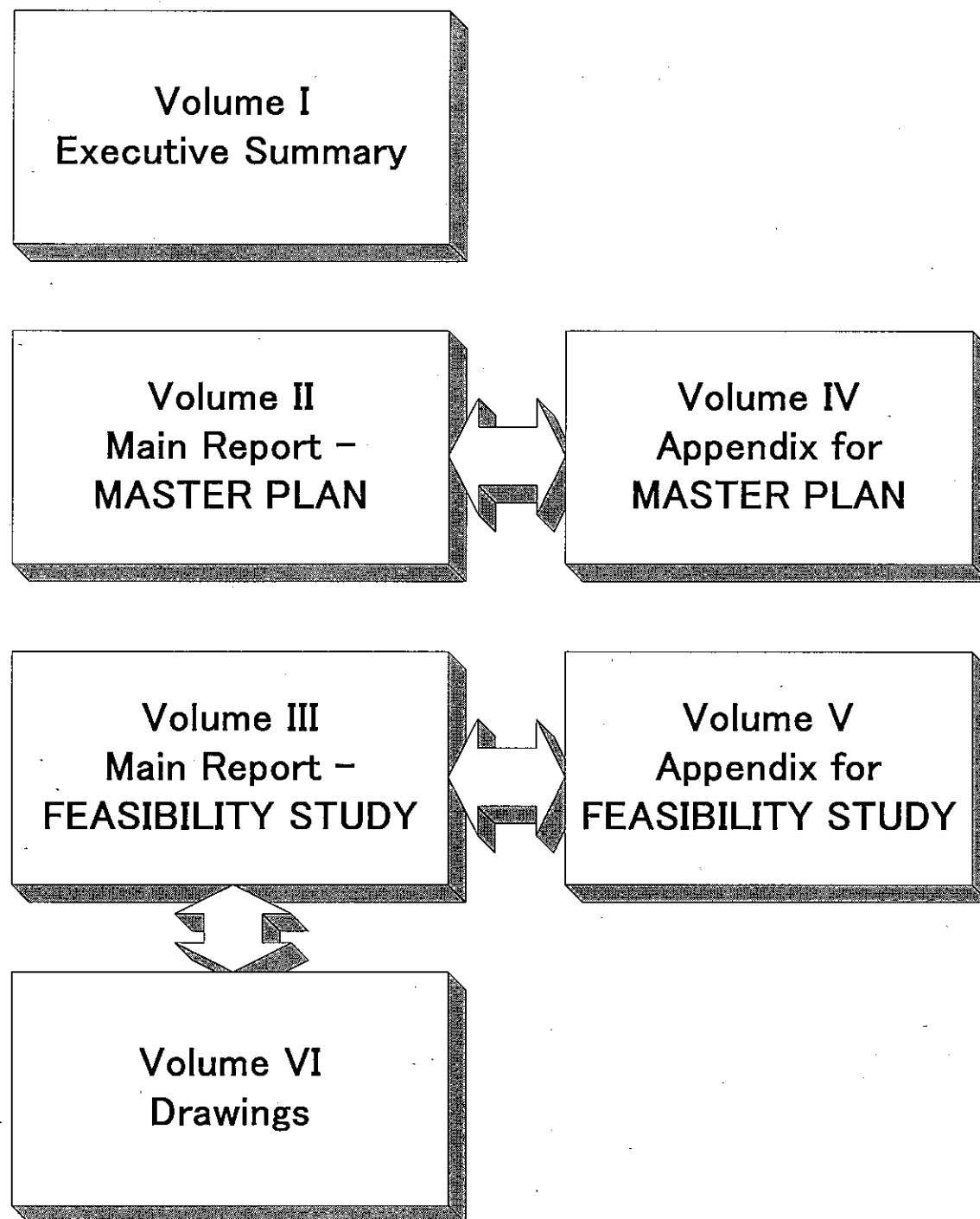
This report contains the Study Team's findings, conclusions and recommendations derived from the three phases of the Study. The main objective of the Phase I was to conduct a reconnaissance survey. That of Phase II was to formulate a long term master plan and to identify priority projects, whilst that of the Phase III was to examine the feasibility of the priority projects which had previously been identified in Master Plan during the course of the Phase II.

We wish to take this opportunity to express our sincere gratitude to your Agency, the Ministry of Foreign Affairs and the Ministry of Health, Labour and Welfare of the Government of Japan for their valuable advice and suggestions. We would also like to express our deep appreciation to the relevant officers of Public Works Department of the Government of Goa and Ministry of Urban Development of the Government of the Republic of India for their close cooperation and assistance extended to us throughout our Study.

Very truly yours,

Takemasa Mamiya, Team Leader  
Study on Augmentation of Water Supply  
And Sanitation for Goa State in the  
Republic of India

# Structure of Report



## Confirmation of the Design through the Detailed Design Phase

The preliminary design conducted during the feasibility study stage of this project described in this report was based on a preliminary topographic survey and preliminary geotechnical investigations. The preliminary design was undertaken to identify possible locations and land area requirements for the proposed facilities, and potential pipe alignments. The preliminary design was also used to estimate the project costs used in the economic/financial analysis and to provide basic information for international lending agencies. The preliminary design is not suitable to inform construction work.

Construction work should be based on detailed design drawings, not the preliminary design drawings. The detailed design drawings will be prepared as part of the next stage of the project. The detailed design drawings will be based on more detailed topographic survey and further geotechnical investigations. A more detailed topographic survey may provide more accurate information about land ownership. Further geotechnical investigations are required to locate any underground utilities such as telephone and electric cables. Depending on the location of these utilities the location of the proposed facilities, the pipe alignments, or the foundation types of facilities may need to be revised from those proposed in the preliminary design.

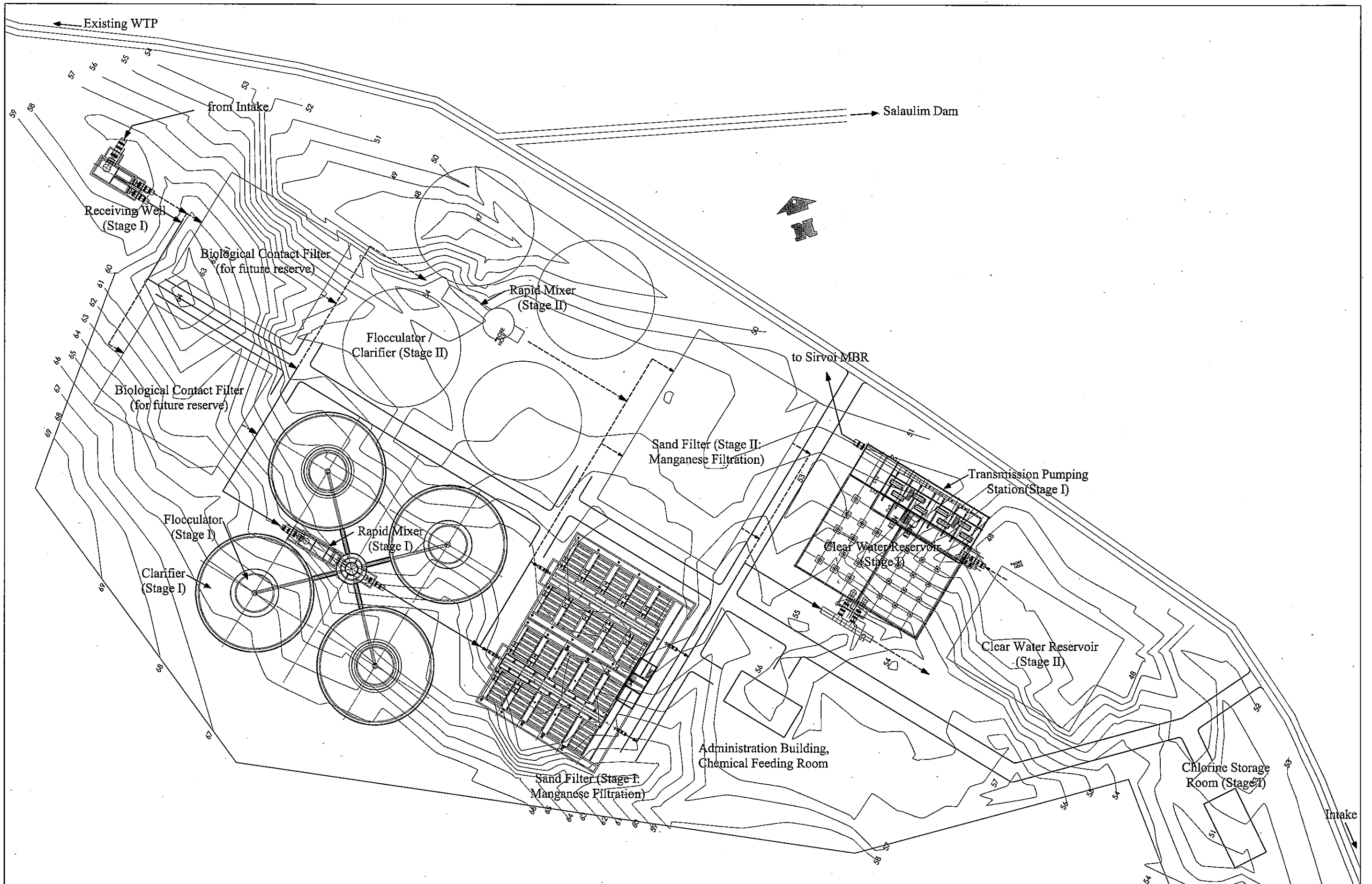
Drawing No.	Drawing Title
W01	Proposed Salaulim Treatment Plant, General Layout Plan of Treatment Facility
W02	Proposed Salaulim Treatment Plant, General Layout Plan of Intake Facility
W03	Proposed Salaulim Treatment Plant, Hydraulic Diagram
W04	Proposed Salaulim Treatment Plant, Intake Facility, Section
W05	Proposed Salaulim Treatment Plant, Intake Facility, Plan-1
W06	Proposed Salaulim Treatment Plant, Intake Facility, Plan-2
W07	Proposed Salaulim Treatment Plant, Intake Facility, Plan-3
W08	Proposed Salaulim Treatment Plant, Receiving Well
W09	Proposed Salaulim Treatment Plant, Biological Contact Filter, Plan
W10	Proposed Salaulim Treatment Plant, Biological Contact Filter, Section
W11	Proposed Salaulim Treatment Plant, Rapid Mixer, Plan
W12	Proposed Salaulim Treatment Plant, Rapid Mixer, Section
W13	Proposed Salaulim Treatment Plant, Flocculator/Clarifier, General Plan
W14	Proposed Salaulim Treatment Plant, Flocculator/Clarifier, Plan
W15	Proposed Salaulim Treatment Plant, Flocculator/Clarifier, Section
W16	Proposed Salaulim Treatment Plant, Filter Basin, Plan
W17	Proposed Salaulim Treatment Plant, Filter Basin, Section-1
W18	Proposed Salaulim Treatment Plant, Filter Basin, Section-2
W19	Proposed Salaulim Treatment Plant, Clear Water Reservoir, Plan
W20	Proposed Salaulim Treatment Plant, Clear Water Reservoir, Section
W21	General Layout Plan for Sirvoi Master Balancing Reservoir
W22	Standard Drawing for Distribution Reservoirs
W23	Transmission Main, Guide Map for TM1 and TM2
W24	Transmission Main, Proposed WTP to Sirvoi MBR, TM1-01
W25	Transmission Main, Proposed WTP to Sirvoi MBR, TM1-02
W26	Transmission Main, Proposed WTP to Sirvoi MBR, TM1-03
W27	Transmission Main, Proposed WTP to Sirvoi MBR, TM1-04
W28	Transmission Main, Proposed WTP to Sirvoi MBR, TM1-05
W29	Transmission Main, Proposed WTP to Sirvoi MBR, TM1-06
W30	Transmission Main, Proposed WTP to Sirvoi MBR, TM1-07
W31	Transmission Main, Proposed WTP to Sirvoi MBR, TM1-08
W32	Transmission Main, Sirvoi MBR to Margao, TM2-01
W33	Transmission Main, Sirvoi MBR to Margao, TM2-02
W34	Transmission Main, Sirvoi MBR to Margao, TM2-03
W35	Transmission Main, Sirvoi MBR to Margao, TM2-04
W36	Transmission Main, Sirvoi MBR to Margao, TM2-05
W37	Transmission Main, Sirvoi MBR to Margao, TM2-06
W38	Transmission Main, Sirvoi MBR to Margao, TM2-07
W39	Transmission Main, Sirvoi MBR to Margao, TM2-08
W40	Transmission Main, Sirvoi MBR to Margao, TM2-09
W41	Transmission Main, Sirvoi MBR to Margao, TM2-10
W42	Transmission Main, Sirvoi MBR to Margao, TM2-11
W43	Transmission Main, Sirvoi MBR to Margao, TM2-12
W44	Transmission Main, Sirvoi MBR to Margao, TM2-13
W45	Transmission Main, Sirvoi MBR to Margao, TM2-14
W46	Transmission Main, Sirvoi MBR to Margao, TM2-15
W47	Transmission Main, Sirvoi MBR to Margao, TM2-16
W48	Transmission Main, Sirvoi MBR to Margao, TM2-17
W49	Transmission Main, Sirvoi MBR to Margao, TM2-18
W50	Transmission Main, Sirvoi MBR to Margao, TM2-19
W51	Transmission Main, Sirvoi MBR to Margao, TM2-20

Study on Augmentation of Water Supply and Sanitation for the Goa State in the Republic of India	
Drawing List	Scale: No. W00

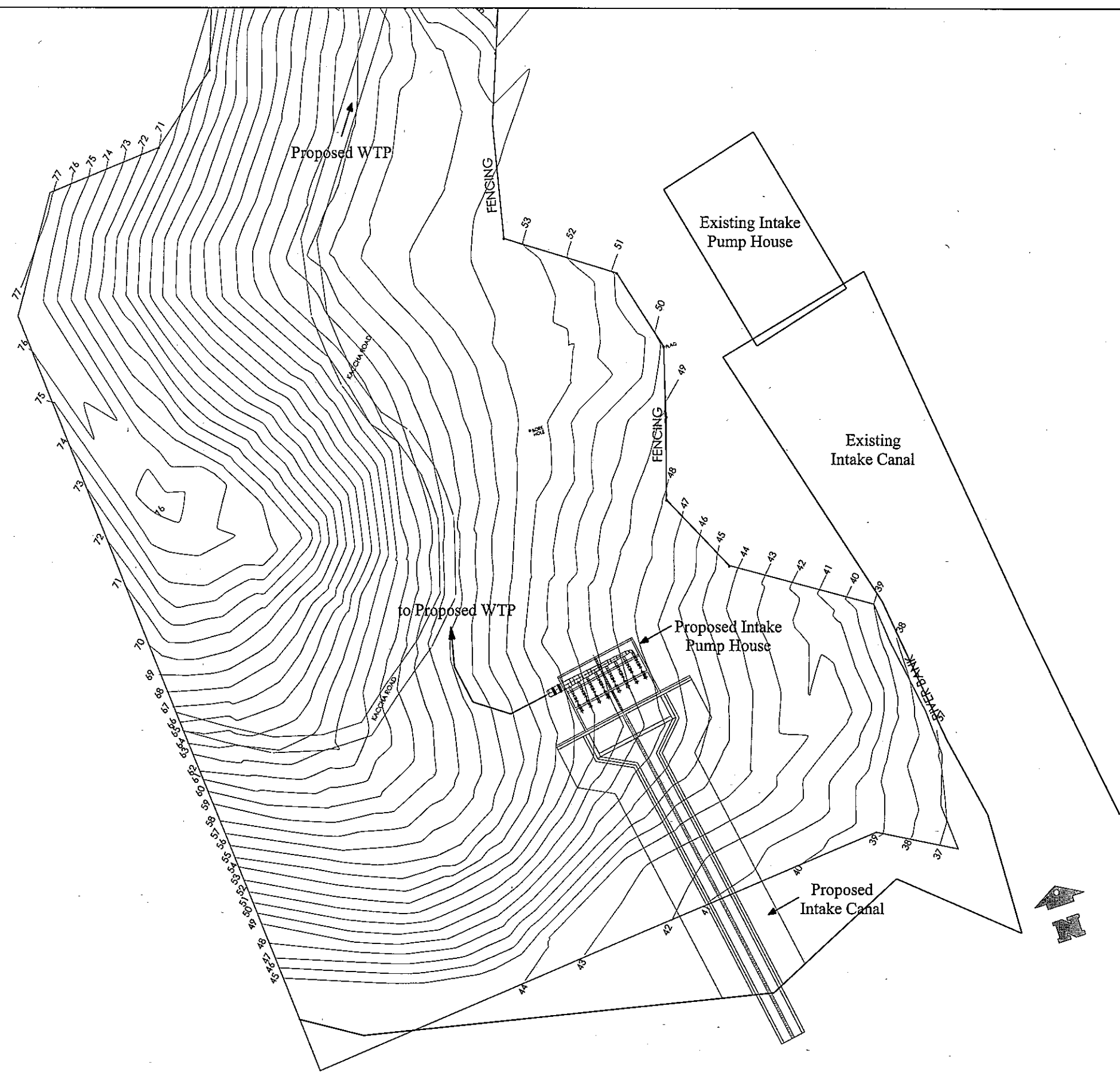
### Drawing List for Sewerage

No.	Title	
S-1	General Plan of Sewerage (F/S)	Margao
S-2	Plan for Sewer Network (FS)	Margao (1/5)
S-3	Plan for Sewer Network (FS)	Margao (2/5)
S-4	Plan for Sewer Network (FS)	Margao (3/5)
S-5	Plan for Sewer Network (FS)	Margao (4/5)
S-6	Plan for Sewer Network (FS)	Margao (5/5)
S-7	Longitudinal Profile of Trunk Line(F/S)	Margao (1/5)
S-8	Longitudinal Profile of Trunk Line(F/S)	Margao (2/5)
S-9	Longitudinal Profile of Trunk Line(F/S)	Margao (3/5)
S-10	Longitudinal Profile of Trunk Line(F/S)	Margao (4/5)
S-11	Longitudinal Profile of Trunk Line(F/S)	Margao (5/5)
S-12	General Layout of Pumping Station	Margao No.1
S-13	General Layout Plan of STP	Margao STP
S-14	Process Diagram of STP	Margao STP
S-15	Hydraulic Profile of STP	Margao STP
S-16	General Plan of Sewerage (F/S)	Mapusa
S-17	Plan for Sewer Network (FS)	Mapusa (1/4)
S-18	Plan for Sewer Network (FS)	Mapusa (2/4)
S-19	Plan for Sewer Network (FS)	Mapusa (3/4)
S-20	Plan for Sewer Network (FS)	Mapusa (4/4)
S-21	Longitudinal Profile of Trunk Line(F/S)	Mapusa (1/4)
S-22	Longitudinal Profile of Trunk Line(F/S)	Mapusa (2/4)
S-23	Longitudinal Profile of Trunk Line(F/S)	Mapusa (3/4)
S-24	Longitudinal Profile of Trunk Line(F/S)	Mapusa (4/4)
S-25	General Layout Plan of STP	Mapusa STP
S-26	Process Diagram of STP	Mapusa STP
S-27	Hydraulic Profile of STP	Mapusa STP
S-28	General Plan of Sewerage (F/S)	North Coastal Belt
S-29	Plan for Sewer Network (FS)	North Coastal Belt (1/5)
S-30	Plan for Sewer Network (FS)	North Coastal Belt (2/5)

No.	Title	
S-31	Plan for Sewer Network (FS)	North Coastal Belt (3/5)
S-32	Plan for Sewer Network (FS)	North Coastal Belt (4/5)
S-33	Plan for Sewer Network (FS)	North Coastal Belt (5/5)
S-34	Longitudinal Profile of Trunk Line(F/S)	North Coastal Belt (1/5)
S-35	Longitudinal Profile of Trunk Line(F/S)	North Coastal Belt (2/5)
S-36	Longitudinal Profile of Trunk Line(F/S)	North Coastal Belt (3/5)
S-37	Longitudinal Profile of Trunk Line(F/S)	North Coastal Belt (4/5)
S-38	Longitudinal Profile of Trunk Line(F/S)	North Coastal Belt (5/5)
S-39	General Layout of Pumping Station	North Coastal Belt No.2
S-40	General Layout Plan of STP	Baga STP
S-41	Process Diagram of STP	Baga STP
S-42	Hydraulic Profile of STP	Baga STP
S-43	Structure of Pumping Station	Conventional Type
S-44	Structure of Pumping Station	Manhole Type
S-45	Structure of STP Facilities	Grit Chamber and Pump Facilities
S-46	Structure of STP Facilities	Primary Settling Tank
S-47	Structure of STP Facilities	Aeration Tank
S-48	Structure of STP Facilities	Oxidation Ditch
S-49	Structure of STP Facilities	Secondary Settling Tank
S-50	Structure of STP Facilities	Disinfection Tank
S-51	Structure of STP Facilities	Sand Filtration Tank
S-52	Structure of STP Facilities	Sludge Thickener
S-53	Structure of STP Facilities	Sludge Digestion Tank
S-54	Structure of STP Facilities	Sludge Dewaterer
S-55	Structure of STP Facilities	SBR Tank
S-56	Reference : General Layout of STP	Mapusa STP for SBR
S-57	Reference : General Layout of STP	Baga STP for SBR



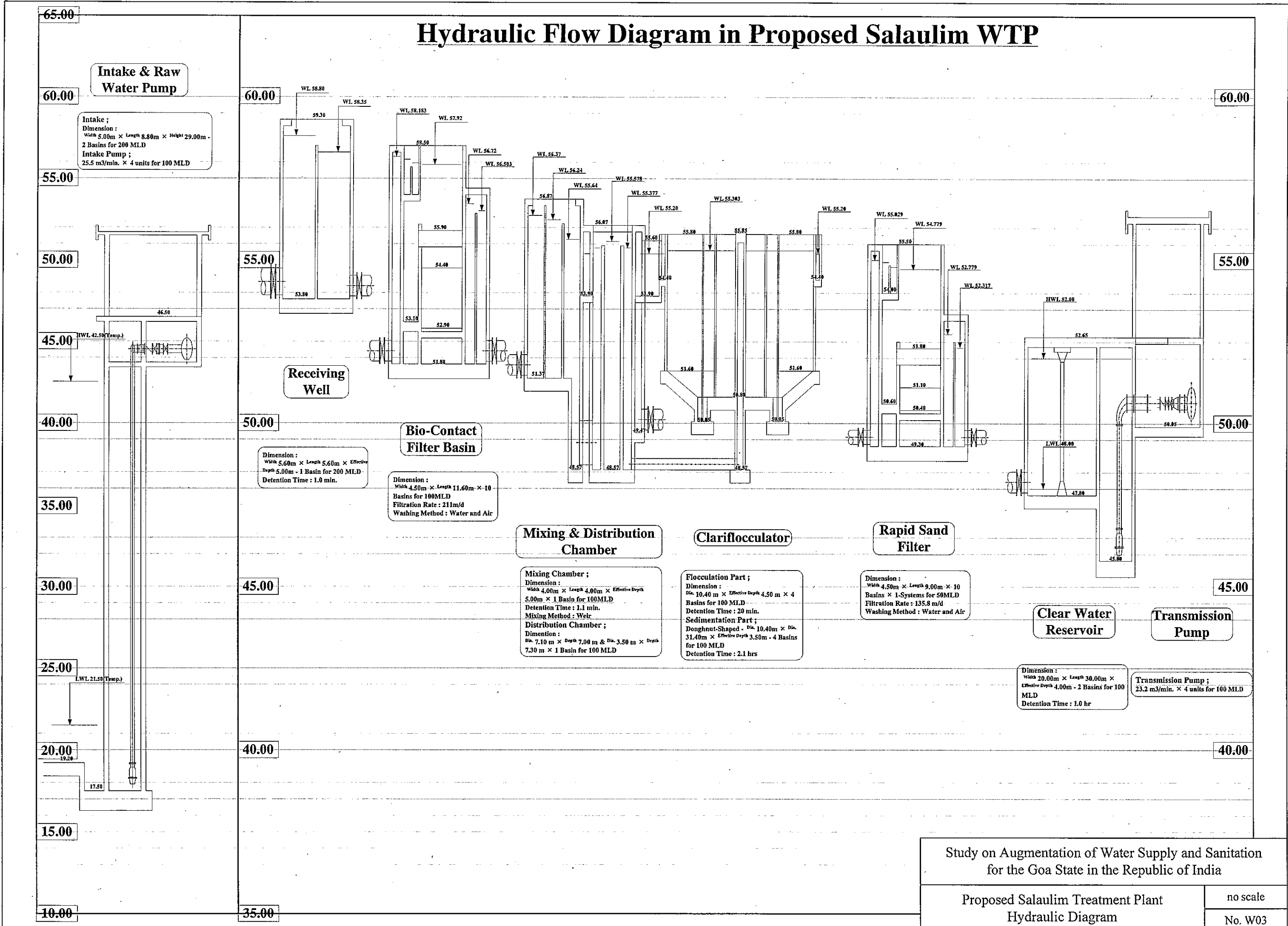
Study on Augmentation of Water Supply and Sanitation for the Goa State in the Republic of India	
Proposed Salaulim Treatment Plant General Layout Plan of Treatment Facility	Scale: 1:1,000 No. W01



Study on Augmentation of Water Supply and Sanitation for the Goa State in the Republic of India	
Proposed Salaulim Treatment Plant General Layout Plan of Intake Facility	Scale: 1:1,000 No. W02



# Hydraulic Flow Diagram in Proposed Salaulim WTP

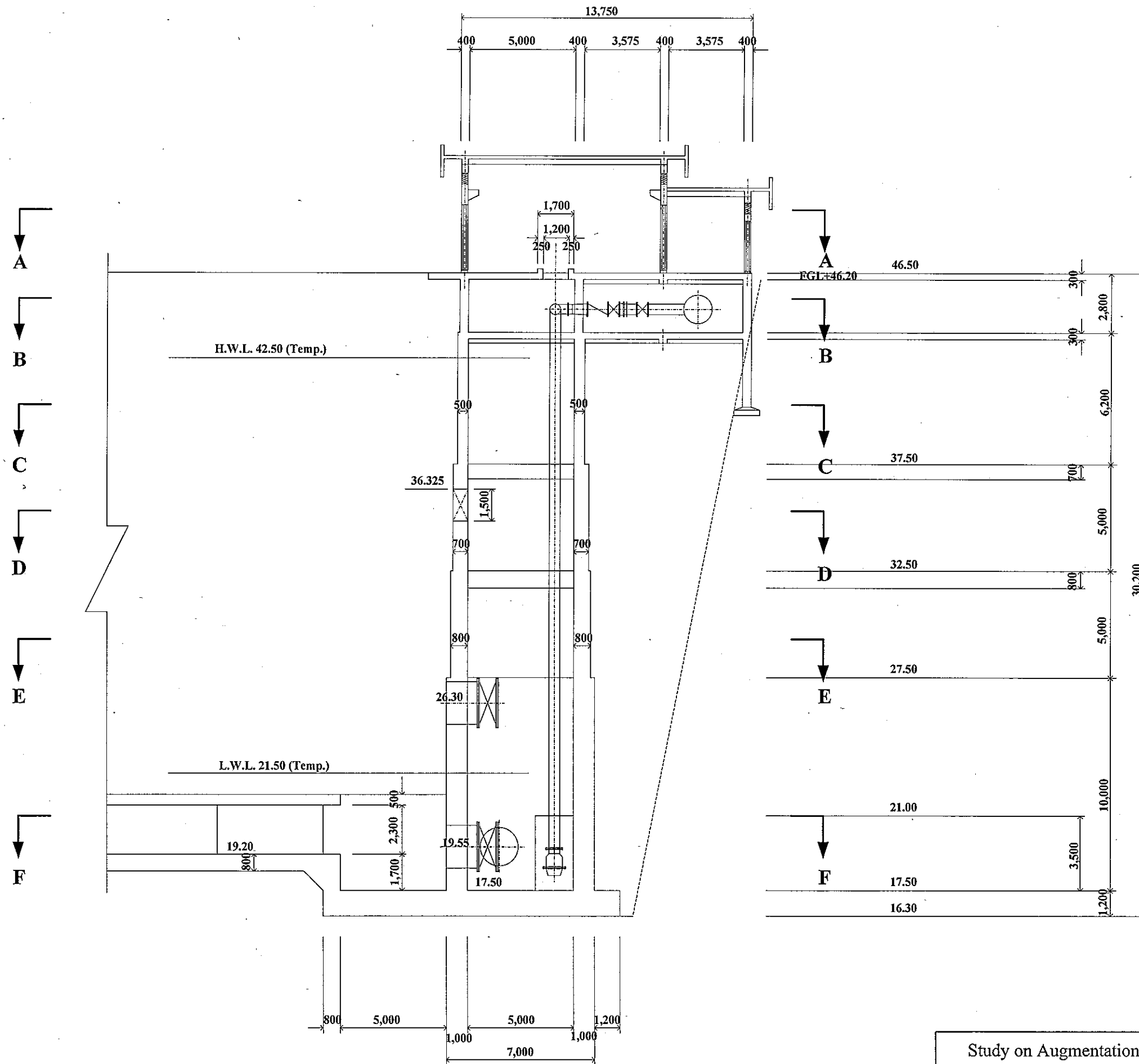


Study on Augmentation of Water Supply and Sanitation  
 for the Goa State in the Republic of India

