Annexure-1

बिहार शहरी आधारभूत संरचना विकास निगम लि०
Bihar Urban Infrastructure Development Corporation Ltd.
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06/08/13

BUIDCO
Building Better Tomorrow
ISO 9001:2008, 14001:200

सं/No.: BUIDCO/YO-07/10-VOL-III-1712 दिनांक/Date : 03/08/13

To,

Sri Raj Kumar Saini
General Manager (Project)
Tri-Tech (Beijing) Company Limited
Plot No-293, Kehsar Singh Estate
West end Marg, Saidula Jab,
New Delhi-110030, India

Sub:- Approval of the BEP of STP at Hajipur Sewerage Project.

Sir,

With reference to above mentioned subject we would like to inform you that, the BEP cited above as submitted by you to IIT, BHU has been vetted and approved. We are returning one copy of the approved document. We once again wish to bring to your notice that the indication in the Layout drawing that "Treated Sewerage disposal (by client)" is not acceptable and that the disposal system is within the scope of the contractor.

The indication that "Transformer/HT Switch gear are in BUIDCo Scope of work" is also not acceptable. "BUIDCo to provide LT power connectivity and terminate the same to LT MCC panel" is also to be changed to reflect that the Transformer/HT Switch gear are in the contractor's scope of work and also that BUIDCo will provide HT power line in the campus of STP.

You are requested to take note of the foregoing and carry out further activities of engineering/procurement/ implementation.

Yours sincerely,

cc: PJ

3/8/13
Chief General Manager
Buidco, Patna

NOTE: ORIGINAL WITH ENGG,
COPY SENT TO HAJIPUR. MR RAJEEV RAI

Certified Copy of Approved & BEP Plan issued to Contractor
3/8/2013

BIHAR URBAN INFRASTRUCTURE DEVELOPMENT CORPORATION LTD., PATNA

SEWERAGE NETWORK AND 22 MLD STP PLANT FOR HAJIPUR TOWN

M/S TRI-TECH (BEIJING) CO. LTD.

TRI-TECH 鼎联
Safety Clean Harmony

BASIC ENGINEERING PACKAGE (Part-1)

Vetted & Approved
Ref: letter No: CE/GB/07-1/2013
dt. 04.07.2013 for details

REVISION 1

NOVEMBER 30, 2012

04.07.13

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Owner	**: Bihar Urban Infrastructure Development Corporation Ltd. Patna**
Project	**: Sewerage Network and 22 MLD STP Plant For Hajipur Town**
Contractor	**: Tri-Tech (Beijing) Company Ltd. Beijing (New Delhi)**
Doc. Name	**: Treatment Scheme for STP**
Doc. No.	**: TT/BEI/HJ/1051/STP/A01 REV. 00 DT. 30.11.2012**

SEWAGE TREATMENT PLANT/TERMINAL PUMPING STATION CAPACITY

The Sewage Treatment Plant is designed for a capacity of 22.0 MLD Average Flow i.e. 49.5 MLD Peak Flow corresponding to the projected flow rate for Year 2026. The Terminal Pumping Station is designed for a capacity of 33.0 MLD Average Flow i.e. 74.25 MLD Peak Flow corresponding to the projected flow rate for Year 2041. The total Site Area available for construction is 300.0 M x 130.0 M which is sufficient to construct the proposed 22.0 MLD Sewage Treatment Plant as also an additional 11.0 MLD Sewage Treatment Plant in future.

RAW SEWAGE INTAKE

Raw sewage will be collected and delivered by gravity via 1.2 M Diameter Outfall Sewer having capacity 74.25 MLD (Year 2041 Design Peak Flow) up to the Receiving Chamber of Terminal Pumping Station at STP Site. The Receiving Chamber has been designed for a Hydraulic Retention Time of 12s (approx.) in order to minimize grit deposition at its bottom.

COARSE SCREENING

1 No. Mechanical Coarse Bar Screen (Working) and 1 No. Manual Coarse Bar Screen (Stand-By) each designed for Peak Flow will be provided. Due to difficulty associated with underground construction of deep Screen Channels of narrow width, the Screen Channels will be constructed at below Ground Level on a RCC Platform covering portion of the Raw Sewage Collection Sump (Wet Well).

Mechanical coarse screening will be carried out continuously/ intermittently as required. The screen operation will be controlled through Timer installed in the Coarse Screen Control Panel. The screenings will be lifted mechanically and dropped in to a Conveyor Belt and finally discharged on to a Wheel Barrow at ground level. The Coarse Bar Screen Channels will be provided with Manual Inlet Isolation Sluice Gates. Outlet Isolation Sluice Gates will not be required as the screened sewage will directly free fall to Raw Sewage Collection Sump (Wet Well) below the Coarse Screen Channels through bottom perforations at the outlet end of the channel. Manual coarse screening will be carried out only during emergency in case the Mechanical Coarse Bar Screen is under maintenance. Manual Screenings will be manually

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raked on to a RCC Perforated Platform and then transferred to Raw Sewage Collection Sump (Wet Well) Top of Structure Level through Bucket - Chain Pulley Arrangement and disposed off manually to Wheel Barrow at Ground Level.

RAW SEWAGE TRANSFER PUMPS

Coarse screened raw sewage will be collected by gravity in a Raw Sewage Sump Wet Well. The Raw Sewage Sump Wet Well will be designed for Hydraulic Retention Time 7.5 Minutes at Year 2041 Design Peak Flow. The Raw Sewage Sump Wet Well will be at present provided with 5 Nos. Submersible Pumps catering to 49.5 MLD i.e. Year 2026 Design Peak Flow (22.0 MLD Year 2026 Design Average Flow). Space will be left for installation of additional 3 Nos. Submersible Pumps in future for catering to Balance Year 2041 Design Peak Flow. The 5 Nos. Submersible Pumps will each have ¼ Peak Flow Capacity such that 4 Nos. Pumps are in operation during Peak Flow, 2 Nos. Pumps are in operation during Average Flow and 1 No. Pump is in operation during Lean Flow. An Ultrasonic Level Sensor (linked to PLC/ SCADA) will be installed in the Raw Sewage Collection Sump and pump selection and operation will be regulated through PLC/ SCADA based on the sump sewage level and its variation. The Raw Sewage Transfer Pumps will be provided with individual PLC/ SCADA Controlled Electrically Actuated Delivery Butterfly Valves. A 600 NB DI K7 Common Delivery Header will transfer pumped raw sewage to the Stilling Chamber.

STILLING CHAMBER/ PLANT BYPASS

The Stilling Inlet Chamber will collect pumped raw sewage and distribute the same to 2 Nos. Mechanical Fine Screen Channels in parallel. Raw sewage can also be bypassed to Outfall Manhole from the Stilling Chamber. The bypass arrangement consists of Bypass Sluice Gate, Bypass Chamber 800 NB RCC Bypass Pipeline/ Bypass Manholes up to the Outfall Manhole.

FINE SCREENING

2 Nos. Mechanical Fine Mat/ Step Screens (1 Working + 1 Stand-By) each designed for Peak Flow will be provided. Mechanical fine screening will be carried out intermittently controlled through Ultrasonic Differential Level Sensor (linked to PLC/SCADA) installed upstream/ downstream of the screen. The Ultrasonic Level Sensor will activate the Mechanical Fine Mat/ Step Screen when the head loss across the screen touches 300 MM and will stop screen operation when the head loss across the screen reduces to 50 MM. The screenings will be collected mechanically in a Conveyor Belt and discharged on to a Wheel Barrow at ground level. The Mechanical Fine Screen Channels will be provided with Manual Inlet / Outlet Isolation Sluice Gates.

GRIT CHAMBERS

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2 Nos. Mechanical Detritus Type Grit Chambers each designed for Half Peak Flow will be provided. 1 No. Grit Chamber will be operational during Average Flow/ Lean Flow and 2 Nos. Grit Chambers will be operational during Peak Flow. The Grit Chambers will be designed hydraulically to allow the entire Peak Flow to be passed through 1 No. Grit Chamber as and when the other is shut down for maintenance. The Grit Chambers will be provided with Manual Inlet Isolation Sluice Gates. Each Grit Chamber will be provided with Central Drive Head / Scraper Arrangement, Rake Classifier and Organic Return Pump (all controlled through PLC/ SCADA). The settled grit will be collected from the Rake Classifier discharge on to Wheel Barrow positioned at ground level. De-gritted sewage will overflow over Grit Chamber Outlet Weir and flow through Grit Chamber Outlet Channel to the Parshall Flume Channel.

PARSHALL FLUME CHANNEL

A Parshall Flume Channel equipped with Ultrasonic Flow Sensor will be provided for the purpose of flow measurement. The Ultrasonic Flow Sensor will have local as well as panel indication linked to PLC/ SCADA and will be provided with remote Totalizer and Recorder. The raw sewage will flow through RCC Channel to the Aeration Tank Inlet Annular Channel.

AERATION TANK

1 No. Aeration Tank will be provided to carry out aerobic biological treatment of raw sewage using activated sludge extended aeration process. It will be operated at a Food to Micro-Organism Ratio of 0.15 Kg BOD/ Kg MLSS – Day and Hydraulic Residence Time 9.6 Hours. The Aeration Tank will be circular in shape with radial central annular channel inlet having distribution orifices and a peripheral weir launder outlet. Oxygenation will be carried out through fine air bubble diffusion using retrievable type Fine Air Bubble Diffusers. 3 Nos. Twin Lobe Rotary Air Blowers operating on 2 Working, 1 Stand-By Basis each equipped with Variable Frequency Drive will be provided to supply air in to the Aeration Tank. The Aeration Tank will have a dissolved Oxygen Sensor linked to PLC SCADA. The Air Blower Speed will be regulated through PLC SCADA depending on the Dissolved Oxygen Level prevailing in the Aeration Tank. Aerated sewage from the Aeration Tank Outlet Chamber to Secondary Clarifier through 1000 NB DI K7 Pipeline provided with flushing connection.

SECONDARY CLARIFER

The Secondary Clarifier will be designed for a Surface Loading Rate of 14.0 M^3/M^2-day at average flow. Settled sludge from the Secondary Clarifier will be collected in a Return Sludge Sump and recycled back to the Aeration Tank on a continuous basis using 3 Nos. Submersible Pumps operating on 2 Working, 1 Stand-By Basis. A tapping from the Pump Delivery Header will be provided to waste excess activated sludge to the Gravity Sludge Thickener. Electrically Actuated Knife Edge Gate Valves will be provided in the Return Sludge Line to Aeration

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Tank and in the Sludge Wasting Line to Gravity Sludge Thickener to regulate the respective flow rates as per requirement. The settled supernatant from the Secondary Clarifier will be discharged through RCC Channel to the Chlorine Contact Tank.

CHLORINATION/ TREATED SEWAGE DISPOSAL

The Chlorine Contact Tank will be of RCC baffled construction having Hydraulic Residence Time 30 minutes at Average Flow. Chlorination will be carried out at the inlet of the Chlorine Contact Tank at a Chlorine Dose 5.0 PPM (max).

Chlorinated sewage will overflow over weir to a Chlorine Tank Outlet Chamber and then through RCC Channel to the Outfall Manhole. The Chlorine Tank Outlet Chamber will be provided with 2 Nos. Submersible Flushing Pumps intermittently operating on 1 Working, 1 Stand-By Basis so as to provide treated sewage for poly-electrolyte solution preparation and for flushing purposes. The Client will arrange to discharge treated sewage from the Outfall Manhole to disposal.

2 Nos. Vacuum Chlorinators (Capacity 5.0 Kg/Hour) operating on 1Working, 1 Stand-By Basis will be provided for chlorination. 3 Nos. Chlorine Tonners will be provided operating on 1 Working, 2 Stand-By Basis. The Vacuum Chlorinator in operation will draw chlorine gas from 1 No. Chlorine Tonner while a second Chlorine Tonner will be kept connected to the Chlorine Gas Manifold ready for change over when the Chlorine Tonner in operation gets exhausted. 2 Nos. Chlorine Dosing Booster Pumps (1Working, 1 Stand-By) will be provided such that chlorine solution is dosed to the Chlorine Contact Tank Inlet Chamber. The Chlorine Dosing Booster Pumps will be PLC/ SCADA controlled and will draw treated sewage from the Chlorine Contact Tank for preparing chlorine solution.

SLUDGE HANDLING

The Gravity Sludge Thickener will be operated at a Design Sludge Loading Rate of 40.0 Kg TSS/M^2-day. It is designed to thicken the excess waste activated sludge to 3.0% TSS concentration (Dry Solids Basis). Thickened sludge from the Gravity Sludge Thickener will be pumped using 2 Nos. Centrifuge Feed Pumps operating on 1 Working, 1 Stand-By Basis to 2 Nos. Solid Bowl Centrifuges operating on 1 Working, 1 Stand-By Basis. The Solid Bowl Centrifuges will be housed in the first floor of the Centrifuge Shed. On-line poly-electrolyte dosing will be carried out to aid sludge dewatering. 2 Nos. Poly Tanks (1Working, 1 Stand-by) and 2 Nos. Poly Dosing Pumps (1 Working, 1 Stand-By) will be provided for the purpose of poly-electrolyte solution preparation and dosing. Dewatered sludge cake from the Solid Bowl Centrifuges will be collected in Tractor Trolleys and disposed off suitably. The supernatant from the Gravity Sludge Thickener and the Centrifuge will be recycled back to the Raw Sewage Sump Wet Well by gravity.

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Project	**: Sewerage Network and 22 MLD STP Plant For Hajipur Town**
Contractor	**: Tri-Tech (Beijing) Company Ltd. Beijing (New Delhi)**
Doc. Name	**: Process Design Calculations for STP Plant**
Doc. No.	**: TT/BEI/HJ/1051/STP/A02 REV. 02 DT. 13.05.2013**

1.0 SEWAGE GENERATION AND CHARACTERISTICS

The 22 MLD Sewage Treatment Plant is designed using the Activated Sludge Extended Aeration Process for the following sewage flow rate and characteristics:

Design Year 2026

Average Flow Rate	:	22.0 MLD i.e. 22000.0 M^3/Day
	=	916.67 M^3/Hour
	=	0.255 M^3/s
Peaking Factor	:	2.25
Peak Flow Rate	:	22000.0 x 2.25 i.e. 49500.0 M^3/day
	=	2062.5 M^3/Hour
	=	0.573 M^3/s

Design Year 2041

Average Flow Rate	:	33.0 MLD i.e. 33000.0 M^3/Day
	=	1375.0 M^3/Hour
	=	0.382 M^3/s
Peaking Factor	:	2.25
Peak Flow Rate	:	33000.0 x 2.25 i.e. 74250.0 M^3/day
	=	3093.8 M^3/Hour
	=	0.859 M^3/s

Note: The Raw Sewage Pumping Station is designed for raw sewage flow rate corresponding to Design Year 2041 whereas the balance STP is designed for raw sewage flow rate corresponding to Design Year 2026. Raw Sewage Pumps will be designed and supplied to cater to raw sewage flow rate corresponding to Design Year 2026 and sufficient vacant space will be provided for installation of additional pumps in future.

BOD	:	300.0 mg/l
COD	:	700.0 mg/l
Suspended Solids SS	:	600.0 mg/l
Bio-Degradable VSS	:	330.0 mg/l (Considered)
Non Bio-Degradable VSS/FSS	:	270.0 mg/l (Considered)

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2.0 TREATED SEWAGE QUALITY

The Treated Sewage Quality shall conform to NRCD Guidelines, as follows:

BOD	<	20.0 mg/L
SS	<	30.0 mg/L

3.0 RECEIVING CHAMBER

No.	:	1
Material of Construction	:	RCC
Year 2041 Peak Flow Rate	:	0.859 M^3/s
Plan Dimensions	:	3.0 M x 3.0 M
Side Water Depth	:	1.15 M
Volume	:	3.0 x 3.0 x 1.15 i.e. 10.4 M^3
Hydraulic Retention Time	:	10.4 / 0.859 i.e. 12.0 s

4.0 MECHANICAL COARSE BAR SCREEN CHANNEL

No.	:	1 (Working)
Material of Construction	:	RCC, with SS 304 Coarse Bar Screen
Design Basis	:	Year 2041 Peak Flow i.e. 0. 859 M^3/s
Angle of Inclination	:	80^0
Length	:	5.0 M
Side Water Depth	:	1.1 M
Inclined Submerged Screen Length	:	(1.1 / Sin 80^0) i.e. 1.12 M
Velocity (through Screen at Peak Flow, NIL Clogging)	:	1.2 M/s
Clear Width	:	0. 859 M^3/s / (1.12 M x 1.2 M/s)
	i.e.	0.639 M
Clear Spacing	:	20 MM
No. of Openings	:	0.639 M/ 0.020 M
	i.e.	32.0
No. of Bars	:	32 + 1 i.e. 33
Bar Size	:	8 MM x 40 MM
Screen Channel Width (Minimum)	:	(32 x 0.020) + (33 x 0.008)
	i.e.	0.904, say 0.95 M
Side Margin for Operating Mechanism	:	0.3 M
Screen Channel Width (Overall)	:	0.95 + 0.3 i.e. 1.25 M
Approach Velocity (Average Flow)	:	0. 382/ (1.25 x 1.1) i.e. 0.28 = 0.3 M/s

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		(approx.), i.e. OK
Screen Height	:	SWD (U/s) + FB (U/s) + Conveyor Height + 0.5 + 0.3 (Safety Factor) i.e. 1.1 + 7.45 + 0.6 + 0.5 + 0.3 = 9.95 M (Minimum)
Head Loss (Design)	:	0.15 M
Operation	:	Automatic (Timer Controlled)
Service	:	Continuous/ Intermittent
Accessory Equipment	:	Electric Motor/ Drive Mechanism w/ Mechanical Travelling Rakes/ Control Panel/ Belt Conveyor (w/ Electric Motor and Drive Arrangement)/ MSEP/ FRP Wheel Barrow (2 Nos.)

Notes:

1. Due to difficulty associated with underground construction of deep Screen Channels of narrow width, the Screen Channel will be constructed at below Ground Level on a RCC Platform covering portion of the Raw Sewage Collection Sump (Wet Well). The Conveyor Belt will be installed at the Raw Sewage Collection Sump (Wet Well) Top of Structure Level i.e. 0.5 M above Ground Level.
2. Screenings will be mechanically collected on to a Conveyor Belt and then disposed off mechanically by gravity to Wheel Barrow at Ground Level.
3. The Belt will start automatically when the Mechanical Screen starts and will stop automatically after a lag period of 60 seconds after the Mechanical Screen stops.
4. Height of Screen/ Conveyor Belt are subject to modification depending on Manufacturer Specifications.

Inlet Isolation Sluice Gate

No.	:	1
Type	:	Flange Back Frame Thimble Mounted, Rising Spindle, Flush Bottom Closure
Design Standard	:	IS: 13349
Material of Construction	:	Cast Iron (as per NIT)
Peak Flow Rate	:	0.859 M^3/s
Size	:	900 MM x 900 MM
Velocity (at Peak Flow)	:	0.859 / (0.900 x 0.900) i.e. 1.06 M/s
Operation	:	Manual

Note: Outlet Isolation Sluice Gates are not required as the screened sewage will directly free fall to Raw Sewage Collection Sump (Wet Well) below the Mechanical Coarse Screen Channel through bottom perforations at the outlet end of the channel.

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5.0 MANUAL COARSE BAR SCREEN CHANNEL

No.	:	1 (Stand-By)
Material of Construction	:	RCC, with SS 304 Coarse Bar Screen
Design Basis	:	Year 2041 Peak Flow i.e. 0.859 M^3/s
Angle of Inclination	:	60^0
Length	:	5.0 M
Side Water Depth	:	1.1 M
Inclined Submerged Screen Length	:	(1.1 / Sin 60^0) i.e. 1.27 M
Velocity (through Screen at Peak Flow, NIL Clogging)	:	1.2 M/s
Clear Width	:	0.859 M^3/s / (1.27 M x 1.2 M/s)
	i.e.	0.564 M
Clear Spacing	:	20 MM
No. of Openings	:	0. 564 M/ 0.020 M
	i.e.	28.2, say 29
No. of Bars	:	29 + 1 i.e. 30
Bar Size	:	8 MM x 40 MM
Screen Channel Width	:	(29 x 0.020) + (30 x 0.008)
	i.e.	0.82, say 0.85 M
Approach Velocity (Average Flow)	:	0. 382/ (0.85 x 1.1) i.e. 0.41 M/s, i.e. OK Screen will take care the velocity at peak flow also
Screen Height	:	SWD (D/s) + FB (D/s) i.e. 1.1 + 0.5 = 1.6 M
Head Loss (Design)	:	0.15 M
Operation	:	Manual
Service	:	Intermittent
Accessory Equipment	:	MSEP Rakes (2 Nos.)/ Bucket Chain Pulley Screenings Removal Arrangement

Notes:

1. Due to difficulty associated with underground construction of deep Screen Channels of narrow width, the Screen Channel will be constructed at below Ground Level on a RCC Platform covering portion of the Raw Sewage Collection Sump (Wet Well).
2. Screenings will be manually raked on to a RCC Perforated Platform and then transferred to Raw Sewage Collection Sump (Wet Well) Top of Structure Level through Bucket - Chain Pulley Arrangement and disposed off manually to Wheel Barrow at Ground Level.

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Inlet Isolation Sluice Gate

No.	:	1
Type	:	Flange Back Frame Thimble Mounted, Rising Spindle, Flush Bottom Closure
Design Standard	:	IS: 13349
Material of Construction	:	Cast Iron (as per NIT)
Peak Flow Rate	:	0.859 M^3/s
Size	:	900 MM x 900 MM
Velocity (at Peak Flow)	:	0.859 / (0.900 x 0.900) i.e. 1.06 M/s
Operation	:	Manual

Note: Outlet Isolation Sluice Gate is not required as the screened sewage will directly free fall to Raw Sewage Collection Sump (Wet Well) below the Mechanical Coarse Screen Channel through bottom perforations at the outlet end of the channel.

6.0 RAW SEWAGE PUMPING STATION

Raw Sewage Collection Sump (Wet Well)

No.	:	1
Material of Construction	:	RCC
Peak Flow Rate	:	0. 859 M^3/s
Hydraulic Retention Time (at Peak Flow)	:	7.5 Minutes
Volume (Required)	:	0.859 x 60 x 7.5 i.e. 386.6 M^3
Diameter	:	18.5 M
Side Water Depth	:	1.45 M
Volume (Provided)	:	(Π/4 x 18.5 x 18.5 x 1.45) i.e. 389.8 M^3
Hydraulic Retention Time (at Average Flow)	:	389.8/ (0.382 x 60) i.e. 17.0 Min, i.e. OK
Accessory	:	Ultrasonic Level Sensor (Linked to PLC/ SCADA)

Raw Sewage Transfer Pumps

Nos.	:	5 (4 Working + 1 Stand-By – Peak Flow)
	:	5 (2 Working + 3 Stand-By –Average Flow)
Design Basis	:	Year 2026 Peak Flow i.e. 2062.5 M^3/Hour
Capacity	:	2062.5/ 4 i.e. 515.6 say 520.0 M^3/Hour
Discharge Head	:	17.0 MWC
Type	:	Submersible Non Clog, Wet Well Installation
Operation	:	Automatic (Controlled by Ultrasonic Level

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		Sensor, linked to PLC/ SCADA)
Material of Construction		
Casing	:	Cast Iron
Impeller	:	Stainless Steel ASTM A 743 CF8M
Shaft/ Fasteners/ Foundation Bolts	:	Stainless Steel 316
Guide Rail	:	Stainless Steel SS 304
Accessory Equipment	:	Submersible Electric Motors/ Lifting Chains/ Guide Rails

Note: It shall be ensured that any pump shall be in operation for minimum 5 minutes

Individual Pump Delivery Lines

Size	:	300 NB
Design Velocity	:	520.0/ 3600/ (Π4 x 0.3 x 0.3) i.e. 2.04 M/s
Material of Construction	:	DI K7
Accessory Equipment	:	Non Return Valve/ Butterfly Valve (Electrically Actuated)/ Pressure Gauge

Combined Pump Delivery Header

Design Flow	:	520.0 x 4 i.e. 2080.0 M^3/Hour
Size	:	600 NB
Design Velocity	:	2080.0/ 3600/ (Π/4 x 0.6 x 0.6)
	i.e.	2.04 M/s
Material of Construction	:	DI K7

Dry Well

Note: The Dry Well be constructed above the Raw Sewage Collection Sump (Wet Well) and will be used for access to the Submersible Pumps for operation and maintenance as required.

No.	:	1
Material of Construction	:	RCC Slabs/ Walkways w/ Hand Railing
Length	:	18.5 M
Width	:	6.0 M
Accessory	:	3.0/ 5.0 Ton Capacity Manual Chain Pulley Hoist with ISMB 300/ 350 Monorail

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7.0 STILLING CHAMBER

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No.	:	1
Material of Construction	:	RCC
Plan Dimensions	:	2.1 x 2.1 M
Straight Water Depth	:	3.95 M
Volume	:	2.1 x 2.1 x 3.95 i.e. 17.4 M^3
Hydraulic Retention Time (at Peak Flow)	:	17.4/ 0.573 i.e. 30.4 s

Bypass Sluice Gate

No.	:	1
Type	:	Flange Back Frame Thimble Mounted, Rising Spindle, Flush Bottom Closure
Design Standard	:	IS: 13349
Material of Construction	:	Cast Iron (as per NIT)
Peak Flow Rate	:	0.573 M^3/s
Size	:	550 MM x 550 MM
Velocity (at Peak Flow)	:	0.573 / (0.550 x 0.550) i.e. 1.89 M/s
Operation	:	Manual

Bypass Chamber

No.	:	1
Material of Construction	:	RCC
Peak Sewage Flow Rate	:	0.573 M^3/s
Plan Dimensions	:	2.1 M x 1.2 M
Side Water Depth	:	2.5 M

Bypass Sewage Pipeline, Bypass Chamber to Treated Sewage Sump Wet Well

No.	:	1
Material of Construction	:	RCC
Peak Flow Rate	:	0.573 M^3/s
Size	:	800 NB
Velocity (at Peak Flow)	:	0.573/ (Π/4 x 0.8 x 0.8) i.e. 1.14 M/s

Bypass Man Holes

Nos.	:	3
Material of Construction	:	RCC (w/ RCC Top Cover Slab)
Diameter	:	1.3 M
Side Water Depth	:	2.5 M (Max)

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8.0 MECHANICAL FINE SCREEN CHANNELS

Nos.	:	2 (1 Working + 1 Stand-By)
Type	:	Mat/ Step Fine Screen
Material of Construction	:	RCC, with SS 304 Fine Screen
Design Basis	:	Peak Flow i.e. 0.573 M^3/s
Angle of Inclination	:	40^0
Length	:	6.0 M
Side Water Depth	:	1.0 M
Height of Screen Protection Plate (Blind Step)	:	0.225 M
Inclined Submerged Screen Length	:	(1.0 / Sin 40^0 – 0.225) i.e. 1.331 M
Velocity (through Screen, at Peak Flow)	:	1.0 M/s
Clear Width	:	0.573 / (1.331 x 1.0)
	i.e.	0.431 M
Clear Spacing	:	6 MM
No. of Openings	:	0.431 / 0.006
	i.e.	71.8, say 72
No. of Bars	:	72 - 1 i.e. 71
Bar Thickness	:	2 MM
Screen Width	:	(72 x 0.006) + (71 x 0.002)
	i.e.	0.574 M, say 0.6 M
Side Margin for Operating Mechanism	:	0.3 M
Screen Channel Width	:	0.6 + 0.3 i.e. 0.9 M
Approach Velocity (Average Flow)	:	0.255/ (0.9 x 1.0) i.e. 0.28 = 0.3 M/s (app.) Screen shall take care peak flow
Height of Screen	:	SWD + Free Board (d/s) + Height (Conveyor) + Free Fall i.e. 1.0 + 0.5 + 0.6 + 0.5 = 2.6 M (Minimum)
Head Loss through Screen	:	300 MM (Maximum)
Design Clogging	:	49% (Maximum)
Operation	:	Automatic (Controlled through Ultrasonic Differential Level Sensor linked to PLC/ SCADA)
Service	:	Intermittent

Hydraulic Check

Approach Velocity (at Peak Flow)	:	0. 0.573/ (0.9 x 1.0) i.e. 0.64 M/s

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Velocity through Screen	:	0.573/ ((1.331) x (72 x 0.006) x (1.0 - 0.0))
(at NIL Clogging)	=	1.0 M/s
Head Loss (at NIL	:	$1/0.7 \times (1^2 - 0.64^2) / (2 \times 9.81)$
Clogging)	=	0.043 M
Velocity through Screen	:	0.573/ ((1.331) x (72 x 0.006) x (1.0 – 0.49))
(at 49% Clogging)	=	1.95 M/s
Head Loss (at 50%	:	$1/0.6 \times (1.94^2 - 0.64^2) / (2 \times 9.81)$
Clogging)	=	0.288 < 0.3 M i.e. OK
Accessory Equipment	:	Drive Mechanism, Control Panel, Belt Conveyor (w/ Electric Motor and Drive Arrangement)/ MS Epoxy Painted/ FRP Chute/ Hand Cart (2 Nos.)

Notes:

1. Ultrasonic Differential Level Sensor will be provided so as to activate Mechanical Fine Screen Drive Mechanism when Upstream Level touches 300 MM above Downstream Level and shuts off Screen Drive Mechanism when Upstream Level reduces to 50 MM above Downstream Level.
2. Screenings will be mechanically collected on to a Conveyor Belt common to both Fine Screens and then disposed off via Chute to Wheel Barrow at Ground Level.
3. The Conveyor Belt will start automatically when the Mechanical Screen starts and will stop automatically after a lag period of 60 seconds after the Mechanical Screen stops.

Inlet Isolation Sluice Gates

Nos.	:	2
Type	:	Open Channel, Rising Spindle, Flush Bottom Closure
Material of Construction	:	Cast Iron (as per NIT)
Peak Flow Rate	:	$0.573\ M^3/s$
Width	:	400 MM
Height	:	1300 MM SWD + 300 MM FB
Velocity (at Half Peak Flow)	:	0.573 / (0.4 x 1.3) i.e. 1.10 M/s
Operation	:	Manual

Outlet Isolation Sluice Gates

Nos.	:	2
Type	:	Open Channel, Rising Spindle, Flush Bottom Closure
Material of Construction	:	Cast Iron (as per NIT)

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Half Peak Flow Rate	:	0.573 M^3/s
Width	:	550 MM
Height	:	1000 MM SWD + 300 MM FB
Velocity (at Peak Flow)	:	0.573 / (0.5 x 1.1) i.e. 1.04 M/s
Operation	:	Manual

9.0 MECHANICAL GRIT CHAMBERS

No.	:	2 (Working)
Material of Construction	:	RCC, with MS Epoxy Painted Grit Scraper/ Rake Classifier/ CI Organic Return Pump
Design Basis	:	Half Peak Flow, i.e. 49500.0/ 2
	=	24750.0 M^3/day
	i.e.	0.286 M^3/s
Design Surface Loading Rate	:	720.0 M^3/M^2-day
Plan Area (Required)	:	24750.0 M^3/day / 720.0 M^3/M^2-day
	i.e.	34.4 M^2
Plan Dimensions	:	5.9 M x 5.9 M
Hydraulic Retention Time	:	60s
Volume	:	0.286 x 60 i.e. 17.2 M^3
Side Water Depth	:	17.2 / (5.9 x 5.9) i.e. 0.49 M
Grit Storage Depth	:	0.41 M
Overall Depth	:	0.49 + 0.41 i.e. 0.9 M

Note: Settled grit in Grit Chamber will be mechanically scraped to Rake Classifier Channel, lifted through Rake Classifier and dropped in to Wheel Barrow positioned at Ground Level.

Inlet Isolation Sluice Gates

Nos.	:	2
Type	:	Open Channel, Rising Spindle, Flush Bottom Closure
Material of Construction	:	Cast Iron (as per NIT)
Design Basis	:	Peak Flow
Peak Flow Rate	:	0.573 M^3/s
Width	:	550 MM
Height	:	950 MM SWD + 300 MM FB
Velocity (at Peak Flow)	:	0.573 / (0.55 x 0.95) i.e. 1.10 M/s
Operation	:	Manual

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10.0 PARSHALL FLUME CHANNEL

No.	:	1
Material of Construction	:	RCC
Peak Flow Rate	:	0.573 M^3/s
Throat Width	:	1.5 Feet (0.457 M)
Length	:	9.8 M
Upstream Head	:	0.672 M
Downstream Head	:	0.421 M (Considered)
Head Loss	:	0.672 – 0.421 = 0.251, say 0.3 M
Side Water Depth (d/s)	:	0.65 M
Width	:	0.8 M
Downstream Velocity	:	0.573/ (0.8 x 0.65) i.e. 1.10 M/s
Side Water Depth (u/s)	:	0.65 + 0.3 i.e. 0.95 M
Flow Measurement	:	Ultrasonic Sensor (Linked to PLC SCADA)

11.0 AERATION TANK

The design sewage characteristics entering the Aeration Tank will be as given in Clause 1.0 above.

No.	:	1
Material of Construction	:	RCC
Type of Aeration	:	Fine Bubble Diffused Aeration
Design Basis	:	Average Flow, i.e. 22000.0 M^3/Day
	i.e.	916.7 M^3/Hour
Inlet BOD to Aeration Tank	:	300.0 mg/l
Inlet BOD Load	:	0.300 Kg/M^3 x 22000.0 M^3/Day
	i.e.	6600.0 Kg BOD/ Day
MLSS Concentration, X	:	5000.0 mg/l
Food to Micro-Organism Ratio	:	0.15 Kg BOD/ Kg MLSS - Day
Hydraulic Retention Time	:	300.0 mg/l / (5000 mg/l x 0.15)
	i.e.	0.4 days (9.6 Hours)
Volume (Required)	:	22000.0 M^3/Day x 0.4 Days
	i.e.	8800.0 M^3
Side Water Depth	:	5.0 M
Plan Area	:	8800.0 M^3 / 5.0 M
	i.e.	1760.0 M^2
Diameter	:	47.4 M
Plan Area Provided	:	∏/4 x 47.4 x 47.4 i.e. 1764.6 M^2, i.e. OK
Accessory	:	On-Line DO Meter (Linked to PLC/ SCADA)

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Aeration Tank Inlet Channel

No.	:	1
Material of Construction	:	RCC
Peak Sewage Flow Rate	:	0.573 M^3/s
Return Sludge Flow Rate	:	0.255 M^3/s
Total Sewage Flow Rate	:	(0.573 + 0.255) i.e. 0.828 M^3/s
Width	:	1.1 M
Side Water Depth	:	0.9 M
Channel Velocity	:	0.828/(20 x ∏/4 x 0.25 x 0.25)
	i.e.	0.84 M/s

Aeration Tank Inlet Annular Channel

No.	:	1
Material of Construction	:	RCC
Peak Sewage Flow Rate	:	0.573 M^3/s
Return Sludge Flow Rate	:	0.255 M^3/s
Total Sewage Flow Rate	:	(0.573 + 0.255) i.e. 0.828 M^3/s
Width	:	0.9 M
Side Water Depth	:	0.8 M
Nos. Orifices	:	20
Orifice Size	:	250 NB
Orifice Spacing	:	1.26 M c/c
Orifice Velocity	:	0.828/(20 x ∏/4 x 0.25 x 0.25)
	i.e.	0.84 M/s

Aeration Tank Outlet Weir Launder

No.	:	1
Material of Construction	:	RCC
Peak Sewage Flow Rate	:	0.573 M^3/s
Return Sludge Flow Rate	:	0.255 M^3/s
Total Sewage Flow Rate	:	(0.573 + 0.255) i.e. 0.828 M^3/s
Peripheral Length	:	148.9 M
Width	:	0.8 M
Side Water Depth (U/s)	:	0.8 M
Side Water Depth (D/s)	:	0.7 M

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Aeration Tank Outlet Chamber

No.	:	1

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Material of Construction	:	RCC
Peak Sewage Flow Rate	:	0.573 M^3/s
Return Sludge Flow Rate	:	0.255 M^3/s
Total Sewage Flow Rate	:	(0.573 + 0.255) i.e. 0.828 M^3/s
Plan Dimensions	:	2.0 M x 2.0 M
Side Water Depth	:	7.45 M
Volume	:	2.0 x 2.0 x 7.45 i.e. 29.8 M^3
Hydraulic Retention Time	:	29.8/ 0.828 i.e. 36 s

Pipeline, Aeration Tank to Secondary Clarifier

Design Flow Rate	:	Peak Flow + Return Sludge Flow
	=	(2.25 + 1.0) x Average Flow
	i.e.	3.25 x 0.255 = 0.828 M^3/s
Pipeline Diameter	:	1000 NB
Pipeline Velocity	:	0.828/ (∏/4 x 1.0 x 1.0) = 1.05 M/s
Pipeline MOC	:	DI K7
Accessory	:	65 NB Flushing Connection (with Valve)

Sludge Generation

Non Bio-Degradable VSS/ FSS	:	0.27 x 22000.0 i.e. 5940.0 Kg/d
Biological Sludge Generation	:	30% of Inlet BOD Load
	:	0.3 x 6600.0 i.e. 1980.0 Kg/day
Total Sludge Generation	:	5940.0 + 1980.0 i.e. 7920.0 Kg/day
Clarifier Underflow TSS, X_R	:	10000 mg/l
Sludge Recirculation Ratio	:	$X / (X_R - X) =$ 5000 / (10000 – 5000)
	i.e.	1.0

12.0 AERATION TANK POWER CALCULATIONS

Oxygen Requirement	:	1.2 x Inlet BOD Load
	=	1.2 x 6600.0 i.e. 7920.0 Kg O_2/d
	i.e.	330.0 Kg O_2/ Hour
Type of Aeration	:	Fine Bubble Diffused Aeration
Field Oxygen Transfer Efficiency (at 5.0 M SWD)	:	15%
Air Density	:	1.2 Kg/M^3
Oxygen Content in Air	:	23%
Air Flow Rate	:	330.0 / (0.23 x 1.2 x 0.15)
	i.e.	7971.0 M^3/ Hour

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Nos. Air Blowers	:	3 (2 Working, 1 Stand-By)
Air Blower Capacity	:	7971.0/2 i.e. 3985.5 say 4000.0 M^3/Hour
Discharge Pressure	:	0.6 Kg/cm^2
Accessories	:	VFD Drives (Linked to PLC/SCADA)

13.0 SECONDARY CLARIFIER

No.	:	1
Material of Construction	:	RCC, with MS Epoxy Coated Peripheral Drive/ FRP V Notch Weir
Design Flow	:	Average Flow 22000.0 M^3/d
Design Surface Loading Rate	:	14.0 M^3/M^2- Day
Diameter	:	$(22000.0\ M^3/Day\ /\ 14\ M^3/M^2\text{-}d \times 4/\Pi)^{1/2}$
	i.e.	44.7 M
Side Water Depth	:	3.0 M
Volume	:	Π/4 x 44.7 M x 44.7 M x 3.0 M
	i.e.	4707.9 M^3
Hydraulic Retention Time	:	4707.9/ 22000.0 x 24 i.e. 5.1 Hours
Peak Flow Loading Rate	:	(22000.0 x 2.25) / (Π/4 x 44.7 x 44.7)
	=	31.5 M^3/M^2- Day, i.e. OK
Solids Loading Rate	:	22000.0 x(1.0 + 1.0) x 5/(Π/4 x 44.7 x 44.7)
(at Average Flow)	=	140.2 Kg/M^2- Day, i.e. OK

Secondary Clarifier Weir Launder

Design Flow Rate	:	Peak Flow i.e. 0.417 M^3/s
Launder Width	:	0.8 M
Launder MOC	:	RCC
Side Water Depth (U/s)	:	0.6 M
Side Water Depth (D/s)	:	0.55 M

Channel, Secondary Clarifier to Chlorine Contact Tank

Design Flow Rate	:	Peak Flow i.e. 0.573 M^3/s
Channel Width	:	0.9 M
Channel Side Water Depth	:	0.6 M
Channel Velocity	:	0.573/ (0.9 x 0.6) = 1.06 M/s
Channel MOC	:	RCC

Note:

Therefore

14.0 CHLORINE CONTACT TANK

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No.	:	1
Material of Construction	:	RCC (w/ Brick Masonry Baffles)
Hydraulic Retention Time (at Average Flow)	:	30 Minutes
Volume (Required)	:	22000.0/ 24/ 60 x 30 i.e. 458.3 M^3
Diameter	:	14.0 M
Straight Water Depth	:	3.0 M
Volume	:	∏/4 x 14.0 x 14.0 x 3.0 i.e. 461.8 M^3, OK
Chlorine Dose	:	5 PPM (Max)
Chlorine Requirement	:	22000.0 M^3/d x 0.005 Kg/M^3
	=	110.0 Kg /Day i.e. 4.6 Kg/Hour (Max)

Chlorine Contact Tank Outlet Chamber

No.	:	1
Material of Construction	:	RCC
Plan Dimensions	:	4.0 M x 2.5 M
Straight Water Depth	:	2.8 M
Volume	:	4.0 x 2.5 x 2.8 i.e. 28.0 M^3
Hydraulic Retention Time (at Peak Flow)	:	28.0/ 0.573 i.e. 48.9 s

Flushing Pumps

Nos.	:	2 (1 Working, 1 Stand By)
Type	:	Submersible Non Clog, Wet Well Installation
Capacity	:	15.0 M^3/Hour
Discharge Head	:	25.0 MWC
Operation	:	Manual
Material of Construction		
Casing	:	Cast Iron
Impeller	:	Stainless Steel ASTM A 743 CF8M
Shaft/ Fasteners/ Foundation Bolts	:	Stainless Steel 316
Guide Rail	:	Stainless Steel SS 304
Accessory Equipment	:	Submersible Electric Motors/ Lifting Chains/ Guide Rails

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Note: The Flushing Pumps will pump treated sewage as required to the Centrifuges for flushing purpose and to Polyelectrolyte Tanks for preparing polyelectrolyte solution. Flushing Connection (with Valve) will also be provided from the Pump combined

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Delivery Header to the Aeration Tank – Secondary Clarifier Pipeline, Secondary Clarifier Outlet Sludge Pipeline and to the Gravity Sludge Thickener Sludge Outlet Pipeline.

Individual Pump Delivery Lines/ Combined Delivery Header

Size	:	65 NB
Design Velocity	:	15.0/ 3600/ (П/4 x 0.065 x 0.065)
	i.e.	1.26 M/s
Material of Construction	:	GI Class C
Accessory Equipment	:	Non Return Valve/ Isolation Gate Valves/ Pressure Gauge

Channel, Chlorine Contact Tank Outlet Chamber to Outlet Manhole

Design Flow Rate	:	Peak Flow i.e. 0.573 M^3/s
Channel Width	:	0.9 M
Channel Side Water Depth	:	0.6 M
Channel Velocity	:	0.573/ (0.9 x 0.6) = 1.06 M/s
Channel MOC	:	RCC

15.0 CHLORINATION BUILDING

No.	:	1
Material of Construction	:	RCC Roof/ Columns, PCC Floor, Brick Masonry Side Walls for Chlorinator Room, Side Open for Tonner Shed
Chlorinator Room	:	5.0 M x 4.0 M
Height	:	4.5 M
Chlorine Tonner Shed	:	5.0 M x 8.0 M
Height	:	5.0 M

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Vacuum Chlorinators

Nos.	:	2 (1 Working, 1 Stand-By)
Capacity	:	5.0 Kg/ Hour

Chlorine Tonners

Nos.	:	4 (1 Working, 3 Stand-By)
Chlorine Tonner Capacity	:	950.0 Kg

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Total Chlorine Storage	:	950.0 x 4 / 110.0 i.e. 34.5 Days

Chlorine Dosing Booster Pumps

Nos.	:	2 (1 Working, 1 Stand-By)
Capacity	:	4.0 M^3/ Hour
Discharge Head	:	40.0 MWC
MOC	:	Cast Iron
Accessories	:	Control Panel, 3.0 Ton Capacity Manual Hoist complete w/ Manual Geared Traveling Trolley and Monorail, Tonner Lifting Beam, 3.0 Ton Capacity Dial Type Load Indicator, Auto Switchover Facility, Leak Detection/ Absorption Equipment, Safety Equipment

16.0 RETURN SLUDGE SUMP

No.	:	1
Material of Construction	:	RCC
Return Sludge Flow Rate	:	Average Flow x 1.0 i.e. 916.7 M^3/Hour
Hydraulic Retention Time	:	10.0 Minutes
Volume (Required)	:	916.7/ 60 x 10 i.e. 152.8 M^3
Length	:	7.0 M
Width	:	4.0 M
Side Water Depth	:	5.55 M
Volume (Provided)	:	(7.0 x 4.0 x 5.55) i.e. 155.4 M^3, i.e. OK
Accessory	:	Ultrasonic Level Sensor (Linked to PLC/ SCADA)

Return Sludge Pumps

Nos.	:	3 (2 Working, 1 Stand By)
Type	:	Submersible Non Clog, Wet Well Installation
Return Sludge Flow Rate	:	916.7 M^3/Hour
Sludge Generation	:	7920.0 Kg/ Day
Sludge Concentration	:	1%
Sludge Flow Rate	:	7920.0 Kg/Day / (1000 Kg/M^3 x 0.01)
	=	792.0 M^3/Day i.e. 33.0 M^3/Hour
Pump Capacity (Required)	:	(916.7 + 33.0) / 2 i.e. 474.9 M^3/Hour
Pump Capacity (Provided)	:	475.0 M^3/Hour
Discharge Head	:	7.5 MWC

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Operation	:	Automatic (Controlled by Ultrasonic Level Sensor, linked to PLC/ SCADA)
Material of Construction		
Casing	:	Cast Iron
Impeller	:	Stainless Steel ASTM A 743 CF8M
Shaft/ Fasteners/ Foundation Bolts	:	Stainless Steel 316
Guide Rail	:	Stainless Steel SS 304
Accessory Equipment	:	Submersible Electric Motors/ Lifting Chains/ Guide Rails/ 2.0 Ton Capacity Manual Chain Pulley Hoist/ ISMB 200 Monorail

Note: The Return Sludge Pumps will recycle back the settled sludge from Secondary Clarifiers to the Aeration Tank on a continuous basis. A tapping from the Return Sludge Pumps will waste excess activated sludge to the Gravity Sludge Thickener continuously/ intermittently as required.

Pipeline, Secondary Clarifier to Return Sludge Sump

Size	:	600 NB
Design Velocity	:	475.0 x 2/ 3600/ (Π/4 x 0.6 x 0.6)
	i.e.	0.93 M/s
Material of Construction	:	DI K7
Accessory Equipment	:	Knife Edge Gate Valve/ 80 NB Flushing Connection (with Valve)

Individual Pump Delivery Lines

Size	:	300 NB
Design Velocity	:	475.0/ 3600/ (Π/4 x 0.3 x 0.3)
	i.e.	1.87 M/s
Material of Construction	:	DI K7
Accessory Equipment	:	Non Return Valve/ Knife Edge Gate Valve/ Pressure Gauge

Combined Pump Delivery Header

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Size	:	450 NB
Design Velocity	:	475.0 x 2/ 3600/ (Π/4 x 0.45 x 0.45)
	i.e.	1.66 M/s
Material of Construction	:	DI K7
Accessory Equipment	:	Isolation Knife Edge Gate Valve

(Electrically Actuated)

Waste Sludge Line to Gravity Sludge Thickener

Size	:	100 NB
Design Velocity	:	33.0/ 3600/ (Π/4 x 0.1 x 0.1) i.e. 1.17 M/s
Material of Construction	:	DI K7
Accessory Equipment	:	Knife Edge Gate Valve (Electrically Actuated)

17.0 GRAVITY SLUDGE THICKENER

No.	:	1
Material of Construction	:	RCC w/ Central Drive/ Scraper
Sludge Generation	:	7920.0 Kg/d, Dry Solid Basis
Design Sludge Loading Rate	:	40.0 Kg/M^2-day
Diameter	:	(7920.0 Kg/d / 40.0 Kg/M^2-day x 4/Π) $^{1/2}$
	i.e.	15.9 M
Side Water Depth	:	4.5 M
Volume	:	Π/4 x 15.9 x 15.9 x 4.5 i.e. 893.5 M^3
Thickened Sludge Concentration	:	3.0 %
Thickened Sludge Flow Rate to Centrifuge	:	7920.0 Kg/d / (1000.0 Kg/M^3 x 0.03)
	i.e.	264.0 M^3/d
Hydraulic Retention Time (w.r.t. Thickened Sludge)	:	893.5/ 264.0 i.e. 3.4 Days

18.0 CENTRIFUGE SHED

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Sludge Flow Rate	:	264.0 M^3/day
Centrifuge Operation Hours	:	18.0 Hours/day (Max)
Centrifuge Capacity (Required)	:	264.0/ 18.0 i.e. 14.7 M^3/Hour

No. Centrifuges Provided	:	2 (1 Working/ 1 Stand-By)
Centrifuge Type	:	Solid Bowl
Centrifuge Capacity (Provided)	:	15.0 M^3/Hour

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Centrifuge Feed Pumps

Nos.	:	2 (1 Working, 1 Stand By)
Type	:	Helical Screw Positive Displacement

Capacity	:	15.0 M^3/hour
Discharge Head	:	0.6 Kg/cm^2

Note: The Centrifuge Feed Pumps will draw thickened sludge from the Gravity Sludge Thickener and feed the Solid Bowl Centrifuges continuously/ intermittently as required. The Gravity Sludge Thickener and Centrifuge Supernatant will be recycled back through gravity to the Terminal Pumping Station Wet Well.

Poly-Electrolyte	:	1.5 Kg/ Ton Dry Solids x 7.92 Tons/day
Requirement (Max)	i.e.	11.9 Kg/d
Poly Solution Strength	:	0.1 %
Poly Solution Flow Rate	:	11.9/ (1000 x 0.001) i.e. 11.9 M^3/day
	i.e.	661.1 LPH

No. Poly Tanks	:	2
Poly Tank MOC	:	RCC
Poly Tank Volume (Required)	:	11.9 / 2 i.e. 5.95 M^3
Poly Tank Plan Dimensions	:	2.0 M x 2.0 M
Poly Tank Side Water Depth	:	1.5 M
Poly Tank Volume (Provided)	:	2.0 x 2.0 x 1.5 i.e. 6.0 M^3 i.e. OK
Velocity Gradient	:	200 s^{-1}
Accessory	:	Electric Motor/ Worm Gear Box/ SS 304 Agitator

No. Poly Dosing Pumps	:	2 (1 Working, 1 Stand-By)
Pump Capacity	:	1000 LPH
Pump Discharge Head	:	2.0 Kg/cm^2
Pump MOC	:	PP

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Centrifuge Shed Dimensions

Plan Dimensions	:	8.0 M x 6.0 M
Ground Floor Height	:	4.0 M
Top Floor Height	:	4.5 M

19.0 OUTFALL MANHOLE

No.	:	1
Material of Construction	:	RCC
Diameter	:	2.0 M
Side Water Depth	:	1.7 M

Note: Treated Sewage will be discharged from Outfall Manhole to disposal by Client.