Proposed Salaulim Treatment Plant  
 Hydraulic Diagram

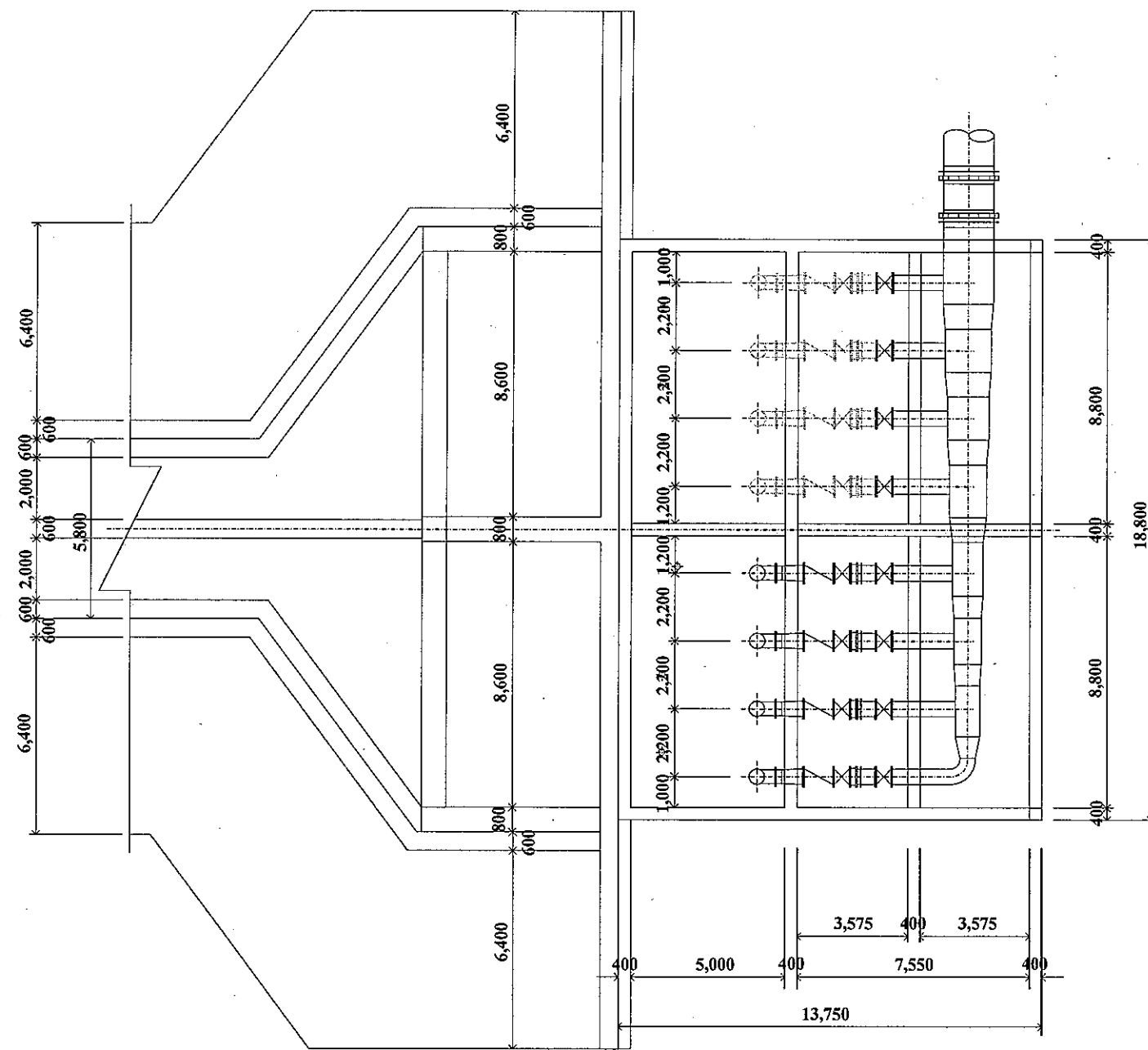
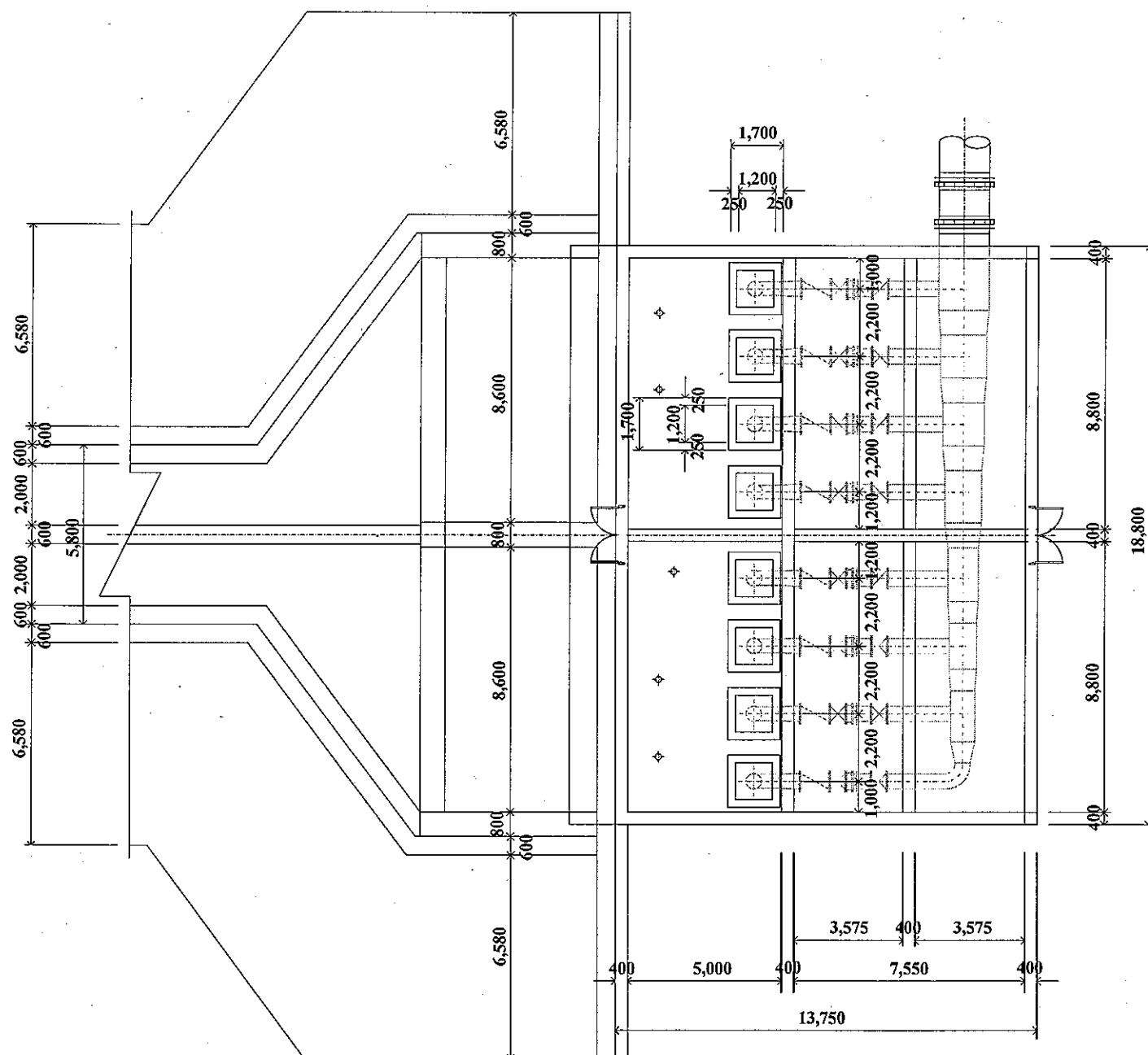
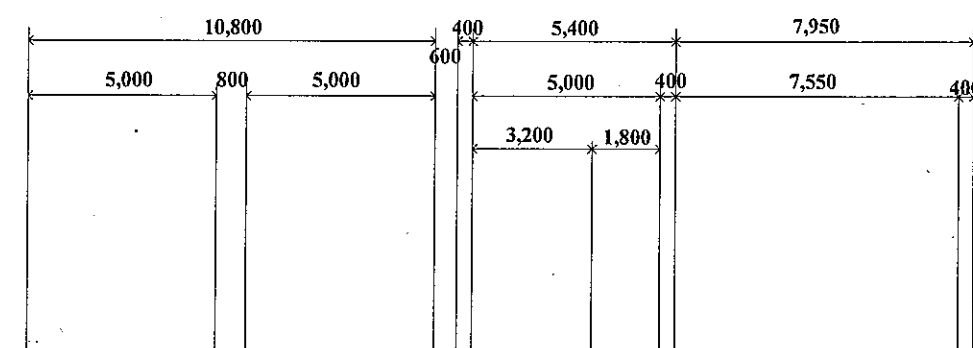
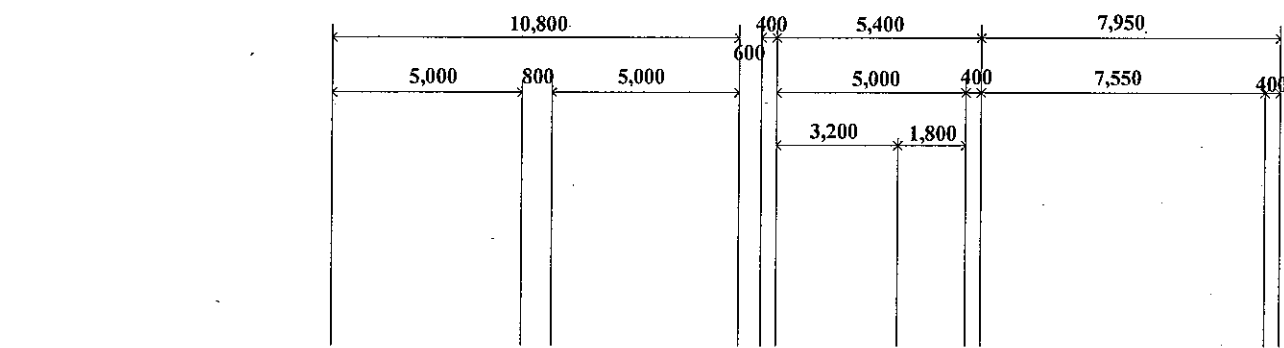
no scale

No. W03



**Section**

Study on Augmentation of Water Supply and Sanitation for the Goa State in the Republic of India	
Proposed Salaulim Treatment Plant Intake Facility, Section	Scale 1:200
	No. W04



**Plan A - A**

**Plan B - B  
(EL 45.30)**

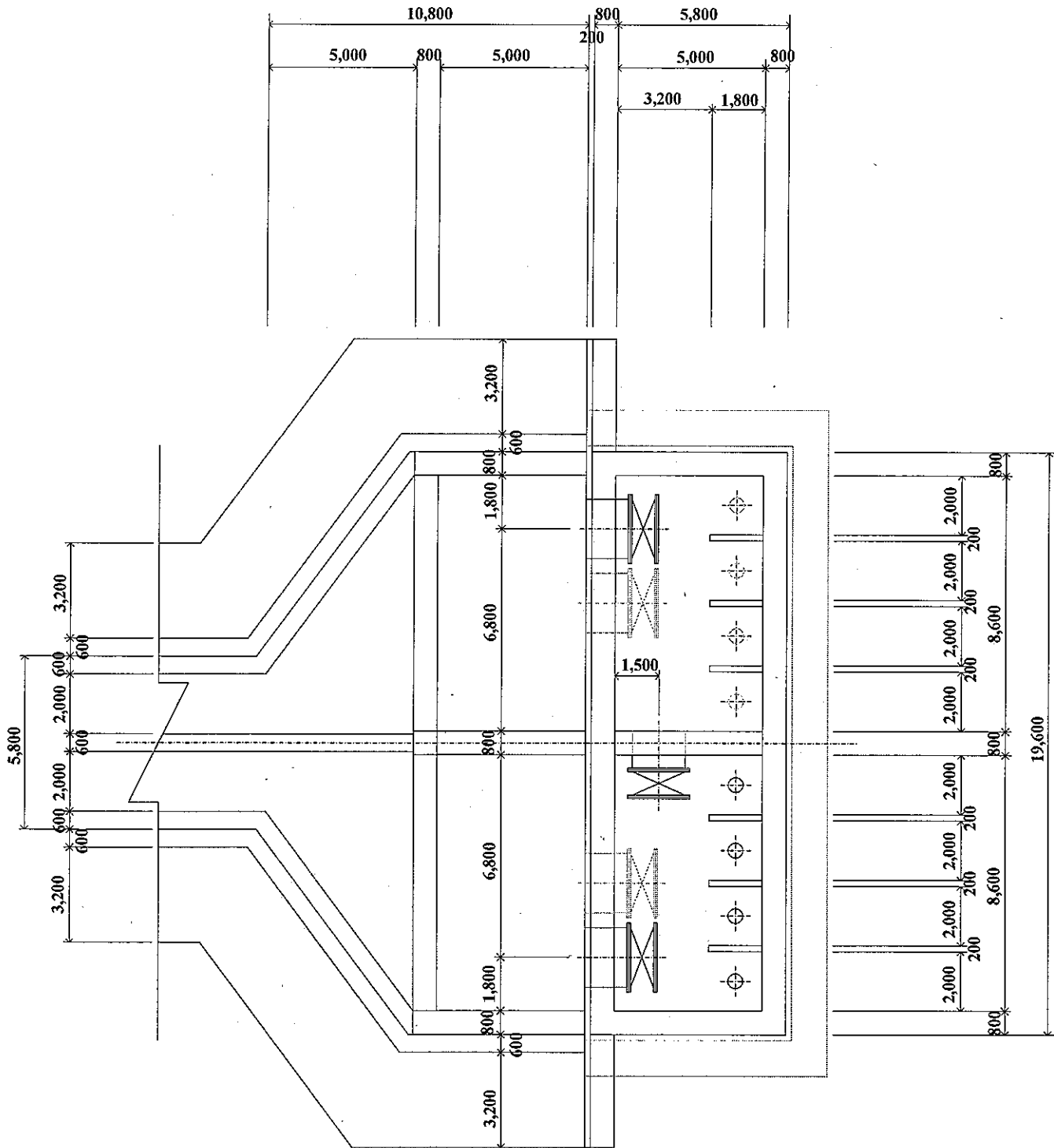
Study on Augmentation of Water Supply and Sanitation  
for the Goa State in the Republic of India

Proposed Salaulim Treatment Plant  
Intake Facility, Plan-1

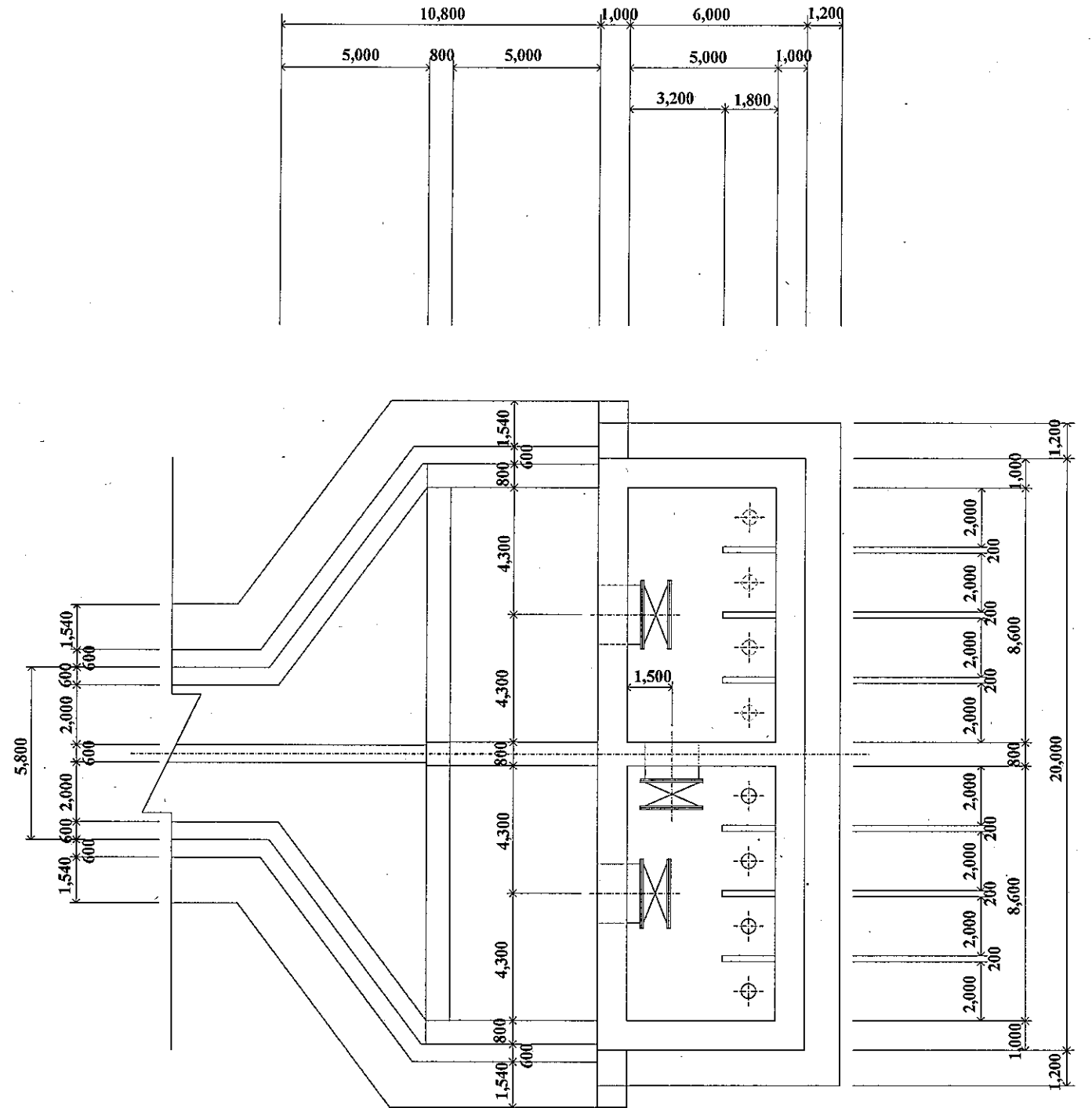
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**Plan E - E**  
**(EL 29.30)**



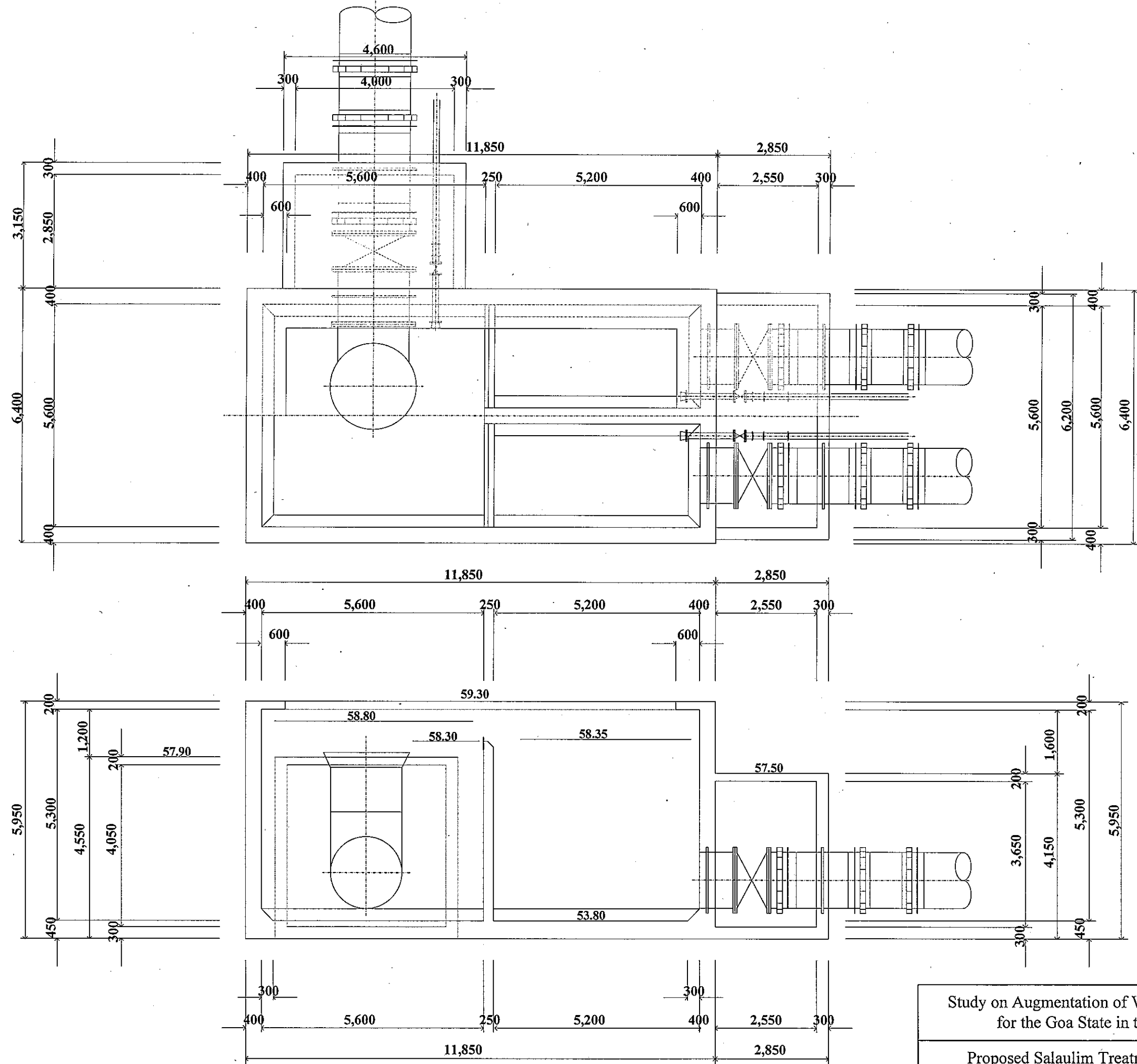
**Plan F - F**  
**(EL 21.00)**

Study on Augmentation of Water Supply and Sanitation  
for the Goa State in the Republic of India

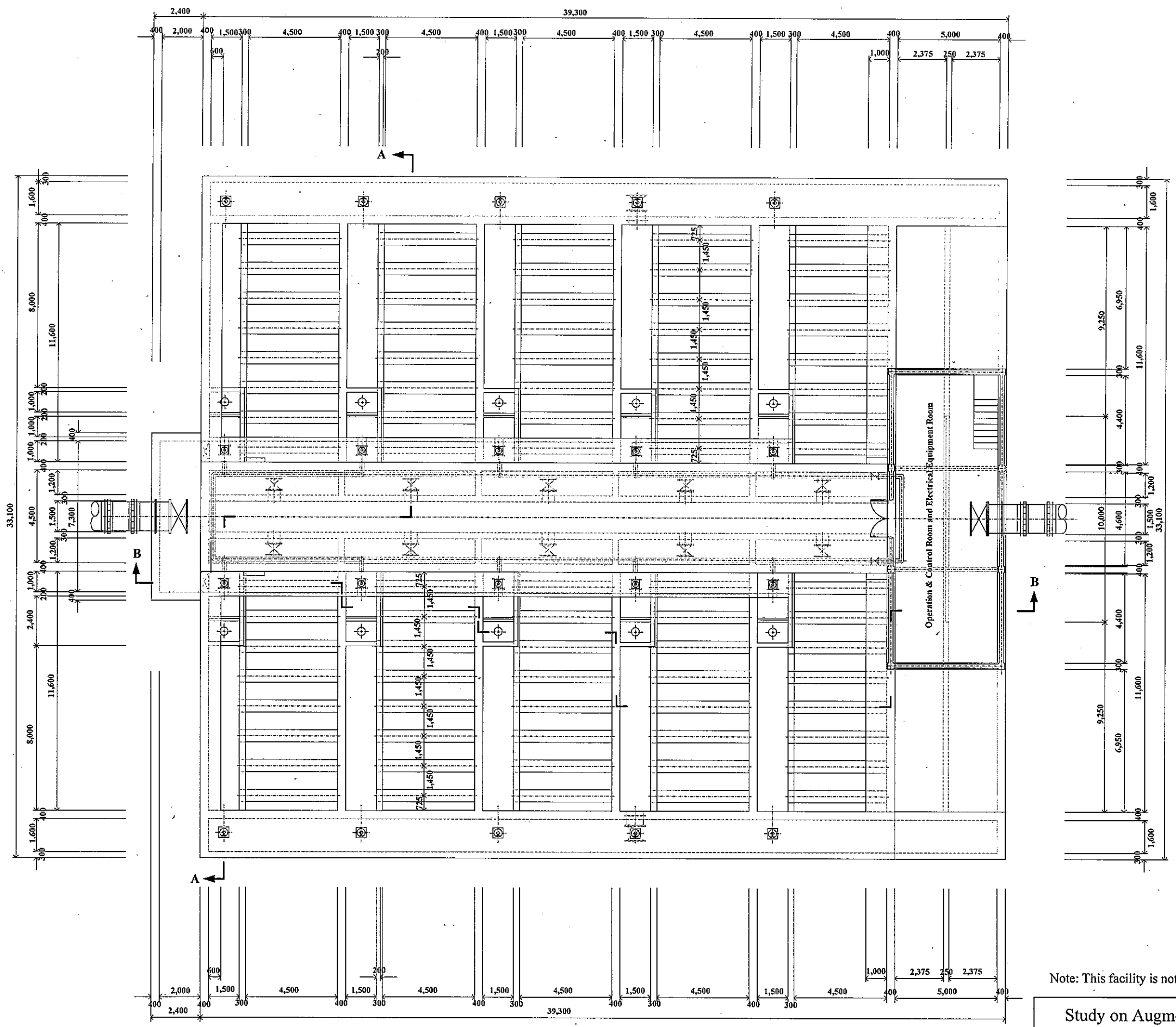
Proposed Salaulim Treatment Plant  
Intake Facility, Plan-3

Scale 1:200

No. W07

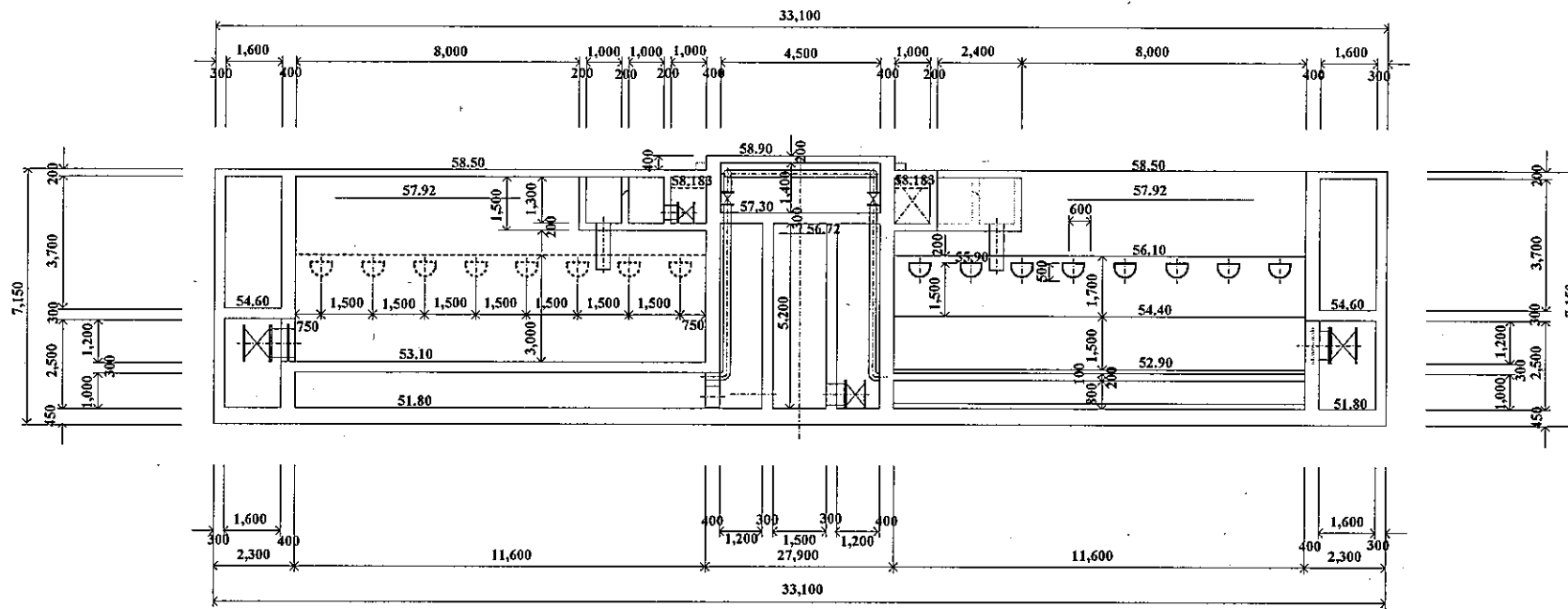


Study on Augmentation of Water Supply and Sanitation for the Goa State in the Republic of India	
Proposed Salaulim Treatment Plant Receiving Well	Scale 1:100
	No. W08

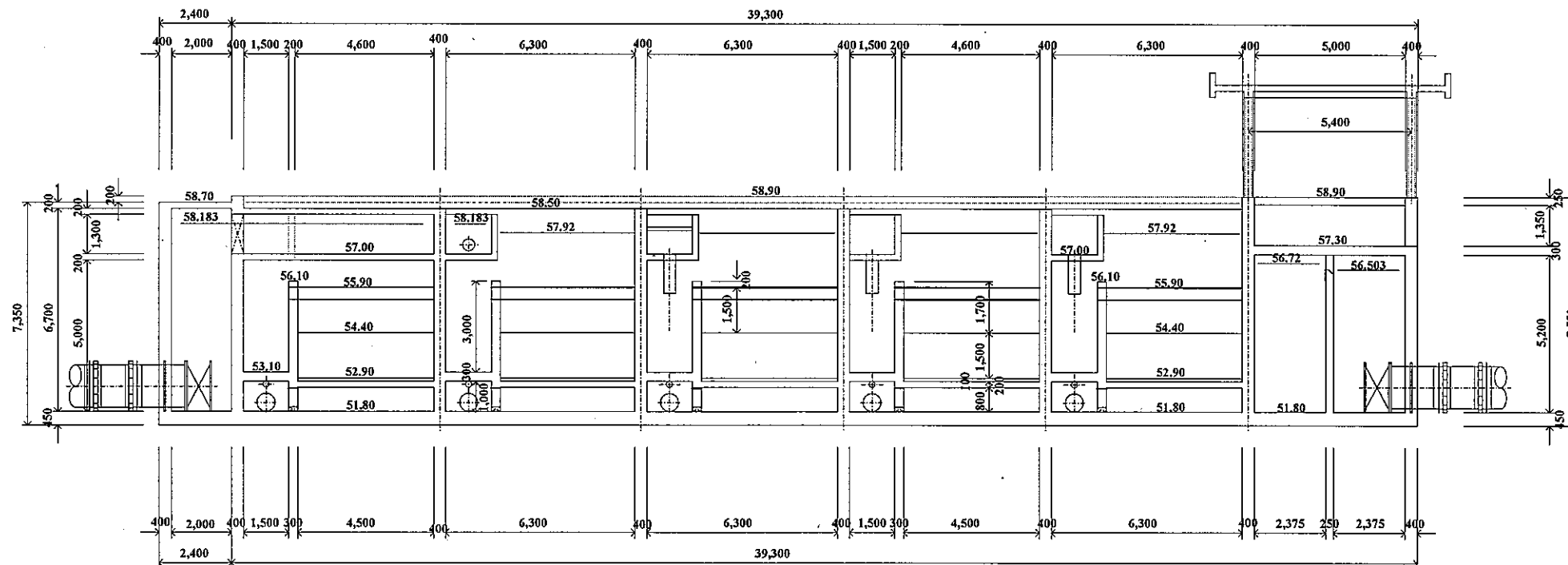


Note: This facility is not proposed at Stage I. This drawing is just for reference.

Study on Augmentation of Water Supply and Sanitation for the Goa State in the Republic of India	
Proposed Salaulim Treatment Plant Biological Contact Filter, Plan	Scale 1:200 No. W09



SECTION A - A



SECTION B - B

Note: This facility is not proposed at Stage I. This drawing is just for reference.