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ANNEXURE-1

22 MLD EXTENDED AERATION ACTIVATED SLUDGE SEWAGE TREATMENT PLANT AT HAJIPUR, BIHAR

SIZES OF MAJOR UNITS

DOC. NO. TT/BEI/HJ/1051/STP/A02 REV 01 DATED 30.11.2012

UNIT	NOS.	DIMENSIONS (M)
Receiving Chamber	1	3.0 x 3.0 x 1.15 SWD + 7.4 FB
Mechanical Coarse Screen Channel	1	5.0 x 1.25 x 1.1 SWD + 0.5 FB
Manual Coarse Screen Channel	1	5.0 x 0.85 x 1.1 SWD + 0.5 FB
Raw Sewage Sump Wet Well	1	18.5 ø x 1.45 SWD + 8.85 FB
Stilling Chamber	1	2.1 x 2.1 x 3.95 SWD + 0.5 FB
Mech Fine Screen Channels	2	6.0 x 0.9 x 1.0 SWD + 0.5 FB
Mechanical Grit Chambers	2	5.9 x 5.9 x 0.9 SWD + 0.5 FB
Parshall Flume Channel	1	9.8 x 0.8 x 0.95 SWD + 0.3 FB
Aeration Tank Inlet Channel	1	1.1 x 0.9 SWD + 0.3 FB
Aeration Tank Inlet Annular Channel	1	8.0 ø x 0.9 x 0.8 SWD + 0.4 FB
Aeration Tank	1	47.4 ø x 5.0 SWD + 0.5 FB
Aeration Tank Outlet Chamber	1	2.0 x 2.0 x 7.45 SWD + 0.6 FB
Secondary Clarifier	1	44.7 ø x 3.0 SWD + 0.5 FB
Clarifier Outlet Channel	1	0.9 x 0.6 SWD + 0.65 FB
Chlorine Contact Tank	1	14.0 ø x 3.0 SWD + 0.75 FB
Chlorine Contact Tank Outlet Chamber	1	4.0 x 2.5 x 2.8 SWD + 0.95 FB
Treated Sewage Channel	1	0.9 x 0.6 SWD + 1.0 FB
Outfall Manhole	1	2.0 ø x 1.7 SWD + 1.1 FB
Chlorination Room	1	5.0 x 4.0 x 4.5 HT
Chlorine Tonner Shed	1	5.0 x 8.0 x 5.0 HT
Return Sludge Sump	1	7.0 x 4.0 x 5.5 SWD + 0.7 FB
Gravity Sludge Thickener	1	15.9 ø x 4.5 SWD + 0.5 FB
Centrifuge Building (G + 1)	1	8.0 x 6.0 x 8.5 HT
[illegible] Dosing Tanks	2	2.0 x 2.0 x 1.5 SWD + 0.5 FB
[illegible]ss Chamber	1	2.1 x 1.2 x 2.5 SWD + 2.35 FB
[illegible]ss Man Holes	3	1.3 ø x 2.5 SWD + 0.4 FB
[illegible]ower Shed	1	6.0 x 10.0 x 5.5 HT

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Administration Building/ MCC/ PLC Control Room/ Laboratory /Work Shop/ Store	1	30.0 x 8.0 x 4.0 HT
Security Room	1	3.0 x 3.0 x 3.0 HT
Open Store Yard	1	10.0 x 10.0
Parking Area	1	10.0 x 6.0
HT Panel/ Transformer Open Area (By BUIDCO)	1	14.0 x 4.0
DG Set Foundation	1	6.0 x 4.0

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wner	: Bihar Urban Infrastructure Development Corporation Ltd. Patna
roject	: Sewerage Network and 22 MLD STP Plant For Hajipur Town
ontractor	: Tri-Tech (Beijing) Company Ltd. Beijing (New Delhi)
oc. Name	: Hydraulic Design Calculations for STP Plant
oc. No.	: TT/BEI/HJ/1051/STP/A03 REV. 02 DT. 13.05.2013

S.NO.	PARAMETER		VALUE	UNIT
1.0	**DESIGN FLOWRATE**			
	Average Flow Rate, Q_A	:	22.000	MLD
		:	0.255	M^3/s
	Peaking Factor, PF		2.250	
	Peak Flow Rate, $Q_P = Q_A * PF$	:	0.573	M^3/s
2.0	**OUTFALL MANHOLE**			
	STP Site High Flood Level (Through Local Enquiry)	:	47.000	M
	STP Approach Road Topographical Level	:	47.000	M
	STP Site Internal Road Level	:	47.000	M
	STP Unit Top of Structure Level (Minimum)	:	47.300	M
	STP Building Plinth Level		47.300	M
	STP Site Finished Ground Level (Considered)	:	46.400	M
	Outfall Manhole Top Water Level (Considered)	:	46.200	M
	Outfall Manhole Invert Level	:	44.400	M
	Outfall Manhole Side Water Depth	:	1.800	M
	Outfall Manhole Top of Structure Level	:	47.300	M
	Free Board	:	1.100	M
3.0	**CHANNEL, CHLORINE CONTACT TANK OUTLET CHAMBER TO OUTFALL MANHOLE**			
	Design Flow Rate, Q_P	:	0.573	M^3/s
	Channel Width, W	:	0.900	M
	Channel Side Water Depth, Z	:	0.600	M
	Channel Velocity, $V = Q_P / (W * Z)$	:	1.061	M/s
	Manning Equation, $V = 1/n * R^{0.667} * S^{0.5}$			
	Co-Efficient of Roughness, n (CPHEEO Manual)	:	0.014	
	Cross-Sectional Area, $A = W * Z$	:	0.540	M^2
	Wetted Perimeter, $P = ((Z * 2) + W)$	:	2.100	M
	Hydraulic Radius, $R = A / P$	:	0.257	M

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S.NO.	PARAMETER		VALUE	UNIT
	Friction Slope, S (by Calculation)	:	0.00135	M/M
	Channel Length (Max), L	:	5.000	M
	Friction Loss, $H_F = S * L$	:	0.007	M
	Exit Head Loss Factor, K	:	1.000	
	Velocity Head = $V^2 / 2g$	:	0.057	M
	Exit Head Loss $H_L = K * V^2 / 2g$	:	0.057	M
	Total Head Loss in Channel, $H_L = H_F + H_K$	:	0.064	M
	Channel Top Water Level	:	46.264	M
	Say	:	**46.300**	M
	Clarifier Outlet Channel Invert Level	:	45.700	M
	Finished Ground Level	:	46.400	M
	Channel Top of Structure Level	:	47.300	M
	Free Board	:	1.000	M
	Entrance Head Loss Factor, K_1	:	0.500	
	Entrance Head Loss $H_L = K_1 * V^2 / 2g$	:	0.029	M
	CCT Outlet Chamber Top Water Level	:	46.329	M
	Say	:	**46.350**	M
4.0	**CHLORINE CONTACT TANK OUTLET CHAMBER**			
	Chlorine Contact Tank Outlet Chamber TWL	:	**46.350**	M
	CCT Outlet Chamber Invert Level (Considered)	:	43.550	M
	CCT Outlet Chamber Side Water Depth	:	2.800	M
	CCT Outlet Chamber Top of Structure Level	:	47.300	M
	Free Board	:	0.950	M
	Finished Ground Level	:	46.400	M
.0	**CHLORINE CONTACT TANK**			
	Design Flow Rate, Q_P	:	0.573	M^3/s
	Chlorine Contact Tank SWD, Z	:	3.000	M
	Chlorine Contact Tank Outlet Weir Length, L	:	4.000	M
	Rectangular Weir Equation, $Q_P = 2/3*C_e*(2g)^{0.5}*L*H^{1.5}$ (CPHEEO Manual)			
	$Ce = (0.602 + (0.075 * H / P))$			
	Head Over Rectangular Weir, H (by Calculation)	:	0.185	M
	Free Fall Across Weir (Considered)	:	0.200	M
	Chlorine Contact Tank Top Water Level	:	**46.550**	M
	Chlorine Contact Tank Invert Level	:	43.550	M
	Outlet Weir Lip Level	:	46.365	M
	Finished Ground Level	:	46.400	M
	Chlorine Contact Tank Top of Structure Level	:	47.300	M
	Free Board	:	0.750	M

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S.NO.	PARAMETER		VALUE	UNIT
6.0	**CHANNEL, SECONDARY CLARIFIER TO CHLORINE CONTACT TANK**			
	Design Flow Rate, Q_P	:	0.573	M^3/s
	Channel Width, W	:	0.900	M
	Channel Side Water Depth, Z	:	0.600	M
	Channel Velocity, $V = Q_P / (W * Z)$	:	1.061	M/s
	Manning Equation, $V = 1/n * R^{0.667} * S^{0.5}$			
	Co-Efficient of Roughness, n (CPHEEO Manual)	:	0.014	
	Cross-Sectional Area, $A = W * Z$	:	0.540	M^2
	Wetted Perimeter, $P = ((Z * 2) + W)$	:	2.100	M
	Hydraulic Radius, $R = A / P$	:	0.257	M
	Friction Slope, S (by Calculation)	:	0.00135	M/M
	Channel Length (Max), L	:	10.000	M
	Friction Loss, $H_F = S * L$	:	0.014	M
	Exit Head Loss Factor, K	:	1.000	
	Velocity Head = $V^2 / 2g$	:	0.057	M
	Exit Head Loss $H_L = K * V^2 / 2g$	:	0.057	M
	Total Head Loss in Channel, $H_L = H_F + H_K$	:	0.071	M
	Clarifier - CCT Tank Channel Top Water Level	:	46.621	M
	Say	:	**46.650**	M
	Clarifier Outlet Channel Invert Level	:	46.050	M
	Finished Ground Level	:	46.400	M
	Channel Top of Structure Level	:	47.300	M
	Free Board	:	0.650	M
.0	**SECONDARY CLARIFIER LAUNDER**			
	Secondary Clarifier Diameter, D	:	44.700	M
	Design Peak Flow Rate, Q_P	:	0.573	M^3/s
	Design Flow Rate/ Half Launder, $Q = Q_P / 2$	:	0.286	M^3/s
	Peripheral Launder Width, W	:	0.800	M
	Camp Equation (for Weir Launder Hydraulic Profile) $H_0 = (yc^2 + 2q^2/gy_c + fLq^2/12grd)^{0.5}$			
	H_0 - Upstream Water Depth			
	y_c - Minimum Downstream Water Depth i.e. Critical Depth (under Ideal Conditions)			
	q - (Flow Rate/ Half Launder) / Launder Width	:	0.358	$M^3/M/s$
	g - Acceleration due to Gravity	:	9.810	M/s^2
	f - Darcy Weissbach Friction Factor (CPHEEO Manual)	:	0.020	
	L - Half Weir Launder Length = $\pi * D / 2$	:	70.224	M
	r - Mean Hydraulic Radius			
	d - Mean Side Water Depth			

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S.NO. PARAMETER		VALUE	UNIT
Calculate Critical Depth $y_c = (q^2/g)$^(1/3)	:	0.236	M
Considering Non-Ideal Conditions, y_c = 0.55 (assumed)	:	0.550	M
Calculate H_0 (w/o Friction Loss), $H_0 = (y_c^2 + 2q^2/gy_c)$ ^ 0.5	:	0.592	M
Estimate H_0 (w/ Friction) = H_0 (w/o Friction) + 0.16 * (H_0 (w/o Friction) - y_c)	:	0.598	M
Estimate d = (H_0 (w/ Friction) + y_c) / 2	:	0.574	M
Estimate r = (W x d) / (W + 2 * d)	:	0.236	M
Calculate $H_0 = (y_c^2 + 2q^2/gy_c + fLq^2/12grd)$^0.5	:	0.601	M
Drop in Launder Water Level = H_0 - y_c	:	0.051	M
Downstream Velocity, $V_D = (Q_P/2) / (W^*y_c)$	:	0.651	M/s
Downstream Velocity Head = $VD^2/2g$	:	0.022	M
90^0 Bend Head Loss Factor, K	:	0.500	
90^0 Bend Head Loss, K * $V_D^2/2g$	:	0.011	M
Say	:	0.051	M
Downstream Launder Top Water Level	:	**46.700**	M
Launder Invert Level	:	46.150	M
Upstream Launder Top Water Level	:	46.752	M
Say	:	**46.750**	M
Design Peak Flow Rate, Q_P	:	0.573	M^3/s
	:	2062.500	M^3/Hr
Clarifier Diameter, D	:	44.700	M
Clarifier Peripheral Launder Length, L_1 = ∏ * D	:	140.447	M
V Notch Weir Spacing, c/c	:	0.200	M
Total Nos. V Notches, N	:	702.237	Nos.
Say	:	702.000	Nos.
Design Flow Rate/ V Notch, $Q_1 = Q_P / N$	:	2.9380	M^3/Hr
V Notch Weir Equation, Q * 5320 = $H^{2.47}$			
Q - Flow Rate/ V Notch, M^3/Hour			
H - Head Over Weir, MM			
Head Over Weir, H	:	49.884	MM
Free Fall across Weir (Provided)	:	100.000	MM
	:	0.100	M
Secondary Clarifier Top Water Level	:	**46.850**	M

SECONDARY CLARIFIER

Secondary Clarifier Top Water Level	:	**46.850**	M
Free Board	:	0.500	M
Secondary Clarifier Top of Structure Level	:	47.350	M
Secondary Clarifier Side Water Depth	:	3.000	M
Secondary Clarifier Invert Level	:	43.850	M

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S.NO.	PARAMETER		VALUE	UNIT
	Design Peak Flow Rate, Q_P	:	0.573	M^3/s
	Return Sludge Flow Rate, $Q_R = Q_A$	:	0.255	M^3/s
	Design Flow Rate, AT Outlet Chamber - Clarifier, $Q_D = Q_P + Q_A$	:	0.828	M^3/s
	Pipeline Diameter, AT Outlet Chamber - Clarifier, D	:	1.000	M
	Pipeline MOC, AT Outlet Chamber - Clarifier	:	DI K7	
	Pipeline Cross - Sectional Area, $A = \pi/4 * D * D$	:	0.786	M^2
	Pipeline Velocity, $V = (Q_P + Q_A) / A$	:	1.054	M/s
	Pipeline Length (to Clarifier Central Column), L (Max)	:	35.000	M
	Hazen William Equation, $V = 0.849 * C * R^{0.63} * S^{0.54}$			
	Co-Efficient of Roughness, C (CPHEEO Manual)	:	100.000	
	Hydraulic Radius, R = D/4	:	0.250	M
	Friction Slope, S	:	0.0015	M/M
	Pipeline Friction Loss, S * L	:	0.052	M
	Velocity Head, $V^2 / 2g$	:	0.057	M
	Entrance Loss Co-Efficient	:	0.500	
	Exit Loss Co-Efficient	:	1.000	
	Total Entrance/ Exit Losses, $1.5 * V^2 / 2g$	:	0.085	M
	Total Pipeline Friction/ Entrance/ Exit Head Losses	:	0.137	M
	Central Column ID, D_1	:	1.000	M
	Cross-Sectional Area, $A_1 = \pi/4 * D_1 * D_1$	:	0.786	M^2
	Velocity (through Central Column), $V_1 = Q_D / A_1$	:	1.054	M/s
	Hazen William Equation, $V = 0.849 * C * R^{0.63} * S^{0.54}$			
	Co-Efficient of Roughness, C (CPHEEO Manual)	:	120.000	
	Hydraulic Radius, $R = D_1 / 4$	:	0.250	M
	Friction Slope, S_1	:	0.0011	M/M
	Height of Central Column, H	:	7.500	M
	Central Column Friction Loss, $S_1 * H$	:	0.006	M
	No. Central Column Ports	:	4.000	Nos.
	Port Width, W	:	0.400	M
	Port Height, Z	:	1.000	M
	Port Cross Section Area, $A_2 = W * Z$	:	1.600	M^2
	Velocity (through Ports), $V_2 = Q_D / A_2$	:	0.517	M/s
	Orifice Equation, V = 0.6 * (2gH)^0.5			
	Head Loss (through Ports)	:	0.038	M
	Total Head Loss (AT Outlet Chamber - Clarifier)	:	0.181	M
	Aeration Tank Outlet Chamber Top Water Level	:	47.030	M
	Say	:	**47.050**	M
	Secondary Clarifier Diameter	:	44.700	M
	Central Column Inner Diameter	:	1.000	M
	Central Column Wall Thickness (Considered)	:	0.150	M
	Central Column Outer Diameter	:	1.300	M

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S.NO.	PARAMETER		VALUE	UNIT
	Sludge Pit Width	:	1.000	M
	Sludge Pit Depth	:	1.000	M
	Clarifier Zone Bottom Floor Length	:	41.400	M
	Clarification Zone Bottom Floor Half Length	:	20.700	M
	Bottom Floor Slope (Horizontal : Vertical)	:	12.000	
	Slope Height (Minimum)	:	1.725	M
	Slope Height (Considered)	:	1.750	M
	Sludge Pit Top Level	:	42.100	M
	Sludge Pit Bottom Level	:	41.100	M
	Minimum Vertical Clearance for RCC Duct (Considered)	:	1.500	M
	Central Column Invert Level (Minimum)	:	39.600	M
	Central Column Invert Level (Design)	:	39.600	M
9.0	**AERATION TANK OUTLET CHAMBER**			
	Design Flow Rate, AT Outlet Chamber - Clarifier, $Q_D = Q_P + Q_A$	:	0.828	M^3/s
	Aeration Tank Outlet Chamber Top Water Level	:	**47.050**	M
	Aeration Tank Outlet Chamber Invert Level	:	39.600	M
	Aeration Tank Outlet Chamber Side Water Depth	:	7.451	M
	Say		7.450	M
	Aeration Tank Diameter	:	47.400	M
	Aeration Tank Inlet/ Outlet Angular Stagger (Refer Layout)	:	225.000	Deg.
	Aeration Tank Peripheral Weir Travel Length (Max)	:	93.082	M
	Aeration Tank Peripheral Weir Launder Width	:	0.800	M
	Camp Equation (for Weir Launder Hydraulic Profile)			
	$H_0 = (yc^2 + 2q^2/gy_c + fLq^2/12grd)$^0.5			
	H_0 - Upstream Water Depth			
	y_c - Minimum Downstream Water Depth i.e. Critical Depth (under Ideal Conditions)			
	q - (Flow Rate/ Half Launder) / Launder Width	:	0.517	$M^3/M/s$
	g - Acceleration due to Gravity	:	9.810	M/s^2
	f - Darcy Weissbach Friction Factor (CPHEEO Manual)	:	0.020	
	L - Weir Launder Length	:	93.082	M
	r - Mean Hydraulic Radius			
	d - Mean Side Water Depth			
	Calculate Critical Depth $y_c = (q^2/g)$^(1/3)	:	0.301	M
	Considering Non-Ideal Conditions, y_c = 0.7 (Assumed)	:	0.700	M
	Calculate H_0 (w/o Friction Loss), $H_0 = (y_c^2 + 2q^2/gy_c)$ ^ 0.5	:	0.754	M
	Estimate H_0 (w/ Friction) = H_0 (w/o Friction) + 0.16 * (H_0 (w/o Friction) - y_c)	:	0.762	M
	Estimate d = (H_0 (w/ Friction) + y_c) / 2	:	0.731	M
	Estimate r = (W x d) / (W + 2 * d)	:	0.259	M
	Calculate $H_0 = (y_c^2 + 2q^2/gy_c + fLq^2/12grd)$^0.5	:	0.768	M
	Drop in Launder Water Level = $H_0 - y_c$	:	0.068	M
	Say	:	0.100	M
	Downstream Velocity, $V_D = Q_D / (W*y_c)$	:	1.478	M/s

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S.NO.	PARAMETER		VALUE	UNIT
	Downstream Velocity Head = $V_D^2/2g$	:	0.111	M
	Exit Head Loss Factor, K	:	1.000	
	Exit Head Loss, K * $V_D^2/2g$	:	0.111	M
	Say	:	0.114	M
	Downstream Launder Top Water Level	:	47.165	M
	Say	:	**47.200**	M
	Launder Invert Level	:	46.500	M
	Upstream Launder Top Water Level	:	**47.300**	M
	Weir Launder Top of Structure Level	:	47.900	M
	Weir Launder Free Board	:	0.600	M
	Design Flow Rate, AT Outlet Chamber - Clarifier, $Q_D = Q_P + Q_A$	:	0.828	M^3/s
	Aeration Tank Outlet Peripheral Weir Length, L	:	148.931	M
	Rectangular Weir Equation, Q_P = 2/3*C_e*(2g)^0.5*L*H^1.5 (CPHEEO Manual)			
	Ce = (0.602 + (0.075 * H / Z))			
	Head Over Rectangular Weir, H (by Calculation)	:	0.008	M
	Free Fall Across Weir (Considered)	:	0.100	M
	Aeration Tank Top Water Level	:	**47.400**	M
	Outlet Weir Lip Level	:	47.392	M
	Finished Ground Level	:	46.400	M
	Free Board	:	0.500	M
	Aeration Tank Outlet Chamber Top of Structure Level	:	47.900	M
10.0	**AERATION TANK**			
	Aeration Tank Top Water Level	:	**47.400**	M
	Aeration Tank Side Water Depth	:	5.000	M
	Aeration Tank Invert Level	:	42.400	M
	Free Board	:	0.500	M
	Aeration Tank Top of Structure Level	:	47.900	M
	Finished Ground Level	:	46.400	M
	Design Flow Rate, AT Inlet Chamber - Aeration Tank, $Q_D = Q_P + Q_A$	:	0.828	M^3/s
	Aeration Tank Inlet Annular Channel Width, W	:	0.900	M
	Aeration Tank Inlet Annular Channel Side Water Depth, Z	:	0.800	M
	Aeration Tank Inlet Annular Channel Velocity, V = Q_D/ (W*Z)	:	1.149	M/s
	Aeration Tank Inlet Annular Channel Diameter, D	:	8.000	M
	Aeration Tank Inlet Annular Channel Length, L	:	25.136	M
	Inlet Orifice Spacing, c/c, X	:	1.200	M
	No. Inlet Orifices, N = L/X	:	20.000	Nos.
	Inlet Orifice Diameter, D	:	0.250	M
	Inlet Orifice Cross Section Area, A = N * (Π/4 * D * D)	:	0.982	M^2
	Inlet Orifice Velocity, $V_1 = Q_D / A$	:	0.843	M/s
	Orifice Equation, V = 0.6 * (2gH)^0.5			
	Head Loss (through Orifices)	:	0.101	M
	Aeration Tank Inlet Annular Channel Top Water Level	:	47.500	M

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S.NO.	PARAMETER		VALUE	UNIT
	Say	:	**47.500**	M
	Aeration Tank Inlet Annular Channel Invert Level	:	46.700	M
	Aeration Tank Inlet Annular Channel Top of Structure Level	:	47.900	M
	Free Board	:	0.399	M
	Say	:	0.400	M
	Aeration Tank Inlet Channel Width, W	:	1.100	M
	Aeration Tank Inlet Channel Side Water Depth, Z	:	0.800	M
	Channel Velocity, $V = Q_P / (W * Z)$	:	0.940	M/s
	Manning Equation, $V = 1/n * R^{0.667} * S^{0.5}$			
	Co-Efficient of Roughness, n (CPHEEO Manual)	:	0.014	
	Cross-Sectional Area, $A = W * Z$	:	0.880	M^2
	Wetted Perimeter, $P = ((Z * 2) + W)$	:	2.700	M
	Hydraulic Radius, $R = A / P$	:	0.326	M
	Friction Slope, S (By Calculation)	:	0.00077	M/M
	Channel Length (Max), L	:	28.000	M
	Friction Loss, $H_F = S * L$	:	0.022	M
	Exit Head Loss Factor, K	:	1.000	
	Velocity Head = $V^2 / 2g$	:	0.045	M
	Exit Head Loss $H_L = K * V^2 / 2g$	:	0.045	M
	Total Head Loss in Channel, $H_L = H_F + H_K$	:	0.067	M
	Aeration Tank Inlet Channel Top Water Level	:	47.567	M
	Say	:	**47.600**	M
	Aeration Tank Inlet Channel Invert Level	:	46.800	M
	Aeration Tank Inlet Channel Top of Structure Level	:	47.900	M
	Free Board	:	0.300	M
11.0	**PARSHALL FLUME CHANNEL**			
	Design Flow Rate, Q_P	:	0.573	M^3/s
	Flow Equation $Q_A = 1.056 * h_1^{1.538}$ (Ref: ILRI USA)			
	Upstream Head h_1	:	0.672	M
	Modular Limit h_2/h_1	:	0.700	
	Downstream Head h_2 (Max)	:	0.470	M
	Downstream Head h_2 (Assumed)	:	0.421	M
	Head Loss, $H_L = h_1 - h_2$	:	0.251	M
	Say	:	0.300	M
	Width, W	:	0.800	M
	Throat Depth, N	:	0.229	M
	Side Water Depth (Downstream), D_2	:	0.650	M
	Downstream Velocity, $V_2 = Q_A / (W * D_2)$	:	1.102	M/s
	Downstream Velocity Head, $V_2^2/2g$	:	0.062	M
	45^0 bend Head Loss Factor, K	:	1.000	

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S.NO.	PARAMETER		VALUE	UNIT
	45^0 bend Head Loss, $H_L = K * V^2/2g$	:	0.062	M
	Exit Head Loss Factor, K	:	1.000	
	Exit Head Loss, $K * V_2^2/2g$	:	0.062	M
	Parshall Flume Top Water Level (Downstream)	:	47.724	M
	Say	:	**47.750**	M
	Parshall Flume Invert Level	:	47.100	M
	Parshall Flume Top Water Level (Upstream)	:	**48.050**	M
	Free Board	:	0.300	M
	Parshall Flume Top of Structure Level	:	48.350	M
	Finished Ground Level	:	46.400	M
	Side Water Depth (Upstream), D_1	:	0.950	M
	Upstream Velocity, $V_1 = Q_P / (W*D_1)$	:	0.754	M/s
	Upstream Velocity Head = $V_1^2 / 2g$	:	0.029	M/s
	Entrance Head Loss Co-Efficient, K_1	:	0.500	
	Entrance Head Loss = $K_1 * V_1^2 / 2g$	:	0.014	M
	Grit Chamber Outlet Channel Top Water Level	:	48.064	M
	Say	:	**48.100**	M

12.0 GRIT CHAMBERS

	Peak Flow Rate, Q_P	:	0.573	M^3/s
	Grit Chamber SWD, Z	:	0.900	M
	Grit Chamber Outlet Weir Length, L	:	5.900	M
	Rectangular Weir Equation, $Q_P = 2/3*C_e*(2g)$^0.5*L*H^1.5 (CPHEEO Manual)			
	Ce = (0.602 + (0.075 * H / P))			
	Head Over Rectangular Weir, H (by Calculation)	:	0.142	M
	Free Fall Across Weir (Considered) including head over weir	:	0.200	M
	Grit Chamber Top Water Level	:	**48.300**	M
	Grit Chamber Invert Level	:	47.400	M
	Free Board	:	0.500	M
	Grit Chamber Top of Structure Level	:	48.800	M
	Outlet Weir Lip Level	:	48.158	M
	Finished Ground Level	:	46.400	M

3.0 MECHANICAL FINE SCREEN CHANNELS

	Peak Flow Rate, Q_P	:	0.573	M^3/s
	Grit Chamber Inlet Gate Width, W	:	0.550	M
	Grit Chamber Inlet Gate SWD, Z	:	0.950	M
	Velocity (through Gate), $V = Q_P / (W*Z)$	:	1.096	M/s
	Velocity Head = $V^2 / 2g$	:	0.061	M
	Sluice Gate Head Loss Factor, K	:	0.800	
	Nos. Sluice Gates, N	:	1.000	
	Head Loss, Fine Screen Channel Outlet Chamber to Grit Chamber, $H_L = N * K * V^2/2g$	:	0.049	M
	Fine Screen Channel Outlet Chamber TWL		48.349	M

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S.NO.	PARAMETER		VALUE	UNIT
	Say	:	**48.350**	M
	Fine Screen Channel Outlet Chamber Invert Level	:	47.400	M
	Fine Screen Channel Outlet Chamber SWD	:	0.950	M
	Fine Screen Channel Outlet Gate Width, W	:	0.550	M
	Fine Screen Channel Outlet Gate SWD, Z	:	1.000	M
	Velocity (through Gate), V = QP / (W*Z)	:	1.042	M/s
	Velocity Head = $V^2 / 2g$	:	0.055	M
	Sluice Gate Head Loss Factor, K	:	0.800	
	Nos. Sluice Gates, N	:	1.000	
	Head Loss, Fine Screen Channel to Fine Screen Channel Outlet Chamber, $H_L = N * K * V^2/2g$	:	0.044	M
	Fine Screen Channel Top Water Level (Downstream)	:	48.394	M
	Say	:	**48.400**	M
	Fine Screen Channel Side Water Depth	:	1.000	M
	Fine Screen Channel Invert Level	:	47.400	M
	Free Board (Downstream)	:	0.500	M
	Fine Screen Channel Top of Structure Level (d/s)	:	48.900	M
	Head Loss across Screen (49% Clogging, Refer Process Calculations)	:	0.300	M
	Fine Screen Channel Top Water Level (Upstream)	:	**48.700**	M
	Fine Screen Channel Top of Structure Level (u/s)	:	49.250	M
	Free Board (Upstream)	:	0.549	M
	Say	:	0.550	M
	Finished Ground Level	:	46.400	M
14.0	**STILLING CHAMBER**			
	Peak Flow Rate, Q_P	:	0.573	M^3/s
	Fine Screen Channel Inlet Gate Width, W	:	0.400	M
	Fine Screen Channel Inlet Gate SWD, Z	:	1.300	M
	Velocity (through Gate), V = QP / (W*Z)	:	1.102	M/s
	Velocity Head = $V^2 / 2g$	:	0.062	M
	Sluice Gate Head Loss Factor, K	:	0.800	
	Nos. Sluice Gates, N	:	1.000	
	Head Loss, Stilling Chamber to Fine Screen Channel, $H_L = N * K * V^2/2g$	:	0.049	M
	Stilling Chamber Top Water Level	:	48.750	M
	Say	:	**48.750**	M
	Finished Ground Level	:	46.400	M
	Raw Sewage Pumped Delivery Header Diameter, D	:	0.600	M
	Gap, Finished Ground Level - Pipeline Soffit Level	:	0.800	M
	Raw Sewage Pumped Delivery Header Soffit Level	:	45.600	M
	Raw Sewage Pumped Delivery Header Invert Level	:	45.000	M
	Gap, Pipeline Invert Level - Stilling Chamber Invert Level	:	0.200	M
	Stilling Chamber Invert Level	:	44.800	M
	Stilling Chamber Side Water Depth	:	3.950	M
	Free Board	:	0.500	M
	Stilling Chamber Top of Structure Level		49.250	M

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S.NO.	PARAMETER		VALUE	UNIT
15.0	**INLET BYPASS**			
	Outfall Manhole Top Water Level (Considered)	:	46.200	M
	Peak Flow Rate, Q_P	:	0.573	M^3/s
	Bypass Sewer Pipeline Diameter, D	:	0.800	M
	Bypass Sewer Pipeline MOC	:	RCC	
	Finished Ground Level	:	46.400	M
	Gap, FGL - Bypass Sewer Soffit Level	:	1.000	M
	Bypass Sewer Pipeline Soffit Level	:	45.400	M
	Bypass Sewer Pipeline Invert Level	:	44.600	M
	Bypass Sewer Pipeline Velocity, $V = Q_P/(\Pi * D * D/4)$	:	1.140	M/s
	Velocity Head = $V_1^2 / 2g$	:	0.066	M
	Entrance Head Loss Co-Efficient, K_1	:	0.500	
	Exit Head Loss Co-Efficient , K_2	:	1.000	
	Nos. Entrances/ Exits (Refer Layout) including one at near boundary of plar	:	5.000	
	Entrance/ Exit Head Loss, $H_K = 4 * (K_1+K_2) * V^2 / 2g$	:	0.496	M
	Bypass Sewer Pipe Line Length (Max), L	:	130.000	M
	Hazen William Equation, $V = 0.849 * C * R^{0.63} * S^{0.54}$			
	Hazen William Co-Efficient, C (CPHEEO Manual)	:	120.000	
	Hydraulic Radius, R = D/4	:	0.200	M
	Friction Slope, S (by Calculation)	:	0.00159	M/M
	Friction Loss, $H_F = S * L$	:	0.207	M
	Total Head Loss, $H_L = H_F + H_K$	:	0.703	M
	Bypass Chamber Top Water Level (By Calculation)	:	46.903	M
	Say	:	**46.900**	M
	Gap, Bypass Sewer Pipeline IL - Bypass Chamber IL	:	0.200	M
	Bypass Chamber Invert Level	:	44.400	M
	Bypass Chamber Side Water Depth	:	2.500	M
	Bypass Chamber Top of Structure Level	:	49.250	M
	Free Board	:	2.349	M
	Say	:	2.350	M
	Stilling Chamber Top Water Level	:	**48.750**	M
	Bypass Gate Width, W	:	0.550	M
	Bypass Gate SWD, Z	:	0.550	M
	Velocity (through Gate), $V = Q_P / (W*Z)$	:	1.894	M/s
	Velocity Head = $V^2 / 2g$	:	0.183	M
	Sluice Gate Head Loss Factor, K	:	0.800	
	Head Loss, Stilling Chamber to Bypass Chamber, $H_L = K * V^2/2g$	:	0.146	M
	Bypass Chamber Top Water Level (Maximum Allowable)	:	48.604	M
	Say	:	48.600	M
	Bypass Manhole Top Water Level (Maximum)	:	**46.900**	M
	Bypass Manhole Top of Structure Level	:	47.300	M
	Free Board	:	0.400	M
	Bypass Manhole Invert Level	:	44.400	M
	Bypass Manhole Side Water Depth (Maximum)	:	2.500	M

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Owner	**: Bihar Urban Infrastructure Development Corporation Ltd. Patna**
Project	**: Sewerage Network and 22 MLD STP Plant For Hajipur Town**
Contractor	**: Tri-Tech (Beijing) Company Ltd. Beijing (New Delhi)**
Doc. Name	**: STP Plant Automation Philosophy**
Doc. No.	**: TT/BEI/HJ/1051/STP/A04 REV. 00 DT. 30.11.2012**

(Refer Process & Instrumentation Diagram Drawing No. TT/BEI/HJ/1051/STP/A10).