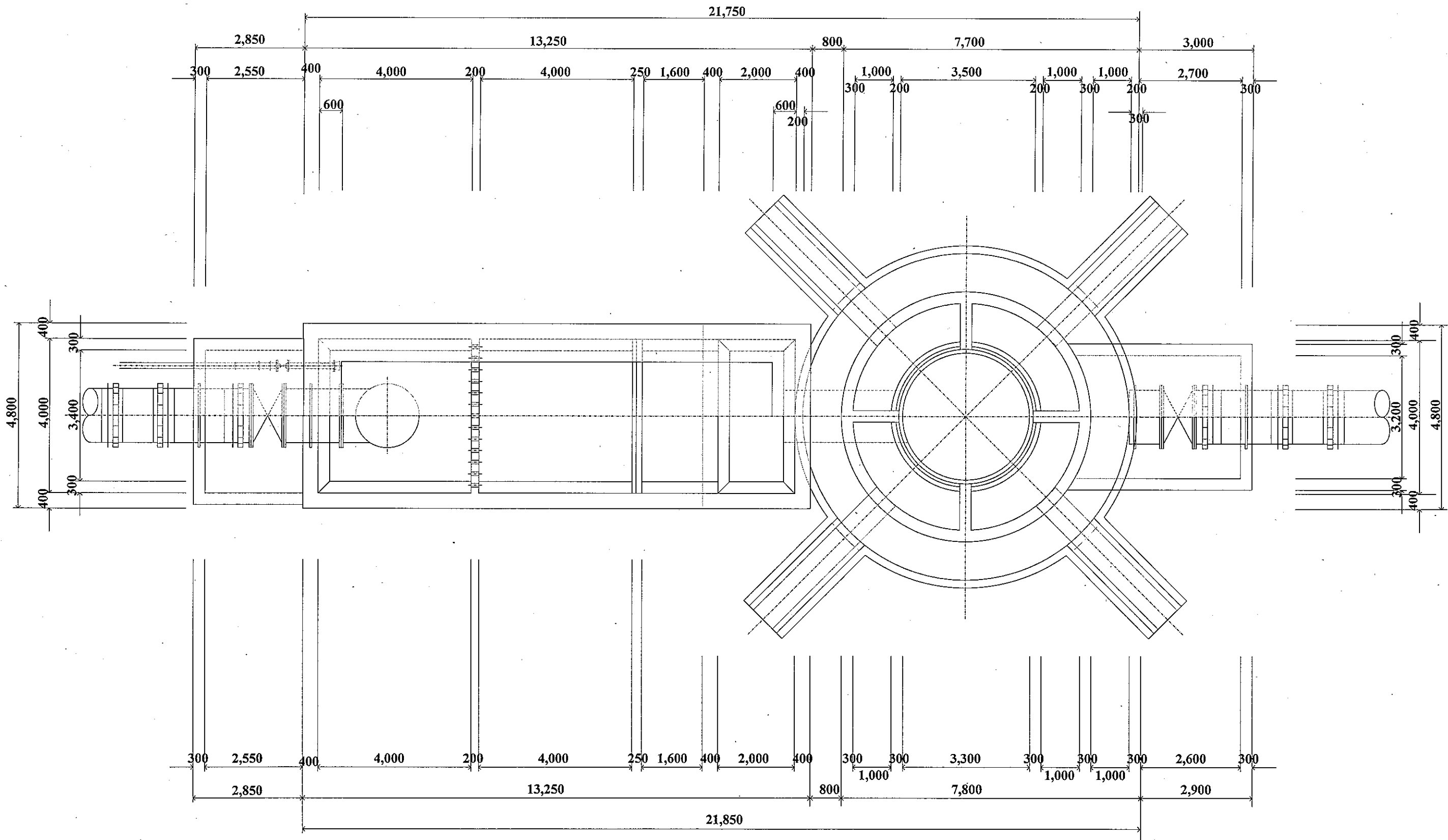
Study on Augmentation of Water Supply and Sanitation  
for the Goa State in the Republic of India

Proposed Salaulim Treatment Plant  
Biological Contact Filter, Section

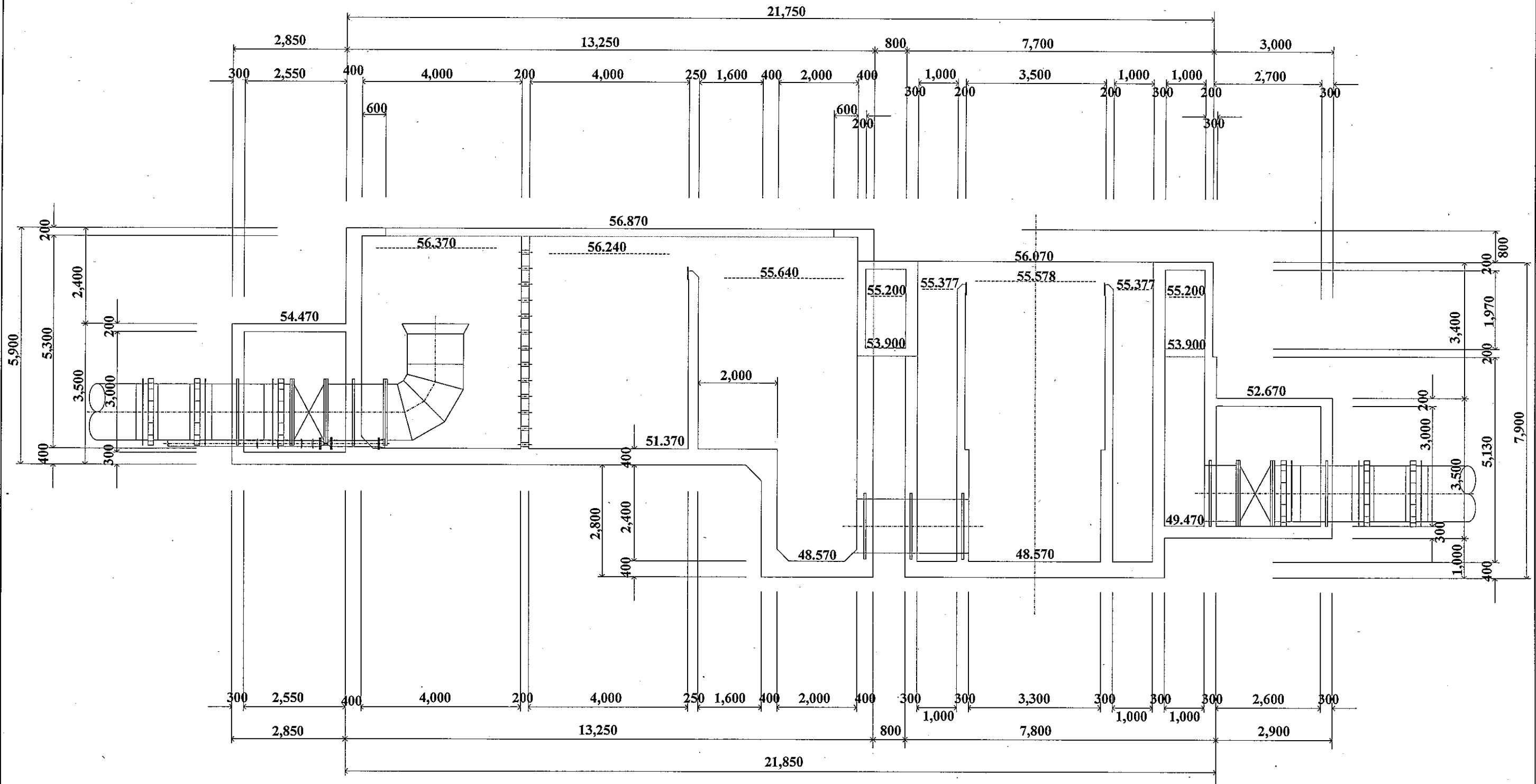
Scale 1:200

No. W10



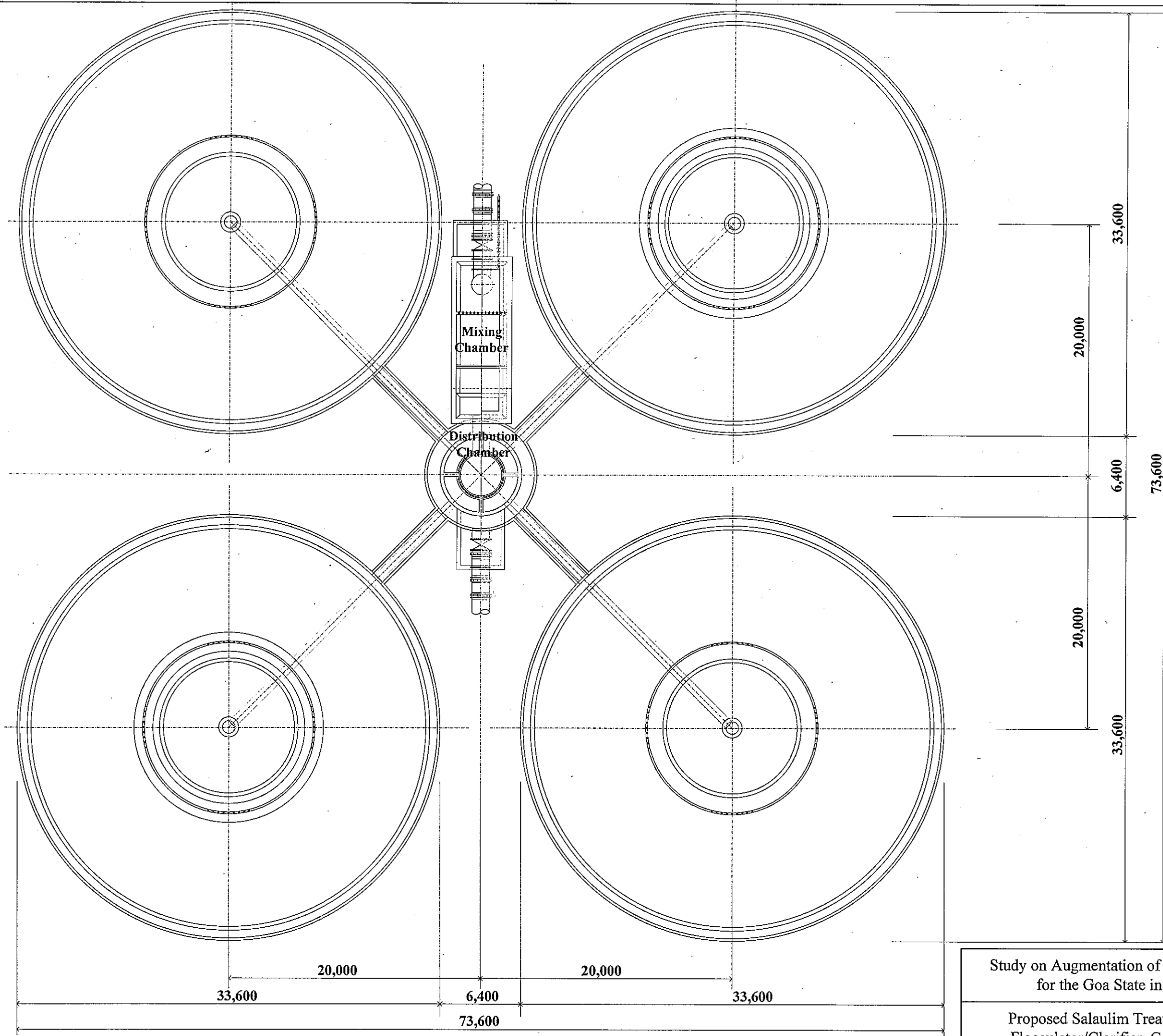


Study on Augmentation of Water Supply and Sanitation for the Goa State in the Republic of India	
Proposed Salaulim Treatment Plant Rapid Mixer, Plan	Scale 1:100
	No. W11

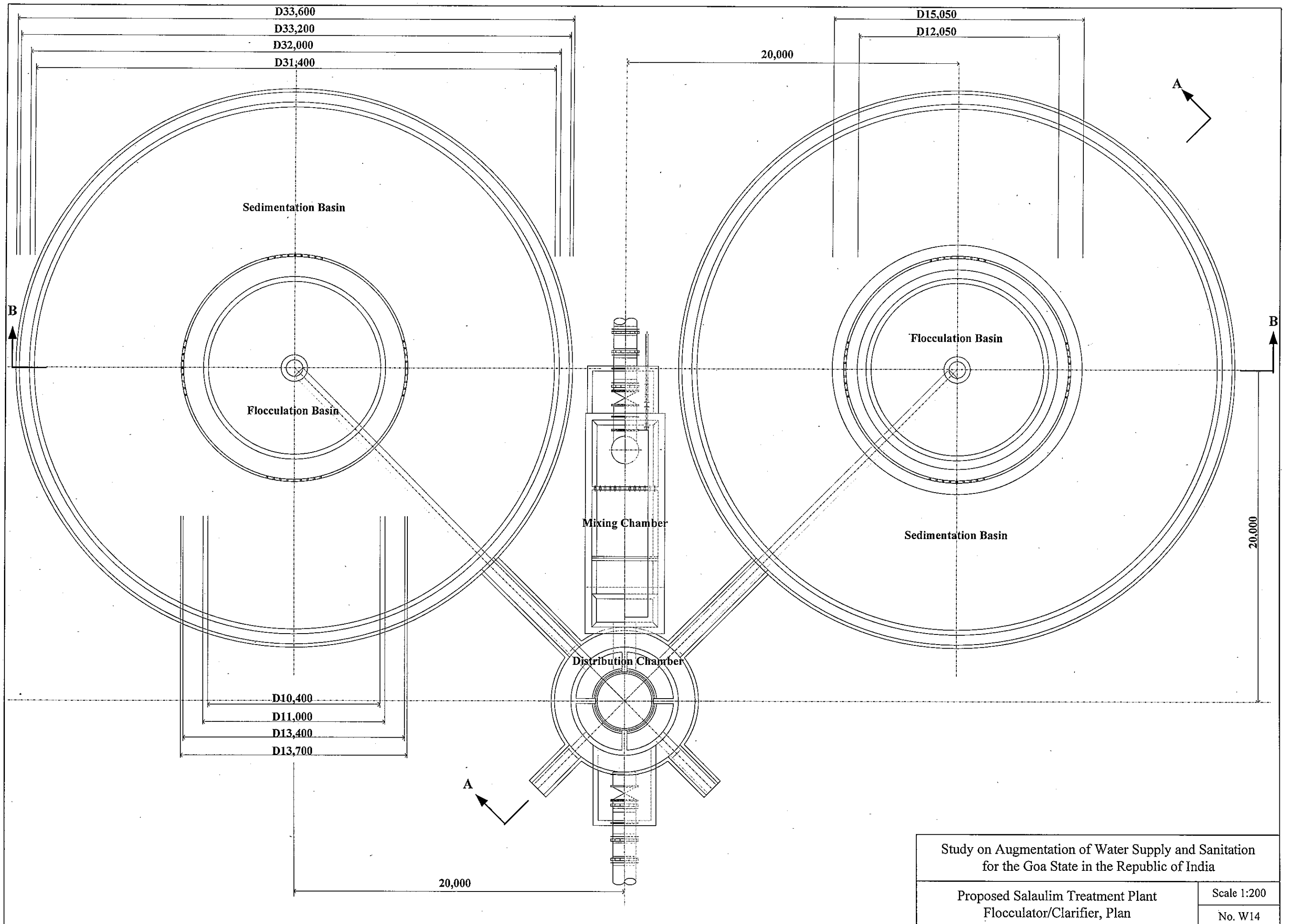


Study on Augmentation of Water Supply and Sanitation  
for the Goa State in the Republic of India

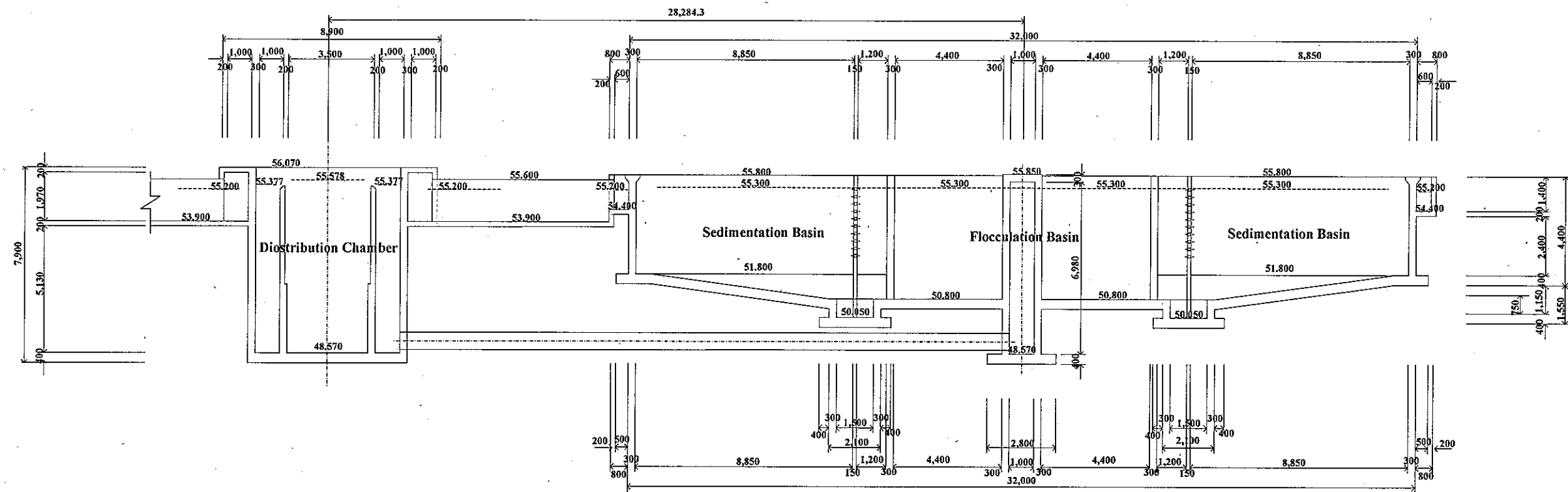
Proposed Salaulim Treatment Plant Rapid Mixer, Section	Scale 1:100
	No. W12



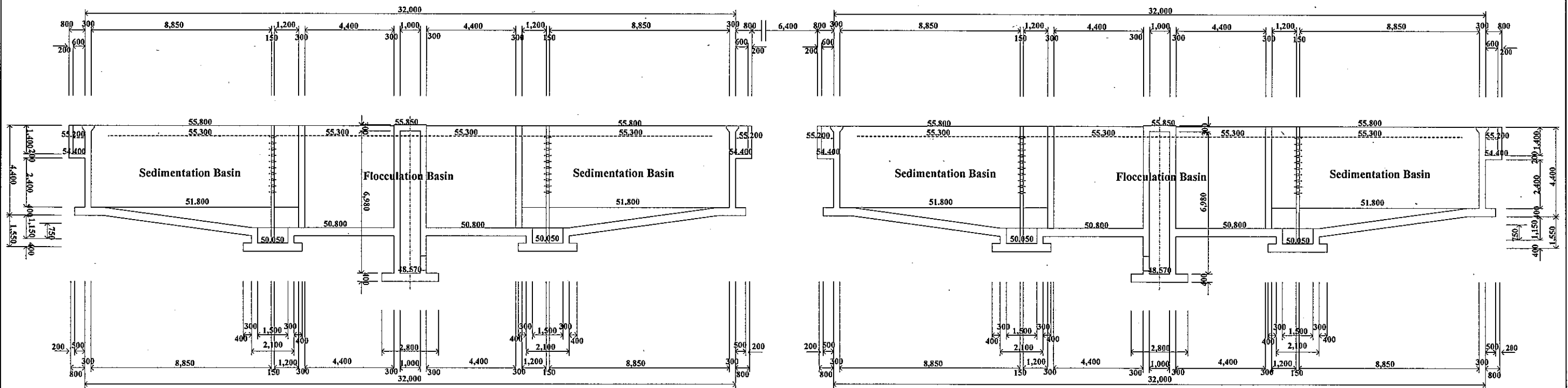
Study on Augmentation of Water Supply and Sanitation for the Goa State in the Republic of India	
Proposed Salaulim Treatment Plant Flocculator/Clarifier, General Plan	Scale 1:300 No. W13



Study on Augmentation of Water Supply and Sanitation for the Goa State in the Republic of India	
Proposed Salaulim Treatment Plant Flocculator/Clarifier, Plan	Scale 1:200 No. W14



Section A - A



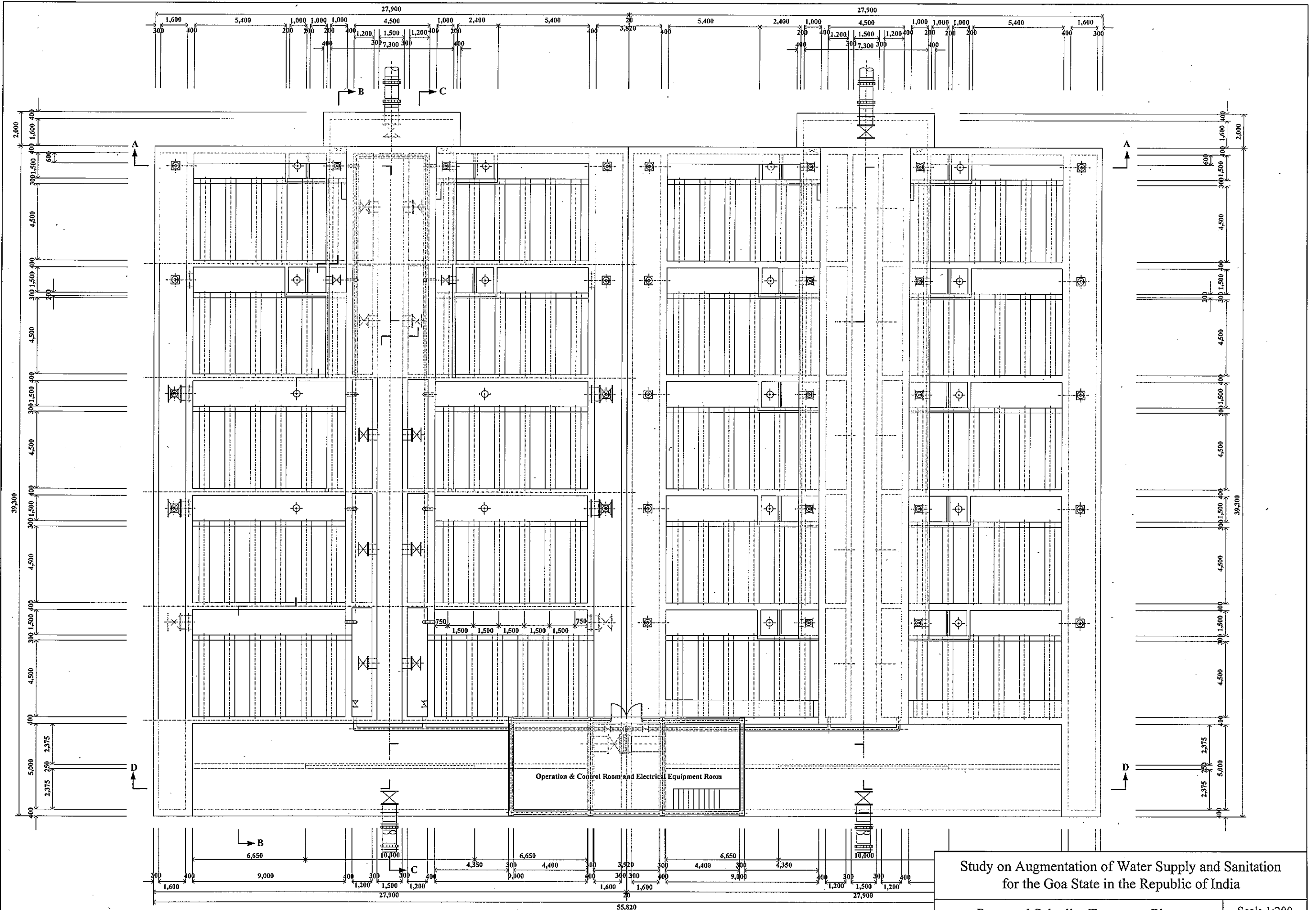
Section B - B

Study on Augmentation of Water Supply and Sanitation  
for the Goa State in the Republic of India

Proposed Salaulim Treatment Plant  
Flocculator/Clarifier, Section

Scale 1:200

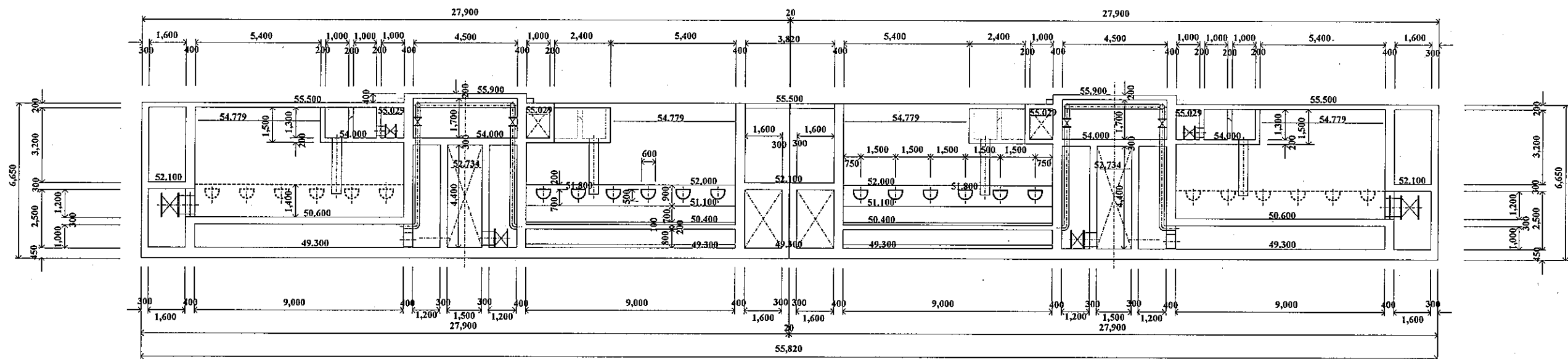
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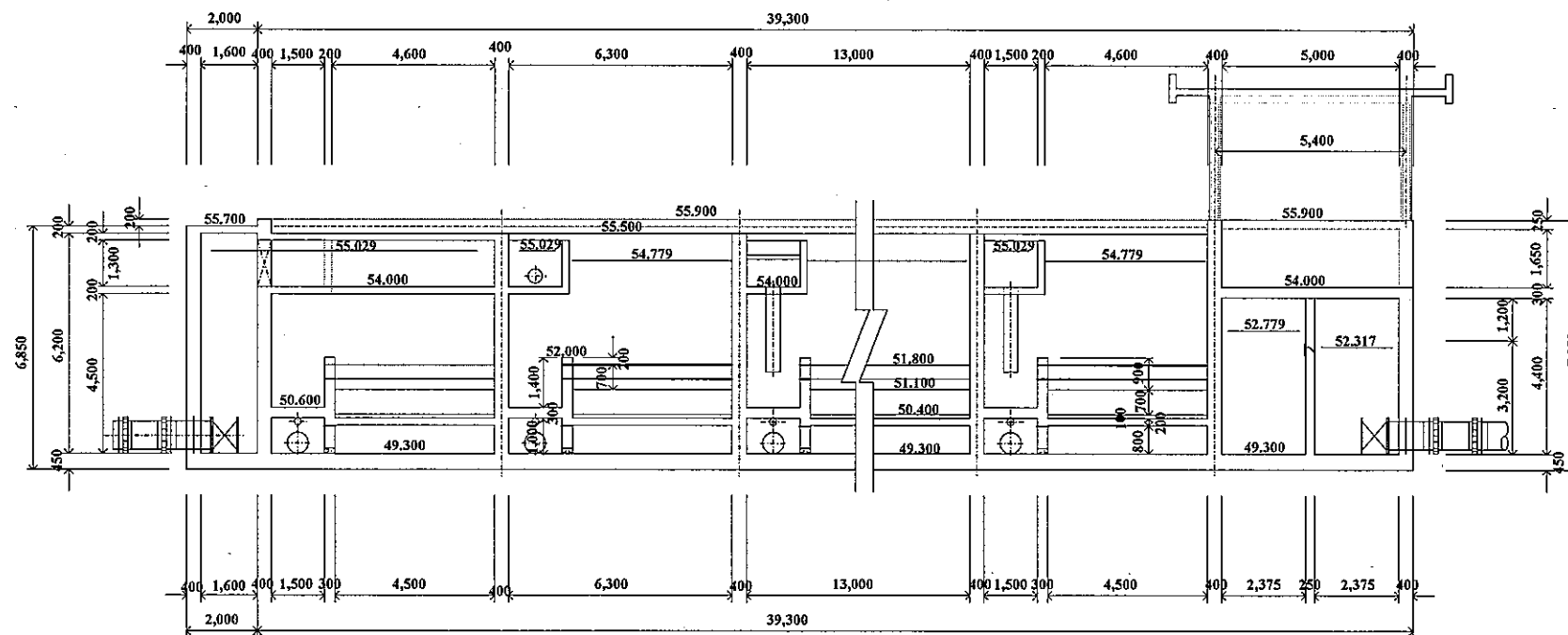
Study on Augmentation of Water Supply and Sanitation  
for the Goa State in the Republic of India

Proposed Salaulim Treatment Plant  
Filter Basin, Plan

Scale 1:200  
No. W16



**SECTION A - A**



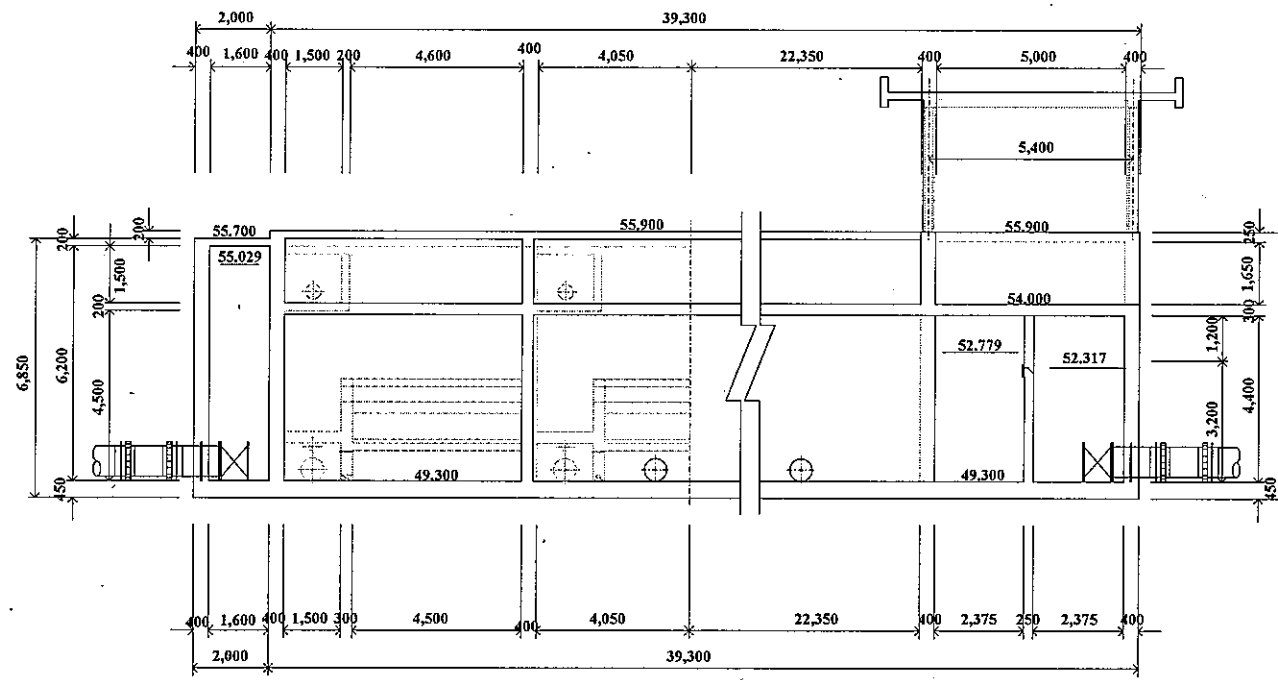
**SECTION B - B**

Study on Augmentation of Water Supply and Sanitation  
for the Goa State in the Republic of India

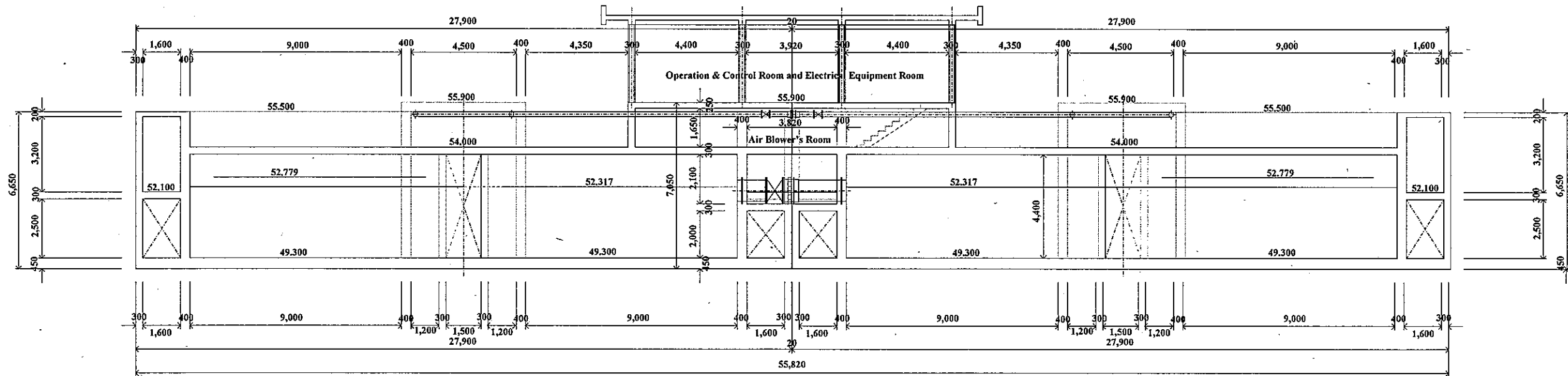
Proposed Salaulim Treatment Plant  
Filter Basin, Section-1