GENERAL DESCRIPTION

Each Electrical Drive of the Sewage Treatment Plant can be controlled as follows:

1.0 Through Local Push Button START/ STOP Station installed locally near the drive when in LOCAL Mode.
2.0 Through the Motor Control Center (MCC).
3.0 Through PLC/ SCADA installed in the Control Room when MCC is in REMOTE Mode. In REMOTE MANUAL Mode the Electrical Drive can be operated manually through Soft Keys on the SCADA Screen. In REMOTE AUTO Mode the Electrical Drive will START/ STOP automatically through software already installed in the PLC.

Details of Plant Automation pertaining to specific units are as follows:

TERMINAL PUMPING STATION

MECHANICAL SCREEN CHANNEL

1.0 Inlet Gate will be manually operated.
2.0 Mechanical Coarse Screen/ Conveyor Belt will be Timer Operated. Timer setting will be 0 – 30 minutes for Cycle Time 30 minutes. Conveyor Belt will automatically stop after a Lag Period of 60 seconds following Mechanical Screen Stop.

RAW SEWAGE SUMP WET WELL

1.0 Raw Sewage Transfer Pumps will be operated through PLC SCADA linked to Ultrasonic Level Sensor. During rising Sump Level 1 No. Raw Sewage Transfer Pump will come in to operation at Low Level 1 of the Sump Wet Well. A second Pump will come in to operation at Low Level 2. A third Pump will come in to operation at High Level 1. A fourth Pump will come in to operation at High Level 2. The operating sequence of the Raw Sewage Transfer Pumps will be rotated weekly through PLC SCADA. During decreasing Sump Level the operating sequence will be reversed.
2.0 Individual Pump Delivery Electrically Actuated Butterfly Valves will automatically OPEN when at PUMP START and automatically CLOSE at PUMP STOP.

3.0 Pump(s) in operation will be tripped automatically through Level Switch Hard Wire Interlock at Low Low Level in the Sump Wet Well.
4.0 Alarm will sound in the Control Panel at Sump Wet Well High High Level and Low Low Level activated by Ultrasonic Level Sensor.
5.0 Alarm will sound in the Control Panel at Sump Wet Well High High Level and Low Low Level activated by Level Switch.

SEWAGE TREATMENT PLANT

MECHANICAL FINE SCREEN CHANNELS

1.0 Inlet/ Outlet Gates will be manually operated.
2.0 Mechanical Fine Screen will be operated through PLC/ SCADA linked to ultrasonic Differential Level Sensor. Mechanical Fine Screen in operation will automatically START when Head Loss across the Screen touches 300 MMWC and automatically STP when Head Loss across Screen falls to 50 MMWC. Conveyor Belt will stop automatically after a Lag Period of 60 seconds following Mechanical Screen Stop. The operating sequence of the Mechanical Fine Screens will be rotated weekly through PLC SCADA.
3.0 Alarm will sound in the Control Panel when Head Loss across Fine Screen touches 350 MM activated by Ultrasonic Level Sensor.

GRIT CHAMBERS

1.0 Inlet Gates will be manually operated.
2.0 Grit Chamber ON/OFF operation will be controlled through PLC/ SCADA.
3.0 Torque Switch will automatically trip Grit Chamber Central Drive at high torque load. Torque Alarm will sound in Control Panel.

AERATION TANK

1.0 Air Blowers ON/OFF operation will be controlled through PLC/ SCADA. The operating sequence of the Air Blowers will be rotated daily through PLC SCADA.
2.0 Air Blower Speed will be regulated through Air Blower Variable Frequency Drive controlled by PLC/ SCADA linked to dissolved oxygen level in Aeration Tank monitored through DO Sensor.

SECONDARY CLARIFIER

1.0 Secondary Clarifier ON/OFF operation will be controlled through PLC/ SCADA.
2.0 Torque Switch will automatically trip Secondary Clarifier at high torque load. Torque Alarm will sound in Control Panel.

FLUSHING PUMPS

1.0 Flushing Pump ON/OFF operation will be controlled through PLC/ SCADA.
2.0 Level Switch will automatically trip Flushing Pump in operation at low level in Chlorine Contact Tank Outlet Chamber. Low Level Alarm will sound in Control Panel.

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RETRUN SLUDGE SUMP

1.0 Return Sludge Pump ON/OFF operation will be controlled through PLC/ SCADA. The operating sequence of the Return Sludge Pumps will be rotated weekly through PLC SCADA.
2.0 Level Switch will automatically trip Return Sludge Pump in operation at low level in Return Sludge Sump. Low Level Alarm will sound in Control Panel.
3.0 Electrically Actuated Knife Gate Valves recycling sludge to Aeration Tank and wasting sludge to Gravity Sludge Thickener will automatically regulated through PLC/ SCADA.

GRAVITY SLUDGE THICKENER

1.0 Gravity Sludge Thickener ON/OFF operation will be controlled through PLC/ SCADA.
2.0 Torque Switch will automatically trip Gravity Sludge Thickener at high torque load. Torque Alarm will sound in Control Panel.

CENTRIFUGE FEED PUMPS

1.0 Centrifuge Feed Pump ON/OFF operation will be controlled through PLC/ SCADA.
2.0 Pressure Switch will automatically trip Centrifuge Feed Pump/ Centrifuge/ Poly Dosing Pump in operation at high pressure in pump delivery line. Pressure Alarm will sound in Control Panel.

POLY DOSING TANKS/ PUMPS

1.0 Poly Tank Agitator/ Poly Dosing Pump ON/OFF operation will be controlled through PLC/ SCADA.
2.0 Level Switch will automatically trip Poly Dosing Pump in operation at low level in Poly Tank. Low Level Alarm will sound in Control Panel.

CHLORINATION SYSTEM

1.0 Chlorine Dosing Booster Pump ON/OFF operation will be controlled through PLC/ SCADA.
2.0 Chlorine Leak Detector will detect chlorine leak in Chlorination Building/ Chlorine Tonner Shed and sound alarm in Control Panel. Simultaneously Air Blower connected to Chlorine Tonner Hood will activate and pump chlorine contaminated air to Caustic Solution Tank.

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PROJECT	22 MLD SEWAGE TREATMENT PLANT AT HAJIPUR TOWN, BIHAR
CLIENT	BIHAR URBAN INFRASTRUCTURE DEVELOPMENT CORPORATION LTD (BUIDCO)
CONTRACTOR	TRI-TECH (BEIJING) COMPANY LTD, BEIJING, NEW DELHI
TITLE	ELECTRICAL LOAD LIST-STP
DOCUMENT NO	TT/BEI/HJ/1051/STP/A05 REVISION-0 30/11/12

LOAD DESCRIPTION	NO. OF DRIVES			EQUIPMENT RATING (KW)	POWER SUPPLY/ FREQUENCY/ NO. OF PHASES	WORKING LOAD	CONNECTE LOAD
	TOTAL	WORKING	STAND BY				
	A	B	C	D	E	F=BxD	G=AxD
TOTAL KW						618.70	858.55
COLLECTION SUMP						185.95	233.95
MECHANICAL COARSE SCREENS MOTOR	1	1	0	3.7	415V ± 10% 50 Hz ± 5% 3 PHASE	3.7	3.70
CONVEYOR	1	1	0	1.5		1.5	1.50
RAW SEWAGE WET WELL PUMP	5	4	1	45		180	225.00
MOTORISED VALVE AT DISCHARGE OF RAW SEWAGE WET WELL PUMP	5	1	4	0.75		0.75	3.75
GRIT REMOVAL EQUIPMENT						11.90	14.10
MECHANICAL FINE SCREENS MOTOR	2	1	1	2.2	415V ± 10% 50 Hz ± 5% 3 PHASE	2.2	4.40
CONVEYOR	1	1	0	1.5		1.5	1.50
GRIT SCRAPPER	2	2	0	1.5		3	3.00
GRIT CLASSIFIER	2	2	0	1.5		3	3.00
ORGANIC RETURN PUMP	2	2	0	1.1		2.2	2.20
SECONDARY TREATMENT							
BIOLOGICAL TREATMENT						264.00	396.00
AERATION AIR BLOWER	3	2	1	132	415V ± 10% 50 Hz ± 5% 3 PHASE	264	396.00
CLARIFICATION						39.75	58.80
SECONDARY CLARIFIER SCRAPPER	1	1	0	2.2	415V ± 10% 50 Hz ± 5% 3 PHASE	2.2	2.20
RETURN ACTIVATED SLUDGE PUMP	3	2	1	18.5		37	55.50
MOTORISED VALVE AT DISCHARGE OF RAS & WAS	2	1	1	0.55		0.55	1.10
CHLORINATION						18.90	27.80
CCT FLUSHING & RECIRCULATION PUMP	2	1	1	1.5	415V ± 10% 50 Hz ± 5% 3 PHASE	1.5	3.00
CHLORINE BOOSTER PUMP	2	1	1	1.5		1.5	3.00
LEAK ABSORPTION BLOWER	2	1	1	2.2		2.2	4.40
LEAK ABSORPTION CAUSTIC SODA PUMP	2	1	1	3.7		3.7	7.40
POWER SUPPLY FOR CHLORINATOR SYSTEM	1	1	0	5		5	5.00
POWER SUPPLY FOR LEAK ABSORPTION SYSTEM	1	1	0	5		5	5.00
SLUDGE TREATMENT							
SLUDGE HANDLING						25.40	47.10
SLUDGE THICKENER SCRAPPER	1	1	0	3.7	415V ± 10% 50 Hz ± 5% 3 PHASE	3.7	3.70
CENTRIFUGE FEED PUMP	2	1	1	3.7		3.7	7.40
CENTRIFUGE	2	1	1	18		18	36.00
CHEMICAL DOSING						3.00	6.00
POLY DOSING TANK MIXER			1	1.5	415V ± 10% 50 Hz ± 5% 3 PHASE	1.5	3.00
POLY DOSING PUMP			1	1.5		1.5	3.00

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PROJECT	22 MLD SEWAGE TREATMENT PLANT AT HAJIPUR TOWN, BIHAR
CLIENT	BIHAR URBAN INFRASTRUCTURE DEVELOPMENT CORPORATION LTD (BUIDCO)
CONTRACTOR	TRI-TECH (BEIJING) COMPANY LTD, BEIJING, NEW DELHI
TITLE	ELECTRICAL LOAD LIST-STP
DOCUMENT NO	TT/BEI/HJ/1051/STP/A05 REVISION-0 30/11/12

LOAD DESCRIPTION	NO. OF DRIVES			EQUIPMENT RATING (KW)	POWER SUPPLY/ FREQUENCY/ NO. OF PHASES	WORKING LOAD	CONNECTI LOAD
	TOTAL	WORKING	STAND BY				
	A	B	C	D	E	F=BxD	G=AxD
NON-PROCESS LOAD						69.80	74.80
INSTRUMENTATION/PLC/SCADA SYSTEM	1	1	0	10	415V ± 10% 50 Hz ± 5% 3 PHASE	10	10.00
LABORATORY	1	1	0	10		10	10.00
INTERNAL BUILDING LIGHTING	1	1	0	10		10	10.00
STREET LIGHTING	1	1	0	5		5	5.00
EXTERNAL LIGHTING	1	1	0	5		5	5.00
VENTILATION & AC SYSTEM	1	1	0	10		10	10.00
BOREWELL PUMP	1	1	0	3.7		3.7	3.70
DEWATERING PUMP	1	1	0	1.1		1.1	1.10
UPS & BATTERY CHARGER	2	2	0	5		10	10.00
WELDING RECAPTACLES	2	1	1	5		5	10.00

: **KW RATING OF THE EQUIPMENT IS TENTATIVE. FINAL LOAD LIST WILL BE PROVIDED DURING DETAIL ENGINEERING.**

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Owner	**: Bihar Urban Infrastructure Development Corporation Ltd. Patna**
Project	**: Sewerage Network and 22 MLD STP Plant For Hajipur Town**
Contractor	**: Tri-Tech (Beijing) Company Ltd. Beijing (New Delhi)**
Doc. Name	**: Pumping Head Calculations for Return Sludge Pumps**
Doc. No.	**: TT/BEI/HJ/1051/STP/A06 REV. 00 DT. 30.11.2012**

S.NO.	PARAMETER		VALUE	UNIT
1.0	**DESIGN FLOWRATE**			
	Individual Pump Flow Rate, Q_1	:	475.000	M^3/Hr
		:	0.132	M^3/s
	Nos. Return Sludge Pumps, N	:	3.000	
	Nos. Return Sludge Pumps (Working), N_1	:	2.000	
	Total Return Sludge Pumped Flow Rate, $Q = N_1*Q_1$	:	950.000	M^3/Hr
		:	0.264	M^3/s
	Gravity Thickener Sludge Header Flow Rate, Q_2	:	33.000	M^3/Hr
		:	0.009	M^3/s

2.0 STATIC HEAD CALCULATION (RETURN SLUDGE SUMP - AERATION TANK)

Refer Layout Plan Drawing No. TT/BEI/HJ/1051/STP/A05 Rev. 01

Total Return Sludge Pumped Flow Rate, $Q = N_1*Q_1$	:	0.264	M^3/s
Pipeline Diameter	:	0.600	M
Pipeline MOC	:	DI K7	
Pipeline Cross - Sectional Area, A = П/4 *D*D	:	0.283	M^2
Pipeline Velocity, $V = Q_P / A$	:	0.933	M/s
Pipeline Length, Clarifier Sludge Pit - Return Sludge Sump, L (Max)	:	30.000	M
Hazen William Equation, $V = 0.849*C*R^{0.63}*S^{0.54}$			
Co-Efficient of Roughness, C (CPHEEO Manual)	:	100.000	
Hydraulic Radius, R = D/4	:	0.150	M
Friction Slope, S	:	0.00216	M/M
Pipeline Friction Loss, S * L	:	0.065	M

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S.NO.	PARAMETER		VALUE	UNIT
	Velocity Head, $V^2 / 2g$	:	0.044	M
	Entrance Loss Co-Efficient, K_1	:	0.500	
	Exit Loss Co-Efficient, K_2	:	1.000	
	Knife Edge Gate Valve Loss Co-efficient, K_3	:	1.000	
	Entrance/Exit/Valve Loss Co-Efficient $K = K_1+K_2+K_3$	:	2.500	
	Entrance/Exit/Valve Head Loss = $K * V^2/2g$	:	0.111	M
	Total Friction/ Fittings Head Loss	:	0.176	M
	Say	:	0.200	M
	Secondary Clarifier Top Water Level	:	46.850	M
	Return Sludge Sump Top Water Level	:	46.650	M
	Aeration Tank Inlet Channel Top Water Level	:	47.600	M
	Gap, Pump Delivery Pipeline to Inlet Channel TWL	:	0.100	M
	Pump Delivery Pipeline Bottom Discharge Level	:	47.700	M
	Static Head	:	**1.050**	M

3.0 STATIC HEAD CALCULATION (RETURN SLUDGE SUMP - GRAVITY SLUDGE THICKENER)

Refer Layout Plan Drawing No. TT/BEI/HJ/1051/STP/A05 Rev. 01

Return Sludge Sump Top Water Level	:	46.650	M
Gravity Sludge Thickener Top Water Level	:	49.900	M
Gap, Pump Delivery Pipeline to Inlet Chamber TWL	:	0.100	M
Pump Delivery Pipeline Bottom Discharge Level	:	50.000	M
Static Head	:	**3.350**	M

4.0 INDIVIDUAL PUMP DELIVERY PIPE FRICTION LOSS

Pump Flow Rate, Q_1	:	0.132	M^3/s
Pump Delivery Pipeline Diameter, D	:	0.300	M
Pump Delivery Pipeline Length (Max), L	:	8.000	M
Pump Delivery Pipeline MOC	:	DI K7	
Pipe Velocity, $V = Q_P/ (3.142*D*D/4)$	:	1.866	M/s
Hazen William Equation, $V = 0.849 * C * R^{0.63} * S^{0.54}$			
Hazen William Co-Efficient, C (CPHEEO Manual)	:	100.000	
Hydraulic Radius, R = D/4		0.075	M

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S.NO.	PARAMETER		VALUE	UNIT
	Friction Slope, S (by Calculation)	:	0.01747	M/M
	Pipe Friction Loss, $H_F = S * L$	:	**0.140**	M

5.0 AERATION TANK COMBINED DELIVERY HEADER FRICTION LOSS

Pump Flow Rate, Q	:	0.264	M^3/s
Pump Delivery Pipeline Diameter, D	:	0.450	M
Pump Delivery Pipeline Length (Max), L	:	60.000	M
Pump Delivery Pipeline MOC	:	DI K7	
Pipe Velocity, $V = Q_P / (3.142*D*D/4)$	:	1.659	M/s
Hazen William Equation, $V = 0.849 * C * R^{0.63} * S^{0.54}$			
Hazen William Co-Efficient, C (CPHEEO Manual)	:	100.000	
Hydraulic Radius, R = D/4	:	0.113	M
Friction Slope, S (by Calculation)	:	0.00875	M/M
Pipe Friction Loss, $H_F = S * L$	:	**0.525**	M

6.0 THICKENER SLUDGE WASTING HEADER FRICTION LOSS

Pump Flow Rate, Q_2	:	0.009	M^3/s
Pump Delivery Pipeline Diameter, D	:	0.100	M
Pump Delivery Pipeline Length (Max), L	:	30.000	M
Pump Delivery Pipeline MOC	:	DI K7	
Pipe Velocity, $V = Q_P / (3.142*D*D/4)$	:	1.167	M/s
Hazen William Equation, $V = 0.849 * C * R^{0.63} * S^{0.54}$			
Hazen William Co-Efficient, C (CPHEEO Manual)	:	100.000	
Hydraulic Radius, R = D/4	:	0.025	M
Friction Slope, S (by Calculation)	:	0.02638	M/M
Pipe Friction Loss, $H_F = S * L$	:	**0.791**	M

7.0 FITTINGS LOSSES - PUMP SUCTION

Pump Flow Rate, Q_1	:	0.132	M^3/s
Pump Suction Pipeline Diameter, D	:	0.250	M
Suction Velocity $V = Q/(3.142/4*D*D)$	:	2.688	M/s
Velocity Head = $V^2/2g$	:	0.368	M

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S.NO.	PARAMETER		VALUE	UNIT
	Entrance Loss Co-Efficient, K	:	0.500	
	Pump Suction Fittings Losses = K * $V^2/2g$	:	**0.184**	M

8.0 FITTINGS LOSSES - INDIVIDUAL PUMP DELIVERY

Pump Flow Rate, Q_1	:	0.132	M^3/s
Pump Delivery Pipeline Diameter, D	:	0.300	M
Delivery Velocity V = Q/(3.142/4*D*D)	:	1.866	M/s
Velocity Head = $V^2/2g$	:	0.178	M
Loss Co-Efficient, Reducer 300 NB - 250 NB, K_1	:	1.000	
Loss Co-Efficient, 90^0 Bends, K_2	:	1.000	
Nos. 90^0 Bends, N	:	2.000	
Loss Co-Efficient Non Return Valve, K_3	:	2.500	
Loss Co-Efficient Knife Edge Gate Valve, K_4	:	1.000	
Total Loss Co-Efficient K = $(K_1+N*K_2+K_3+K_4)$	:	6.500	
Pump Delivery Fittings Losses = K * $V^2/2g$	:	**1.154**	M

9.0 FITTINGS LOSSES - COMBINED PUMP DELIVERY HEADER

Pump Flow Rate, Q	:	0.264	M^3/s
Pump Delivery Pipeline Diameter, D	:	0.450	M
Delivery Velocity V = Q/(3.142/4*D*D)	:	1.659	M/s
Velocity Head = $V^2/2g$	:	0.140	M
Loss Co-Efficient, 90^0 / 45^0 Bends, K_2	:	1.000	
Nos. 90^0 / 45^0 Bends, N	:	9.000	
Loss Co-Efficient Knife Edge Gate Valve, K_4	:	1.000	
Exit Loss Co-Efficient, K_5	:	1.000	
Total Loss Co-Efficient K = $(K_1+N*K_2+K_3+K_4+K_5)$	:	11.000	
Pump Delivery Fittings Losses = K * $V^2/2g$	:	**1.543**	M

10.0 FITTINGS LOSSES - THICKENER SLUDGE WASTING HEADER

Pumped Flow Rate, Q_2	:	0.009	M^3/s
Pump Delivery Pipeline Diameter, D	:	0.100	M
Delivery Velocity V = Q/(3.142/4*D*D)	:	1.167	M/s

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S.NO.	PARAMETER		VALUE	UNIT
	Velocity Head = $V^2/2g$	:	0.069	M
	Loss Co-Efficient, Reducer 450 NB - 100 NB, K_1	:	1.000	
	Loss Co-Efficient, 90^0 / 45^0 Bends, K_2	:	1.000	
	Nos. 90^0 / 45^0 Bends, N	:	8.000	
	Loss Co-Efficient Knife Edge Gate Valve, K_4	:	1.000	
	Exit Loss Co-Efficient, K_5	:	1.000	
	Total Loss Co-Efficient $K = (K_1+N*K_2+K_3+K_4+K_5)$	:	11.000	
	Pump Delivery Fittings Losses = $K * V^2/2g$	:	**0.764**	M

11.0 TOTAL HEAD LOSS (RETURN SLUDGE SUMP - AERATION TANK)

Total Head Loss = Static Head + Individual Pump Pipeline Friction Loss + Combined Delivery Header Friction Loss + Suction Fittings Loss + Individual Delivery Header Fittings Loss + Combined Delivery Header Fittings Loss)	:	4.596	M
Pump Delivery Head (Required)	:	4.600	M
Pump Delivery Head (Provided)	:	**7.500**	M

12.0 TOTAL HEAD LOSS (RETURN SLUDGE SUMP - GRAVITY THICKENER)

Total Head Loss = Static Head + Individual Pump Pipeline Friction Loss + Sludge Wasting Header Friction Loss + Suction Fittings Loss + Individual Delivery Header Fittings Loss + Sludge Wasting Header Fittings Loss)	:	6.382	M
Pump Delivery Head (Required)	:	6.400	M
Pump Delivery Head (Provided)	:	**7.500**	M
Power Rating	:	18.500	KW

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Owner	: Bihar Urban Infrastructure Development Corporation Ltd. Patna
Project	: Sewerage Network and 22 MLD STP Plant For Hajipur Town
Contractor	: Tri-Tech (Beijing) Company Ltd. Beijing (New Delhi)
Doc. Name	: Pumping Head Calculations for Centrifuge Feed Pumps
Doc. No.	: TT/BEI/HJ/1051/STP/A07 REV. 00 DT. 30.11.2012

S.NO.	PARAMETER		VALUE	UNIT
1.0	**DESIGN FLOWRATE**			
	Pump Flow Rate, Q	:	15.000	M^3/Hr
		:	0.0042	M^3/s
2.0	**STATIC HEAD CALCULATION**			
	Gravity Sludge Thickener Top Water Level	:	49.900	M
	Centrifuge Floor Level	:	51.300	M
	Height, Floor Level - Centrifuge Centre Line	:	1.000	M
	Centrifuge Centre Line Level	:	52.300	M
	Static Head	:	**2.400**	M
3.0	**PUMP SUCTION/ DELIVERY PIPE FRICTION LOSS**			
	Pump Flow Rate, Q	:	0.0042	M^3/s
	Pump Suction/ Delivery Pipeline Diameter, D	:	0.100	M
	Pump Delivery Pipeline Length (Max), L	:	40.000	M
	Pump Delivery Pipeline MOC	:	DI K7	
	Pipe Velocity, $V = Q_P / (\pi * D * D/4)$	:	0.530	M/s
	Hazen William Equation, $V = 0.849 * C * R^{0.63} * S^{0.54}$			
	Hazen William Co-Efficient, C (CPHEEO Manual)	:	100.000	
	Hydraulic Radius, R = D/4	:	0.025	M
	Friction Slope, S (by Calculation)	:	0.00612	M/M
	Pipe Friction Loss, $H_F = S * L$	:	**0.245**	M

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4.0 FITTINGS LOSSES - PUMP SUCTION

S.NO.	PARAMETER		VALUE	UNIT
	Pump Flow Rate, Q	:	0.0042	M^3/s
	Pump Suction Pipeline Diameter, D	:	0.100	M
	Suction Velocity V = Q/(∏/4*D*D)	:	0.530	M/s
	Velocity Head = $V^2/2g$	:	0.014	M
	Entrance Loss Co-Efficient, K_1	:	0.500	
	$45^0/90^0$ Bend Loss Co-Efficient, K_2	:	1.000	
	Nos. $45^0/90^0$ Bends, N	:	6.000	
	Knife Edge Gate Valve Loss Co-Efficient, K_3	:	1.000	
	100 NB x 65 NB Reducer Loss Co-Efficient, K_4	:	1.000	
	Total Head Loss Co-Efficient, $K = K_1+N*K_2+K_3+K_4$	:	8.500	
	Pump Suction Fittings Losses = K * $V^2/2g$	:	**0.122**	M

5.0 FITTINGS LOSSES - PUMP DELIVERY

Pump Flow Rate, Q	:	0.0042	M^3/s
Pump Delivery Pipeline Diameter, D	:	0.100	M
Delivery Velocity V = Q/(∏/4*D*D)	:	0.530	M/s
Velocity Head = $V^2/2g$	:	0.014	M
Loss Co-Efficient, Reducer 100 NB - 65 NB, K_1	:	1.000	
Loss Co-Efficient, 90^0 Bends, K_2	:	1.000	
Nos. 90^0 Bends, N	:	6.000	
Loss Co-Efficient Knife Edge Gate Valve, K_3	:	1.000	
Nos. Knife Edge Gate Valves, N_1	:	2.000	
Exit Loss Co-Efficient, K_4	:	1.000	
Total Loss Co-Efficient $K = (K_1 + N*K_2 + N_1*K_3 + K_4)$	:	10.000	
Pump Delivery Fittings Losses = K * $V^2/2g$	:	**0.143**	M

6.0 TOTAL HEAD LOSS

Total Head Loss = Static Head + Friction Loss + Suction Fittings Loss + Delivery Fittings Loss	:	2.910	M
Pump Delivery Head (Required)	:	3.000	M
Pump Delivery Head (Provided)	:	**6.000**	M

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Owner : Bihar Urban Infrastructure Development Corporation Ltd. Patna
Project : Sewerage Network and 16 MLD STP Plant For Hajipur Town
Contractor : Tri-Tech (Beijing) Company Ltd. Beijing (New Delhi)
Doc. Name : Broad Specifications of Mechanical Equipment
Doc. No. : TT/BEI/HJ/1051/STP/A12 REV. 00 DT. 30.11.2012

Sr. No.	Description	Unit	Qty.	Location
1.0	**SLUICE GATES**			
i	Flange Back Frame Wall Thimble Mounted Sluice Gate, Specification IS: 13349, Flush Bottom Closure, Upward Opening Rising Spindle Type, Size 400 MM x 400 MM, Design Seating Head 1.5 M (Max), Design Unseating Head Not Applicable, C/L - P/L Distance 7.9 M, MOC Wall Thimble/ Frame & Slide/ Lifting Mechanism/ Pedestal Gear House Cover/ Stem Guide Cast Iron IS: 210 Grade FG 200, MOC Seating Faces/ Stem & Stem Extension/ Stem Coupling/ Fasteners/ Anchor Bolts SS ASTM A276 Type 316, Wedge/ Stem Nut SS ASTM A743 CF8M/ MOC Lift Nut Bronze ASTM B148/ Manual Operation/ Balance Specifications as per Tender Documents.	Nos.	2	IPS1
ii	Flange Back Frame Wall Thimble Mounted Sluice Gate, Specification IS: 13349, Flush Bottom Closure, Upward Opening Rising Spindle Type, Size 650 MM x 650 MM, Design Seating Head 1.5 M (Max), Design Unseating Head Not Applicable, C/L - P/L Distance 9.0 M, MOC Wall Thimble/ Frame & Slide/ Lifting Mechanism/ Pedestal Gear House Cover/ Stem Guide Cast Iron IS: 210 Grade FG 200, MOC Seating Faces/ Stem & Stem Extension/ Stem Coupling/ Fasteners/ Anchor Bolts SS ASTM A276 Type 316, Wedge/ Stem Nut SS ASTM A743 CF8M/ MOC Lift Nut Bronze ASTM B148/ Manual Operation/ Balance Specifications as per Tender Documents.	Nos.	2	IPS2
iii	Flange Back Frame Wall Thimble Mounted Sluice Gate, Specification IS: 13349, Flush Bottom Closure, Upward Opening Rising Spindle Type, Size 800 MM x 800 MM, Design Seating Head 1.5 M (Max), Design Unseating Head Not Applicable, C/L - P/L Distance 8.75 M, MOC Wall Thimble/ Frame & Slide/ Lifting Mechanism/ Pedestal Gear House Cover/ Stem Guide Cast Iron IS: 210 Grade FG 200, MOC Seating Faces/ Stem & Stem Extension/ Stem Coupling/ Fasteners/ Anchor Bolts SS ASTM A276 Type 316, Wedge/ Stem Nut SS ASTM A743 CF8M/ MOC Lift Nut Bronze ASTM B148/ Manual Operation/ Balance Specifications as per Tender Documents.	Nos.	2	IPS3
iv	Flange Back Frame Wall Thimble Mounted Sluice Gate, Specification IS: 13349, Flush Bottom Closure, Upward Opening Rising Spindle Type, Size 450 MM x 450 MM, Design Seating Head 1.5 M (Max), Design Unseating Head Not Applicable, C/L - P/L Distance 8.6 M, MOC Wall Thimble/ Frame & Slide/ Lifting Mechanism/ Pedestal Gear House Cover/ Stem Guide Cast Iron IS: 210 Grade FG 200, MOC Seating Faces/ Stem & Stem Extension/ Stem Coupling/ Fasteners/ Anchor Bolts SS ASTM A276 Type 316, Wedge/ Stem Nut SS ASTM A743 CF8M/ MOC Lift Nut Bronze ASTM B148/ Manual Operation/ Balance Specifications as per Tender Documents.	Nos.	2	IPS4
v	Flange Back Frame Wall Thimble Mounted Sluice Gate, Specification IS: 13349, Flush Bottom Closure, Upward Opening Rising Spindle Type, Size 900 MM x 900 MM, Design Seating Head 1.5 M (Max), Design Unseating Head Not Applicable, C/L - P/L Distance 8.1 M (HOLD), MOC Wall Thimble/ Frame & Slide/ Lifting Mechanism/ Pedestal Gear House Cover/ Stem Guide Cast Iron IS: 210 Grade FG 200, MOC Seating Faces/ Stem & Stem Extension/ Stem Coupling/ Fasteners SS ASTM A276 Type 316, Wedge/ Stem Nut SS ASTM A743 CF8M/ MOC Lift Nut Bronze ASTM B148/ Manual Operation/ Balance Specifications as per Tender Documents.	Nos.	2	TPS
vi	Flange Back Frame Wall Thimble Mounted Sluice Gate, Specification IS: 13349, Flush Bottom Closure, Upward Opening Rising Spindle Type, Size 550 MM x 550 MM, Design Seating Head 1.5 M (Max), Design Unseating Head Not Applicable, C/L - P/L Distance 2.8 M (Approx.), MOC Wall Thimble/ Frame & Slide/ Lifting Mechanism/ Pedestal Gear House Cover/ Stem Guide Cast Iron IS: 210 Grade FG 200, MOC Seating Faces/ Stem & Stem Extension/ Stem Coupling/ Fasteners/ Anchor Bolts SS ASTM A276 Type 316, Wedge/ Stem Nut SS ASTM A743 CF8M/ MOC Lift Nut Bronze ASTM B148/ Manual Operation/ Balance Specifications as per Tender Documents.	Nos.	1	STP BYPASS

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iv	Open Channel Side Wall Mounted Sluice Gate, Flush Bottom Closure, Upward Opening Rising Spindle Type, Width 400 MM x Height 1600 MM, Design Seating Head 1.5 M (Max), Design Unseating Head Not Applicable, MOC Frame & Slide/ Lifting Mechanism/ Pedestal Gear House Cover/ Stem Guide Cast Iron IS: 210 Grade FG 200, MOC Seating Faces/ Stem & Stem Extension/ Stem Coupling/ Fasteners/ Anchor Bolts SS ASTM A276 Type 316, Wedge/ Stem Nut SS ASTM A743 CF8M/ MOC Lift Nut Bronze ASTM B148/ Manual Operation.	Nos.	2	STP FINE SCREEN INLET
v	Open Channel Side Wall Mounted Sluice Gate, Flush Bottom Closure, Upward Opening Rising Spindle Type, Width 550 MM x Height 1300 MM, Design Seating Head 1.5 M (Max), Design Unseating Head Not Applicable, MOC Frame & Slide/ Lifting Mechanism/ Pedestal Gear House Cover/ Stem Guide Cast Iron IS: 210 Grade FG 200, MOC Seating Faces/ Stem & Stem Extension/ Stem Coupling/ Fasteners/ Anchor Bolts SS ASTM A276 Type 316, Wedge/ Stem Nut SS ASTM A743 CF8M/ MOC Lift Nut Bronze ASTM B148/ Manual Operation.	Nos.	2	STP FINE SCREEN OUTLET
vi	Open Channel Side Wall Mounted Sluice Gate, Flush Bottom Closure, Upward Opening Rising Spindle Type, Width 550 MM x Height 1250 MM, Design Seating Head 1.5 M (Max), Design Unseating Head Not Applicable, MOC Frame & Slide/ Lifting Mechanism/ Pedestal Gear House Cover/ Stem Guide Cast Iron IS: 210 Grade FG 200, MOC Seating Faces/ Stem & Stem Extension/ Stem Coupling/ Fasteners/ Anchor Bolts SS ASTM A276 Type 316, Wedge/ Stem Nut SS ASTM A743 CF8M/ MOC Lift Nut Bronze ASTM B148/ Manual Operation.	Nos.	2	STP GRIT INLET
2.0	**MECHANICAL COARSE BAR SCREENS**			
i	(TENTATIVE) Mechanical Coarse Bar Screen, MOC SS304, Width 0.3 M, Angle of Inclination 80^0, Height 10.7 M (Minimum), Bar Size 8 MM x 40 MM, Nos. Bars 8, Clear Spacing 25 MM, Nos. Clear Spacings 7, Maximum Velocity through Screen 1.2 M/s, to suit underground Mechanical Coarse Bar Screen Channel having Peak Flow Rate 0.150 M^3/s, Dimensions Length 5.0 M, Width 0.6 M (including 0.3 M Width for Screen Drive Mechanism), Side Water Depth (Upstream, Max) 0.7 M, Side Water Depth (Downstream) 0.45 M, Upstream Free Board (to Top of Wet Well) 8.6 M, Head Loss across Screen 0.15 M (Max), Height of Conveyor Belt above Channel Top of Strucure Level 0.6 M (approx.), Height of Screen Top above Conveyor Belt 0.5 M (approx.), complete with Control Panel, Electric Motor, Drive Arrangement, Mechanical Travelling Rakes and all Accesories. Note 1: The underground Mechanical Coarse Bar Screen Channel will be constructed at Invert Level RL 40.1 M (w.r.t. Finished Ground Level 48.40 M) on RCC Platform on top of a Wet Well having Dimensions 10.0 M Diameter x 1.0 M SWD with Top Water Level RL 39.80 M such that Invert Level of Screen Channel is 0.3 M above Wet Well Top Water Level. Note 2: Screenings will be lifted up to a Conveyor Belt above Wet Well Top of Structure Level and discharged to a Hand Cart positioned at Ground Level outside the Wet Well. Note 3. Screen operation will be Timer Controlled.	Set	1	IPS1
ii	Belt Conveyor, Horizontal Troughed Type, Length 6.0 M c/c, Belt Width 0.6 M, Speed/ Belt MOC (as per Manufacturer Standard) complete with Electric Motor/ Drive Assembly/ Pulleys/ Rollers/ Base Frame/ Discharge Chute and all Accessories.	Set	1	IPS1

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iii	(TENTATIVE) Mechanical Coarse Bar Screen, MOC SS304, Width 0.5 M, Angle of Inclination 80^0, Height 10.75 M (Minimum), Bar Size 8 MM x 40 MM, Nos. Bars 15, Clear Spacing 25 MM, Nos. Clear Spacings 14, Maximum Velocity through Screen 1.2 M/s, to suit underground Mechanical Coarse Bar Screen Channel having Peak Flow Rate 0.406 M^3/s, Dimensions Length 5.0 M, Width 0.8 M (including 0.3 M Width for Screen Drive Mechanism), Side Water Depth (Upstream, Max) 1.0 M, Side Water Depth (Downstream) 0.85 M, Upstream Free Board (to Top of Wet Well) 8.35 M, Head Loss across Screen 0.15 M (Max), Height of Conveyor Belt above Channel Top of Strucure Level 0.6 M (approx.), Height of Screen Top above Conveyor Belt 0.5 M (approx.), complete with Control Panel, Electric Motor, Drive Arrangement, Mechanical Travelling Rakes and all Accesories. Note 1: The underground Mechanical Coarse Bar Screen Channel will be constructed at Invert Level RL 40.85 M (w.r.t. Finished Ground Level 49.20 M) on RCC Platform on top of a Wet Well having Dimensions 14.0 M Diameter x 1.2 M SWD with Top Water Level RL 40.55 M such that Invert Level of Screen Channel is 0.3 M above Wet Well Top Water Level. Note 2: Screenings will be lifted up to a Conveyor Belt above Wet Well Top of Structure Level and discharged to a Hand Cart positioned at Ground Level outside the Wet Well. Note 3. Screen operation will be Timer Controlled.	Set	1	IPS2
iv	Belt Conveyor, Horizontal Troughed Type, Length 8.0 M c/c, Belt Width 0.6 M, Speed/ Belt MOC (as per Manufacturer Standard) complete with Electric Motor/ Drive Assembly/ Pulleys/ Rollers/ Base Frame/ Discharge Chute and all Accessories.	Set	1	IPS2
v	(TENTATIVE) Mechanical Coarse Bar Screen, MOC SS304, Width 0.65 M, Angle of Inclination 80^0, Height 10.6 M (Minimum), Bar Size 8 MM x 40 MM, Nos. Bars 20, Clear Spacing 25 MM, Nos. Clear Spacings 19, Maximum Velocity through Screen 1.2 M/s, to suit underground Mechanical Coarse Bar Screen Channel having Peak Flow Rate 0.641 M^3/s, Dimensions Length 5.0 M, Width 0.95 M (including 0.3 M Width for Screen Drive Mechanism), Side Water Depth (Upstream, Max) 1.15 M, Side Water Depth (Downstream) 1.0 M, Upstream Free Board (to Top of Wet Well) 8.0 M, Head Loss across Screen 0.15 M (Max), Height of Conveyor Belt above Channel Top of Strucure Level 0.6 M (approx.), Height of Screen Top above Conveyor Belt 0.5 M (approx.), complete with Control Panel, Electric Motor, Drive Arrangement, Mechanical Travelling Rakes and all Accesories. Note 1: The underground Mechanical Coarse Bar Screen Channel will be constructed at Invert Level RL 40.20 M (w.r.t. Finished Ground Level 47.50 M) on RCC Platform on top of a Wet Well having Dimensions 14.0 M Diameter x 1.9 M SWD with Top Water Level RL 38.90 M such that Invert Level of Screen Channel is 0.3 M above Wet Well Top Water Level. Note 2: Screenings will be lifted up to a Conveyor Belt above Wet Well Top of Structure Level and discharged to a Hand Cart positioned at Ground Level outside the Wet Well. Note 3. Screen operation will be Timer Controlled.	Set	1	IPS3
vi	Belt Conveyor, Horizontal Troughed Type, Length 8.0 M c/c, Belt Width 0.6 M, Speed/ Belt MOC (as per Manufacturer Standard) complete with Electric Motor/ Drive Assembly/ Pulleys/ Rollers/ Base Frame/ Discharge Chute and all Accessories.	Set	1	IPS3
vii	(TENTATIVE) Mechanical Coarse Bar Screen, MOC SS304, Width 0.3 M, Angle of Inclination 80^0, Height 10.25 M (Minimum), Bar Size 8 MM x 40 MM, Nos. Bars 9, Clear Spacing 25 MM, Nos. Clear Spacings 8, Maximum Velocity through Screen 1.2 M/s, to suit underground Mechanical Coarse Bar Screen Channel having Peak Flow Rate 0.186 M^3/s, Dimensions Length 5.0 M, Width 0.6 M (including 0.3 M Width for Screen Drive Mechanism), Side Water Depth (Upstream, Max) 0.8 M, Side Water Depth (Downstream) 0.65 M, Upstream Free Board (to Top of Wet Well) 8.0 M, Head Loss across Screen 0.15 M (Max), Height of Conveyor Belt above Channel Top of Strucure Level 0.6 M (approx.), Height of Screen Top above Conveyor Belt 0.5 M (approx.), complete with Control Panel, Electric Motor, Drive Arrangement, Mechanical Travelling Rakes and all Accesories. Note 1: The underground Mechanical Coarse Bar Screen Channel will be constructed at Invert Level RL 42.15 M (w.r.t. Finished Ground Level 50.00 M) on RCC Platform on top of a Wet Well having Dimensions 11.0 M Diameter x 1.0 M SWD with Top Water Level RL 41.85 M such that Invert Level of Screen Channel is 0.3 M above Wet Well Top Water Level. Note 2: Screenings will be lifted up to a Conveyor Belt above Wet Well Top of Structure Level and discharged to a Hand Cart positioned at Ground Level outside the Wet Well. Note 3. Screen operation will be Timer Controlled.	Set	1	IPS4
viii	Belt Conveyor, Horizontal Troughed Type, Length 6.5 M c/c, Belt Width 0.6 M, Speed/ Belt MOC (as per Manufacturer Standard) complete with Electric Motor/ Drive Assembly/ Pulleys/ Rollers/ Base Frame/ Discharge Chute and all Accessories.	Set	1	IPS4

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ix	(TENTATIVE) Mechanical Coarse Bar Screen, MOC SS304, Width 0.95 M, Angle of Inclination 80^0, Height 9.95 M (Minimum), Bar Size 8 MM x 40 MM, Nos. Bars 33, Clear Spacing 20 MM, Nos. Clear Spacings 32, Maximum Velocity through Screen 1.2 M/s, to suit underground Mechanical Coarse Bar Screen Channel having Peak Flow Rate 0.859 M^3/s, Dimensions Length 5.0 M, Width 1.25 M (including 0.3 M Width for Screen Drive Mechanism), Side Water Depth (Upstream, Max) 1.1 M, Side Water Depth (Downstream) 0.95 M, Downstream Free Board (to Top of Wet Well) 7.45 M, Head Loss across Screen 0.15 M (Max), Height of Conveyor Belt above Channel Top of Strucure Level 0.6 M (approx.), Height of Screen Top above Conveyor Belt 0.5 M (approx.), complete with Control Panel, Electric Motor, Drive Arrangement, Mechanical Travelling Rakes and all Accesories. Note 1: The underground Mechanical Coarse Bar Screen Channel will be constructed at Invert Level RL 38.75 M (w.r.t. Finished Ground Level 46.40 M) on RCC Platform on top of a Wet Well having Dimensions Diameter 18.5 M x 1.9 M SWD and Top Water Level RL 38.45 M such that Invert Level of Screen Channel is 0.3 M above Wet Well Top Water Level. Note 2: Screenings will be lifted up to a Conveyor Belt above Wet Well Top of Structure Level and discharged to a Hand Cart positioned at Ground Level outside the Wet Well. Note 3. Screen operation will be Timer Controlled.	Set	1	TPS
x	Belt Conveyor, Horizontal Troughed Type, Length 10.5 M c/c, Belt Width 0.6 M, Speed/ Belt MOC (as per Manufacturer Standard) complete with Electric Motor/ Drive Assembly/ Pulleys/ Rollers/ Base Frame/ Discharge Chute and all Accessories.	Set	1	TPS
3.0	**MANUAL COARSE BAR SCREENS**			
i	Manual Coarse Bar Screen, MOC SS304, Width 0.3 M, Angle of Inclination 60^0, Height 1.2 M, Bar Size 8 MM x 40 MM, Nos. Bars 7, Clear Spacing 25 MM, Nos. Clear Spacings 6, Maximum Velocity through Screen 1.2 M/s, to suit underground Manual Coarse Bar Screen Channel having Peak Flow Rate 0.150 M^3/s, Dimensions Length 5.0 M, Width 0.3 M, Side Water Depth (Upstream, Max) 0.7 M, Side Water Depth (Downstream) 0.55 M, Upstream Free Board (to Top of Screen Channel) 0.5 M, Head Loss across Screen 0.15 M (Max), complete with Lifting Arrangement and 2 Nos. Manual Rakes. Note 1: The underground Manual Coarse Bar Screen Channel will be constructed at Invert Level RL 40.10 M (w.r.t. Finished Ground Level 48.40 M) on RCC Platform on top of a Wet Well having Dimensions Diameter 10.0 M x 1.0 M SWD and Top Water Level RL 39.80 M such that Invert Level of Screen Channel is 0.3 M above Wet Well Top Water Level. Note 2: Screenings will be manually raked on to a RCC Perforated Platform and then transferred to Wet Well Top of Structure Level through Bucket - Chain Pulley Arrangement and disposed off manually to Hand Cart at Ground Level.	Set	1	IPS1
ii	Manual Coarse Bar Screen, MOC SS304, Width 0.4 M, Angle of Inclination 60^0, Height 1.5 M, Bar Size 8 MM x 40 MM, Nos. Bars 13, Clear Spacing 25 MM, Nos. Clear Spacings 12, Maximum Velocity through Screen 1.2 M/s, to suit underground Manual Coarse Bar Screen Channel having Peak Flow Rate 0.406 M^3/s, Dimensions Length 5.0 M, Width 0.4 M, Side Water Depth (Upstream, Max) 1.15 M, Side Water Depth (Downstream) 1.0 M, Upstream Free Board (to Top of Screen Channel) 0.5 M, Head Loss across Screen 0.15 M (Max), complete with Lifting Arrangement and 2 Nos. Manual Rakes. Note 1: The underground Manual Coarse Bar Screen Channel will be constructed at Invert Level RL 40.85 M (w.r.t. Finished Ground Level 49.20 M) on RCC Platform on top of a Wet Well having Dimensions Diameter 14.0 M x 1.2 M SWD and Top Water Level RL 40.55 M such that Invert Level of Screen Channel is 0.3 M above Wet Well Top Water Level. Note 2: Screenings will be manually raked on to a RCC Perforated Platform and then transferred to Wet Well Top of Structure Level through Bucket - Chain Pulley Arrangement and disposed off manually to Hand Cart at Ground Level.	Set	1	IPS2

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iii	Manual Coarse Bar Screen, MOC SS304, Width 0.6 M, Angle of Inclination 60^0, Height 1.7 M, Bar Size 8 MM x 40 MM, Nos. Bars 18, Clear Spacing 25 MM, Nos. Clear Spacings 17, Maximum Velocity through Screen 1.2 M/s, to suit underground Manual Coarse Bar Screen Channel having Peak Flow Rate 0.642 M^3/s, Dimensions Length 5.0 M, Width 0.6 M, Side Water Depth (Upstream, Max) 1.15 M, Side Water Depth (Downstream) 1.0 M, Upstream Free Board (to Top of Screen Channel) 0.5 M, Head Loss across Screen 0.15 M (Max), complete with Lifting Arrangement and 2 Nos. Manual Rakes. Note 1: The underground Manual Coarse Bar Screen Channel will be constructed at Invert Level RL 40.20 M (w.r.t. Finished Ground Level 47.50 M) on RCC Platform on top of a Wet Well having Dimensions Diameter 14.0 M x 1.9 M SWD and Top Water Level RL 38.90 M such that Invert Level of Screen Channel is 0.3 M above Wet Well Top Water Level. Note 2: Screenings will be manually raked on to a RCC Perforated Platform and then transferred to Wet Well Top of Structure Level through Bucket - Chain Pulley Arrangement and disposed off manually to Hand Cart at Ground Level.	Set	1	IPS3
iv	Manual Coarse Bar Screen, MOC SS304, Width 0.3 M, Angle of Inclination 60^0, Height 1.3 M, Bar Size 8 MM x 40 MM, Nos. Bars 8, Clear Spacing 25 MM, Nos. Clear Spacings 7, Maximum Velocity through Screen 1.2 M/s, to suit underground Manual Coarse Bar Screen Channel having Peak Flow Rate 0.186 M^3/s, Dimensions Length 5.0 M, Width 0.3 M, Side Water Depth (Upstream, Max) 0.8 M, Side Water Depth (Downstream) 0.65 M, Upstream Free Board (to Top of Screen Channel) 0.5 M, Head Loss across Screen 0.15 M (Max), complete with Lifting Arrangement and 2 Nos. Manual Rakes. Note 1: The underground Manual Coarse Bar Screen Channel will be constructed at Invert Level RL 42.15 M (w.r.t. Finished Ground Level 50.00 M) on RCC Platform on top of a Wet Well having Dimensions Diameter 11.0 M x 1.0 M SWD and Top Water Level RL 41.85 M such that Invert Level of Screen Channel is 0.3 M above Wet Well Top Water Level. Note 2: Screenings will be manually raked on to a RCC Perforated Platform and then transferred to Wet Well Top of Structure Level through Bucket - Chain Pulley Arrangement and disposed off manually to Hand Cart at Ground Level.	Set	1	IPS4
v	Manual Coarse Bar Screen, MOC SS304, Width 0.85 M, Angle of Inclination 60^0, Height 1.6 M, Bar Size 8 MM x 40 MM, Nos. Bars 30, Clear Spacing 20 MM, Nos. Clear Spacings 29, Maximum Velocity through Screen 1.2 M/s, to suit underground Manual Coarse Bar Screen Channel having Peak Flow Rate 0.859 M^3/s, Dimensions Length 5.0 M, Width 0.85 M, Side Water Depth (Upstream, Max) 1.1 M, Side Water Depth (Downstream) 0.85 M, Downstream Free Board (to Top of Screen Channel) 0.5 M, Head Loss across Screen 0.15 M (Max), complete with Lifting Arrangement amd 2 Nos. Manual Rakes. Note 1: The underground Manual Coarse Bar Screen Channel will be constructed at Invert Level RL 38.45 M (w.r.t. Ground Level 0.0 M) on RCC Platform on top of a Wet Well having Dimensions Diameter 18.5 M x 1.45 M SWD and Top Water Level RL 38.45 M such that Invert Level of Screen Channel is 0.3 M above Wet Well Top Water Level. Note 2: Screenings will be manually raked on to a RCC Perforated Platform and then transferred to Wet Well Top of Structure Level through Bucket - Chain Pulley Arrangement and disposed off manually to Hand Cart at Ground Level.	Set	1	TPS
4.0	**SUBMERSIBLE PUMPS**			
i	(TENTATIVE) Raw Sewage Transfer Pumps, Submersible Non Clog, 3 Working + 1 Stand-By, MOC Casing Cast Iron/ Impeller CF8M/ Shaft/ Fasteners/ Foundation Bolts SS 316, Capacity 185.0 M^3/Hour x Head 26.0 MWC, Solid Handling Size 100 MM, Fluid Sewage, Design Specific Gravity 1.0 complete with Control Panel/ Electric Motor (IP 68 w/ Overload Protection/ Temperature Trip and Moisture Trip) / Duck Foot Bend/ Auto Coupling/ SS 304 Lifting Chain, SS 304 Guide Rail and all Accessories.	Set	4	IPS1
ii	Raw Sewage Transfer Pumps, Submersible Non Clog, 4 Working + 1 Stand-By, MOC Casing Cast Iron/ Impeller CF8M/ Shaft/ Fasteners/ Foundation Bolts SS 316, Capacity 370.0 M^3/Hour x Head 21.0 MWC, Solid Handling Size 100 MM, Fluid Sewage, Design Specific Gravity 1.0 complete with Control Panel/ Electric Motor (IP 68 w/ Overload Protection/ Temperature Trip and Moisture Trip) / Duck Foot Bend/ Auto Coupling/ SS 304 Lifting Chain, SS 304 Guide Rail and all Accessories.	Set	5	IPS2