Scale 1:200

No. W17



**SECTION C - C**



**SECTION D - D**

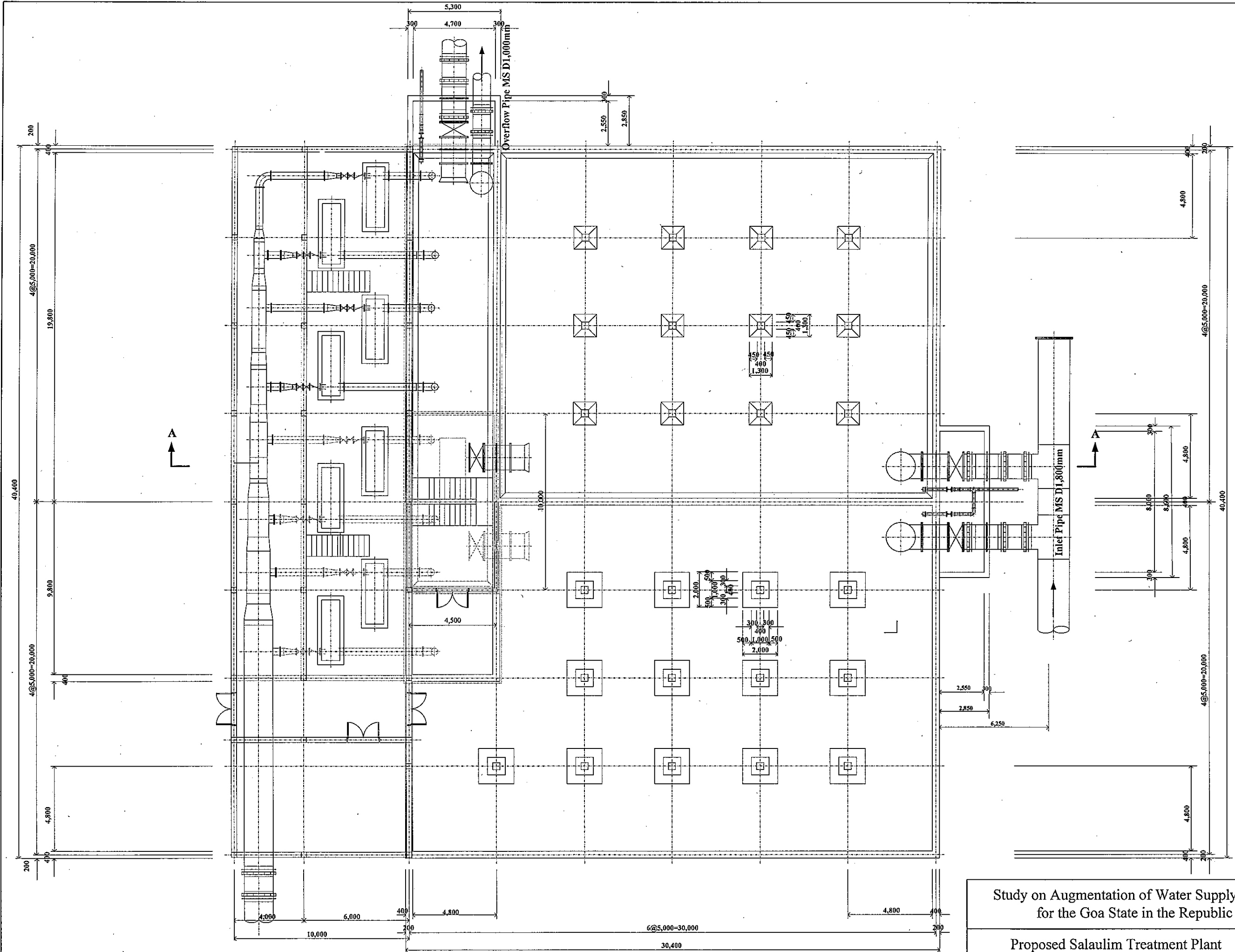
Study on Augmentation of Water Supply and Sanitation  
for the Goa State in the Republic of India

Proposed Salaulim Treatment Plant  
Filter Basin, Section-2

Scale 1:200

No. W18

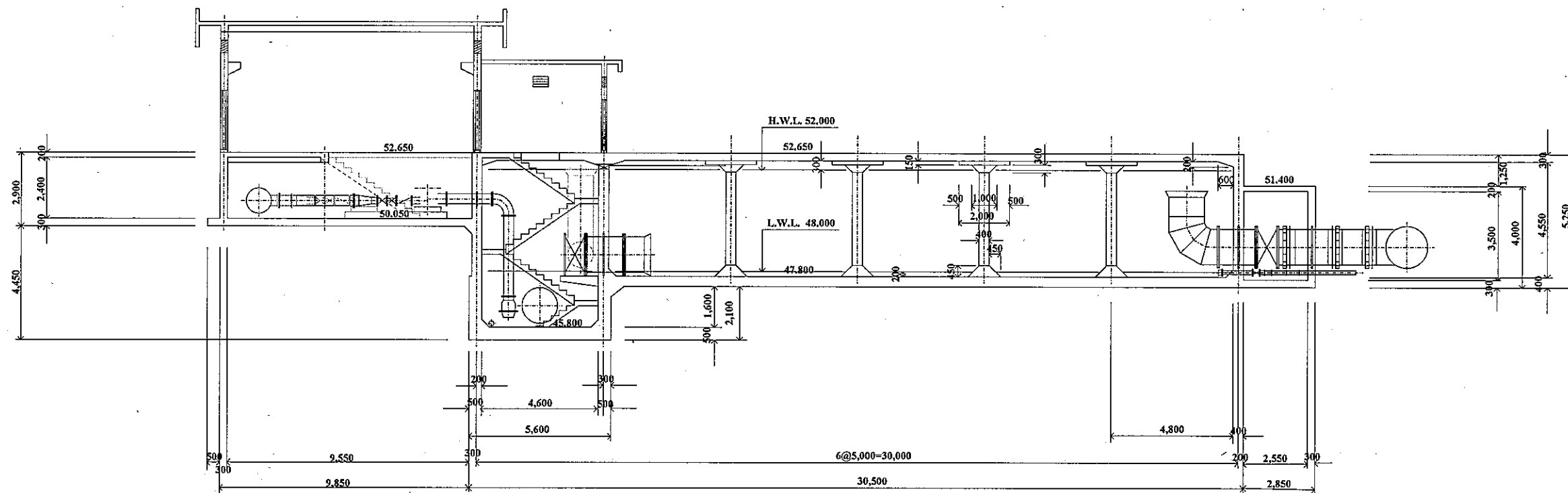




Study on Augmentation of Water Supply and Sanitation  
for the Goa State in the Republic of India

Proposed Salaulim Treatment Plant  
Clear Water Reservoir, Plan

Scale 1:200  
No. W19

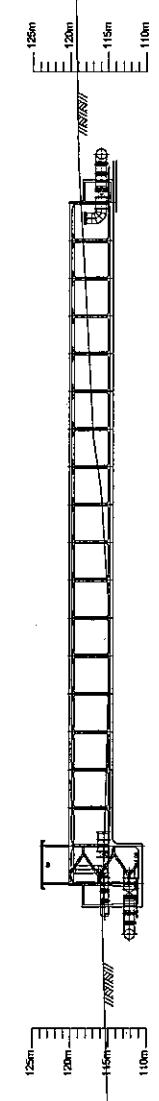
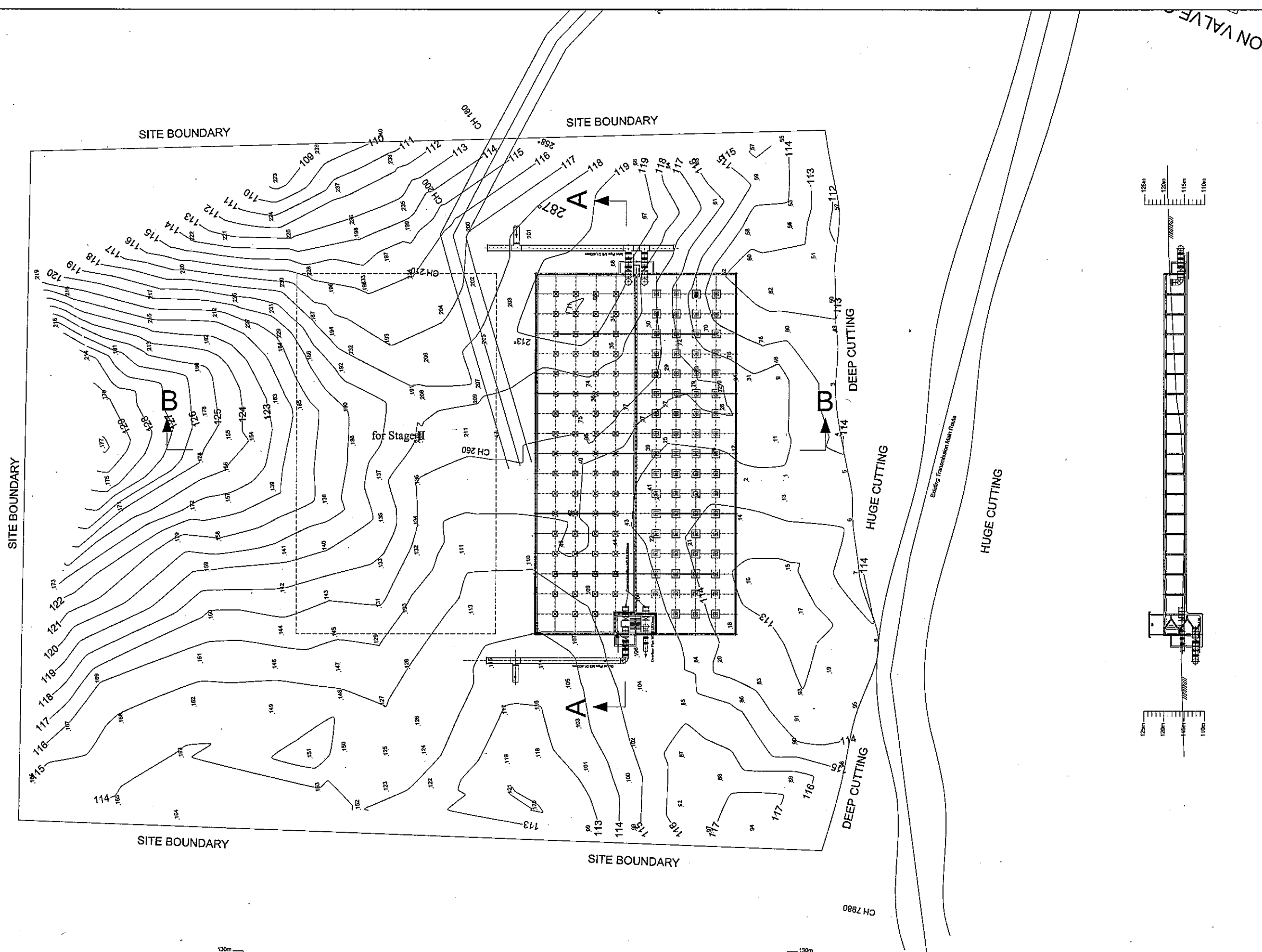


Study on Augmentation of Water Supply and Sanitation  
for the Goa State in the Republic of India

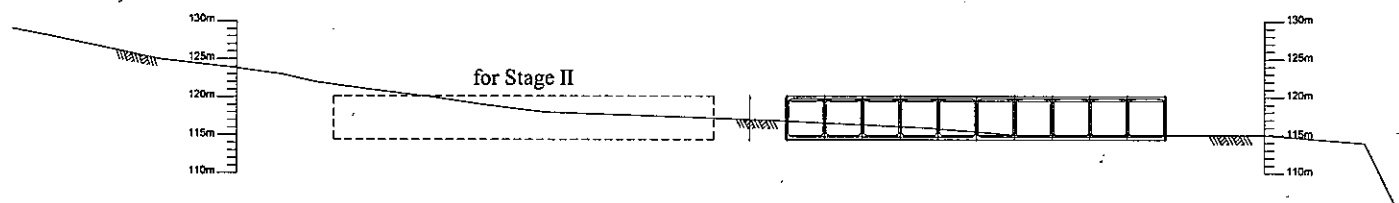
Proposed Salaulim Treatment Plant  
Clear Water Reservoir, Section

Scale 1:200

No. W20

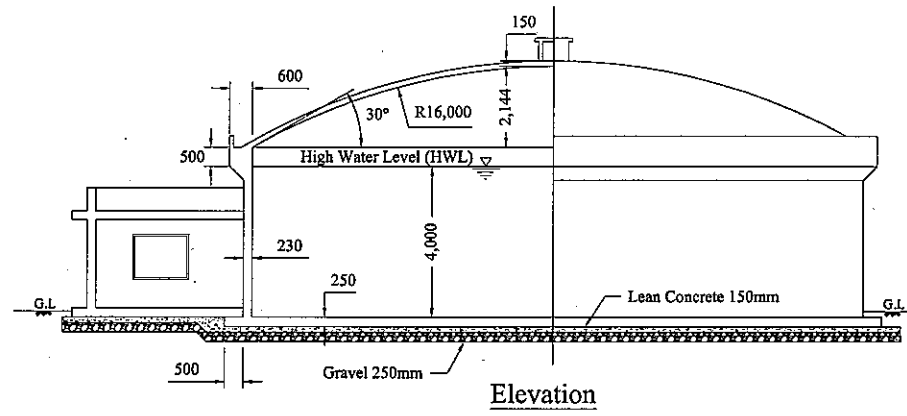


Section A-A

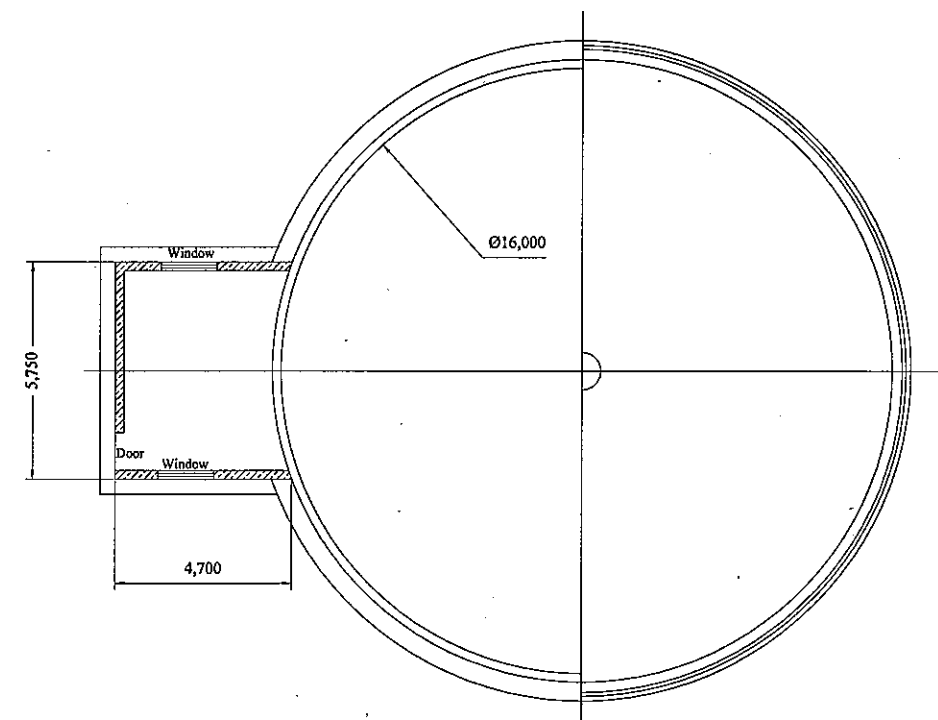


Section B-B

Study on Augmentation of Water Supply and Sanitation for the Goa State in the Republic of India	
General Layout Plan for Sirvoi Master Balancing Reservoir	Scale: 1:1,000 No. W21

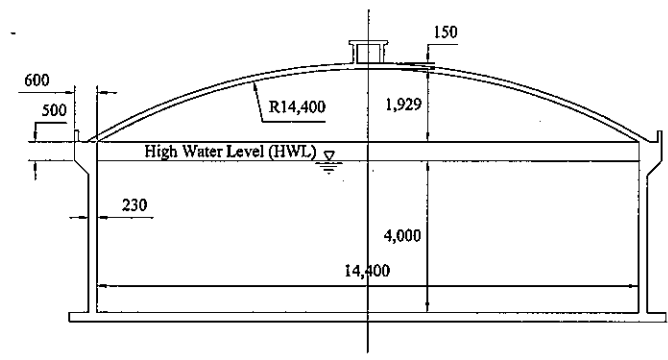


Elevation

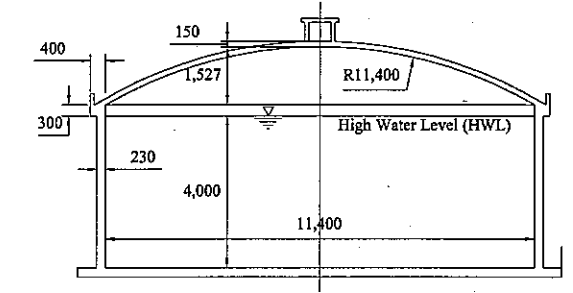


Plan

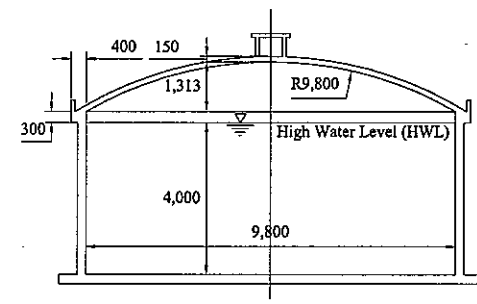
800 M3 G.L.R with Control (Pump) Room



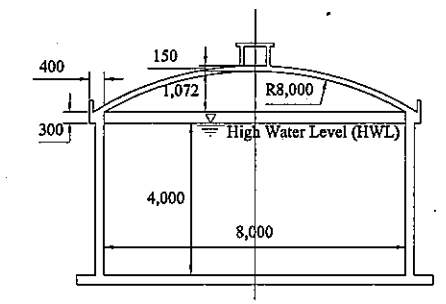
650 M3 GLR



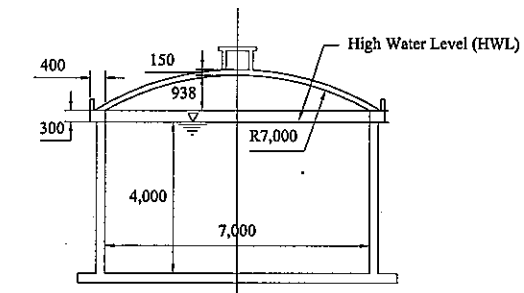
400 M3 GLR



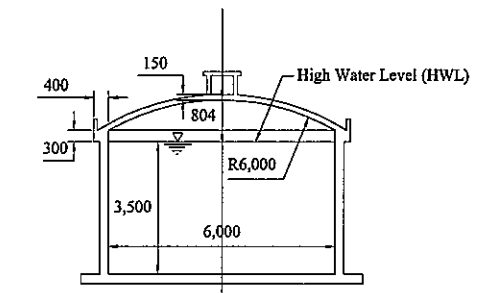
300 M3 GLR



200 M3 GLR

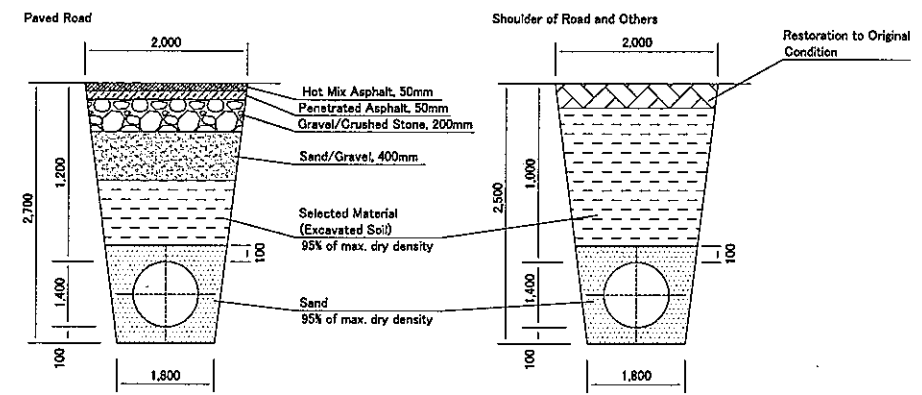
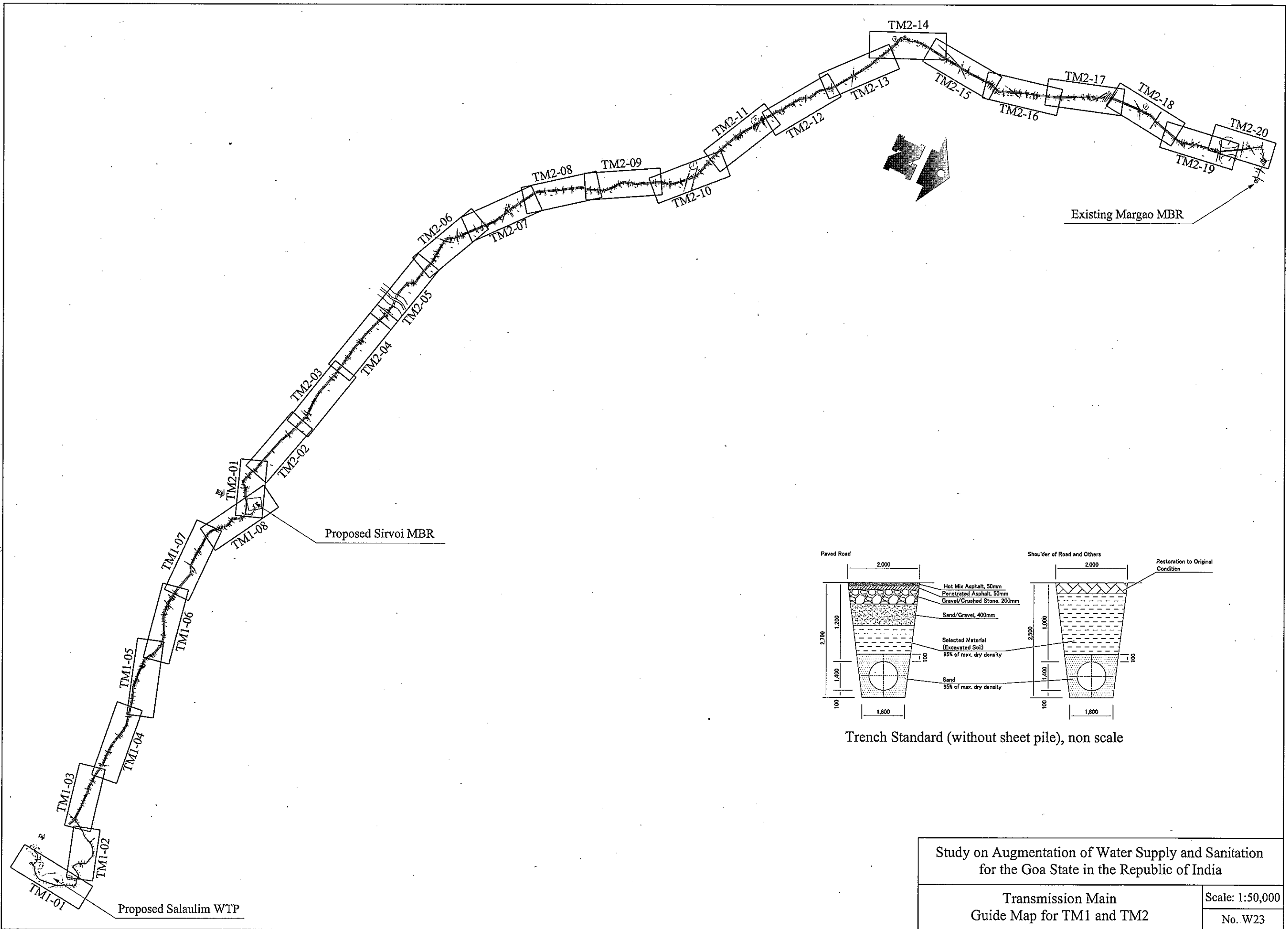


150 M3 GLR



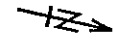
200 M3 GLR

Study on Augmentation of Water Supply and Sanitation for the Goa State in the Republic of India	
Standard Drawing for Distribution Reservoirs	Scale: 1:200
No. W22	

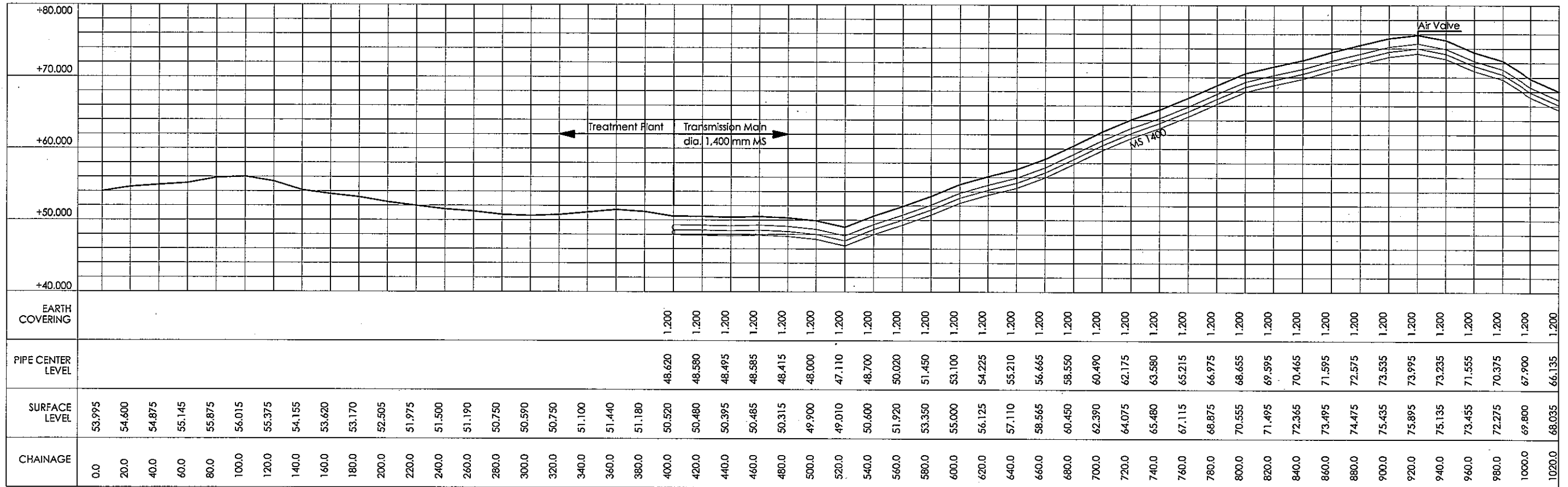
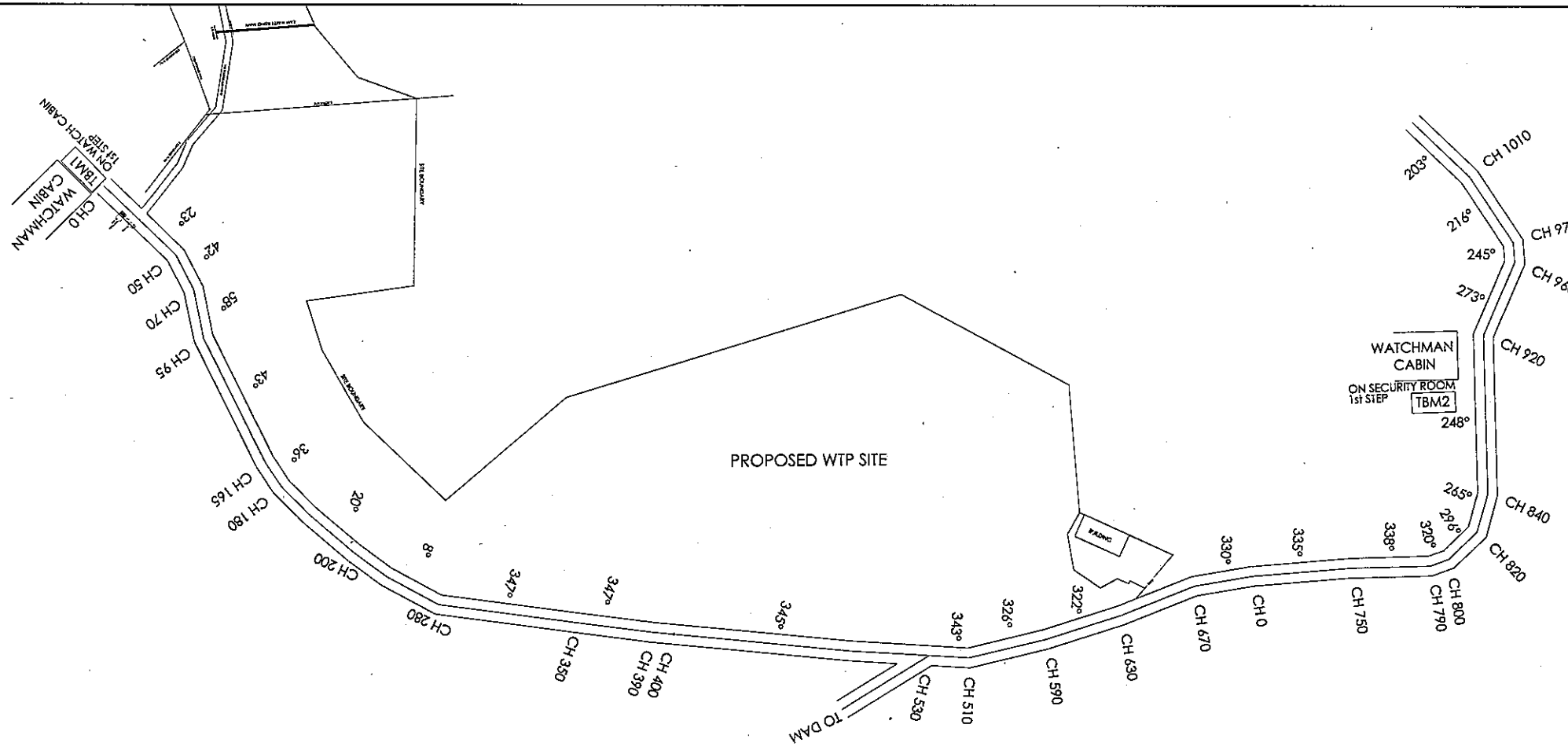


Trench Standard (without sheet pile), non scale

Study on Augmentation of Water Supply and Sanitation for the Goa State in the Republic of India	
Transmission Main Guide Map for TM1 and TM2	Scale: 1:50,000
	No. W23