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iii	Raw Sewage Transfer Pumps, Submersible Non Clog, 4 Working + 1 Stand-By, MOC Casing Cast Iron/ Impeller CF8M/ Shaft/ Fasteners/ Foundation Bolts SS 316, Capacity 580.0 M^3/Hour x Head 25.0 MWC, Solid Handling Size 100 MM, Fluid Sewage, Design Specific Gravity 1.0 complete with Control Panel/ Electric Motor (IP 68 w/ Overload Protection/ Temperature Trip and Moisture Trip) / Duck Foot Bend/ Auto Coupling/ SS 304 Lifting Chain, SS 304 Guide Rail and all Accessories.	Set	5	IPS3
iv	Raw Sewage Transfer Pumps, Submersible Non Clog, 4 Working + 1 Stand-By, MOC Casing Cast Iron/ Impeller CF8M/ Shaft/ Fasteners/ Foundation Bolts SS 316, Capacity 170.0 M^3/Hour x Head 33.0 MWC, Solid Handling Size 100 MM, Fluid Sewage, Design Specific Gravity 1.0 complete with Control Panel/ Electric Motor (IP 68 w/ Overload Protection/ Temperature Trip and Moisture Trip) / Duck Foot Bend/ Auto Coupling/ SS 304 Lifting Chain, SS 304 Guide Rail and all Accessories.	Set	5	IPS4
v	(TENTATIVE) Raw Sewage Transfer Pumps, Submersible Non Clog, 4 Working + 1 Stand-By, MOC Casing Cast Iron/ Impeller CF8M/ Shaft/ Fasteners/ Foundation Bolts SS 316, Capacity 520.0 M^3/Hour x Head 17.0 MWC, Solid Handling Size 100 MM, Fluid Sewage, Design Specific Gravity 1.0 complete with Control Panel/ Electric Motor (IP 68 w/ Overload Protection/ Temperature Trip and Moisture Trip) / Duck Foot Bend/ Auto Coupling/ SS 304 Lifting Chain, SS 304 Guide Rail and all Accessories.	Set	5	TPS
iii	Return Sludge Pumps, Submersible Non Clog, 2 Working + 1 Stand-By, MOC Casing Cast Iron/ Impeller CF8M/ Shaft/ Fasteners/ Foundation Bolts SS 316, Capacity 475.0 M^3/Hour x Head 7.5 MWC, Biological Soft Solid Handling Size 100 MM, Fluid Sewage, Design Specific Gravity 1.02 complete with Control Panel/ Electric Motor (IP 68 w/ Overload Protection/ Temperature Trip and Moisture Trip) / Duck Foot Bend/ Auto Coupling/ SS 304 Lifting Chain, SS 304 Guide Rail and all Accessories.	Set	3	STP
iv	Flushing Pumps, Submersible Non Clog, 1 Working + 1 Stand-By, MOC Casing Cast Iron/ Impeller CF8M/ Shaft/ Fasteners/ Foundation Bolts SS 316, Capacity 15.0 M^3/Hour x Head 25.0 MWC, Solid Handling Size 40 MM, Fluid Sewage, Design Specific Gravity 1.02 complete with Control Panel/ Electric Motor (IP 68 w/ Overload Protection/ Temperature Trip and Moisture Trip) / Duck Foot Bend/ Auto Coupling/ SS 304 Lifting Chain, SS 304 Guide Rail and all Accessories.	Set	2	STP
4.0	**MECHANICAL MAT/ STEP FINE SCREENS**			
i	Mechanical Mat/ Step Fine Screen, MOC SS 304, Width 0.6 M, Angle of Inclination 40^0, Height 2.6 M (Minimum), Bar Width 2 MM, Nos. Bars 71, Clear Spacing 6 MM, Nos. Clear Spacings 72, Maximum Velocity through Screen 1.0 M/s, to suit Fine Screen Channel having Peak Flow Rate 0.573 M^3/s and Dimensions Length 6.0 M Length, Width 0.9 M (including 0.3 M Width for Screen Drive Mechanism) , Side Water Depth (Upstream, Max) 1.3 M SWD, Side Water Depth (Downstream) 1.0 M, Downstream Free Board 0.5 M (to Top of Screen Channel), Head Loss across Screen 300 MM (Maximum), Height of Conveyor Belt above Channel Top of Structure Level 0.6 M (approx.), Height of Screen Top above Conveyor Belt 0.5 M (approx.), complete with Electric Motor/ Drive Arrangement/ Control Panel (with ON/OFF Operation linked to Ultrasonic Differential Level Sensor/ Overload Relay/ Emergency Stop)/ Lifting or Tilting Arrangement (for Inspection/ Cleaning/ Maintenance) and all Accessories. Note 1: Screenings will be lifted up to a Conveyor Belt above Screen Channel Top of Structure Level and discharged via Chute to a Hand Cart positioned at Ground Level. Note 2. Screen operation will be controlled using Ultrasonic Differential Level Sensor linked to Control Panel.	Set	2	STP
ii	Belt Conveyor, Horizontal Troughed Type, Length 3.1 M c/c, Belt Width 0.6 M, Speed/ Belt MOC (as per Manufacturer Standard) complete with Electric Motor/ Drive Assembly/ Pulleys/ Rollers/ Base Frame/ Discharge Chute and all Accessories.	Set	1	STP
6.0	**MECHANICAL DETRITUS TYPE GRIT CHAMBERS**			

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i	Central Drive Head complete with Drive Motor (w/ Overload Protection) / Gear Box/ Full Diameter MS Epoxy Painted Scraper Assembly (w/ Rubber Sqeezers) to suit Square Mechanical Detritus Type Grit Chamber having Dimensions 5.9 M x 5.9 M x 0.9 M SWD + 0.5 M FB/ MS Epoxy Painted Rake Classifier w/ Drive Motor/ Gear Box/ CI Organic Return Pump w/ Electric Motor and all Accesories.	Set.	2	STP
7.0	**AIR BLOWERS**			
i	Air Blowers, Twin Lobe Positive Displacement Air Cooled, Capacity 4000.0 M^3/Hour x Discharge Pressure 0.6 Kg/cm^2, MOC Cast Iron, complete w/ all Electric Motors/ Variable Frequency Drives and all Accessories (including Base Plate/ Safety Valve/ Pulleys/ V Belts/ V Belt Guard/ Eye Bolts/ Suction Filter/ Silencer/ Pressure Relief Valve/ Pressure Gauge/ Acoustic Hood/ Rubber Bellows/ Anti Vibration Pad)	Set	3	STP
8.0	**SECONDARY CLARIFIER**			
i	Secondary Clarifier Peripheral Drive Mechanism consisting of Electric Motor, Worm Reduction Gear Box, Chain Sprocket Drive and Cast Steel Nylon Rubber Coated Drive and Idle Wheel Assembly, MS Bitumen Painted Travelling Half Diameter Bridge, Full Diameter MS Epoxy Painted Scraper Assembly (w/ Rubber Squeezers), Central Bearing, Current Collector and 5 MM Thick FRP V Notch (200 MM Height, 200 MM c/c w/ Adjustible Fixing Arrangement), to suit Bottom Feed Secondary Clarifier having Diameter 44.7 M, Side Water Depth 3.0 M, Free Board 0.5 M, Bottom Slope 1:12 (approx.), Central Column OD 1.2 M, Annular Sludge Hopper 1.0 M Width x 1.0 M Height	Set	1	STP
9.0	**GRAVITY SLUDGE THICKENER**			
i	MS Bitumen Painted Full Diameter Fixed Bridge, Central Drive Mechanism consisting of Electric Motor, Worm Reduction Gear Box/ Bevel Gear (as applicable), MS Epoxy Painted Feed Well and Central Shaft/ Rotating Cage (as applicable), Full Diameter MS Epoxy Painted Picket and Scraper Assembly (w/ Rubber Squeezers), Central Bearing (as applicable), to suit Top Feed Gravity Sludge Thickener having Diameter 15.9 M, Side Water Depth 4.5 M, Free Board 0.5 M, Bottom Slope (as applicable), Central Column (as applicable), Circular Sludge Hopper 0.6 M Width (approx.) x 0.6 M Height (approx.)	Set	1	STP
10.0	**CENTRIFUGE FEED PUMPS**			
i	Helical Screw Positive Displacement Pumps, 1 Working + 1 Stand-By, Capacity 15.0 M^3/Hour x 6.0 MWC Discharge Head, capable of passing Soft Biological Solids Size 100 MM, MOC Cast Iron, complete with Electric Motor/ V Belts/ V Belt Guard/ Base Plate (MS Epoxy Painted)/ Foundation Bolts and all Accessories.	Set	2	STP
13.0	**SOLID BOWL CENTRIFUGES**			
i	Solid Bowl Centrifuge, Type Co-Current/ Counter Current, 1 Working + 1 Stand-By, Capacity 15.0 M^3/Hour (at Biological Sewage Sludge concentration 3.0% Dry Solids Basis), complete with Electric Motor/ V Belts/ Pulleys (suitable for Speed Adjustment)/ Epicyclic Gear (suitable for Differential Speed Adjustment)/ Overload Protection/ Adjustable Weir Plate/ MS Epoxy Painted Base Frame w/ Anti Vibration Pads and all Accessories. MOC SS 304 (Wetted Parts). Feed Chamber/ Solid Bowl/ Solid Discharge Outlet to be Tungsten Carbide lined.	Set	2	STP
	MAKES OF EQUIPMENT			

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SLUICE GATES	JASH/ IVC/ YASHWANT/ ORIENTAL
MECHANICAL/ MANUAL COARSE BAR SCREENS	JASH/ VOLTAS/ SHIVPAD/ METAL FAB/
	MACMET
MECHANNICAL STEP/ MAT FINE SCREENS	JASH/ HUBER (GERMANY)
MECHANICAL GRIT CHAMBERS	VOLTAS/ SHIVPAD/ DORR OLIVER/ FILSEP
AIR BLOWERS	SWAM/ EVEREST/ KAY/ KULKARNI
SECONDARY CLARIFIERS	VOLTAS/ SHIVPAD/ DORR OLIVER/ FILSEP
	EIMCO KCP
GRAVITY SLUDGE THICKENERS	VOLTAS/ SHIVPAD/ DORR OLIVER/ FILSEP
	EIMCO KCP
CENTRIFUGE FEED PUMPS	ROTO/ RAMO/ TUSHACO/ UT PUMPS
SOLID BOWL CENTRIFUGES	ALFA LAVAL/ HILER/ PENWALT/
	HUMBOLDT
VALVES	JASH/ IVC/ FOURESS/ BDK/APOORVA
	DURGA/ CRANE/ KIRLOSKAR/ INTER
MIXERS/ AGITATORS	ATE/ VOLTAS/ REMI/ RATHI/ FIBRE
	& FIBRE
HOIST	JD HOIST & CRANE/ BRADY & MORRIS/
	EDDY CRANES/ REVA
BELT CONVEYOR	ADVANCE DYANAMIC/ MACLEAN
	PROJECT/ METAL FABRICATED
DI PIPES	JINDAL/ JAY BALAJI/ ELECTROSTEEL
DI SPECIALS	KEJRIWAL/ TRUFORM/ RG INDUSTRIES/
	KISWORK/ LANCO
MOTORS	CROMPTON/ JYOTI/ ABB/ MARATHON
	KIRLOSKAR

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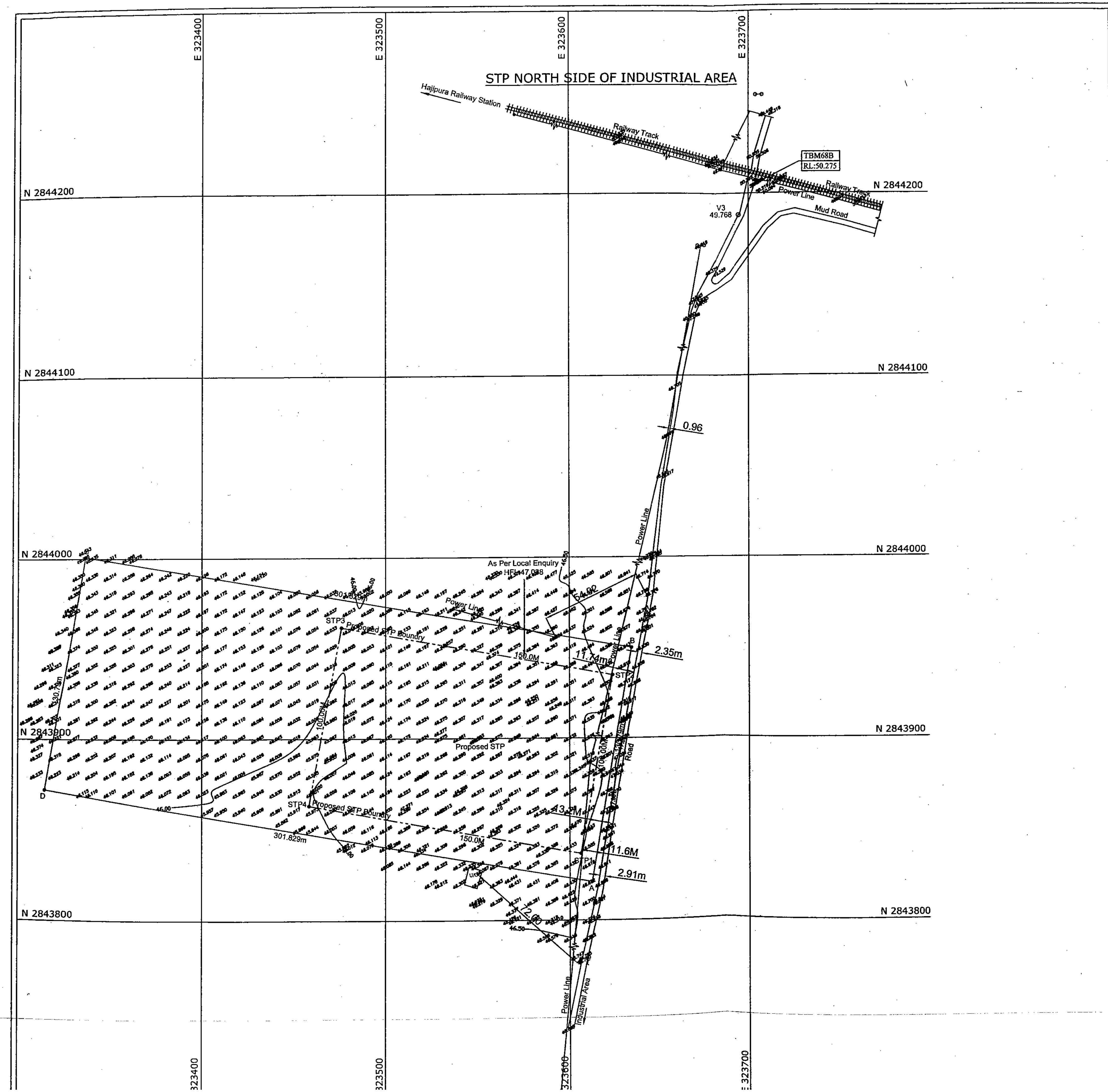
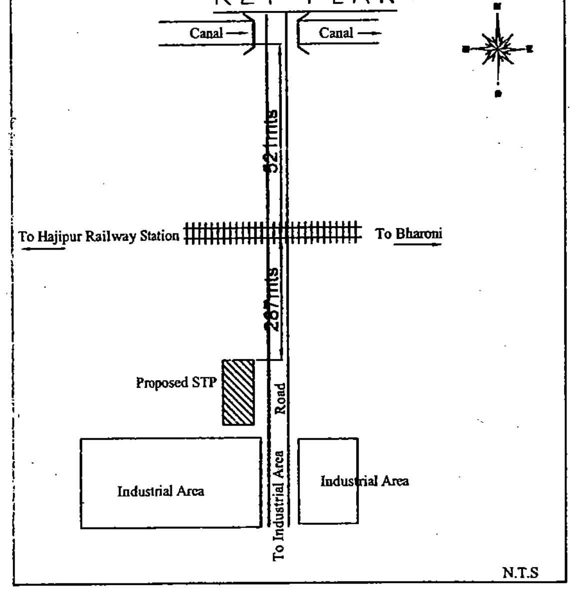


LEGEND

1. ASPHALT ROAD, MUD ROAD/METALLED ROAD.
2. TREE, CULVERT, LAMP POST
3. BORE WELL, MAN HOLE
4. RIVER, STREAM, NALA, FENCE, ROW STONE
5. BOULDERS, ROCKY GROUND, TRANSFORMER, TELEPHONE POLE
6. POWER LINE, PYLON (HIGHTENSION LINE)
7. KILOMETER & FURLONG STONE, SPOT HEIGHT.
8. BUSHES, BENCH MARK, TRAVERSE POINT

KEY PLAN



BOUNDARY CO-ORDINATES & DISTANCES & ANGLE

BOUNDARY POINTS	CO-ORDINATES, DISTANCE & ANGLE			
	EASTING	NORTHING	DISTANCE	ANGLE
STP1	323606.051	2843836.517	150.0M	90°00'00"
STP2	323623.790	2843934.931	100.0M	90°00'00"
STP3	323476.168	2843961.539	150.0M	90°00'00"
STP4	323458.430	2843863.124	100.0M	90°00'00"

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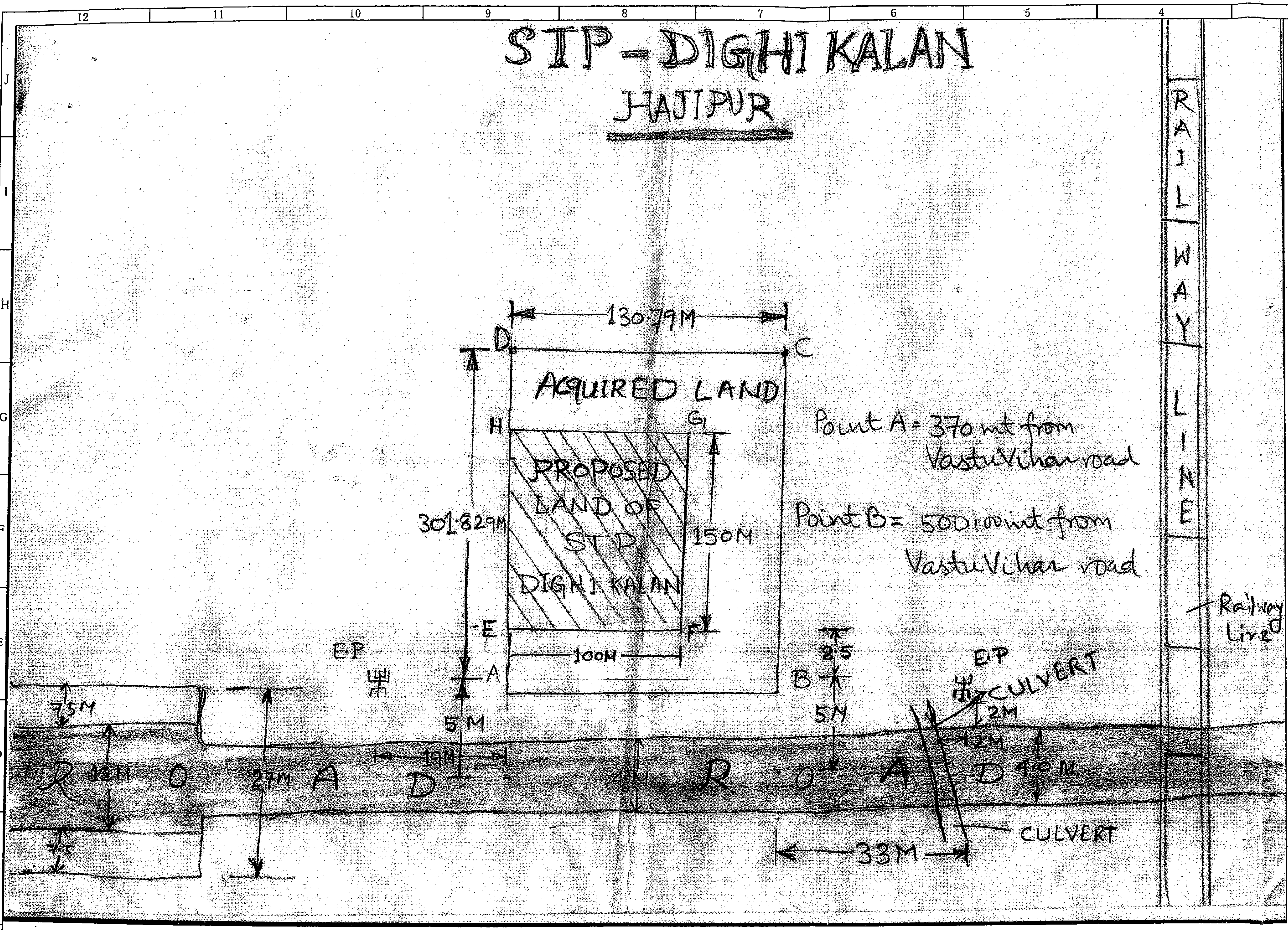
NOTE:-

1. ALL LEVELS ARE IN METERS. UNLESS OTHER WISE MENTIONED.
2. ALL LEVELS ARE CARRIED FROM THE BENCH MARK LOCATED ON SOMPUR BRIDGE OF GANDAK RIVER.
3. TOTAL SURVEYED = 39476.215 SQMTS (A TO D)
   9.754 ACRES
   9 Acres 30.16 GUNTAS
4. TOTAL AREA OF STP BOUNDRY = 15000 SQMTS (STP1 TO STP4)
   3.706 ACRES
   3 Acres 28.24GUNTAS

SHEET 1 OF 1

CLIENT	TRI-TECH Tri-Tech Infrastructure (India) Pvt.Ltd.
TITLE	TOPOGRAPHICAL SURVEY OF STP SITE
ORIGN CLIENT	**BIHAR URBAN INFRASTRUCTURE DEVELOPMENT CORPORATION LTD.** (A Govt. of Bihar Undertaking)
SURVEYED & PREPARED BY	RADIAN SURVEYS #715, OM PLAZA, 3RD FLOOR, 3RD MAIN DR.MODI HOSPITAL ROAD, MAHALAKSHMIPURAM,BANGALORE 86 E-mail : rdnsurveys@gmail.com PH:080-23194839

SCALE: 1:1000	SEASON : 12/11/2012	R0	DRG. NO. HJ/1051/STP/SURVEY/01



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0	28.11.12	SUBMISSION FOR APPROVAL	MS	DR. A.DUTT	
REV.	DATE	DESCRIPTION	DRN.	CHKD.	APPD.

CLIENT: – BIHAR URBAN INFRASTRUCTURE DEVELOPMENT CORPORATION LTD., PATNA

PROJECT: – 22.0 MLD SEWAGE TREATMENT PLANT AT HAJIPUR, BIHAR

BIDDERS NAME: – TRI-TECH TRI–TECH (BEIJING) COMPANY LTD. BEIJING, NEW DELHI

DATE: – 28.11.12	TITLE: – FIELD DIMENSIONAL SURVEY SKETCH OF STP SITE		
DRAWN.: – M.S.			
CHKD.: – DR. A.DUTT	SCALE	SHEET	DRAWING NO. / REV.
APPD.: – DR. A.DUTT	1:1000	1 OF 1	HJ/1051/STP/SURVEY/02 / 0

wner	: Bihar Urban Infrastructure Development Corporation Ltd. Patna
oject	: Sewerage Network and 22 MLD STP Plant For Hajipur Town
ontractor	: Tri-Tech (Beijing) Company Ltd. Beijing (New Delhi)
oc. Name	: Hydraulic Design Calculations for Terminal Pumping station (TPS)
oc. No.	: TT/BEI/HJ/1051/TPS/A01 REV. 01 DT. 30.11.2012

.NO.	PARAMETER		VALUE	UNIT
1.0	**DESIGN FLOWRATE**			
	Average Flow Rate, Q_A	:	33.000	MLD
		:	1375.000	M^3/Hr
		:	0.382	M^3/s
	Peaking Factor, PF		2.250	
	Peak Flow Rate $Q_P = Q_A * PF$	:	3093.750	M^3/Hr
		:	0.859	M^3/s
.0	**RECEIVING CHAMBER**			
	Outfall Sewer to Receiving Chamber Invert Level	:	39.000	M
	Outfall Sewer Diameter	:	1.200	M
	Outfall Sewer Soffit Level	:	40.200	M
	Finished Ground Level (Considered)	:	46.400	M
	Height, Top of Receiving Chamber (Above Ground)	:	0.900	M
	Receiving Chamber Top of Structure Level	:	47.300	M
	Outfall Sewer Capacity, Q_P	:	3093.750	M^3/Hr
		:	0.859	M^3/s
	Sewage Level in Outfall Sewer (Considered, To be confirmed after Detailed Sewer Network Design)	:	80.000	%
	Outfall Sewer Side Water Depth	:	0.960	M
	Outfall Sewer Top Water Level	:	**39.960**	M
	Outfall Sewer Wetted Cross Section Area, A			
	Triangle Portion			
	Triangle Height, H	:	0.360	M
	Subtended Angle, $\theta = \cos^{-1} (H/ (D/2))$	:	53.130	^{0}
	Triangle Base, $B = D/2 * \sin\theta * 2$	:	0.960	M
	Triangle Area, $A_1 = 0.5 * H * B$	:	0.173	M^2

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S.NO.	PARAMETER		VALUE	UNIT
	Circle Segment Portion			
	Subtended Angle, $\theta_1 = 360^0 - (\theta * 2))$	:	253.740	^{0}
	Outfall Sewer Wetted Cross Section Area, A_2	:	0.797	M^2
	Outfall Sewer Wetted Cross Section Area, $A = A_1+A_2$	:	0.970	M^2
	Outfall Sewer Velocity, $V = Q_P / A$	:	0.886	M/s
	Velocity Head, $V^2/2g$	:	0.040	M
	Exit Head Loss Co-Efficient, K	:	1.000	
	Exit Head Loss, $K * V^2/2g$	:	0.040	M
	Receiving Chamber Top Water Level	:	39.920	M
	Say	:	**39.900**	M
	Gap, Outfall Sewer Invert - Receiving Chamber Invert (Considered)	:	0.250	M
	Receiving Chamber Invert Level	:	38.750	M
	Receiving Chamber Side Water Depth	:	1.150	M
	Free Board	:	7.400	M

3.0 MECHANICAL COARSE SCREEN CHANNEL

Peak Flow Rate, Q_P	:	0.859	M^3/s
Inlet Sluice Gate Width, W	:	0.900	M
Inlet Sluice Gate Side Water Depth, Z	:	0.900	M
Velocity (across Sluice Gate), $V = Q_P/ W*Z$	:	1.061	M/s
Velocity Head = $V^2 / 2g$	:	0.057	M
Sluice Gate Head Loss Co-Efficient	:	0.800	
Head Loss across Sluice Gate, $K * V^2 / 2g$	:	0.046	M
Say	:	0.050	M
Coarse Screen Channel Top Water Level (U/s)	:	**39.850**	M
Coarse Screen Channel Invert Level	:	38.750	M
Coarse Screen Channel Side Water Depth (U/s)	:	1.100	M
Head Loss across Coarse Screen (Refer Process Calculations)	:	0.150	M
Coarse Screen Channel Top Water Level (D/s)	:	**39.700**	M
Coarse Screen Channel Top of Structure Level	:	47.300	M
Free Board	:	7.450	M
Finished Ground Level	:	46.400	M

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S.NO.	PARAMETER		VALUE	UNIT
4.0	**RAW SEWAGE SUMP (WET WELL)**			
	Coarse Screen Channel Invert Level	:	38.750	M
	Free Fall, Fine Screen Channel IL - Raw Sewage Sump TWL	:	0.300	M
	Raw Sewage Sump Top Water Level	:	**38.450**	M
	Raw Sewage Sump Side Water Depth	:	1.450	M
	Raw Sewage Sump Invert Level	:	37.000	M
	Finished Ground Level	:	46.400	M
	Dry Well Plinth Level	:	47.300	M
	Height, Dry Well Plinth Level (Above Ground)	:	0.900	M
	Raw Water Sump Top of Structure Level	:	47.300	M
	Raw Water Sump Free Board	:	8.850	M