SCALE: HORIZONTAL:-1:3000  
VERTICAL:-1:600

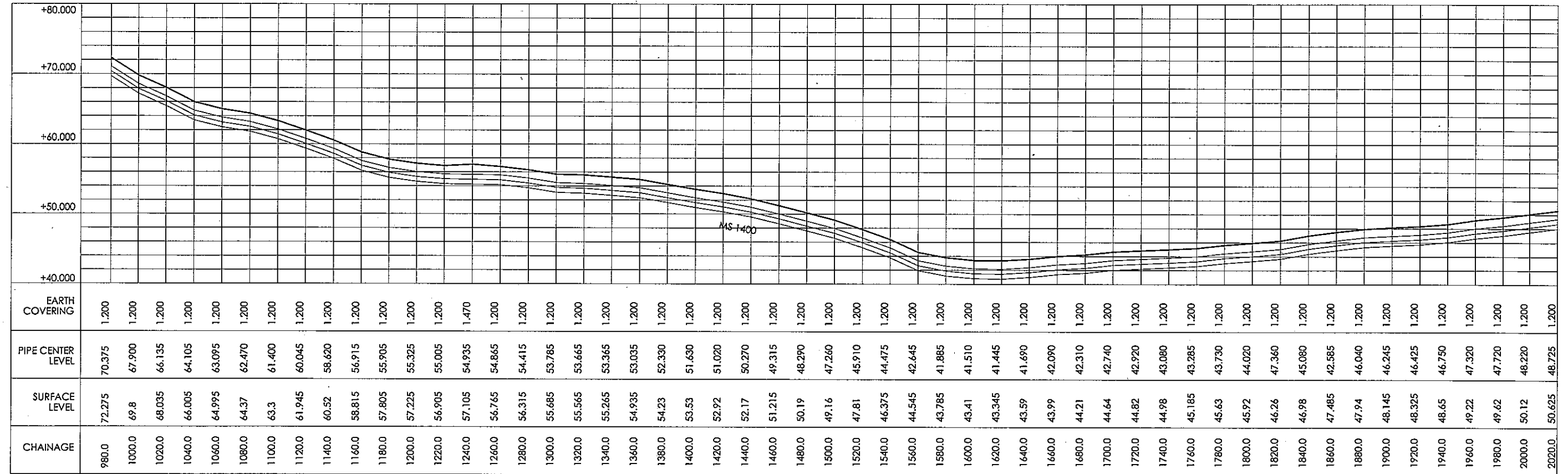
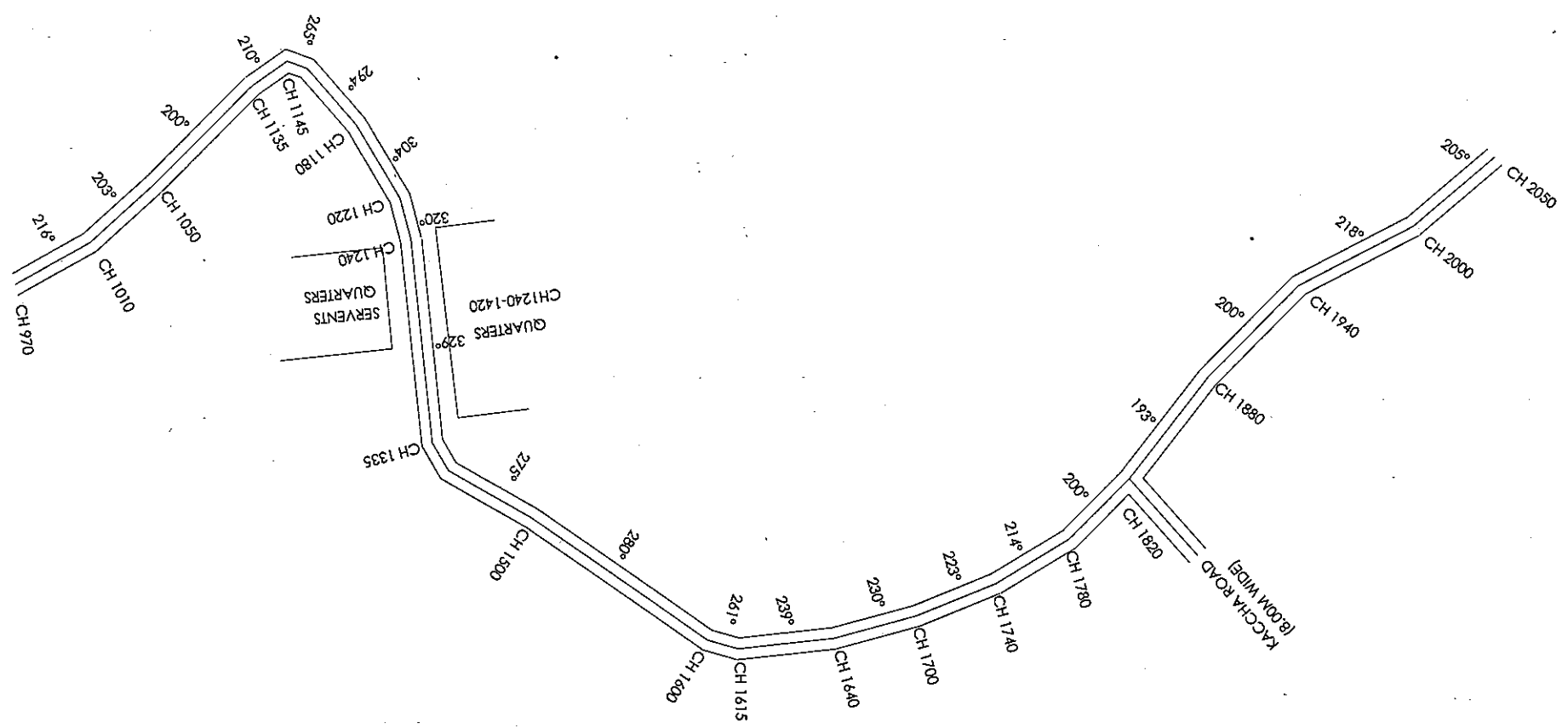


Study on Augmentation of Water Supply and Sanitation  
for the Goa State in the Republic of India

Transmission Main  
Proposed WTP to Sirvoi MBR, TM1-01

Scale: as shown  
No. W24

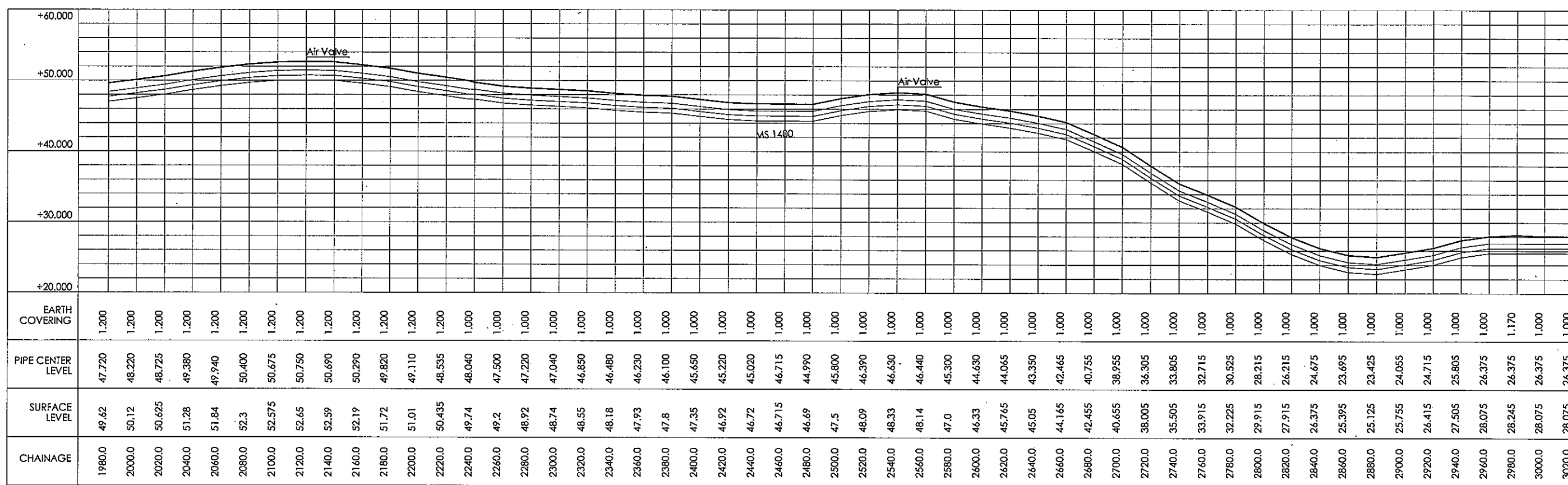
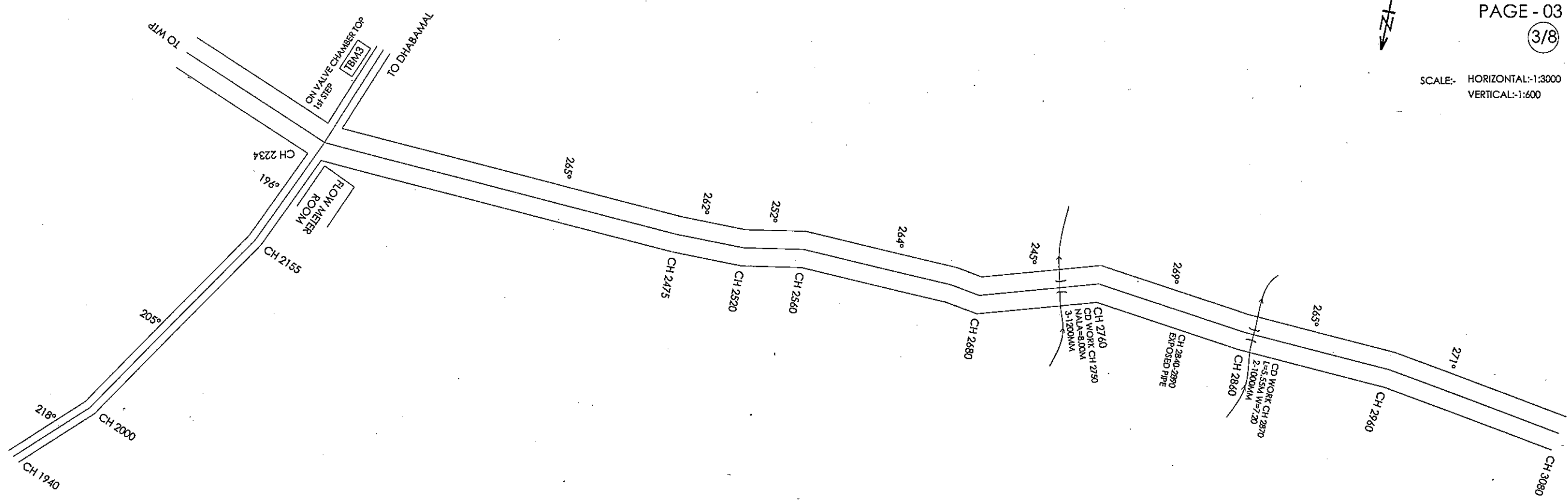
SCALE: HORIZONTAL:-1:3000  
VERTICAL:-1:600



Study on Augmentation of Water Supply and Sanitation  
for the Goa State in the Republic of India

Transmission Main  
Proposed WTP to Sirvoi MBR, TM1-02

Scale: as shown  
No. W25



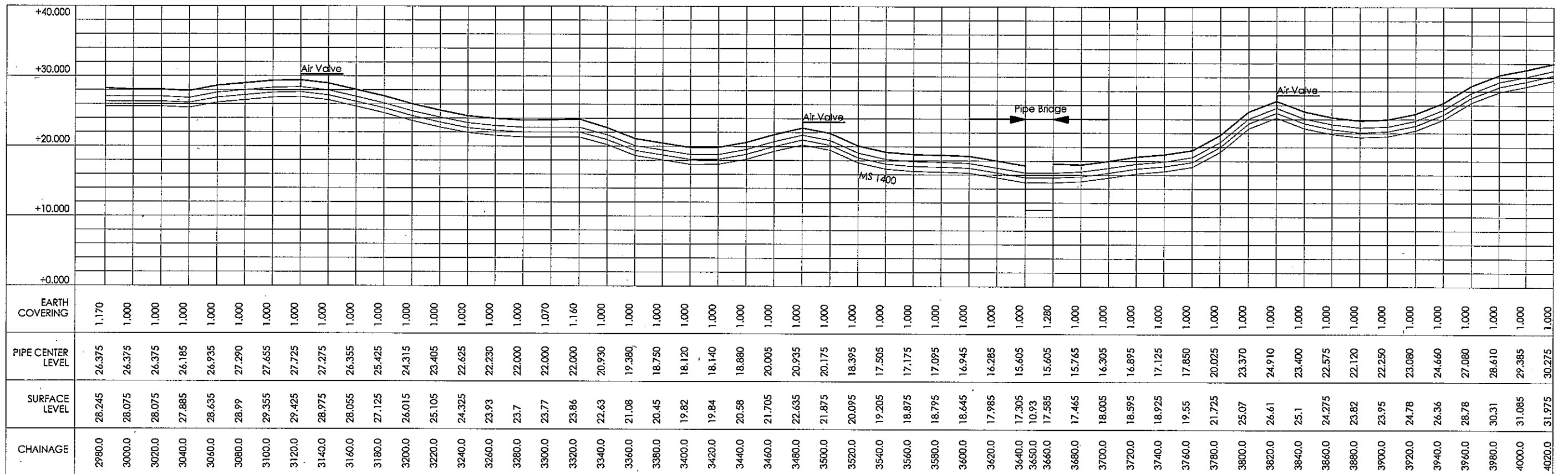
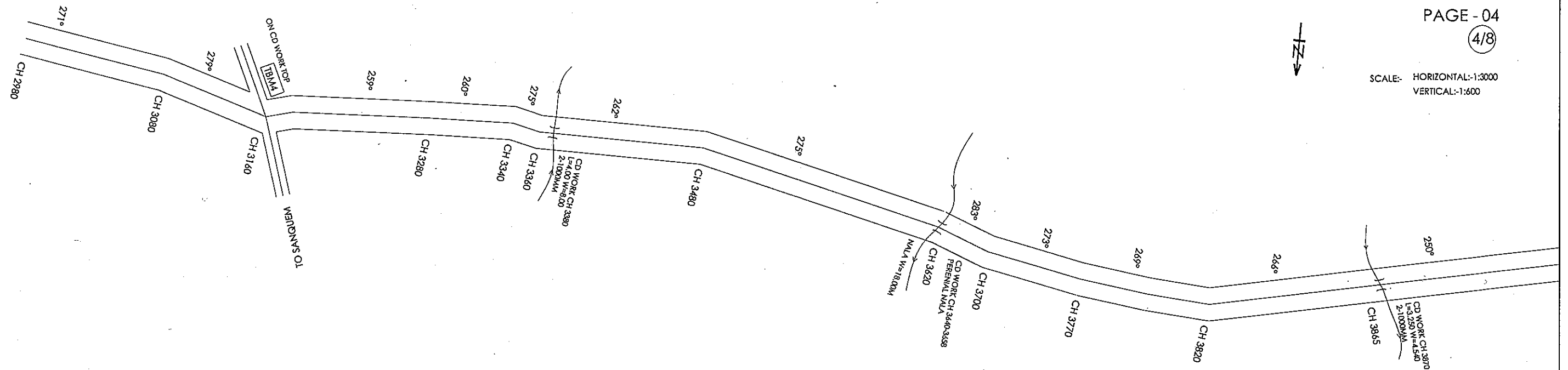
Study on Augmentation of Water Supply and Sanitation  
for the Goa State in the Republic of India

Transmission Main  
Proposed WTP to Sirvoi MBR, TM1-03

Scale: as shown  
No. W26



SCALE: HORIZONTAL:-1:3000  
VERTICAL:-1:600

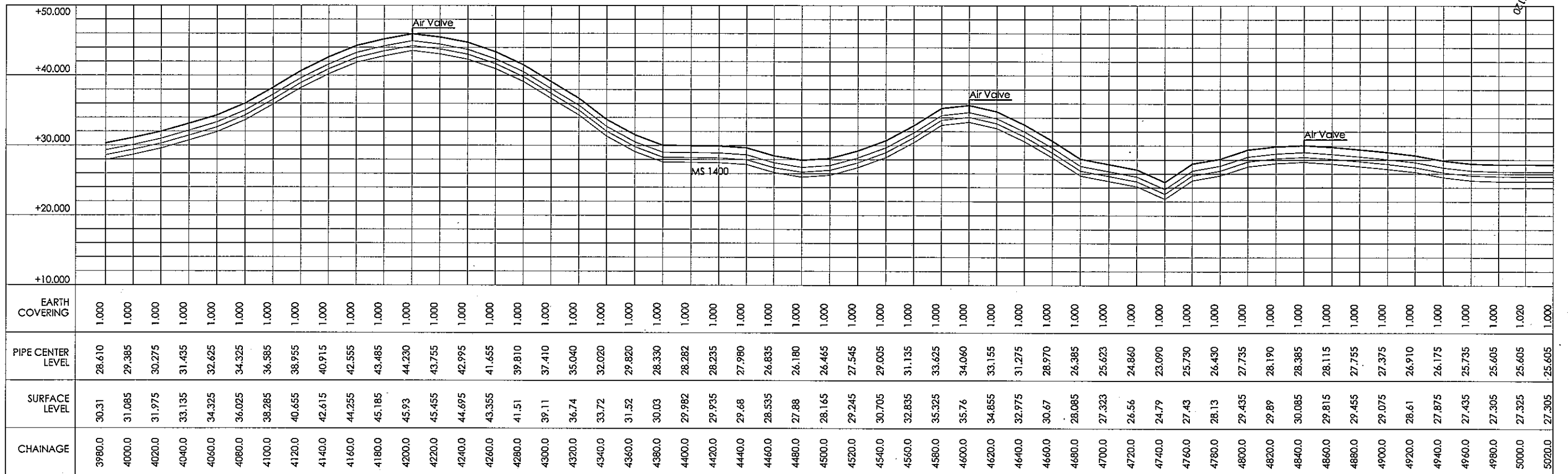
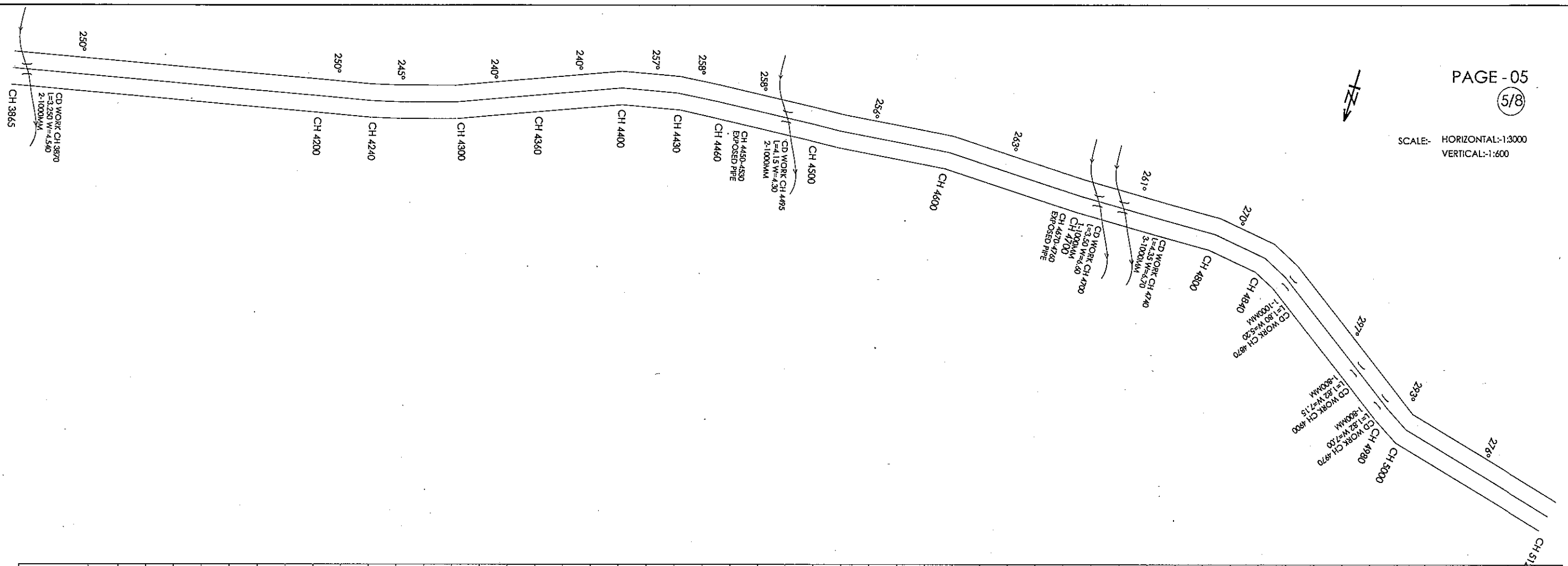


Study on Augmentation of Water Supply and Sanitation  
for the Goa State in the Republic of India

Transmission Main  
Proposed WTP to Sirvoi MBR, TM1-04

Scale: as shown  
No. W27

SCALE: HORIZONTAL:1:3000  
VERTICAL:1:600

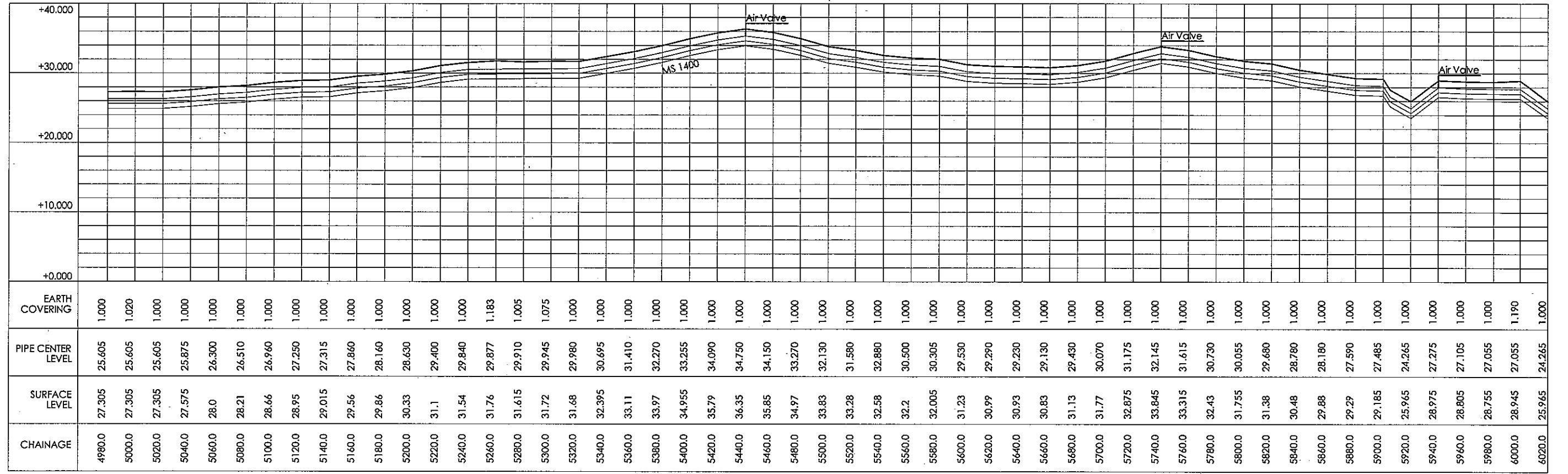
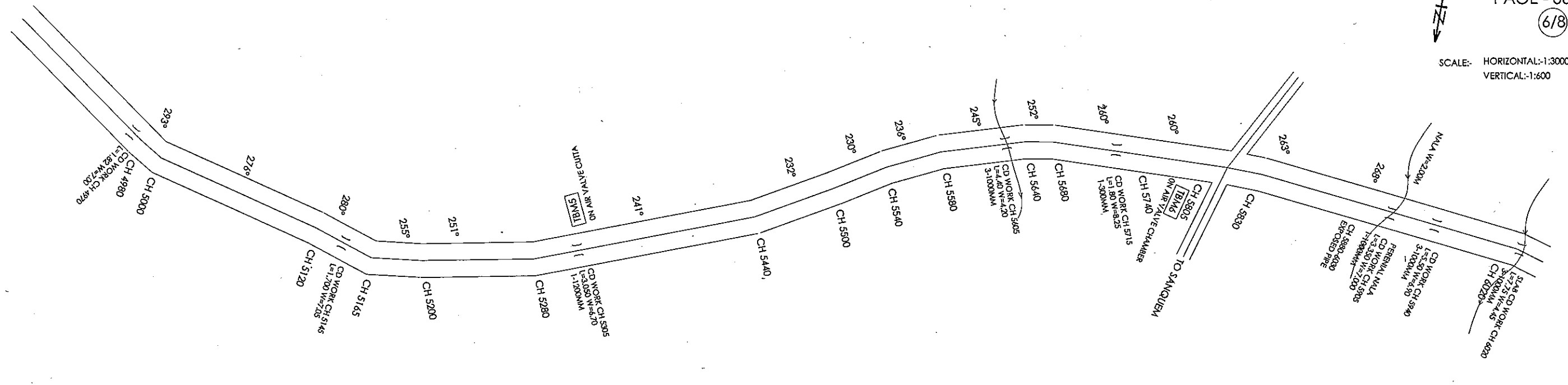


Study on Augmentation of Water Supply and Sanitation  
for the Goa State in the Republic of India

Transmission Main  
Proposed WTP to Sirvoi MBR, TM1-05

Scale: as shown  
No. W28

SCALE: HORIZONTAL:-1:3000  
VERTICAL:-1:600

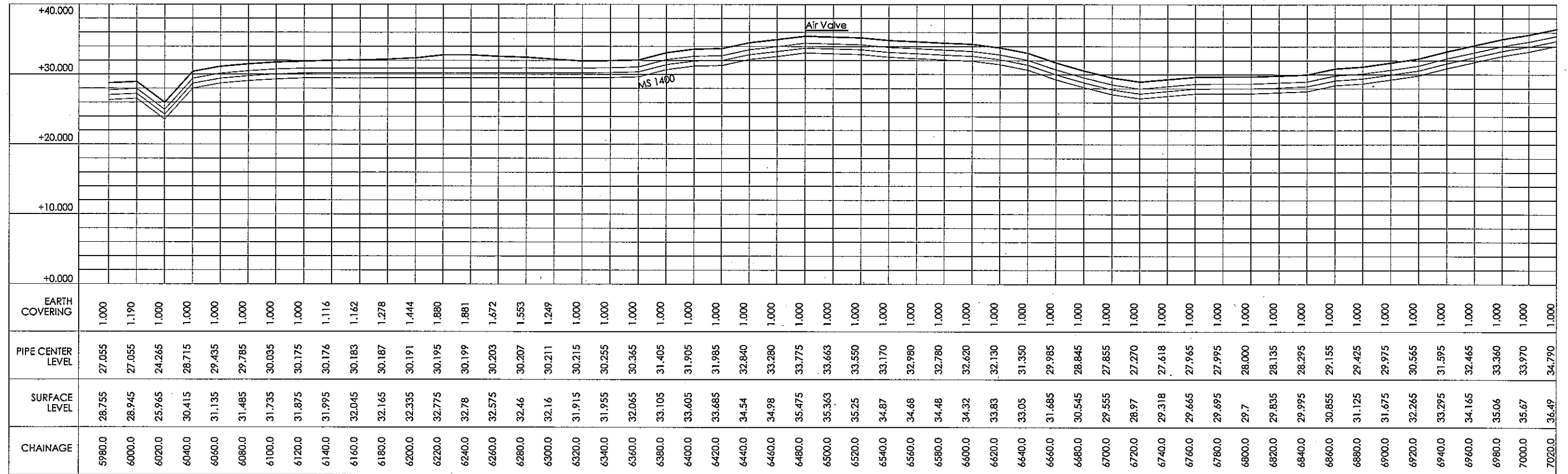
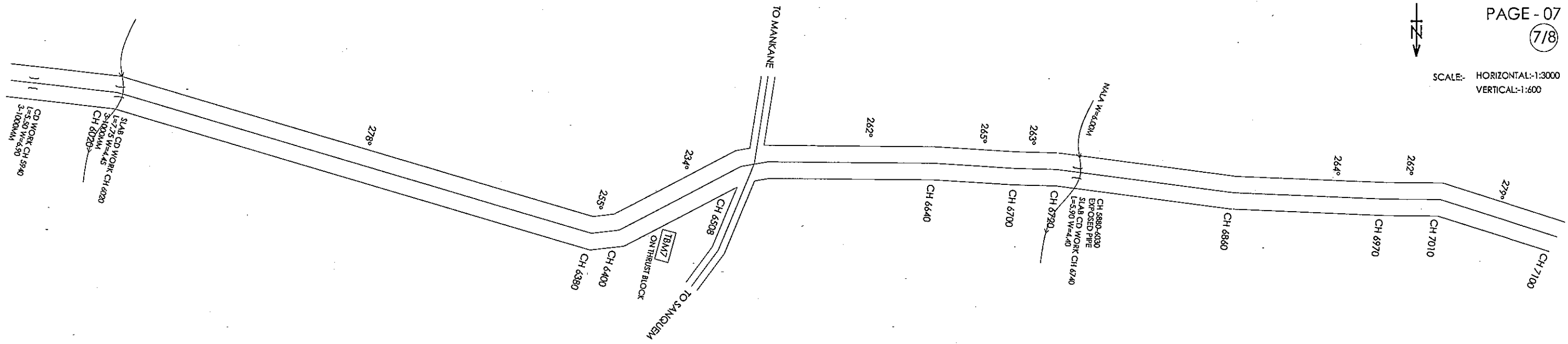


Study on Augmentation of Water Supply and Sanitation  
for the Goa State in the Republic of India

Transmission Main  
Proposed WTP to Sirvoi MBR, TM1-06

Scale: as shown  
No. W29

SCALE- HORIZONTAL-1:3000  
VERTICAL-1:600

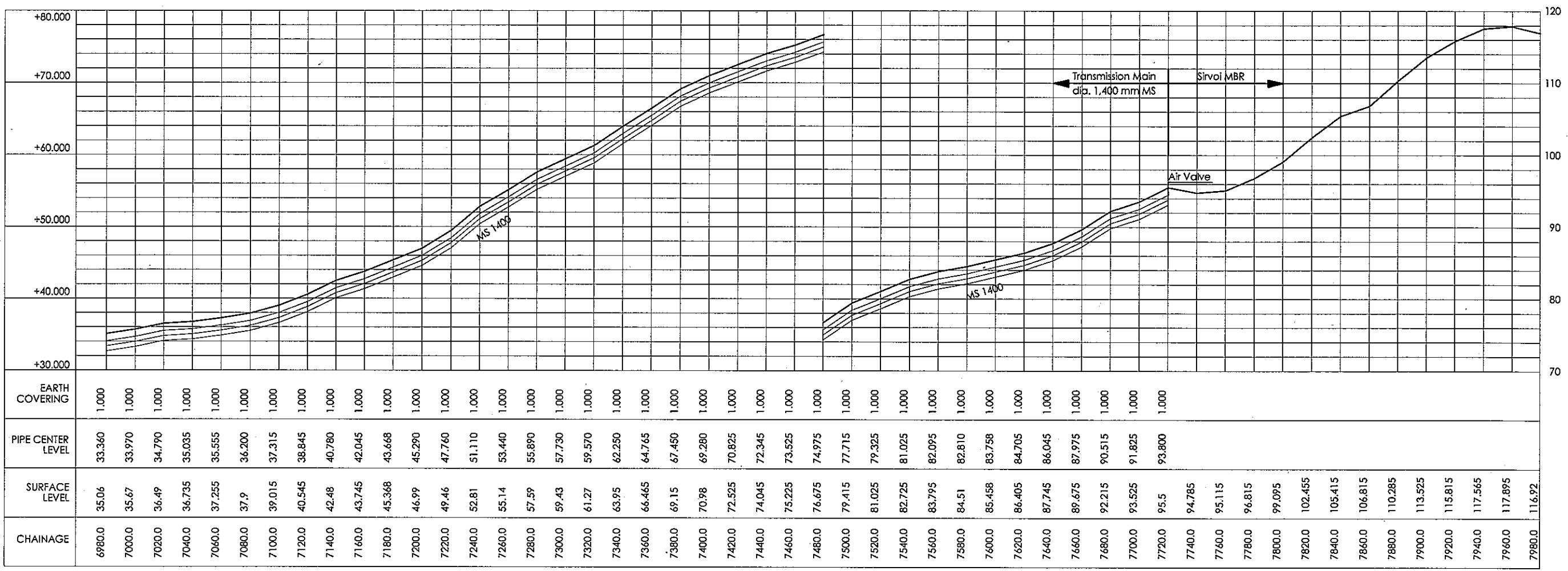
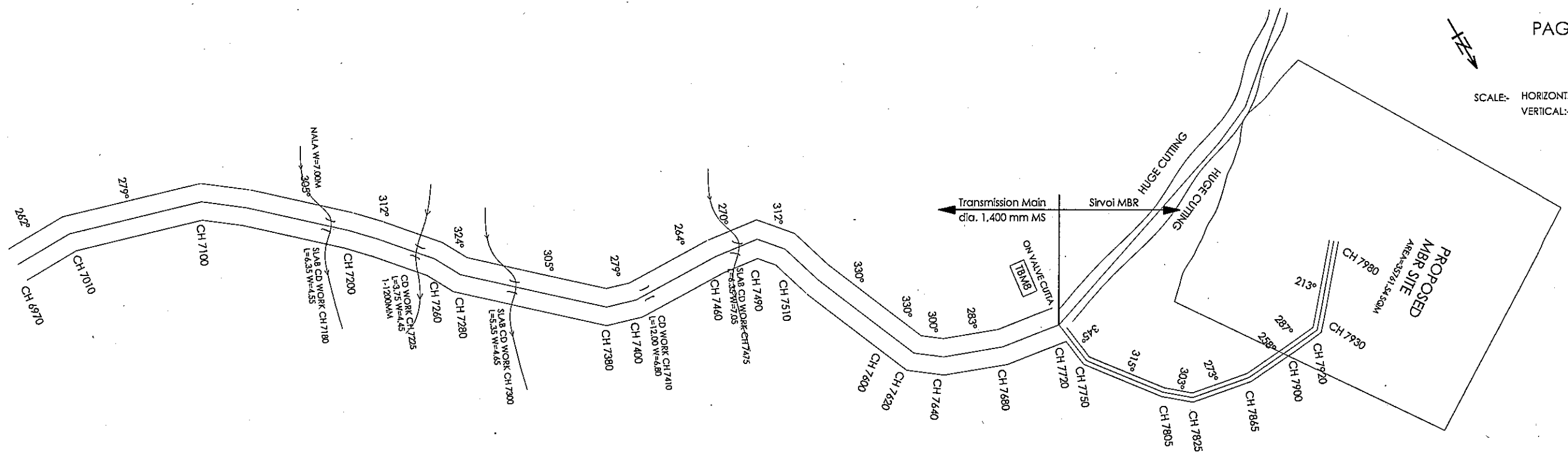


Study on Augmentation of Water Supply and Sanitation  
for the Goa State in the Republic of India

Transmission Main  
Proposed WTP to Sirvoi MBR, TM1-07

Scale: as shown  
No. W30

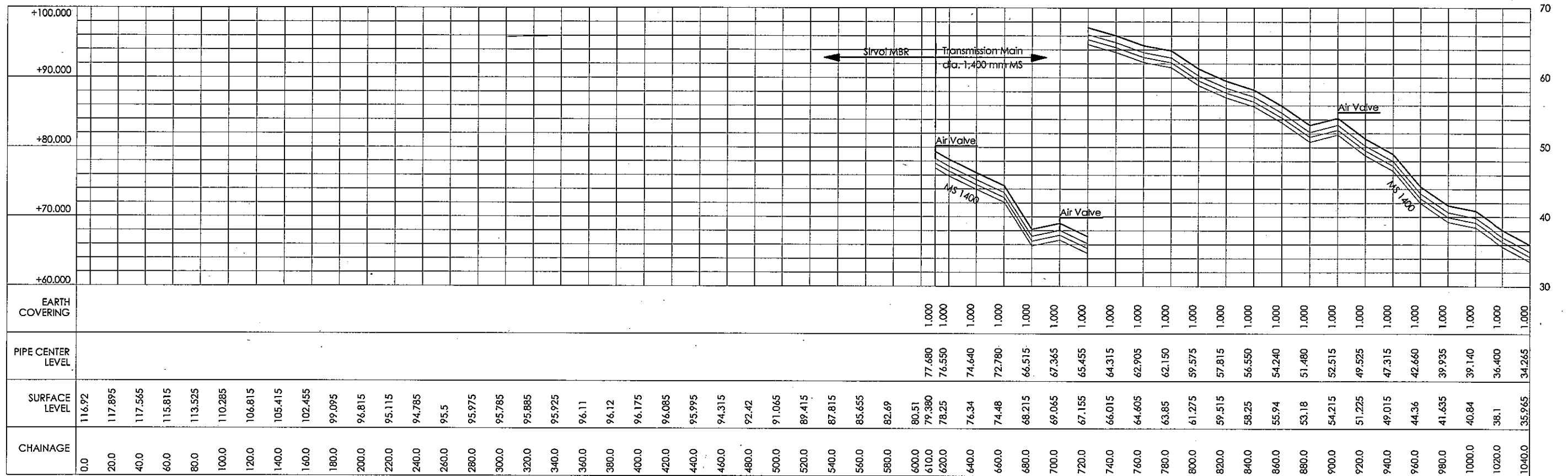
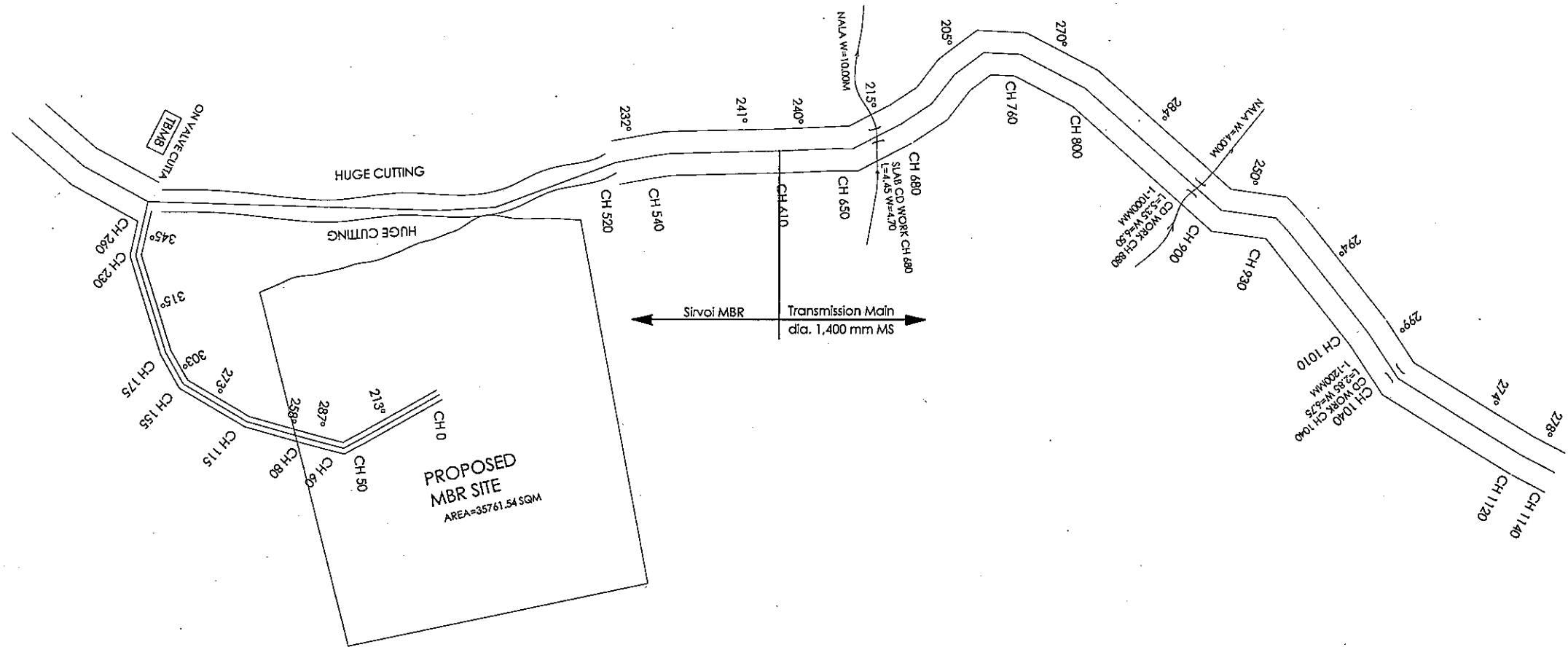
SCALE:- HORIZONTAL:-1:3000  
VERTICAL:-1:600



Study on Augmentation of Water Supply and Sanitation for the Goa State in the Republic of India

Transmission Main  
Proposed WTP to Sirvoi MBR, TM1-08

Scale: as shown  
No. W31



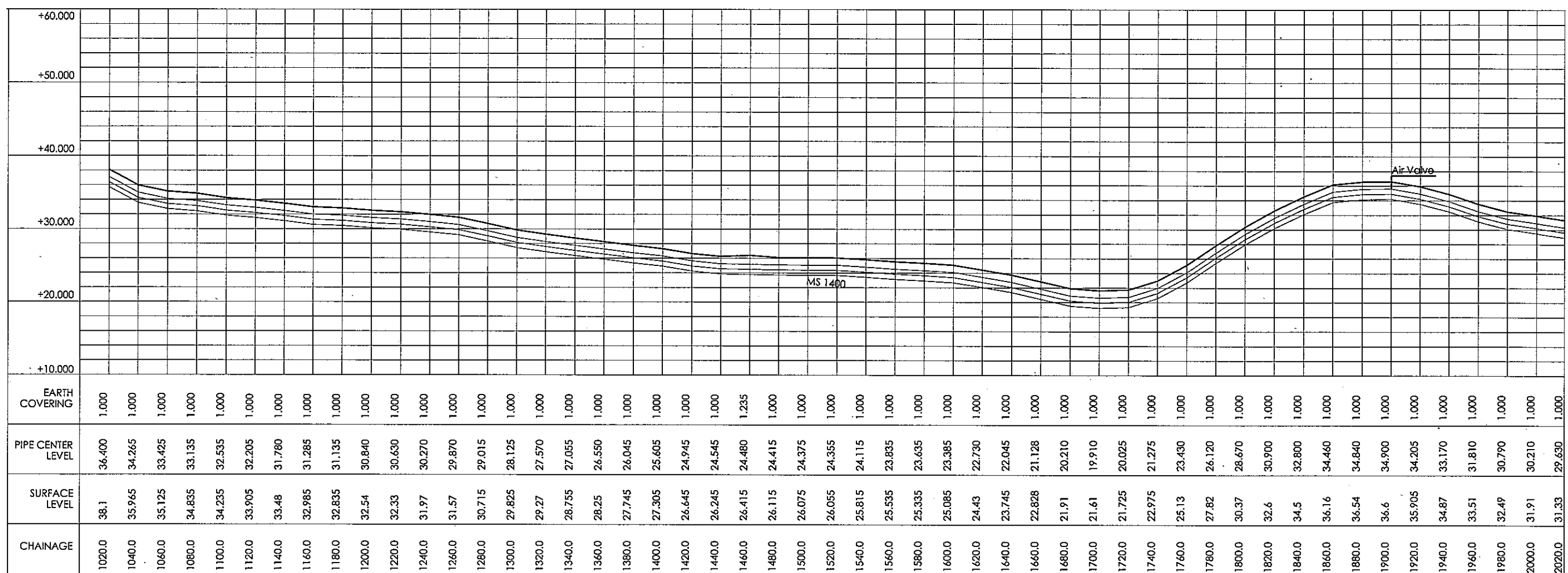
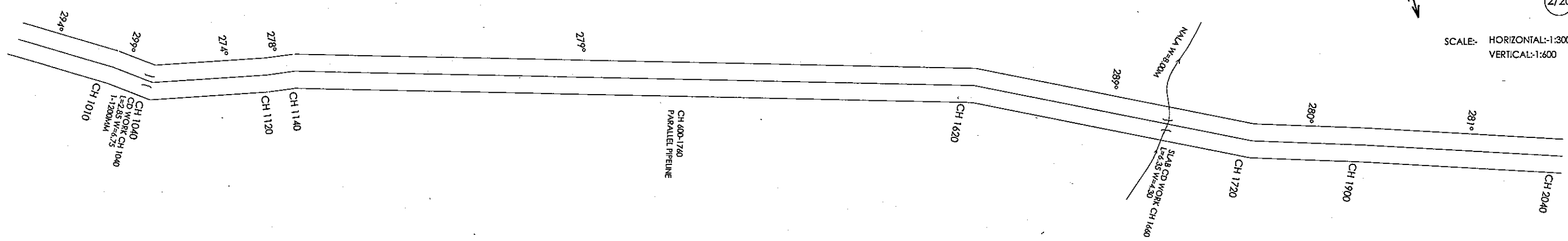
Study on Augmentation of Water Supply and Sanitation for the Goa State in the Republic of India

Transmission Main  
Sirvoi MBR to Margao, TM2-01

Scale: as shown

No. W32

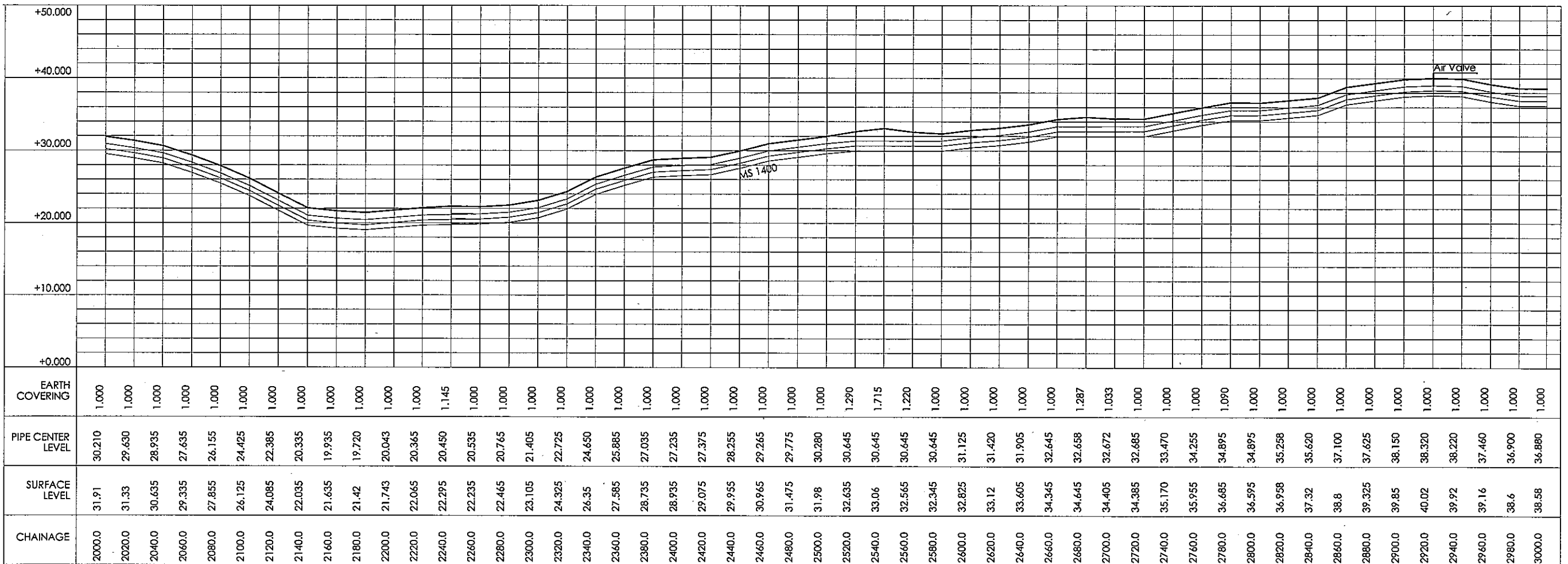
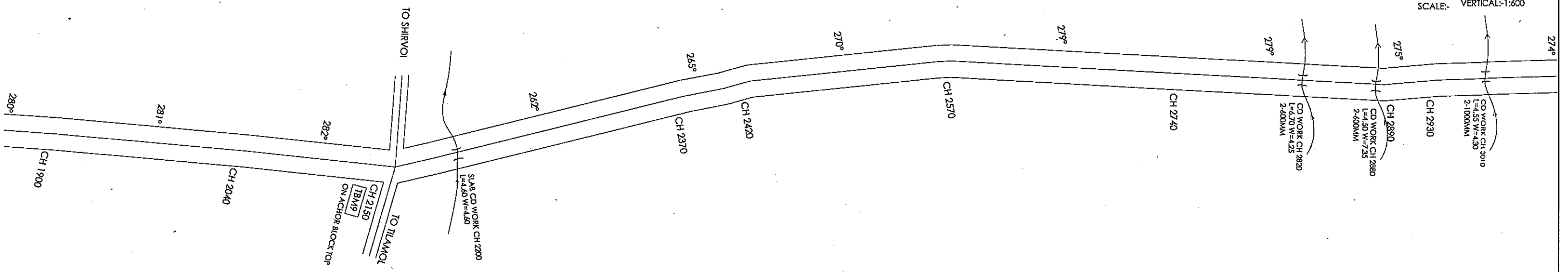
SCALE: HORIZONTAL:1:3000  
VERTICAL:1:600



Study on Augmentation of Water Supply and Sanitation  
for the Goa State in the Republic of India

Transmission Main  
Sirvoi MBR to Margao, TM2-02

Scale: as shown  
No. W33

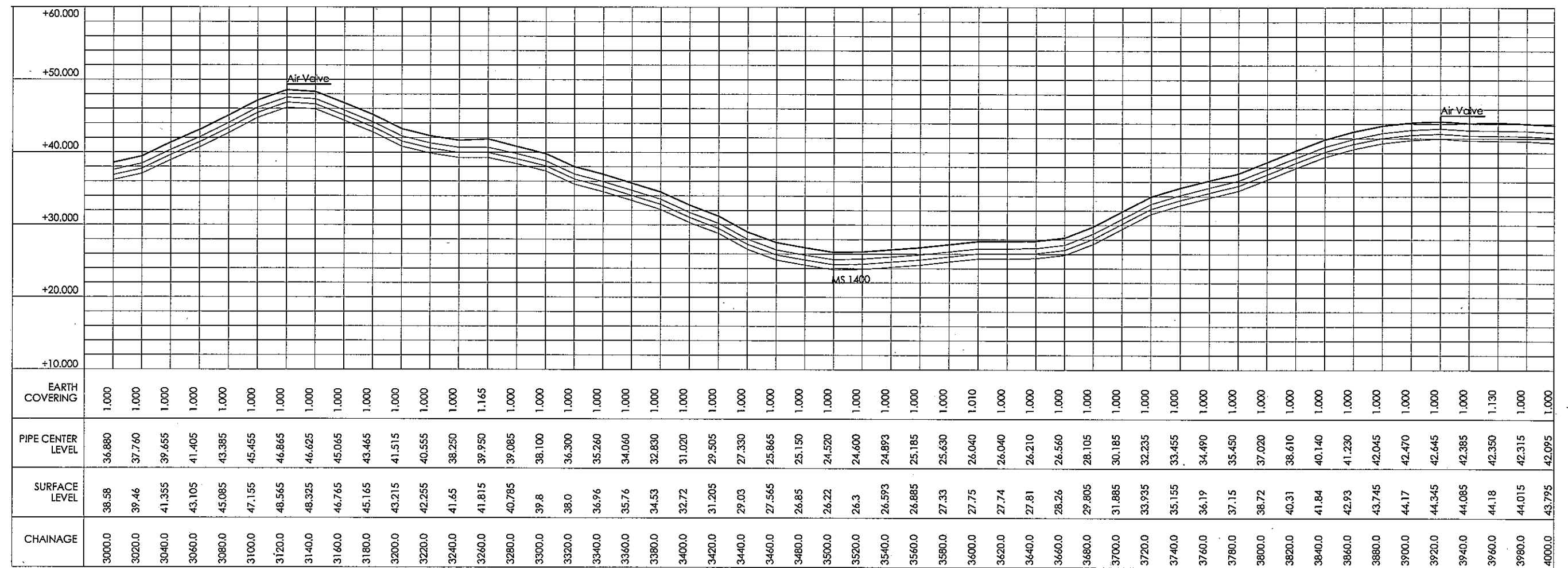
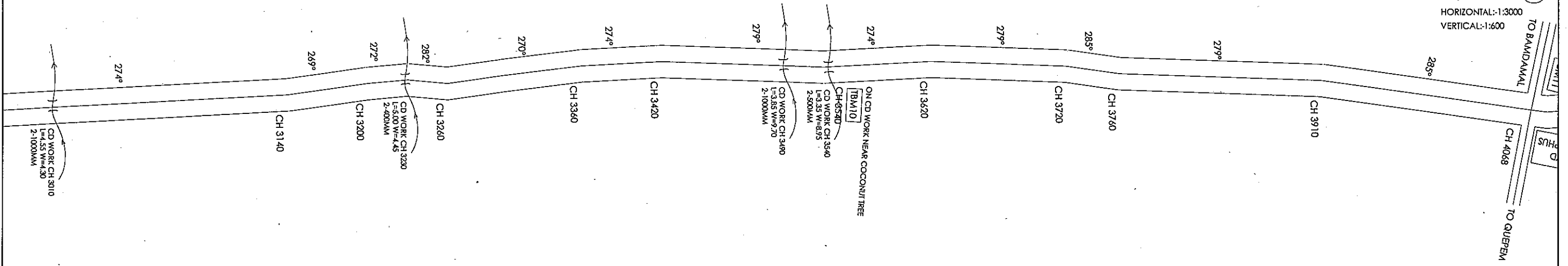


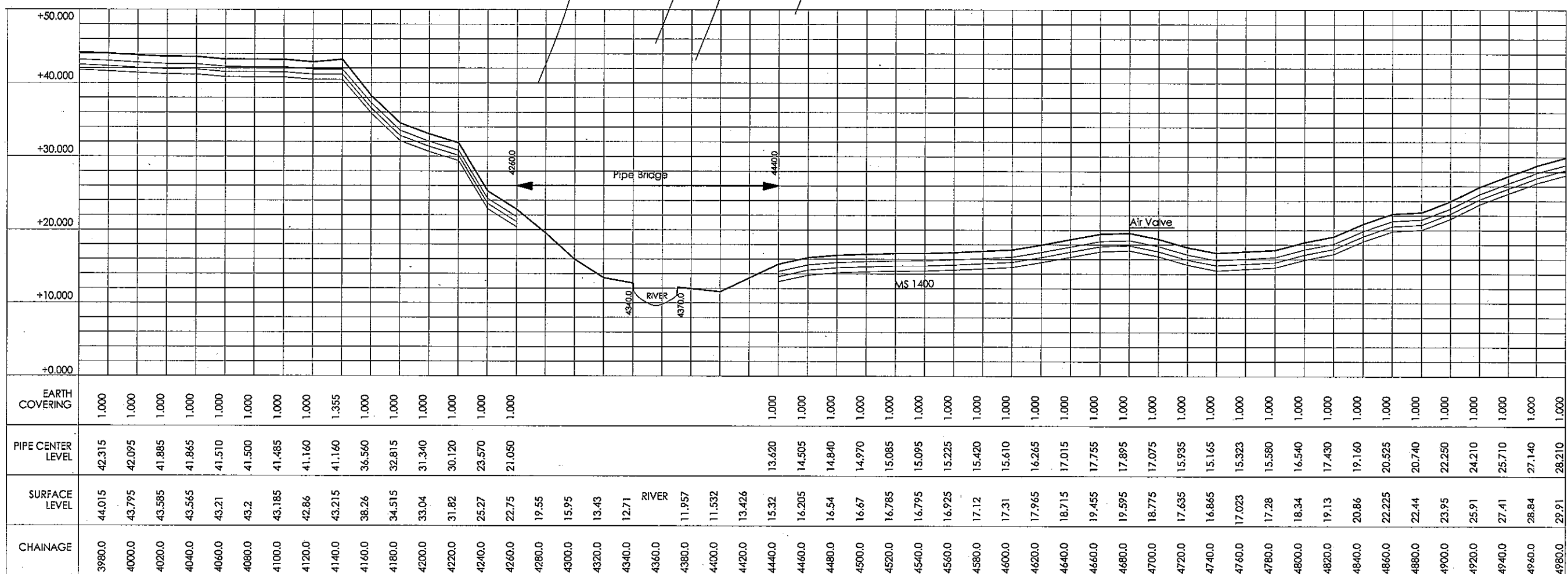
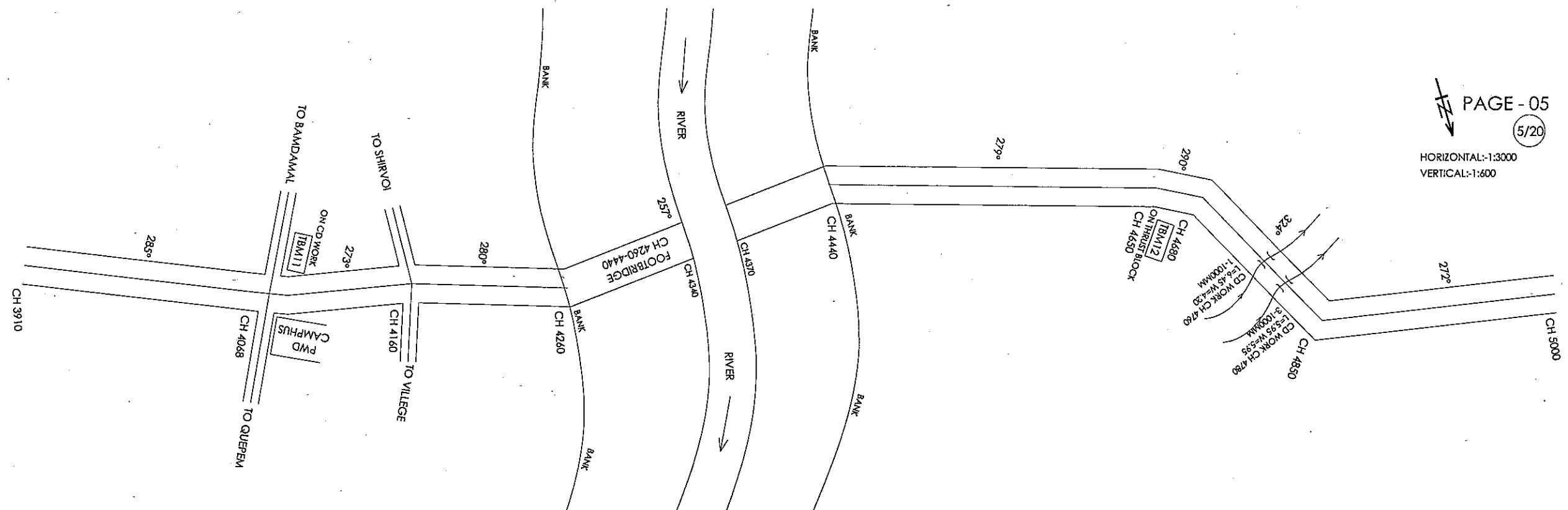
Study on Augmentation of Water Supply and Sanitation for the Goa State in the Republic of India

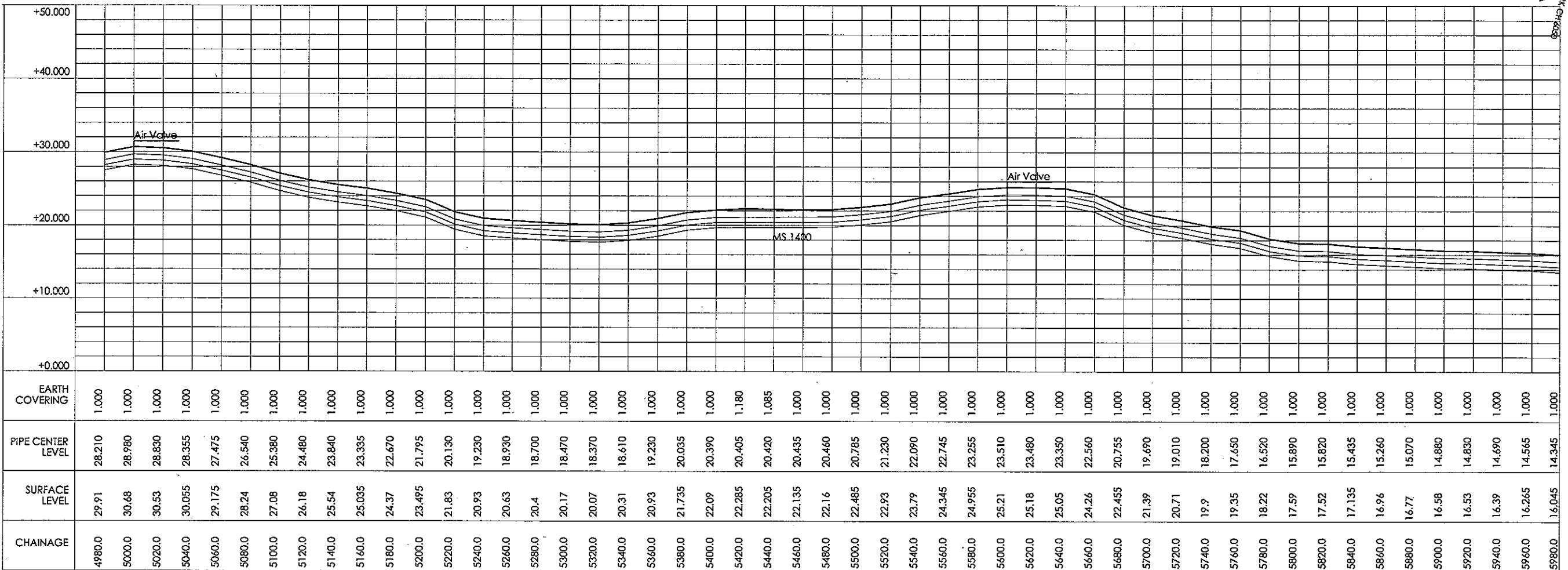
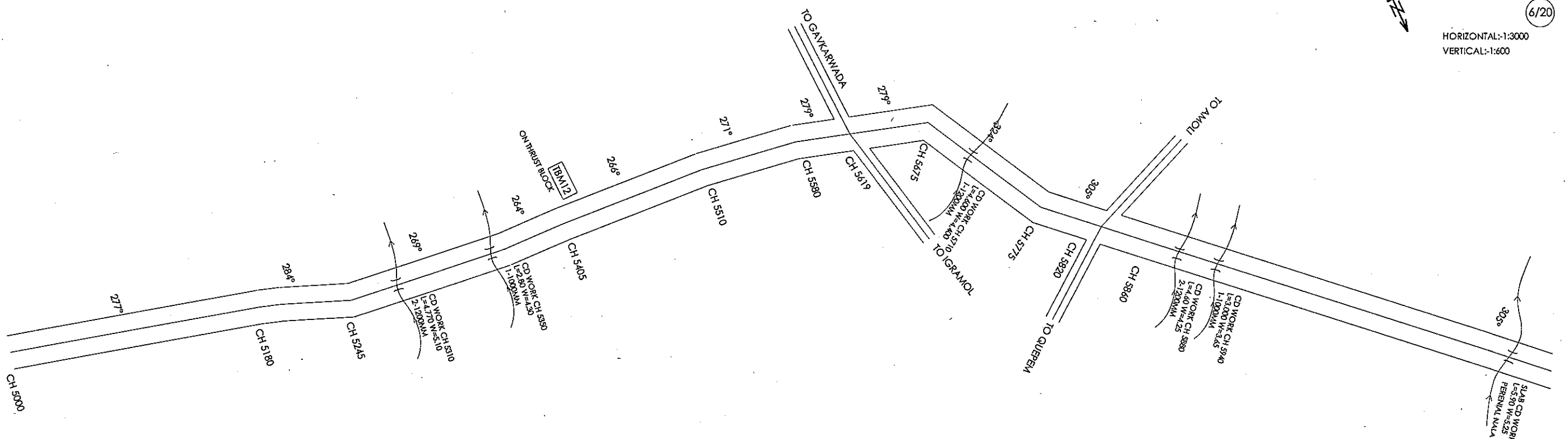
Transmission Main  
Sirvoi MBR to Margao, TM2-03