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wner	: Bihar Urban Infrastructure Development Corporation Ltd. Patna
roject	: Sewerage Network and 22 MLD STP Plant For Hajipur Town
ontractor	: Tri-Tech (Beijing) Company Ltd. Beijing (New Delhi)
oc. Name	: Pumping Head Calculations for Raw Sewage Transfer Pump-TPS
oc. No.	: TT/BEI/HJ/1051/TPS/A02 REV. 00 DT. 30.11.2012

S.NO.	PARAMETER		VALUE	UNIT
	Note: Calculations shown below are tentative subject to finalization of Hajipur Zone 5 Sewer Network Design.			
1.0	Individual Pump Flow Rate, Q	:	520.000	M^3/Hr
		:	0.144	M^3/s
	Total Nos. Pumps	:	5.000	
	Nos. Pumps Working	:	4.000	
	Nos. Pumps Stand-By	:	1.000	
	Combined Pump Flow Rate	:	2080.000	M^3/Hr
		:	0.578	M^3/s
2.0	**STATIC HEAD CALCULATION**			
	Raw Sewage Sump Invert Level	:	37.000	M
	Stilling Chamber Top Water Level	:	48.700	M
	Static Head	:	**11.700**	M
3.0	**PIPE FRICTION LOSS - 300 NB DI K7 INDIVIDUAL DELIVERY**			
	Pump Flow Rate, Q	:	0.144	M^3/s
	Pump Delivery Pipeline Diameter, D	:	0.300	M
	Pump Delivery Pipeline Length (Max), L	:	10.000	M
	Pipe Velocity, $V = Q/(\pi * D * D/4)$	:	2.043	M/s
	Hazen William Equation, $V = 0.849 * C * R^{0.63} * S^{0.54}$			
	Hazen William Co-Efficient, C (CPHEEO Manual)	:	100.000	
	Hydraulic Radius, R = D/4	:	0.075	

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S.NO.	PARAMETER		VALUE	UNIT
	Friction Slope, S (by Calculation)	:	0.02066	M/M
	Pipe Friction Loss, $H_F = S * L$	:	**0.207**	M

4.0	**PIPE FRICTION LOSS - 600 NB DI K7 COMMON DELIVERY HEADER**			
	Pump Flow Rate, Q	:	0.578	M^3/s
	Pump Delivery Pipeline Diameter, D	:	0.600	M
	Pump Delivery Pipeline Length (Max), L	:	20.000	M
	Pipe Velocity, $V = Q/ (\Pi*D*D/4)$	:	2.043	M/s
	Hazen William Equation, $V = 0.849 * C * R^{0.63} * S^{0.54}$			
	Hazen William Co-Efficient, C (CPHEEO Manual)	:	100.000	
	Hydraulic Radius, R = D/4	:	0.150	M
	Friction Slope, S (by Calculation)	:	0.00920	M/M
	Pipe Friction Loss, $H_F = S * L$	:	**0.184**	M

5.0	**FITTINGS LOSSES - PUMP SUCTION**			
	Pump Flow Rate, Q	:	0.144	M^3/s
	Pump Suction Diameter, D	:	0.250	M
	Suction Velocity $V = Q/(\Pi/4*D*D)$	:	2.942	M/s
	Velocity Head = $V^2/2g$	:	0.441	M
	Entrance Loss Co-Efficient, K	:	0.500	
	Pump Suction Fittings Losses = $K * V^2/2g$	:	**0.221**	M

6.0	**FITTINGS LOSSES - 300 NB DI K7 INDIVIDUAL PUMP DELIVERY**			
	Pump Flow Rate, Q	:	0.144	M^3/s
	Pump Delivery Pipeline Diameter, D	:	0.300	M
	Delivery Velocity $V = Q/(\Pi/4*D*D)$	:	2.043	M/s
	Velocity Head = $V^2/2g$	:	0.213	M
	Loss Co-Efficient, Reducer 300 NB - 250 NB, K_1	:	1.000	
	Loss Co-Efficient, 90^0 Bends, K_2	:	1.000	
	Nos. 90^0 Bends, N	:	2.000	
	Loss Co-Efficient Non Return Valve, K_4	:	2.500	

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S.NO.	PARAMETER		VALUE	UNIT
	Loss Co-Efficient Butterfly Valve, K_5	:	1.000	
	Total Loss Co-Efficient K = (K_1 + N*K_2 + K4 + K5)	:	6.500	
	Pump Delivery Fittings Losses = K * $V^2/2g$	:	**1.383**	M

7.0 FITTINGS LOSSES - 600 NB DI K7 COMMON DELIVERY HEADER

	Pump Flow Rate, Q	:	0.578	M^3/s
	Pump Delivery Pipeline Diameter, D	:	0.600	M
	Delivery Velocity V = Q/(∏/4*D*D)	:	2.043	M/s
	Velocity Head = $V^2/2g$	:	0.213	M
	Loss Co-Efficient, 90^0 / 45^0 Bends, K_2	:	1.000	
	Nos. 90^0 / 45^0 Bends, N (Max)	:	4.000	
	Exit Loss Co-Efficient, K_6	:	1.000	
	+ K5 + K6)	:	5.000	
	Pump Delivery Fittings Losses = K * $V^2/2g$	:	**1.064**	M

7.0 TOTAL HEAD LOSS CALCULATION

	Total Head Loss = Static Head + Friction Loss + Suction Fittings Loss + Delivery Fittings Loss	:	14.758	M
	Pump Delivery Head (Required)	:	14.800	M
	Pump Delivery Head (Provided)	:	**17.000**	M
	Pump Rating	:	45.000	KW

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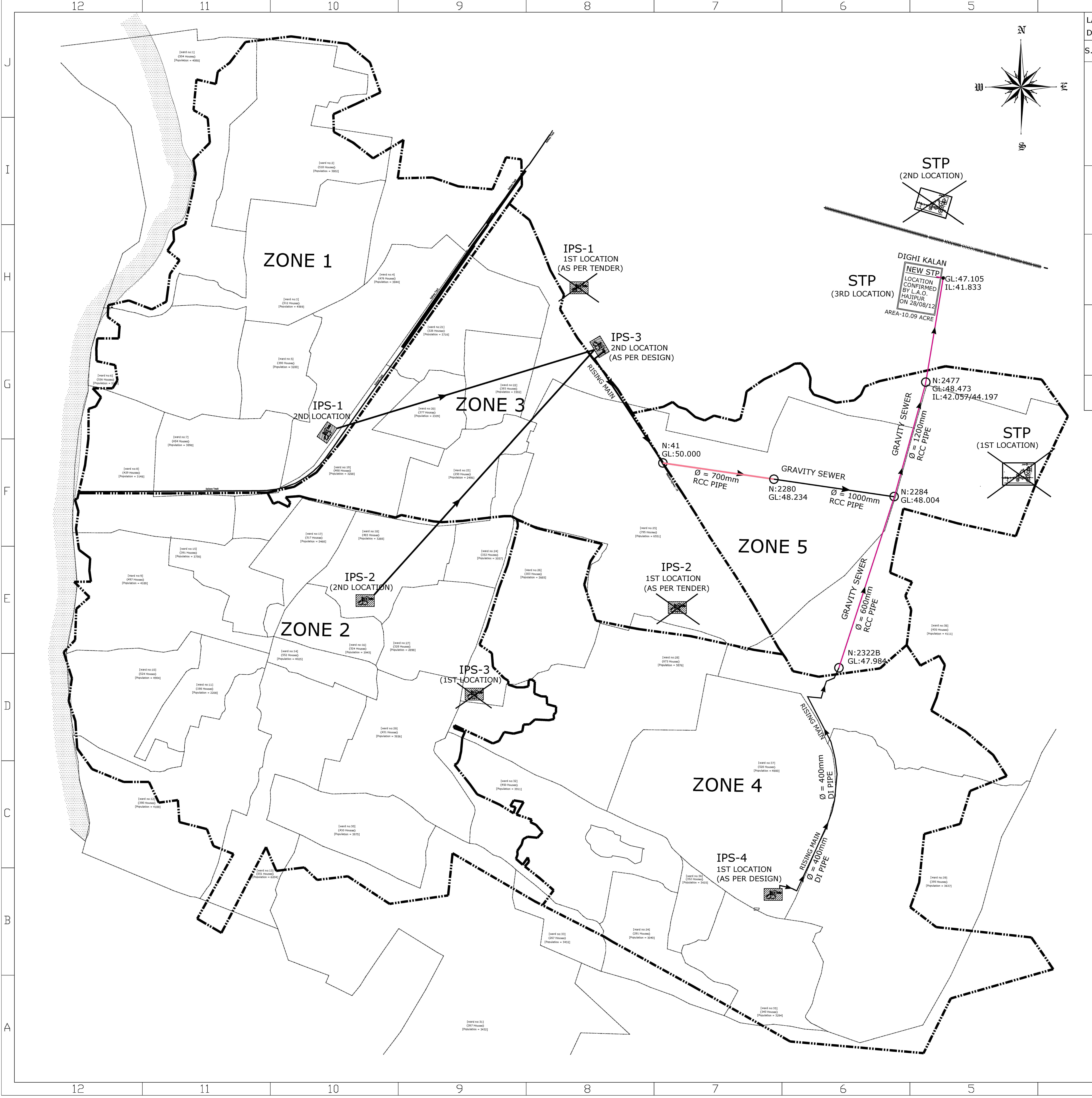
Annexure-2



ZONE 1
ZONE 2
ZONE 3
ZONE 4
ZONE 5
IPS-1
1ST LOCATION
(AS PER TENDER)
IPS-3
2ND LOCATION
(AS PER DESIGN)
RISING MAIN
IPS-1
2ND LOCATION
IPS-2
(2ND LOCATION)
IPS-3
(1ST LOCATION)
IPS-2
1ST LOCATION
(AS PER TENDER)
IPS-4
1ST LOCATION
(AS PER DESIGN)
RISING MAIN
Ø = 400mm
DI PIPE
RISING MAIN
Ø = 400mm
DI PIPE
STP
(2ND LOCATION)
DIGHI KALAN
NEW STP
LOCATION CONFIRMED BY L.A.O. HAJIPUR ON 28/08/12
AREA-10.09 ACRE
GL:47.105
IL:41.833
STP
(3RD LOCATION)
N:2477
GL:48.473
IL:42.057/44.197
GRAVITY SEWER
Ø = 1200mm
RCC PIPE
STP
(1ST LOCATION)
N:41
GL:50.000
Ø = 700mm
RCC PIPE
GRAVITY SEWER
N:2280
GL:48.234
Ø = 1000mm
RCC PIPE
N:2284
GL:48.004
GRAVITY SEWER
Ø = 600mm
RCC PIPE
N:2322B
GL:47.984
N
E
S
W

KEY PLAN

LEGEND

1. SEWER PIPE	
2. SEWER NODE	
3. FLOW DIRECTION	
4. PIPE ID	CO:2384
5. PIPE DIAMETER	D:200mm
6. PIPE SLOPE	S:1in 420
7. PIPE LENGTH	L:101.5m
8. ZONE BOUNDARY	
9. WARD BOUNDARY	

PIPE DIAMETER	PIPE COLORS
(A) PIPE Ø 150	
(B) PIPE Ø 200	
(C) PIPE Ø 250	
(D) PIPE Ø 300	
(E) PIPE Ø 350	
(F) PIPE Ø 400	
(G) PIPE Ø 450	
(H) PIPE Ø 600	
(I) PIPE Ø 700	

REV.	DATE	DESCRIPTION	DRN.	CHKD.	APPD.
3	06.08.14	REVISED AS PER BUIDCO DISCUSSION	P.B.	M.B.	ARUN

CLIENT:- BIHAR URBAN INFRASTRUCTURE DEVELOPMENT CORPORATION LTD., PATNA

PROJECT:- SEWERAGE NETWORK & 22 MLD STP PLANT FOR HAJIPUR TOWN

BIDDERS NAME:-

DATE:- 06.08.14

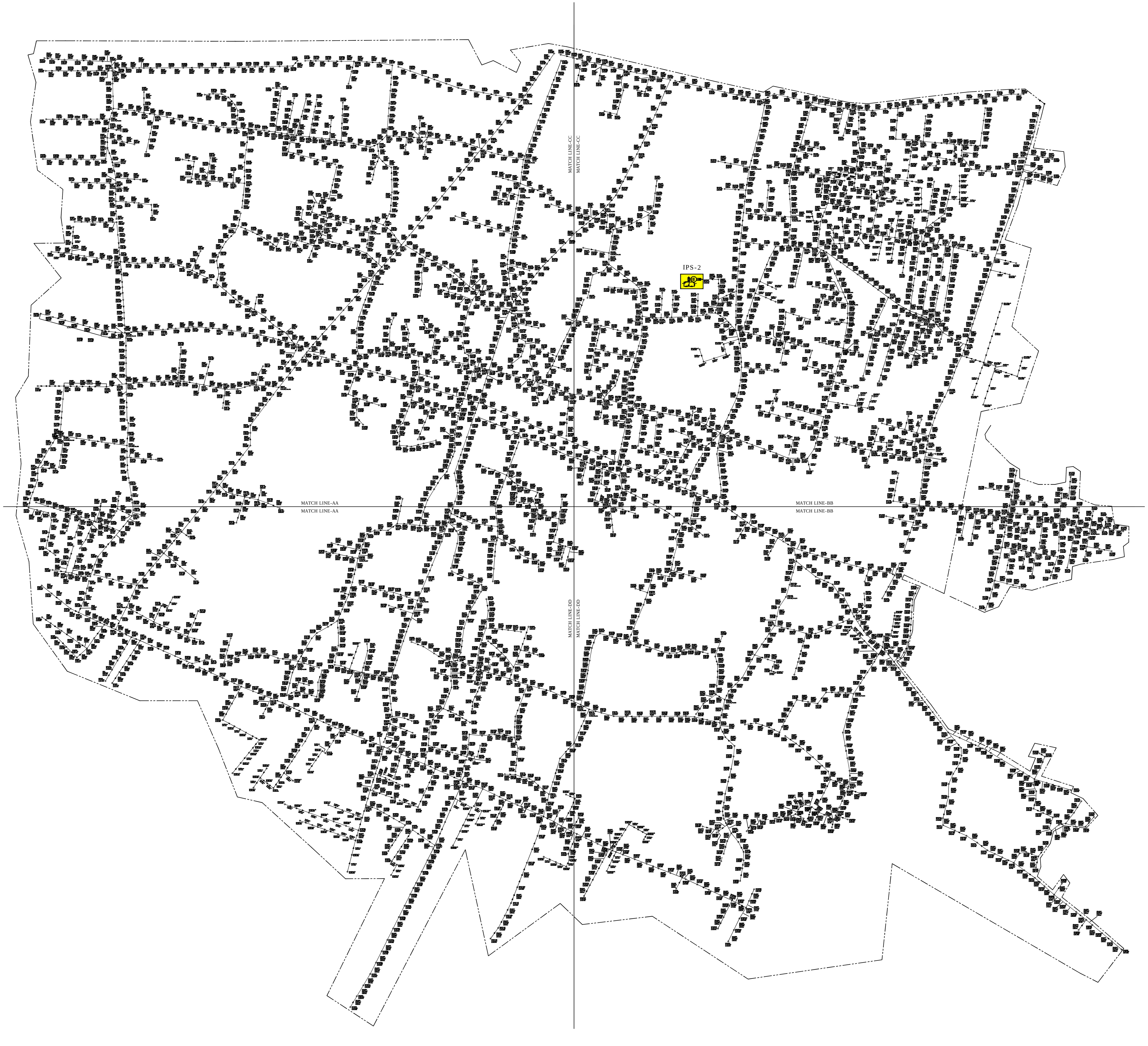
DRAWN.:- P.B.

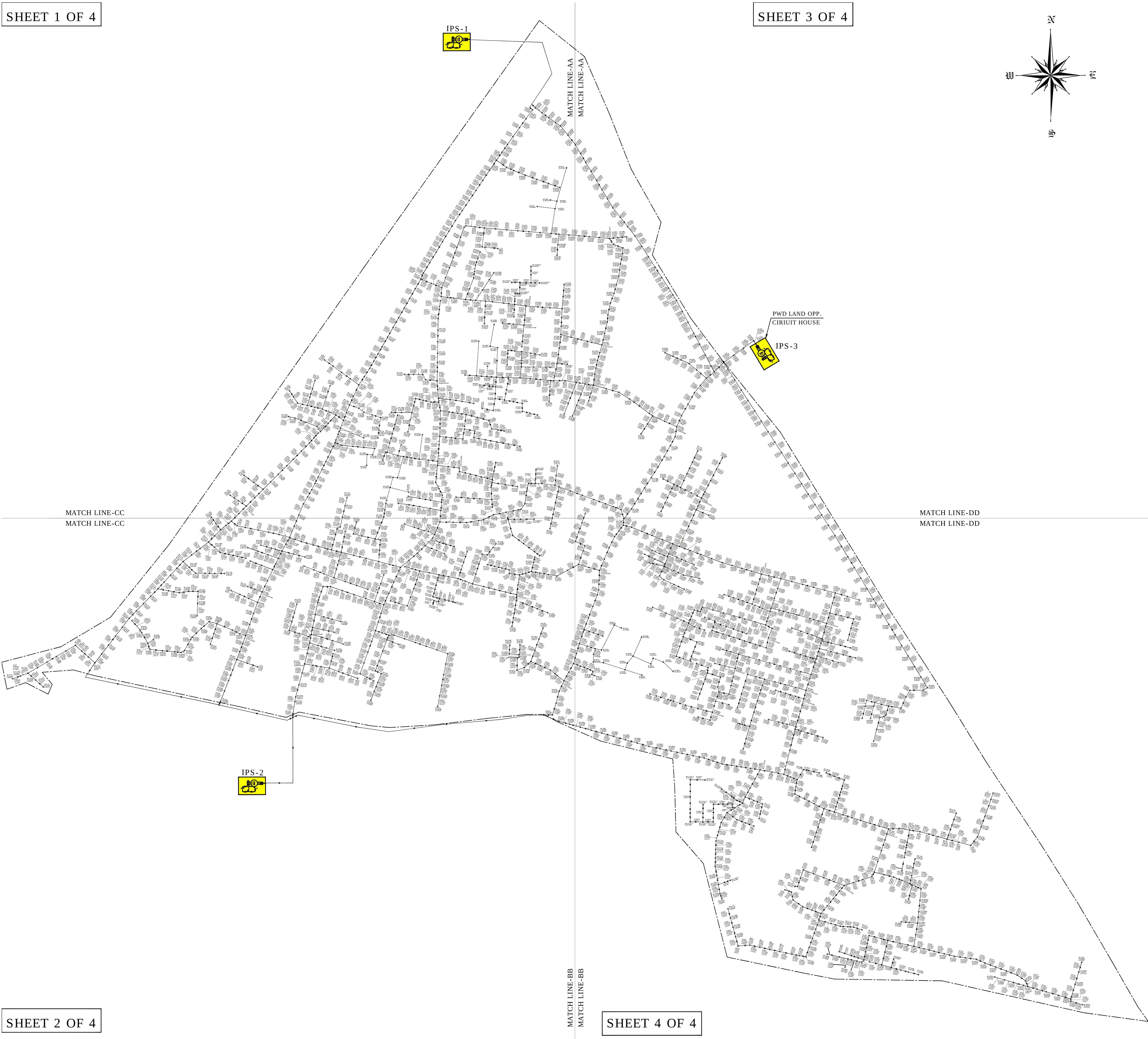
CHKD.:- M.B.

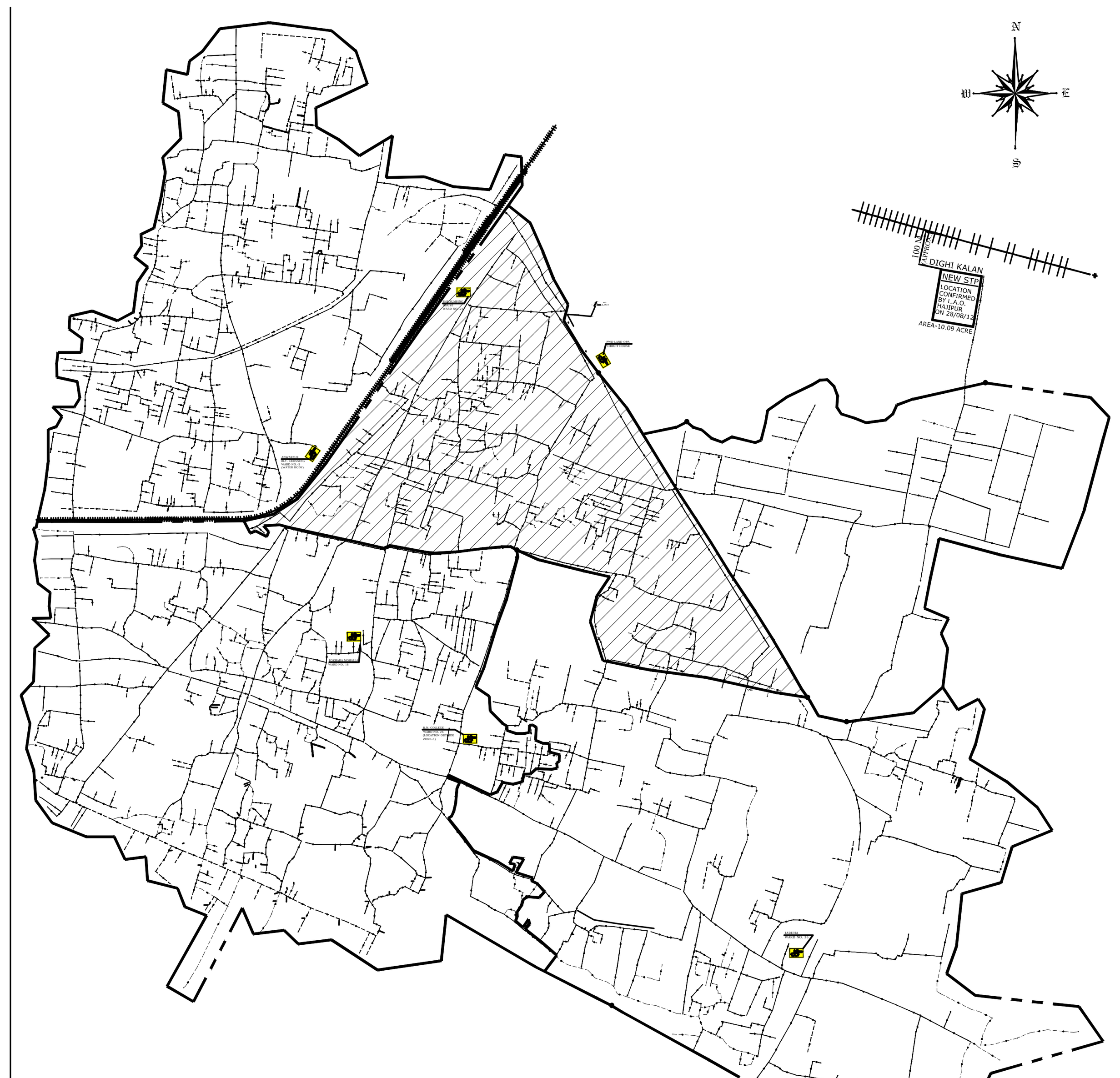
APPD.:- ARUN

DRAWING TITLE:- SEWERAGE NETWORK CONSTUCTION DRAWING FOR ZONE-I

SCALE	SHEET	DRAWING NO.	REV.
1:1000	1 OF 1	HJ/1051/SEW/CONST./01	3


MATCH LINE-CC
MATCH LINE-CC
IPS-2
MATCH LINE-AA
MATCH LINE-AA
MATCH LINE-BB
MATCH LINE-BB
MATCH LINE-DD
MATCH LINE-DD





KEY PLAN

LEGEND

1. SEWER PIPE
2. MISSING LINE
3. LAYING NOT POSSIBLE DUE TO NARROW ROAD
4. MANHOLE
5. FLOW DIRECTION
6. PIPE ID — Co:100
7. PIPE DIAMETER — D:200mm
8. PIPE SLOPE — S:1in 420
9. PIPE LENGTH — L:101.5m
10. ZONE BOUNDARY
11. WARD BOUNDARY

PIPE DIAMETER	PIPE COLORS
(A) PIPE Ø 150	
(B) PIPE Ø 200	
(C) PIPE Ø 250	
(D) PIPE Ø 300	
(E) PIPE Ø 350	
(F) PIPE Ø 400	
(G) PIPE Ø 500	
(H) PIPE Ø 600	
(I) PIPE Ø 800	
(J) PIPE Ø 1000	

REV.	DATE	DESCRIPTION	DRN.	CHKD.	APPD.
3	12.02.14	REVISED AS PER BUIDCO DISCUSSION	P.B.	MB	AKS
2	20.01.14	REVISED AS PER BUIDCO DISCUSSION	P.B.	MB	AKS
1	13.01.14	REVISED AS PER BUIDCO DISCUSSION	P.B.	MB	AKS
0	26.08.13	SUBMISSION FOR APPROVAL	P.B.	MB	AKS

CLIENT:- BIHAR URBAN INFRASTRUCTURE DEVELOPMENT CORPORATION LTD., PATNA

PROJECT:- SEWERAGE NETWORK & 22 MLD STP PLANT FOR HAJIPUR TOWN

BIDDERS NAME:-

DATE:- 26.08.13
DRAWN.:- P.B.
CHKD.:- M.B.
APPD.:- A.K.S.

DRAWING TITLE:- SEWERAGE NETWORK CONSTUCTION DRAWING FOR ZONE-III

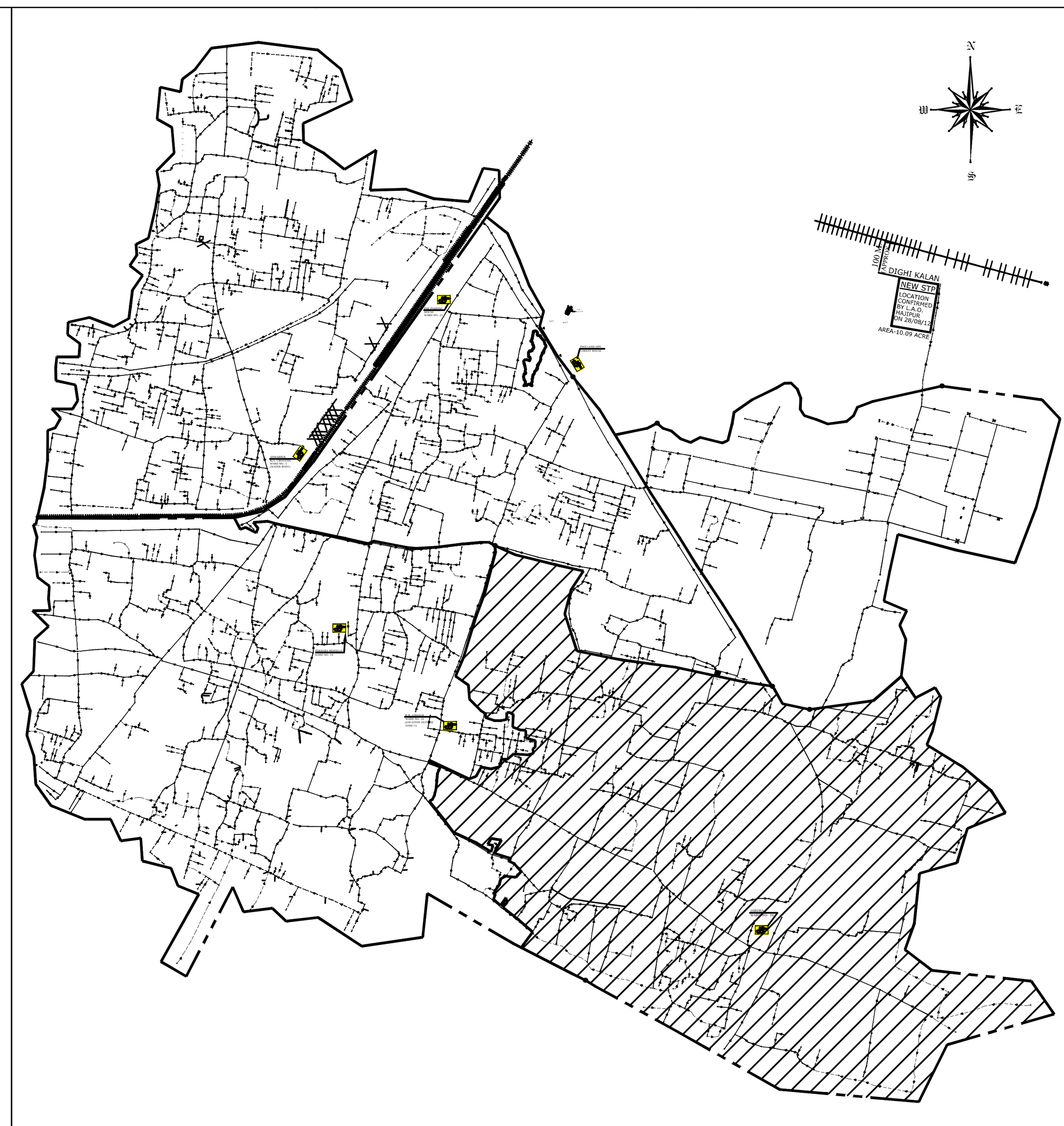
SCALE	SHEET	DRAWING NO.	REV.
1:1000	1 OF 1	HJ/1051/SEW/CONST./03	3

12 11 10 9 8 7 6 5 4

J I H G F E D C

NOTE:-

1. FOR DETAILED DRAWING REFER WARDWISE DRAWINGS.
2. FLOW FROM THIS ZONE (IPS-4) IS PUMPED INTO ZONE - 5 AT NODE NO. 2322B.
3. THERE IS NO FLOW IS COMMING INTO THIS ZONE FROM OTHER ZONES.