Scale: as shown  
No. W34







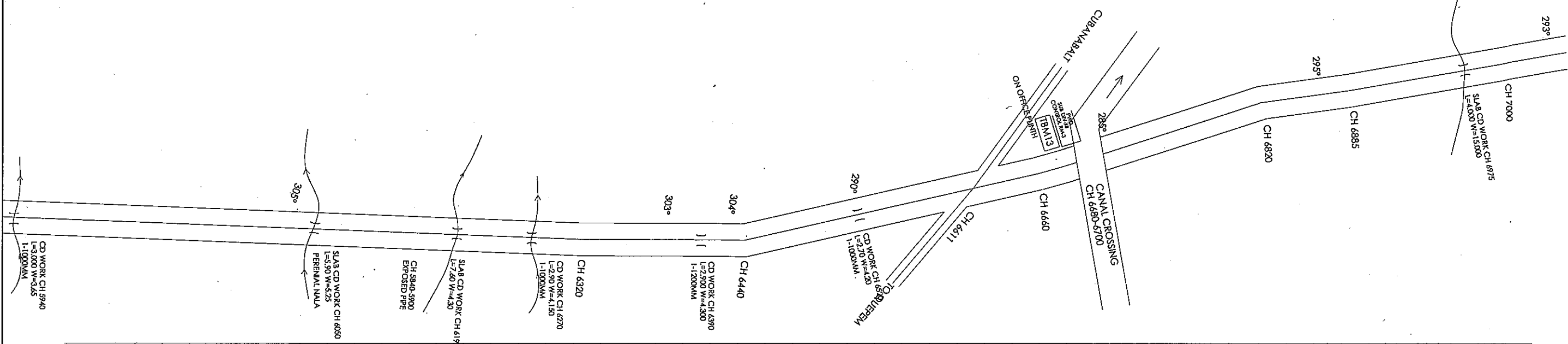


Study on Augmentation of Water Supply and Sanitation  
for the Goa State in the Republic of India

Transmission Main  
Sirvoi MBR to Margao, TM2-06

Scale: as shown  
No. W37

HORIZONTAL:-1:3000  
VERTICAL:-1:600

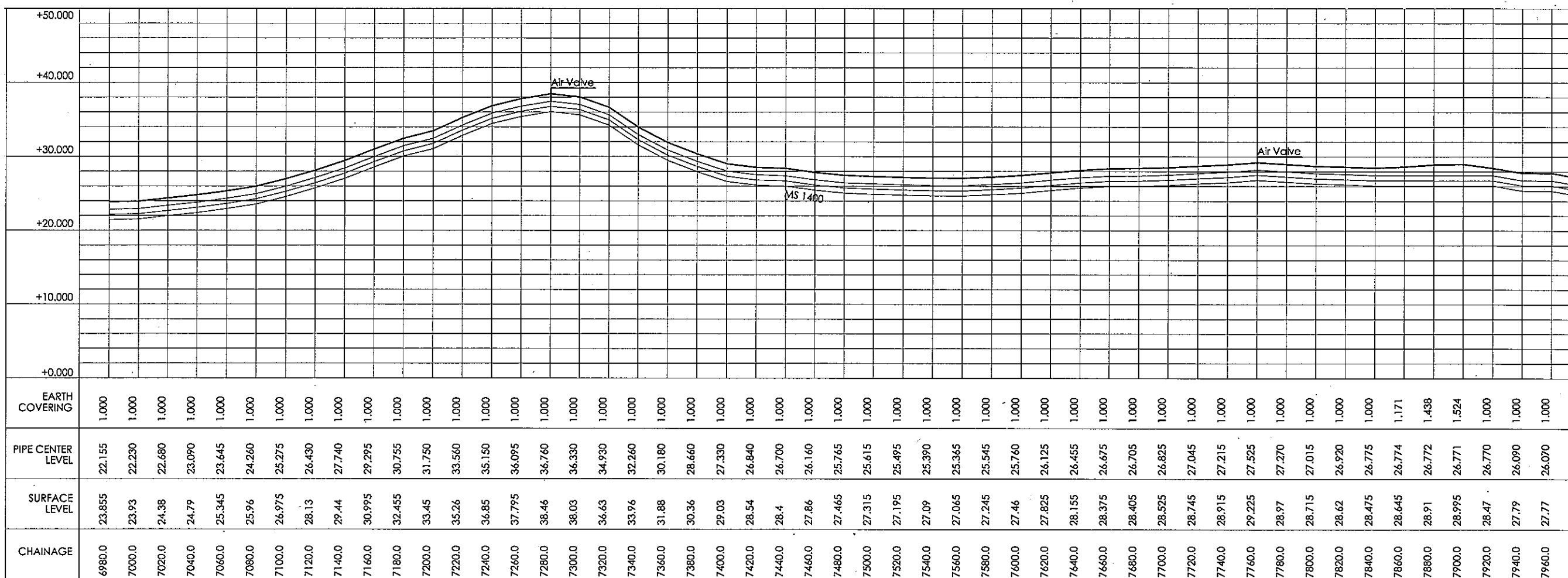
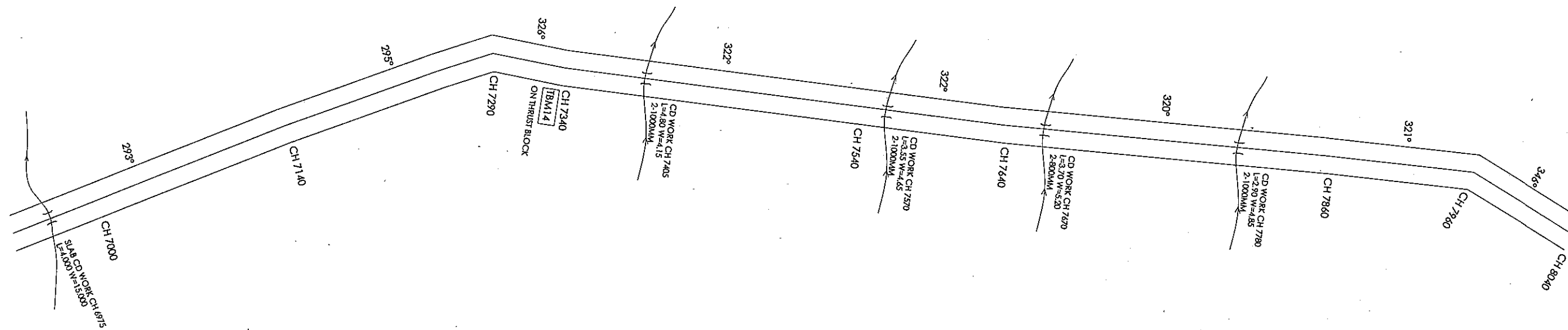


CHAINAGE	SURFACE LEVEL	PIPE CENTER LEVEL	EARTH COVERING
5980.0	16.045	14.345	1.000
6000.0	15.705	14.005	1.000
6020.0	15.605	13.905	1.000
6040.0	15.495	13.795	1.000
6060.0	15.175	13.475	1.000
6080.0	14.755	13.055	1.000
6100.0	14.765	13.060	1.005
6120.0	14.76	13.060	1.000
6140.0	14.825	13.125	1.000
6160.0	15.085	13.385	1.000
6180.0	15.415	13.715	1.000
6200.0	15.745	14.045	1.000
6220.0	16.25	14.185	1.365
6240.0	16.025	14.325	1.000
6260.0	16.175	14.475	1.000
6280.0	16.25	14.550	1.000
6300.0	16.465	14.765	1.000
6320.0	16.665	14.965	1.000
6340.0	16.895	15.195	1.000
6360.0	17.32	15.620	1.000
6380.0	17.8	16.100	1.000
6400.0	18.045	16.345	1.000
6420.0	18.345	16.645	1.000
6440.0	18.635	16.935	1.000
6460.0	18.795	16.961	1.134
6480.0	18.695	16.987	1.008
6500.0	18.645	17.013	0.932
6520.0	18.85	17.039	1.111
6540.0	18.765	17.065	1.000
6560.0	18.945	17.245	1.000
6580.0	19.045	17.345	1.000
6600.0	19.365	17.440	1.225
6620.0	19.235	17.535	1.000
6640.0	19.655	17.955	1.000
6660.0	19.97	18.27	1.000
6680.0	20.405	18.705	1.000
6700.0	17.815	17.815	1.000
6720.0	19.905	19.905	1.000
6740.0	21.625	21.625	1.000
6760.0	22.565	22.565	1.000
6780.0	23.57	23.57	1.000
6800.0	25.27	25.27	1.000
6820.0	26.455	26.455	1.000
6840.0	26.94	26.94	1.000
6860.0	27.18	27.18	1.000
6880.0	27.14	27.14	1.000
6900.0	26.74	26.74	1.000
6920.0	25.77	25.77	1.000
6940.0	24.62	24.62	1.000
6960.0	24.03	24.03	1.000
6980.0	23.855	23.855	1.000

Study on Augmentation of Water Supply and Sanitation  
for the Goa State in the Republic of India

Transmission Main  
Sirvoi MBR to Margao, TM2-07

Scale: as shown  
No. W38

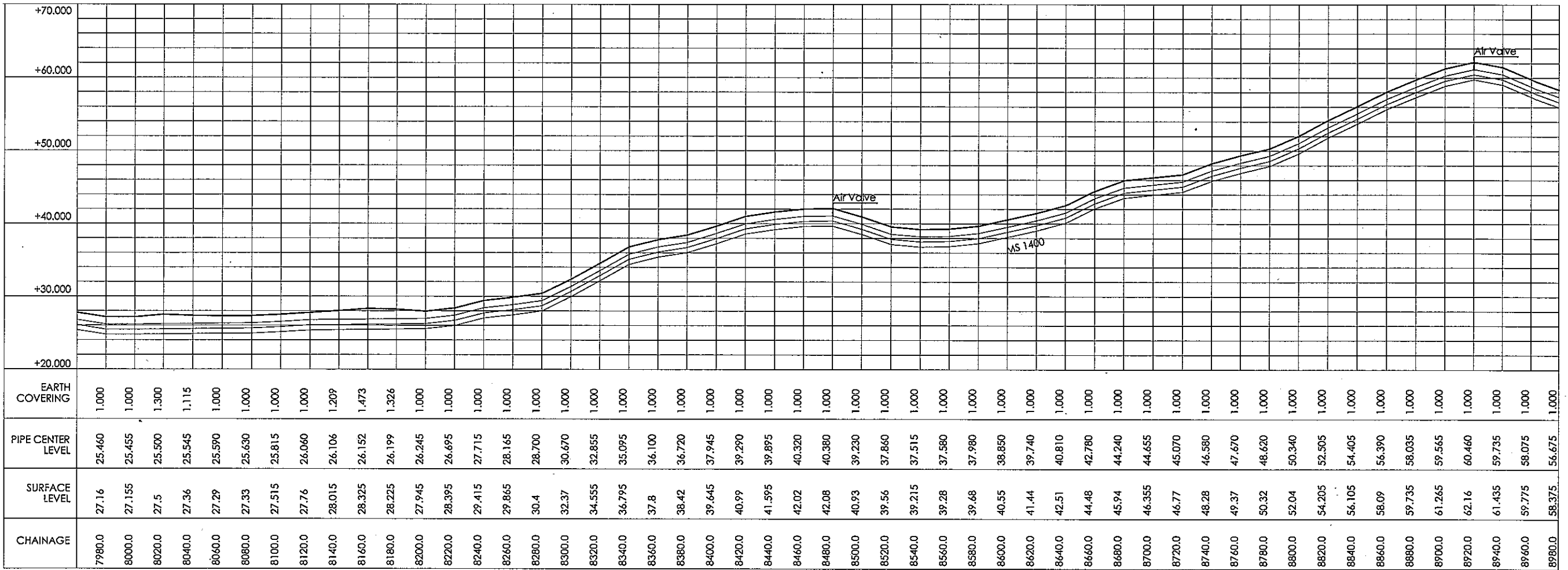
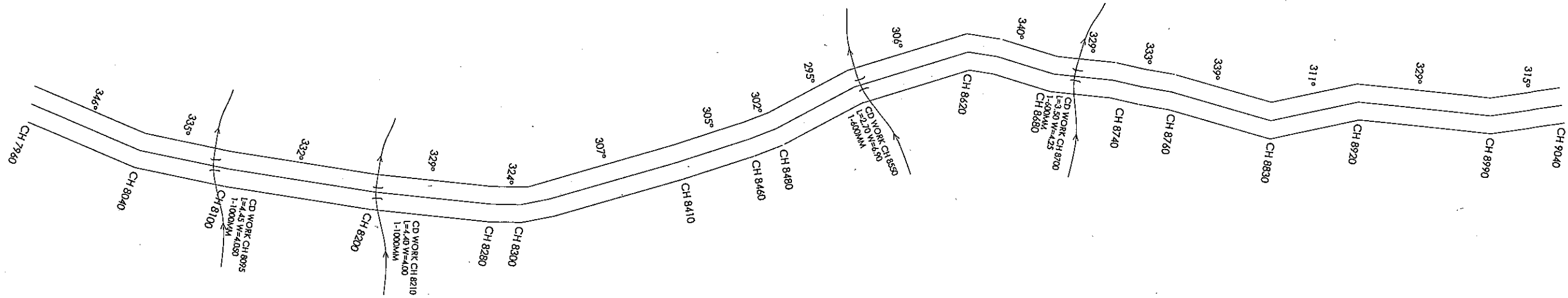


Study on Augmentation of Water Supply and Sanitation  
for the Goa State in the Republic of India

Transmission Main  
Sirvoi MBR to Margao, TM2-08

Scale: as shown  
No. W39

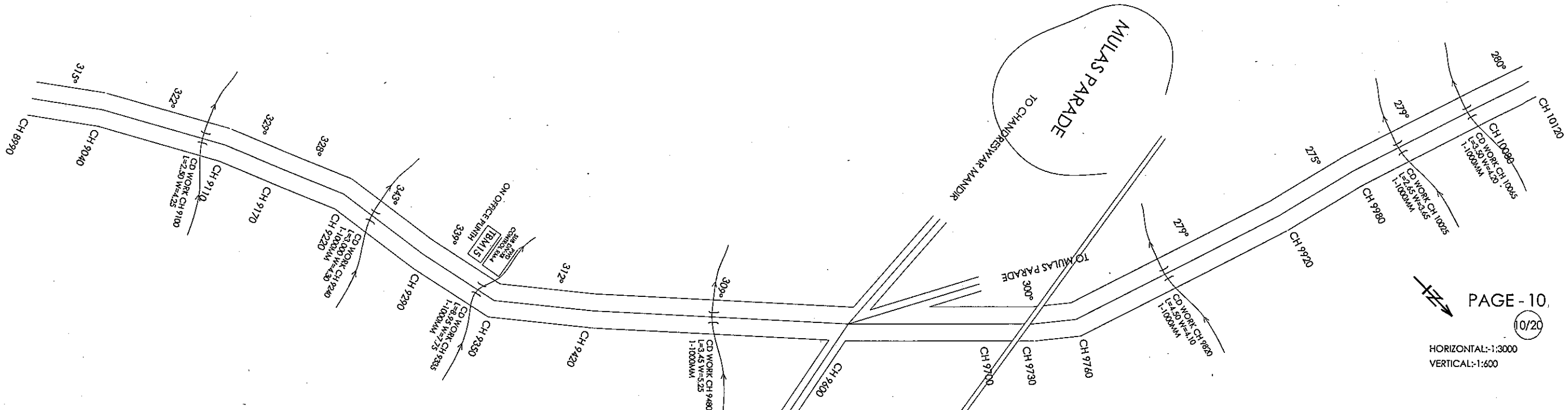
9/20



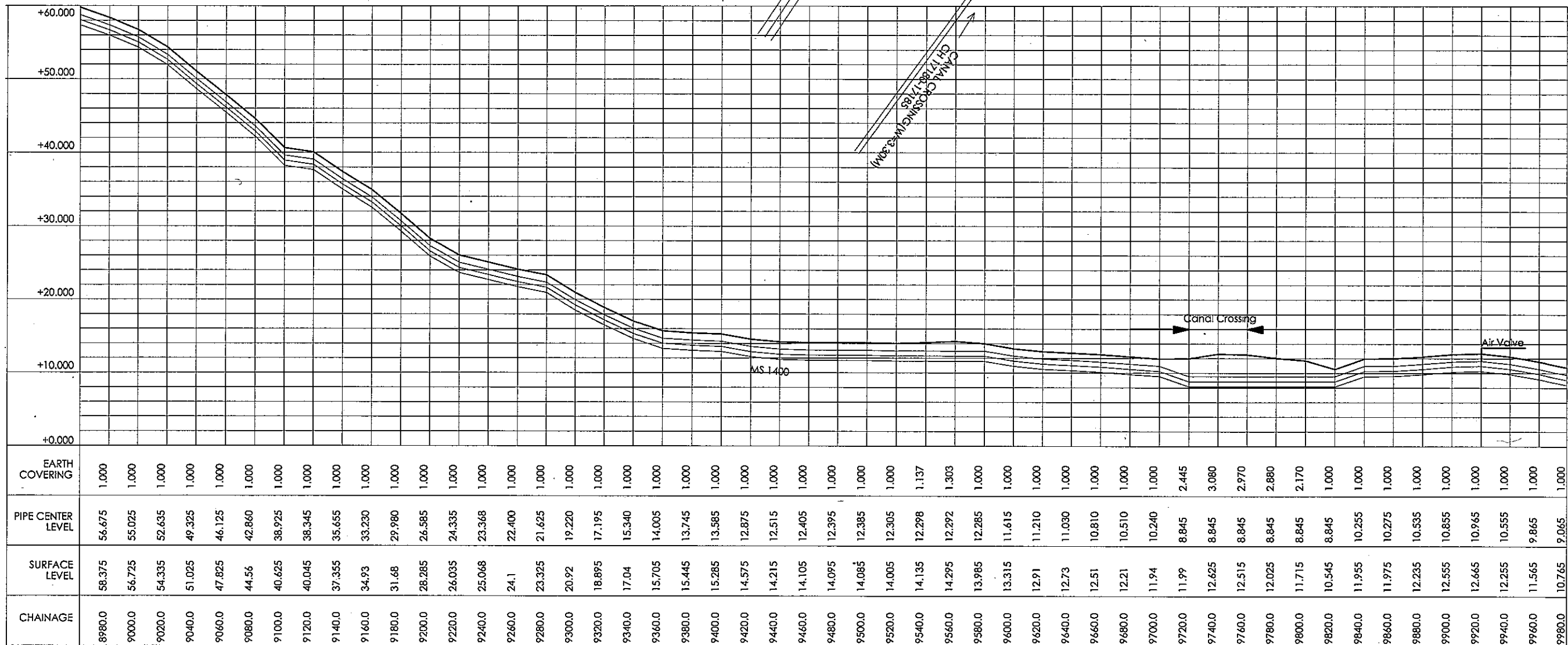
Study on Augmentation of Water Supply and Sanitation  
 for the Goa State in the Republic of India

Transmission Main  
 Sirvoi MBR to Margao, TM2-09

Scale: as shown  
 No. W40



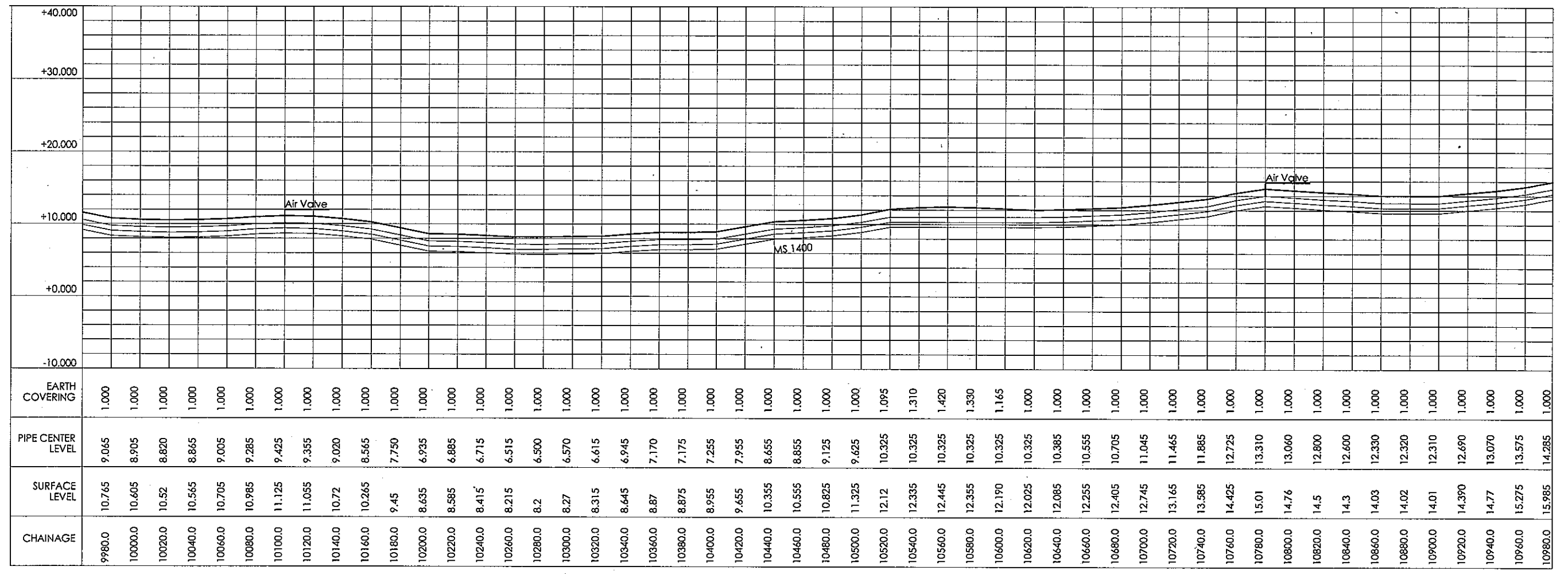
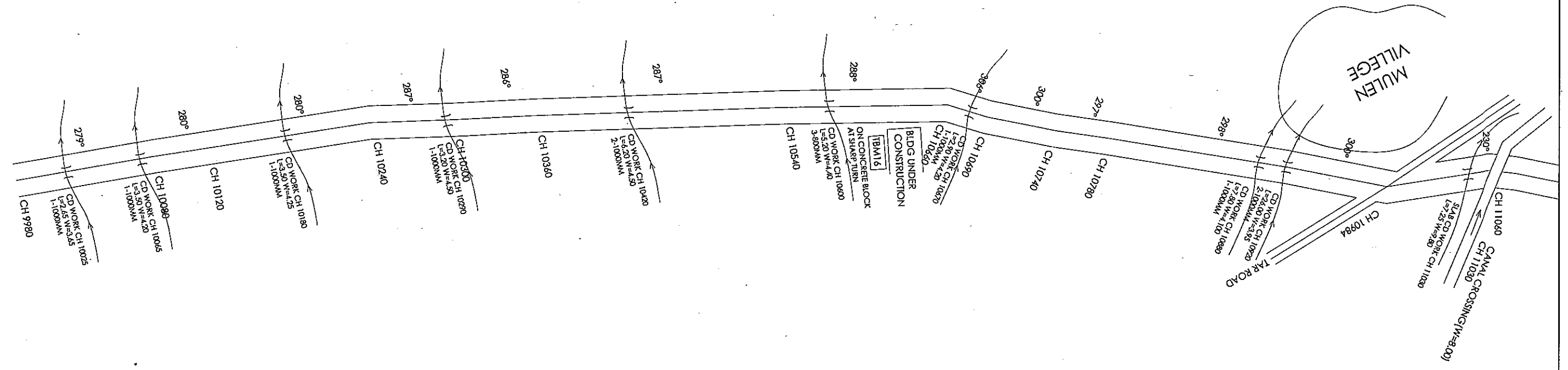
PAGE - 10  
 10/20  
 HORIZONTAL:-1:3000  
 VERTICAL:-1:600



Study on Augmentation of Water Supply and Sanitation  
 for the Goa State in the Republic of India

Transmission Main  
 Sirvoi MBR to Margao, TM2-10

Scale: as shown  
 No. W41

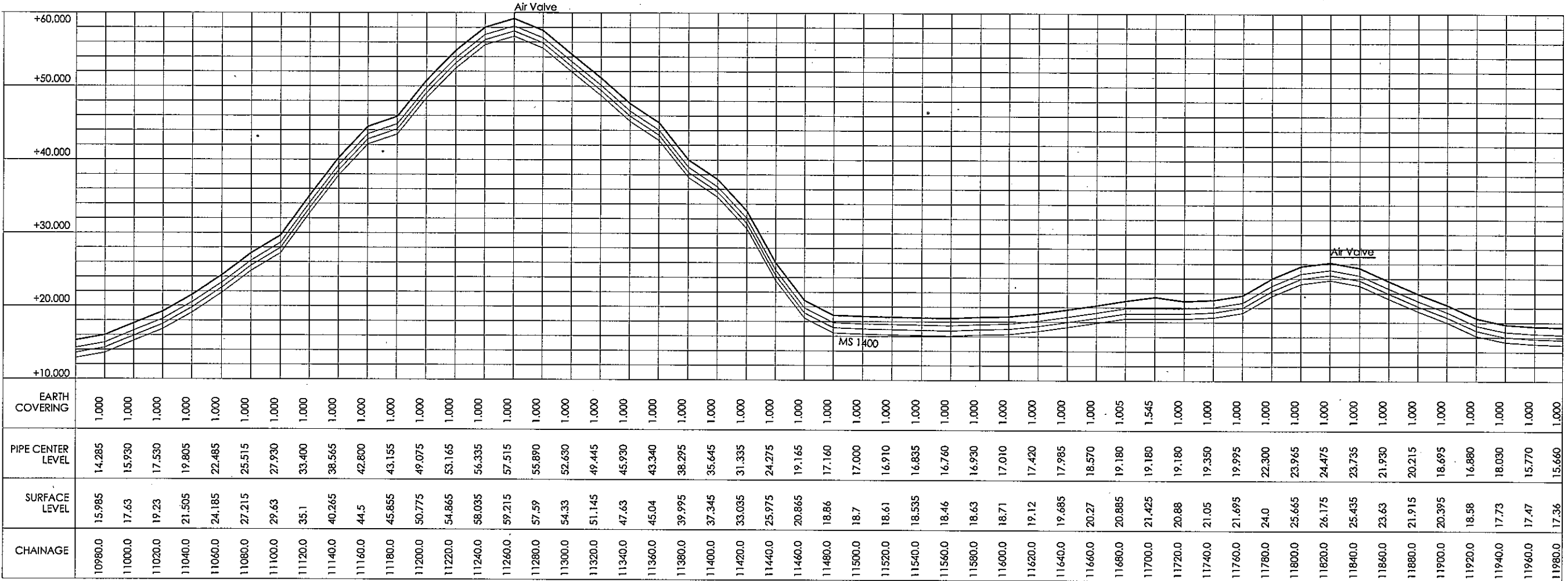
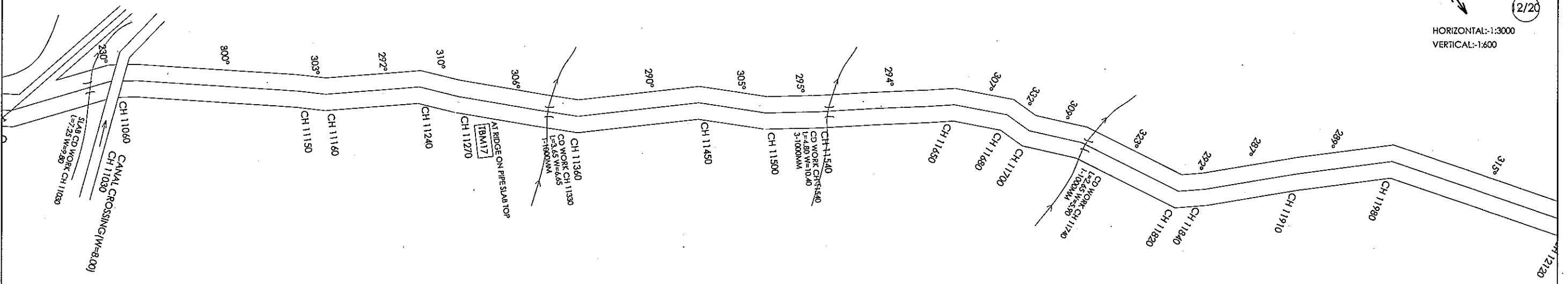


Study on Augmentation of Water Supply and Sanitation for the Goa State in the Republic of India

Transmission Main  
Sirvoi MBR to Margao, TM2-11

Scale: as shown  
No. W42

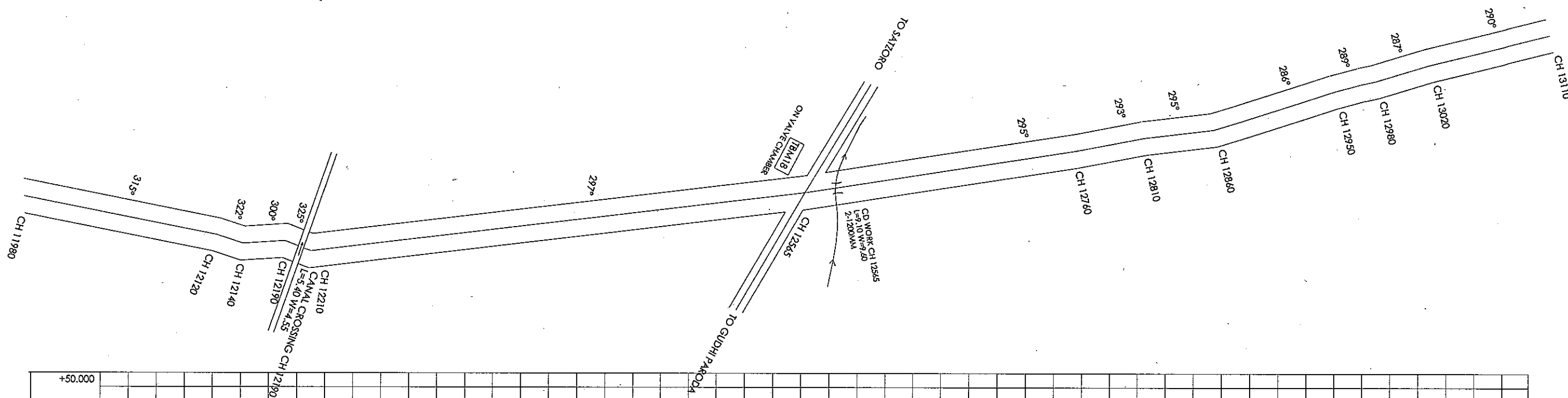




Study on Augmentation of Water Supply and Sanitation  
 for the Goa State in the Republic of India

Transmission Main  
 Sirvoi MBR to Margao, TM2-12

Scale: as shown  
 No. W43

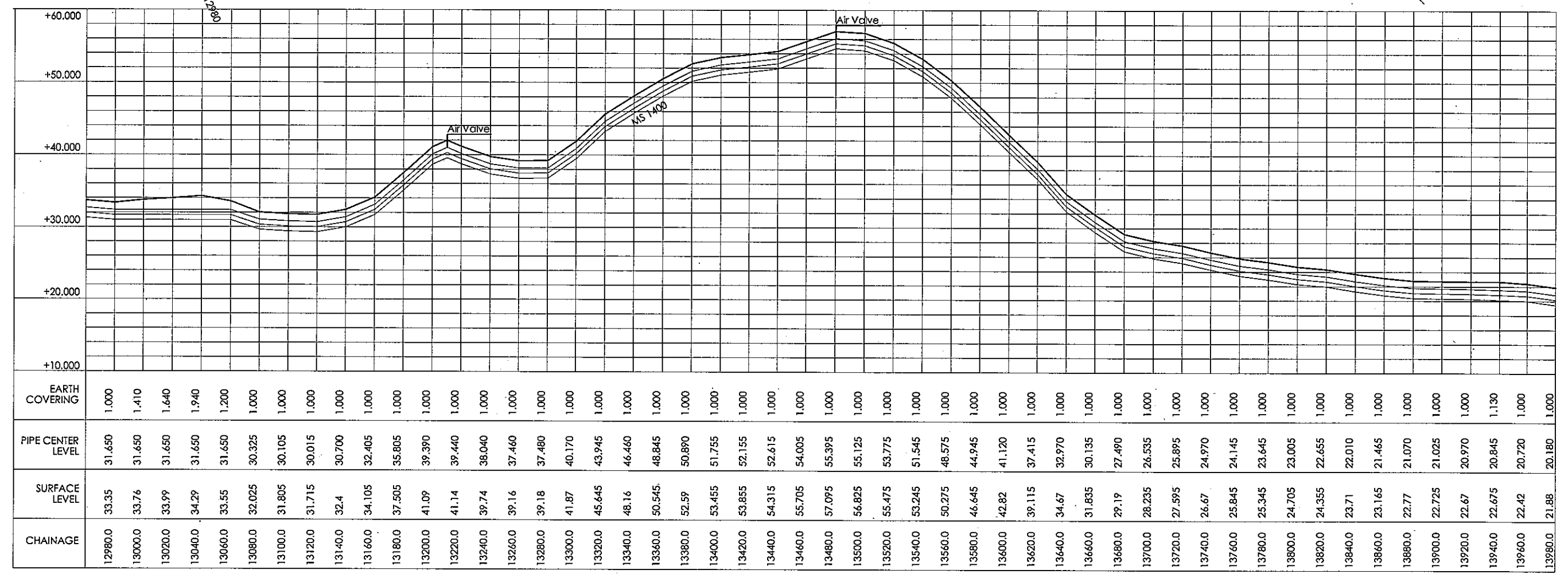
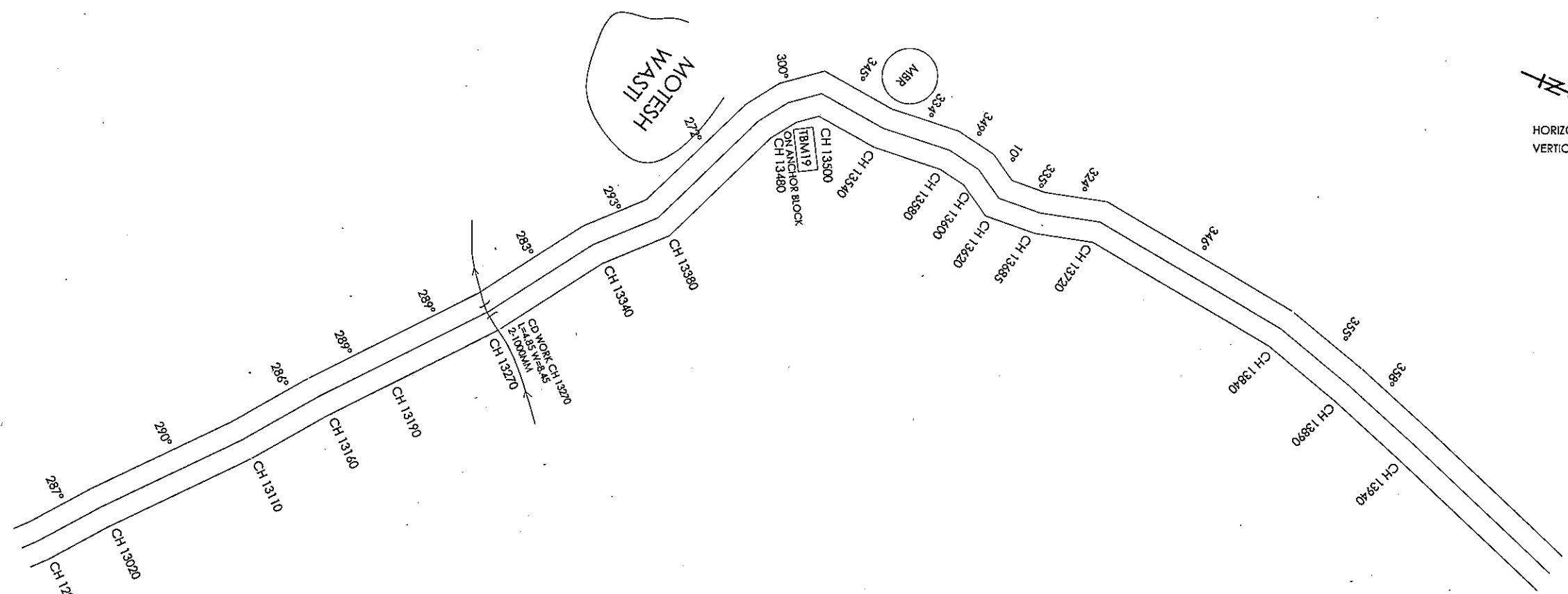


CHAINAGE	SURFACE LEVEL	PIPE CENTER LEVEL	EARTH COVERING
11980.0	17.36	15.660	1.000
12000.0	17.15	15.450	1.000
12020.0	17.18	15.445	1.035
12040.0	17.075	15.441	1.630
12060.0	17.165	15.436	1.029
12080.0	17.12	15.432	0.988
12100.0	17.21	15.427	0.801
12120.0	17.3	15.423	1.171
12140.0	17.45	15.418	1.332
12160.0	17.6	15.414	1.486
12180.0	17.245	15.409	1.136
12200.0	16.975	15.405	0.870
12220.0	17.1	15.400	1.000
12240.0	16.94	15.240	1.000
12260.0	16.66	14.960	1.000
12280.0	16.6	14.900	1.000
12300.0	16.595	14.895	1.000
12320.0	16.535	14.835	1.000
12340.0	16.395	14.695	1.000
12360.0	16.245	14.545	1.000
12380.0	16.07	14.370	1.000
12400.0	15.94	14.240	1.000
12420.0	15.8	14.100	1.000
12440.0	15.815	14.028	0.87
12460.0	15.805	13.957	1.148
12480.0	15.585	13.885	1.000
12500.0	15.45	13.750	1.000
12520.0	15.37	13.670	1.000
12540.0	15.21	13.510	1.000
12560.0	15.155	13.455	1.000
12580.0	15.08	13.380	1.000
12600.0	15.14	13.440	1.000
12620.0	15.31	13.610	1.000
12640.0	16.51	14.810	1.000
12660.0	16.98	15.280	1.000
12680.0	17.15	15.450	1.000
12700.0	17.55	15.850	1.000
12720.0	17.99	16.290	1.000
12740.0	18.575	16.875	1.000
12760.0	19.545	17.845	1.000
12780.0	21.67	19.970	1.000
12800.0	24.44	22.740	1.000
12820.0	27.725	26.025	1.000
12840.0	30.515	28.815	1.000
12860.0	35.355	33.655	1.000
12880.0	37.615	35.915	1.000
12900.0	37.305	35.605	1.000
12920.0	36.415	34.715	1.000
12940.0	35.37	33.670	1.000
12960.0	33.68	31.980	1.000
12980.0	33.35	31.650	1.000

Study on Augmentation of Water Supply and Sanitation  
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Transmission Main  
Sirvoi MBR to Margao, TM2-13

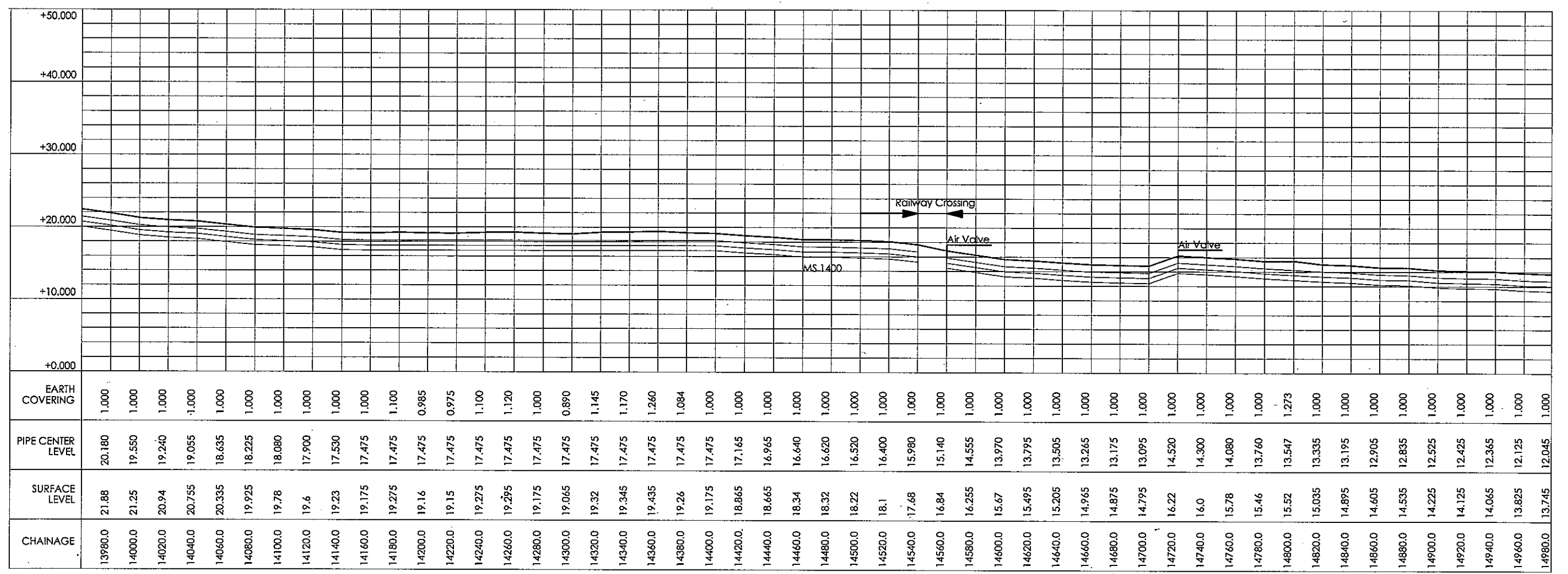
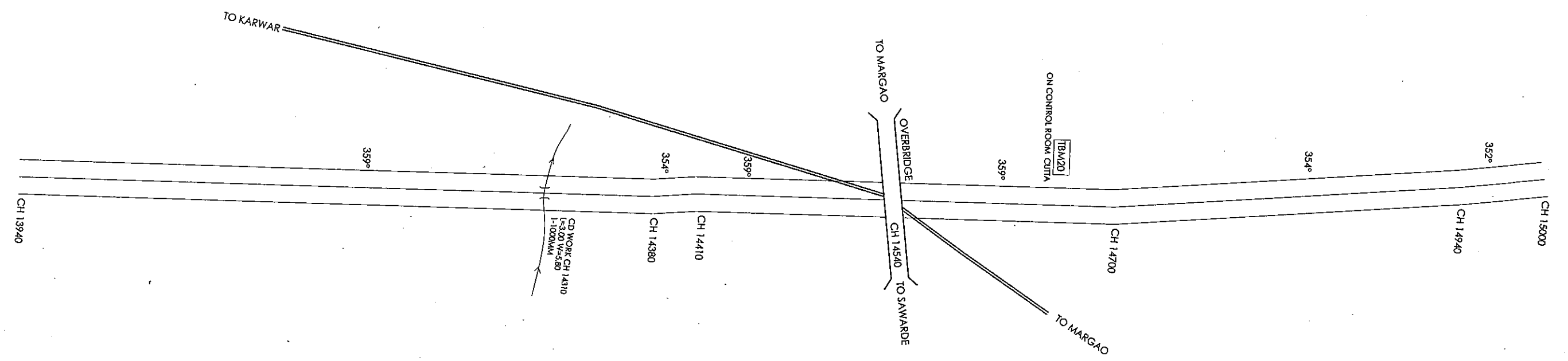
Scale: as shown  
No. W44

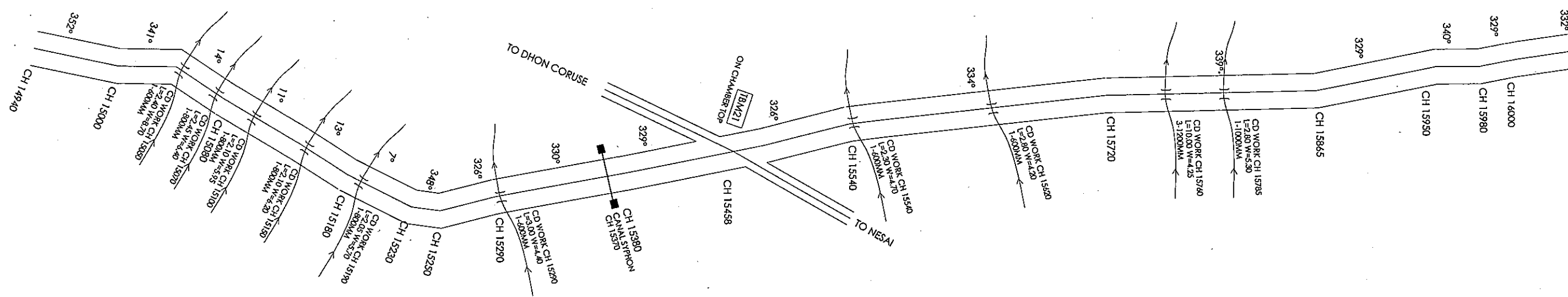
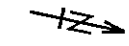


Study on Augmentation of Water Supply and Sanitation  
 for the Goa State in the Republic of India

Transmission Main  
 Sirvoi MBR to Margao, TM2-14

Scale: as shown  
 No. W45





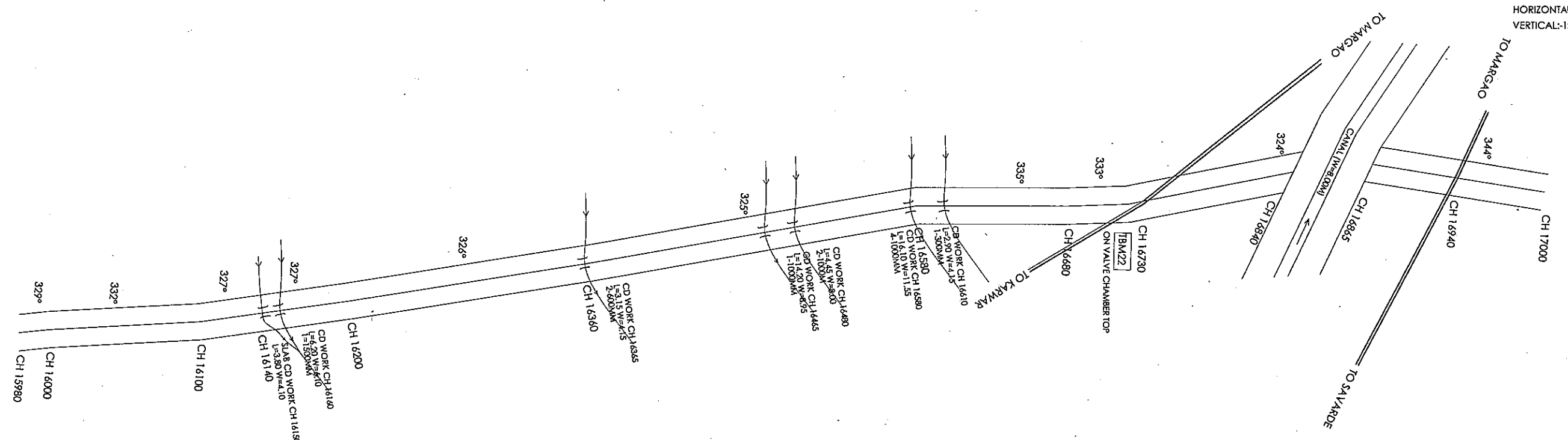
CHAINAGE	SURFACE LEVEL	PIPE CENTER LEVEL	EARTH COVERING
14980.0	13.745	12.045	1.000
15000.0	13.325	11.625	1.000
15020.0	13.125	11.425	1.000
15040.0	12.705	11.005	1.000
15060.0	12.755	10.997	1.058
15080.0	12.69	10.990	1.000
15100.0	12.54	10.840	1.000
15120.0	12.44	10.740	1.000
15140.0	12.4	10.700	1.000
15160.0	12.405	10.700	5.001
15180.0	12.495	10.700	5.071
15200.0	12.385	10.700	5.980
15220.0	12.495	10.700	5.071
15240.0	12.455	10.700	5.501
15260.0	12.255	10.555	1.000
15280.0	12.1	10.400	1.000
15300.0	12.015	10.315	1.000
15320.0	11.92	10.220	1.000
15340.0	11.96	10.260	1.000
15360.0	12.145	10.445	1.000
15380.0	12.275	10.575	1.000
15400.0	12.215	10.515	1.000
15420.0	12.105	10.405	1.000
15440.0	11.965	10.265	1.000
15460.0	11.785	10.085	1.000
15480.0	11.88	10.085	5.091
15500.0	11.71	10.010	1.000
15520.0	11.68	9.980	1.000
15540.0	11.578	9.878	1.000
15560.0	11.415	9.715	1.000
15580.0	11.335	9.635	1.000
15600.0	11.28	9.580	1.000
15620.0	11.19	9.490	1.000
15640.0	11.1	9.400	1.000
15660.0	11.055	9.355	1.000
15680.0	11.155	9.355	1.101
15700.0	11.205	9.355	1.150
15720.0	11.285	9.355	1.230
15740.0	11.135	9.355	1.080
15760.0	11.11	9.355	1.055
15780.0	11.085	9.355	1.030
15800.0	10.915	9.215	1.000
15820.0	10.835	9.135	1.000
15840.0	11.165	9.135	1.330
15860.0	11.145	9.135	1.010
15880.0	11.355	9.135	1.520
15900.0	11.175	9.135	1.340
15920.0	11.125	9.135	1.290
15940.0	11.06	9.135	1.225
15960.0	10.985	9.135	1.150
15980.0	10.76	9.060	1.000

Study on Augmentation of Water Supply and Sanitation for the Goa State in the Republic of India

Transmission Main  
Sirvoi MBR to Margao, TM2-16

Scale: as shown  
No. W47

HORIZONTAL: 1:3000  
VERTICAL: 1:600

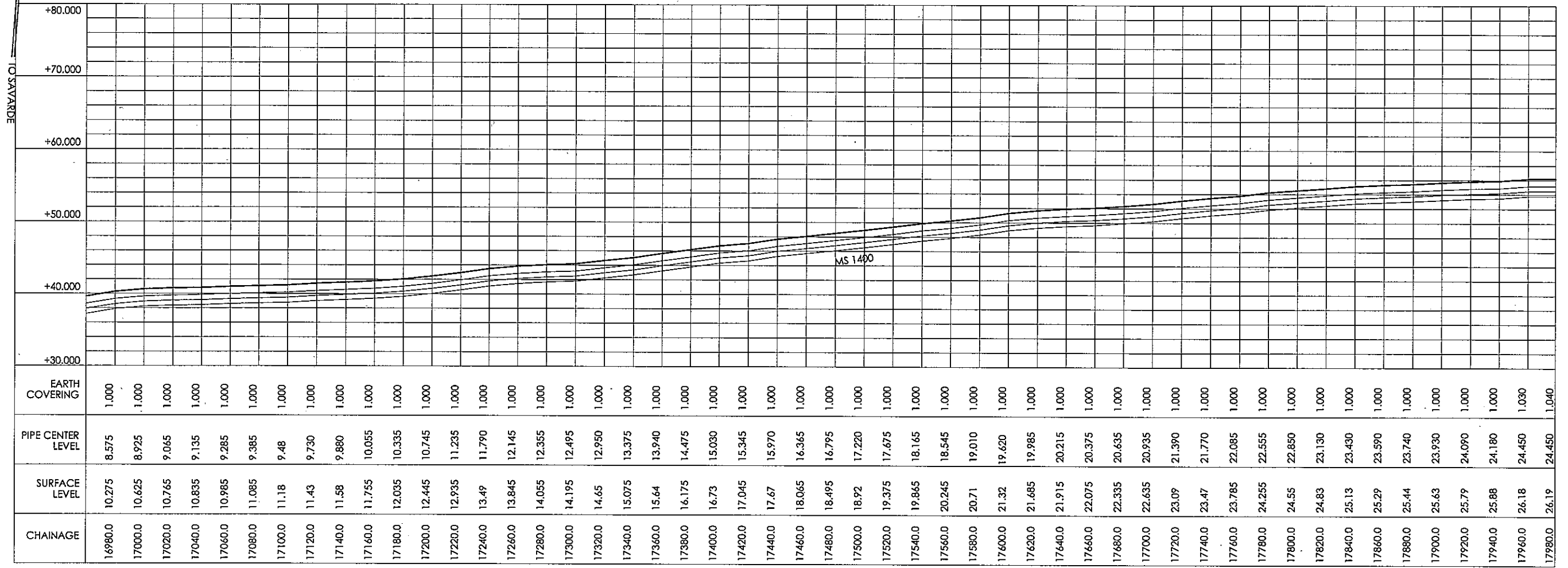
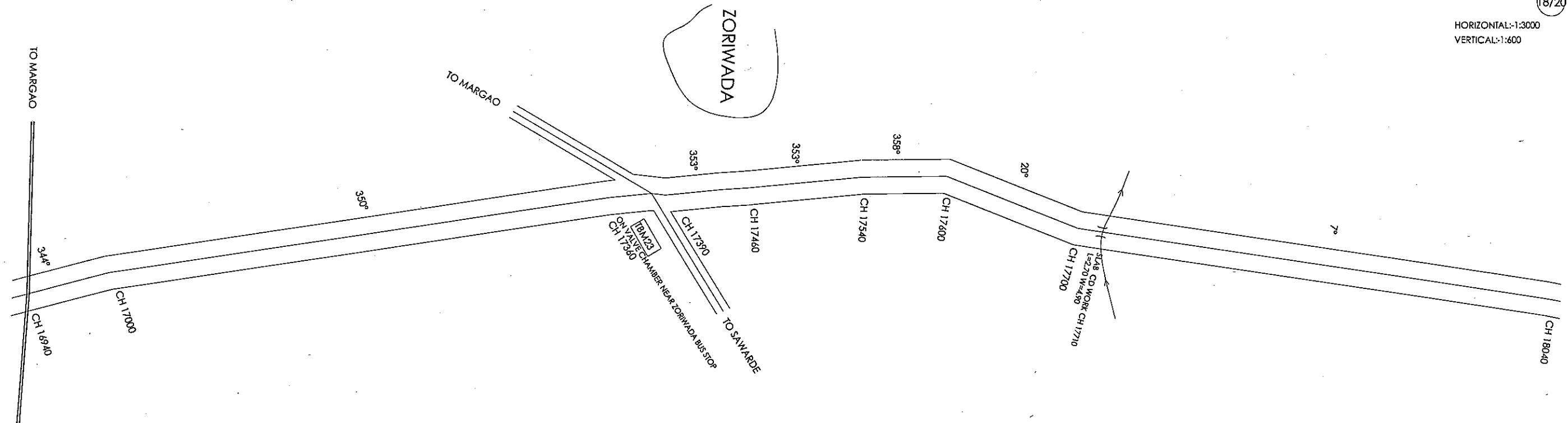


CHAINAGE	SURFACE LEVEL	PIPE CENTER LEVEL	EARTH COVERING
15980.0	10.76	9.060	000.1
16000.0	10.64	8.940	000.1
16020.0	10.675	8.907	899.1
16040.0	10.575	8.875	000.1
16060.0	10.595	8.875	002.1
16080.0	10.51	8.875	563.0
16100.0	10.605	8.875	003.1
16120.0	10.665	8.875	009.1
16140.0	10.875	8.875	000.1
16160.0	10.700	8.875	1.125
16180.0	10.525	8.825	1.000
16200.0	10.525	8.825	1.000
16220.0	10.545	8.825	002.1
16240.0	10.48	8.780	000.1
16260.0	10.525	8.780	0.045
16280.0	10.475	8.775	1.000
16300.0	10.355	8.655	1.000
16320.0	10.265	8.565	1.000
16340.0	10.325	8.565	1.060
16360.0	10.44	8.565	1.175
16380.0	10.295	8.565	1.030
16400.0	10.215	8.515	1.000
16420.0	10.295	8.515	1.080
16440.0	10.245	8.515	0.030
16460.0	10.325	8.515	0.110
16480.0	10.275	8.515	0.060
16500.0	10.225	8.515	0.100
16520.0	10.255	8.515	0.040
16540.0	10.355	8.515	1.140
16560.0	10.34	8.515	1.125
16580.0	10.038	8.338	1.000
16600.0	9.735	8.035	1.000
16620.0	9.64	7.940	1.000
16640.0	9.805	8.105	1.000
16660.0	9.975	8.275	1.000
16680.0	10.465	8.765	1.000
16700.0	10.505	8.805	1.000
16720.0	10.735	9.035	1.000
16730.0	11.725		
16740.0	10.9		
16760.0	10.145		
16780.0	10.33		
16800.0	10.335		
16820.0	10.25		
16840.0	15.095		
16862.0	12.99		
16880.0	10.725		
16900.0	9.775		
16920.0	10.545		
16940.0	12.145		
16960.0	9.605	7.905	000.1
16980.0	10.275	8.575	1.000

Study on Augmentation of Water Supply and Sanitation  
for the Goa State in the Republic of India

Transmission Main  
Sirvoi MBR to Margao, TM2-17

Scale: as shown  
No. W48

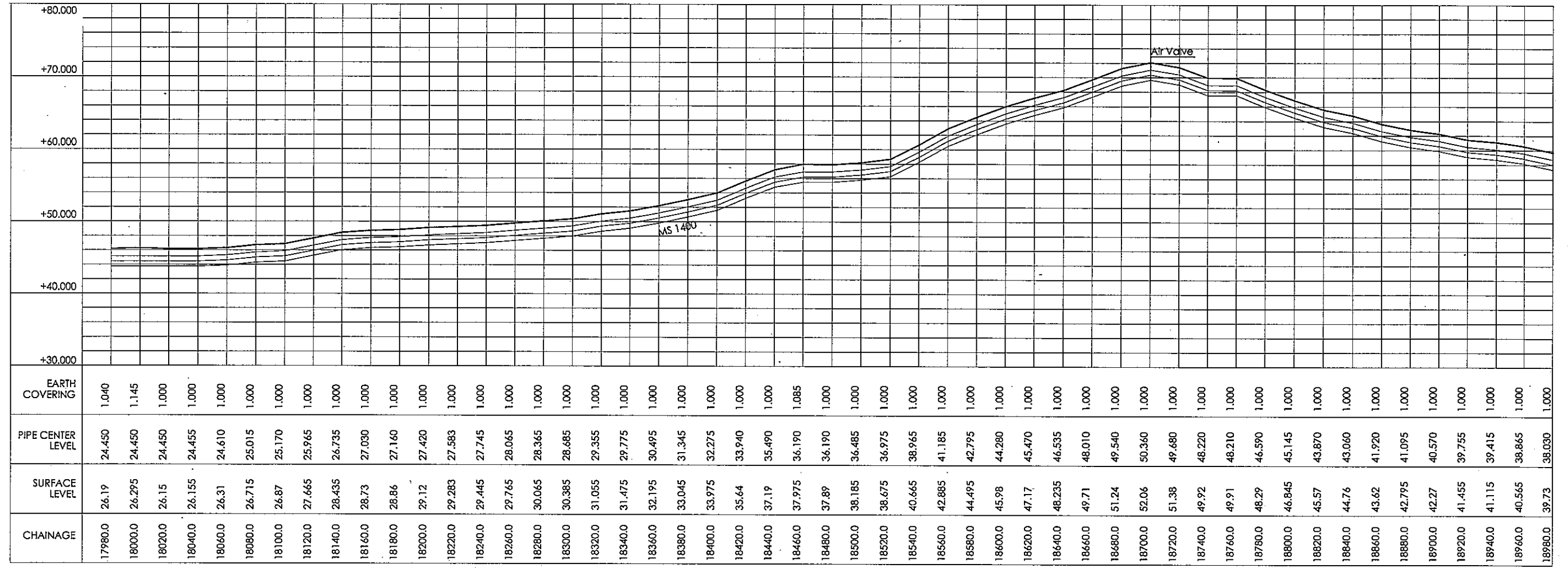
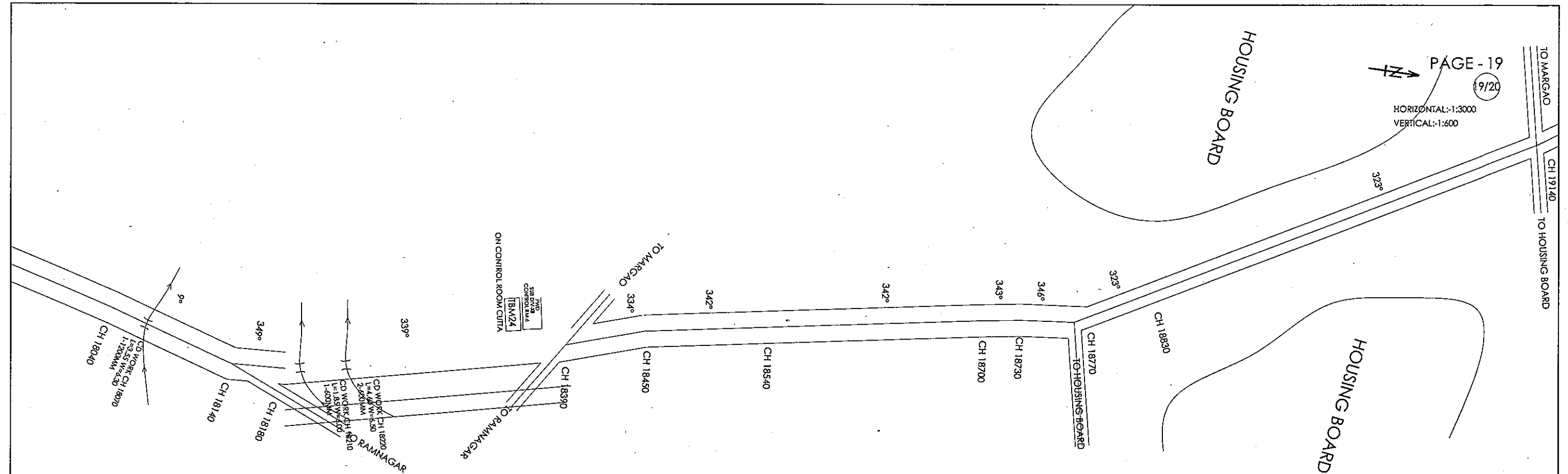


CHAINAGE	SURFACE LEVEL	PIPE CENTER LEVEL	EARTH COVERING
16980.0	10.275	8.575	1.000
17000.0	10.625	8.925	1.000
17020.0	10.765	9.065	1.000
17040.0	10.835	9.135	1.000
17060.0	10.985	9.285	1.000
17080.0	11.085	9.385	1.000
17100.0	11.18	9.48	1.000
17120.0	11.43	9.730	1.000
17140.0	11.58	9.880	1.000
17160.0	11.755	10.055	1.000
17180.0	12.035	10.335	1.000
17200.0	12.445	10.745	1.000
17220.0	12.935	11.235	1.000
17240.0	13.49	11.790	1.000
17260.0	13.845	12.145	1.000
17280.0	14.055	12.355	1.000
17300.0	14.195	12.495	1.000
17320.0	14.65	12.950	1.000
17340.0	15.075	13.375	1.000
17360.0	15.64	13.940	1.000
17380.0	16.175	14.475	1.000
17400.0	16.73	15.030	1.000
17420.0	17.045	15.345	1.000
17440.0	17.67	15.970	1.000
17460.0	18.065	16.365	1.000
17480.0	18.495	16.795	1.000
17500.0	18.92	17.220	1.000
17520.0	19.375	17.675	1.000
17540.0	19.865	18.165	1.000
17560.0	20.245	18.545	1.000
17580.0	20.71	19.010	1.000
17600.0	21.32	19.620	1.000
17620.0	21.685	19.985	1.000
17640.0	21.915	20.215	1.000
17660.0	22.075	20.375	1.000
17680.0	22.335	20.635	1.000
17700.0	22.635	20.935	1.000
17720.0	23.09	21.390	1.000
17740.0	23.47	21.770	1.000
17760.0	23.785	22.085	1.000
17780.0	24.255	22.555	1.000
17800.0	24.55	22.850	1.000
17820.0	24.83	23.130	1.000
17840.0	25.13	23.430	1.000
17860.0	25.29	23.590	1.000
17880.0	25.44	23.740	1.000
17900.0	25.63	23.930	1.000
17920.0	25.79	24.090	1.000
17940.0	25.88	24.180	1.000
17960.0	26.18	24.450	1.030
17980.0	26.19	24.450	1.040

Study on Augmentation of Water Supply and Sanitation  
for the Goa State in the Republic of India

Transmission Main  
Sirvoi MBR to Margao, TM2-18

Scale: as shown  
No. W49



Study on Augmentation of Water Supply and Sanitation  
 for the Goa State in the Republic of India

Transmission Main  
 Sirvoi MBR to Margao, TM2-19

Scale: as shown  
 No. W50