KEY PLAN

LEGEND

1. SEWER PIPE
2. NEW SEWER LINE
3. SEWER NODE
4. INSERT NODE
5. DROP MAIN HOLE
6. FLOW DIRECTION
7. PIPE ID — P:2384
8. PIPE DIAMETER — D:200mm
9. PIPE SLOPE — S:1in 420
10. PIPE LENGTH — L:101.5m
11. ZONE BOUNDARY
12. WARD BOUNDARY

PIPE DIAMETER	PIPE COLORS
(A) PIPE Ø 150	
(B) PIPE Ø 200	
(C) PIPE Ø 250	
(D) PIPE Ø 300	
(E) PIPE Ø 400	
(F) PIPE Ø 450	
(G) PIPE Ø 500	
(G) PIPE Ø 600	
(H) PIPE Ø 700	

REV.	DATE	DESCRIPTION	DRN.	CHKD	REVIEW	APPD.
2	26.07.13	AS PER ACTUAL SITE CONDITIONS	P.B.	S.B.N.	SHIV	R.K.S.
1	04.04.13	AS PER ACTUAL SITE CONDITIONS	M.S.	S.B.N.	SHIV	A. DUTT
0	10.11.12	SUBMISSION FOR APPROVAL	M.S.	S.B.N.	SHIV	A. DUTT

CLIENT:- BIHAR URBAN INFRASTRUCTURE DEVELOPMENT CORPORATION LTD., PATNA

PROJECT:- SEWERAGE NETWORK & 22 MLD STP PLANT FOR HAJIPUR TOWN

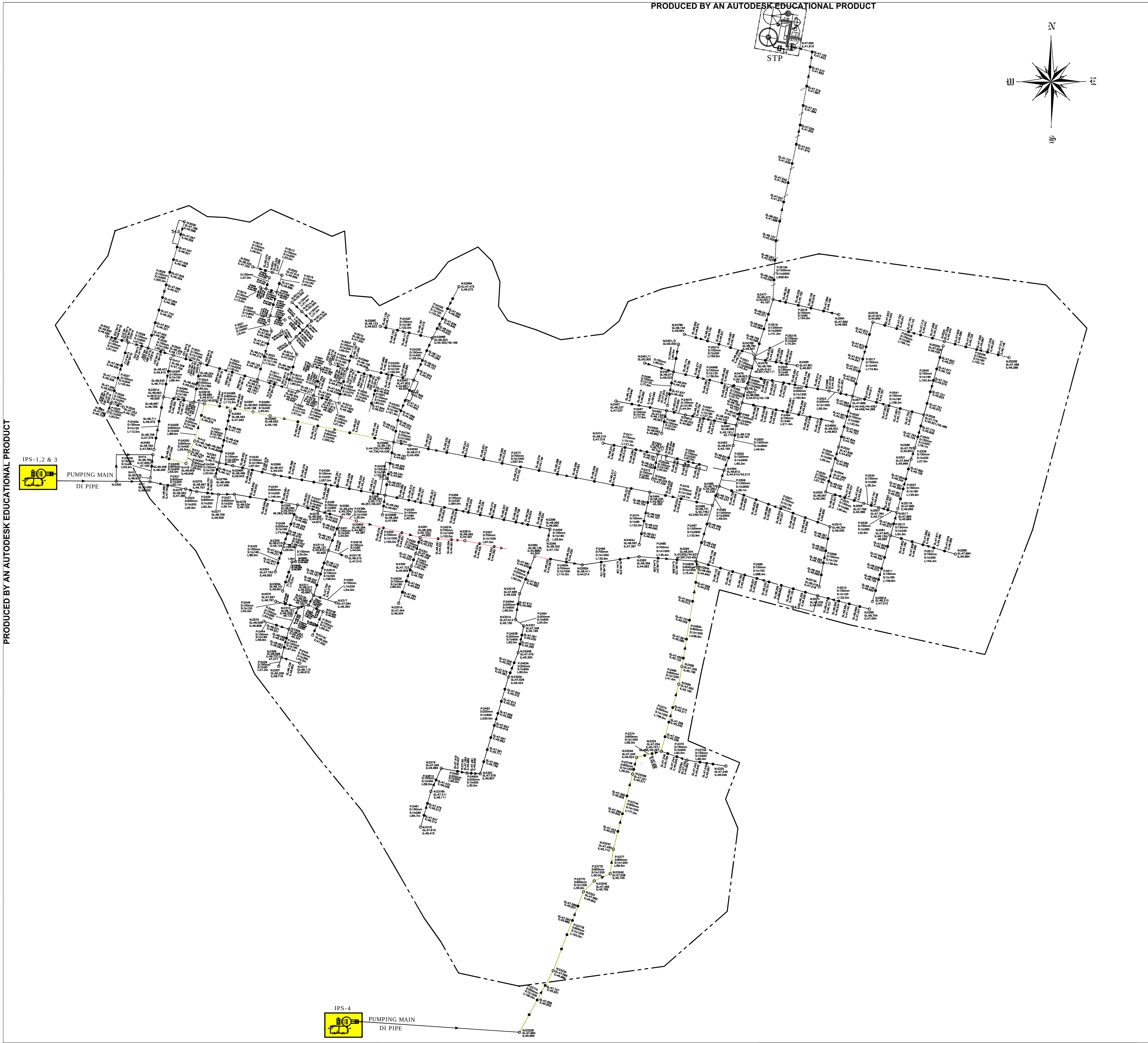
BIDDERS NAME:- TRI-TECH (BEIJING) COMPANY LTD.
BEIJING, NEW DELHI

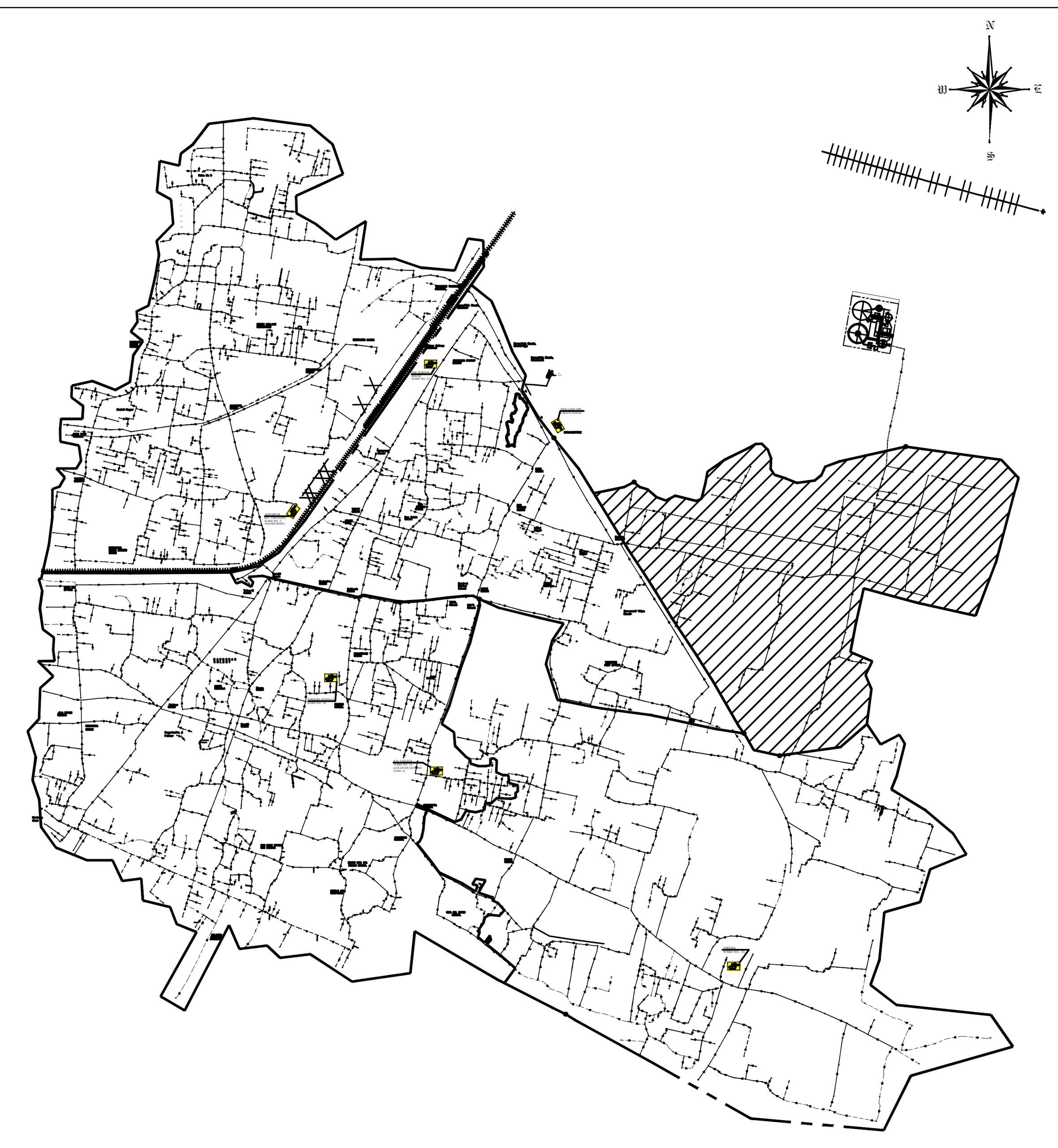
DATE:- 09.11.12
DRAWN.:- MS
CHKD.:- A. DUTT
APPD.:- A. DUTT

DRAWING TITLE:- SEWERAGE NETWORK CONSTUCTION DRAWING FOR ZONE-IV

SCALE	SHEET	DRAWING NO.	REV.
1:7150	1 OF 1	HJ/1051/SEW/CONST./04	2

PRODUCED BY AN AUTODESK EDUCATIONAL PRODUCT





KEY PLAN

LEGEND

1. SEWER PIPE	
2. NEW SEWER LINE	
3. SEWER NODE	
4. INSERT NODE	
5. FLOW DIRECTION	
6. DROP MANHOLE	
7. PIPE ID	P:2384
8. PIPE DIAMETER	D:200mm
9. PIPE SLOPE	S:1in 420
10. PIPE LENGTH	L:101.5m
11. ZONE BOUNDARY	
12. WARD BOUNDARY	

PIPE DIAMETER	PIPE COLORS
(A) PIPE Ø 150	
(B) PIPE Ø 200	
(F) PIPE Ø 600	
(G) PIPE Ø 700	
(I) PIPE Ø 1200	

REV.	DATE	DESCRIPTION	DRN.	CHKD	REVIEW	APPD.
5	03.10.13	REVISED AS PER BUIDCO COMMENTS ON DT. 26.08.13	PKB	SHIV	SHIV	ARUN
4	05.09.13	REVISED AS PER BUIDCO COMMENTS ON DT. 26.08.13	PKB	SHIV	SHIV	ARUN
3	27.02.13	REVISED AS PER DISCUSSED WITH BUIDCO COMMENTS ON DT. 26.02.13	MS	SBN	SHIV	RKS
2	01.02.13	REVISED AS PER BUIDCO COMMENTS	PB	SBN	SHIV	A. DUTT
1	28.12.12	ISSUED FOR GFC APPROVAL	PB	SBN	SHIV	A. DUTT

CLIENT:- BIHAR URBAN INFRASTRUCTURE DEVELOPMENT CORPORATION LTD., PATNA

PROJECT:- SEWERAGE NETWORK & 22 MLD STP PLANT FOR HAJIPUR TOWN

BIDDERS NAME:-

DRAWING TITLE:- SEWERAGE NETWORK CONSTUCTION DRAWING FOR ZONE-V

SCALE	SHEET	DRAWING NO.	REV.
1:1000	1 OF 1	HJ/1051/SEW/CONST./05	5

PRODUCED BY AN AUTODESK EDUCATIONAL PRODUCT
PRODUCED BY AN AUTODESK EDUCATIONAL PRODUCT
PRODUCED BY AN AUTODESK EDUCATIONAL PRODUCT

LAND HANDING OVER STATUS:-

DATED: 13-01-2013

S.NO.	PLANTS DESCRIPTION	STATUS (MARKED ON GROUND)	LOCATION	REFERENCE	REMARKS
1	STP (CRITICAL) 1st Requirement	1ST. LOCATION	NODE 2287	BUIDCO TENDER DPR (BUIDCO/SWG-STP/2010 -11/04 DT.02.08.2010)	
		2ND. LOCATION	DIGHI VILLAGE (NORTH SIDE OF RAILWAY CROS.)	APRIL'12 (AS SHOWN BY HAJIPUR NAGAR PARISHAD)	
		3RD. LOCATION	DIGHI VILLAGE (SOUTH SIDE OF RAILWAY CROS.)	PATRANK NO. 33B-15/11-4874 DT. 14.09.12	MARKED ON DT. 30.11.12
2	IPS-1 3rd Requirement	1ST. LOCATION	NODE 2535	BUIDCO TENDER DPR (BUIDCO/SWG-STP/2010 -11/04 DT.02.08.2010)	
		2ND. LOCATION	ANWARPUR RAILWAY CRO-SSING (W-05)	BUIDCO/SIU-3/YO/03/2012 234 DT. 08.10.12	NOC & COOR-DINATES STILL AWAITED
3	IPS-2 2nd Requirement	1ST. LOCATION	NODE 1593	BUIDCO TENDER DPR (BUIDCO/SWG-STP/2010 -11/04 DT.02.08.2010)	
		2ND. LOCATION	POKHRA MOHALLA (W-18)	BUIDCO/SIU-3/YO/03/2012 234 DT. 08.10.12	NOC & COOR-DINATES STILL AWAITED
4	IPS-3 1st Requirement	1ST. LOCATION- AS PER DESIGN REQUIREMENT	RN COLLEGE (W-26)	BUIDCO/SIU-3/YO/03/2012 234 DT. 08.10.12	
		2ND. LOCATION	PWD LAND (OPP. CIRCUIT HOUSE)	DEC'12 (AS CONFIRMED BY DM HAJIPUR)	NOC & COOR-DINATES STILL AWAITED
5	IPS-4 1st Requirement	1ST. LOCATION- AS PER DESIGN REQUIREMENT	JARUHA (W-36)	BUIDCO/SIU-3/YO/03/2012 234 DT. 08.10.12	NOC & COOR-DINATES STILL AWAITED

REV.	DATE	DESCRIPTION	DRN.	CHKD.	APPD.
01	15.01.13	REVISED AS PER UPDATED LOCATIONS	MS	SHIV	A.DUTT
00	30.11.12		MS	SHIV	A.DUTT

CLIENT:- BIHAR URBAN INFRASTRUCTURE DEVELOPMENT CORPORATION LTD., PATNA

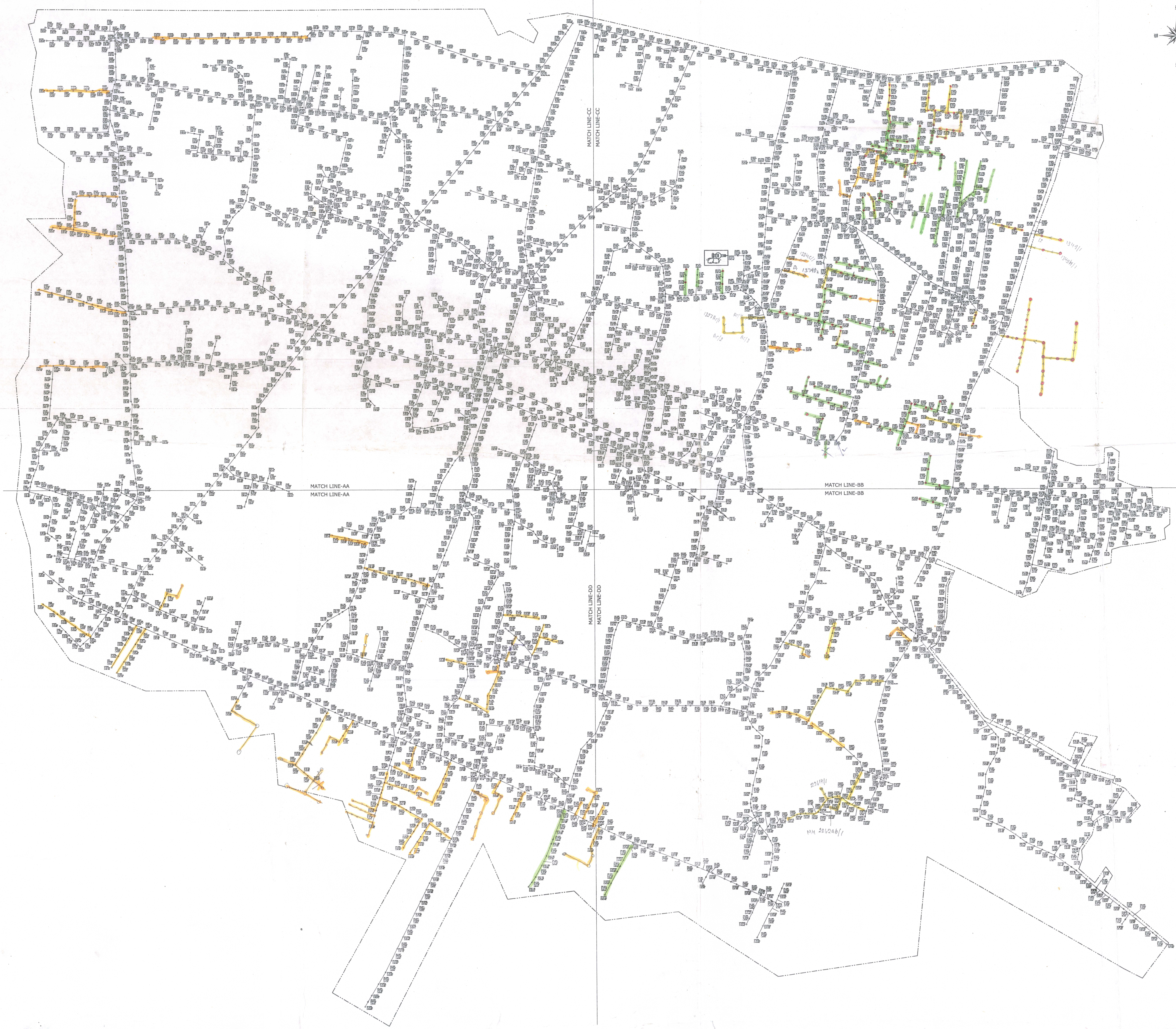
PROJECT:- SEWERAGE NETWORK & 22 MLD STP PLANT FOR HAJIPUR TOWN

BIDDERS NAME:- TRI-TECH (BEIJING) COMPANY LTD. BEIJING, NEW DELHI

DRAWING TITLE:- INTERLINKING OF TPS (STP) WITH DIFFERENT IPS

SCALE	SHEET	DRAWING NO.	REV.
1:7150	1 OF 1	HJ/1051/SEW/INTERLINK/04A	01

ZONE-2



KEY PLAN

LEGEND

1. SEWER PIPE	
2. SEWER NODE	
3. FLOW DIRECTION	
4. PIPE ID	P:2384
5. PIPE DIAMETER	D:200mm
6. PIPE SLOPE	S:1in 420
7. PIPE LENGTH	L:101.5m
8. ZONE BOUNDARY	
9. WARD BOUNDARY	

PIPE DIAMETER	PIPE COLORS
(A) PIPE Ø 150	
(B) PIPE Ø 200	
(C) PIPE Ø 250	
(D) PIPE Ø 300	
(E) PIPE Ø 350	
(B) PIPE Ø 400	
(F) PIPE Ø 450	
(F) PIPE Ø 600	
(G) PIPE Ø 700	

REV.	DATE	DESCRIPTION	DRN.	CHKD	REVIEW	APPD
03	02.06.14	SUBMISSION FOR APPROVAL	PB	MB	MB	AKS

CLIENT:- BIHAR URBAN INFRASTRUCTURE DEVELOPMENT CORPORATION LTD., PATNA

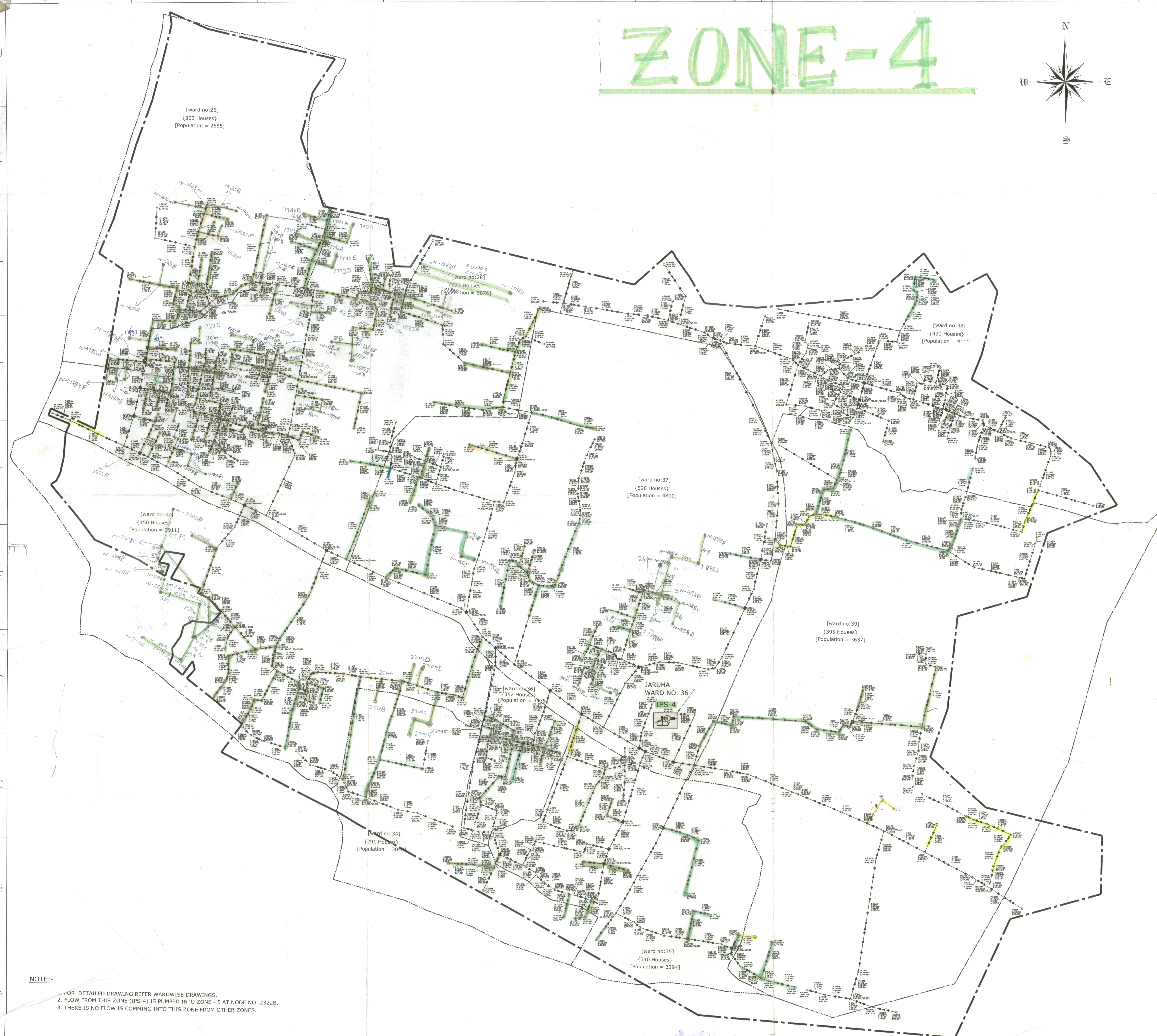
PROJECT:- SEWERAGE NETWORK & 22 MLD STP PLANT FOR HAJIPUR TOWN

BIDDERS NAME:- TRI-TECH (BEIJING) COMPANY LTD. BEIJING, NEW DELHI

DRAWING TITLE:- SEWERAGE NETWORK CONSTUCTION DRAWING FOR ZONE-I II

SCALE | SHEET | DRAWING NO.

ZONE-4



NOTE:-

1. FOR DETAILED DRAWING REFER WARDWISE DRAWINGS.
2. FLOW FROM THIS ZONE (IPS-4) IS PUMPED INTO ZONE - 5 AT NODE NO. 2322B.
3. THERE IS NO FLOW IS COMMING INTO THIS ZONE FROM OTHER ZONES.

KEY PLAN

LEGEND

1. SEWER PIPE
2. NEW SEWER LINE
3. SEWER NODE
4. INSERT NODE
5. DROP MAIN HOLE
6. FLOW DIRECTION
7. PIPE ID — P:2384
8. PIPE DIAMETER — D:200mm
9. PIPE SLOPE — S:1in 420
10. PIPE LENGTH — L:101.5m
11. ZONE BOUNDARY
12. WARD BOUNDARY

PIPE DIAMETER

PIPE COLORS

REV.	DATE	DESCRIPTION	DRN.	CHKD.	REVIEW	AP
1	04.04.13	AS PER ACTUAL SITE CONDITIONS	P.B.	S.EN.	SHIV	R.K
0	20.12.12	SUBMISSION FOR APPROVAL	M.S.	S.BN.	SHIV	A. D
0	10.11.12	SUBMISSION FOR APPROVAL	M.S.	S.B.I.	SHIV	A. D

CLIENT:- BIHAR URBAN INFRASTRUCTURE DEVELOPMENT CORPORATION LTD., PATNA

PROJECT:- SEWERAGE NETWORK & 22 MLD STP PLANT FOR HAJIPUR TOWN

BIDDERS NAME:- TRI-TECH (BEIJING) COMPANY LTD. BEIJING, NEW DELHI

DATE:- 09.11.12

DRAWN.:- MS

CHKD.:- A. DUTT

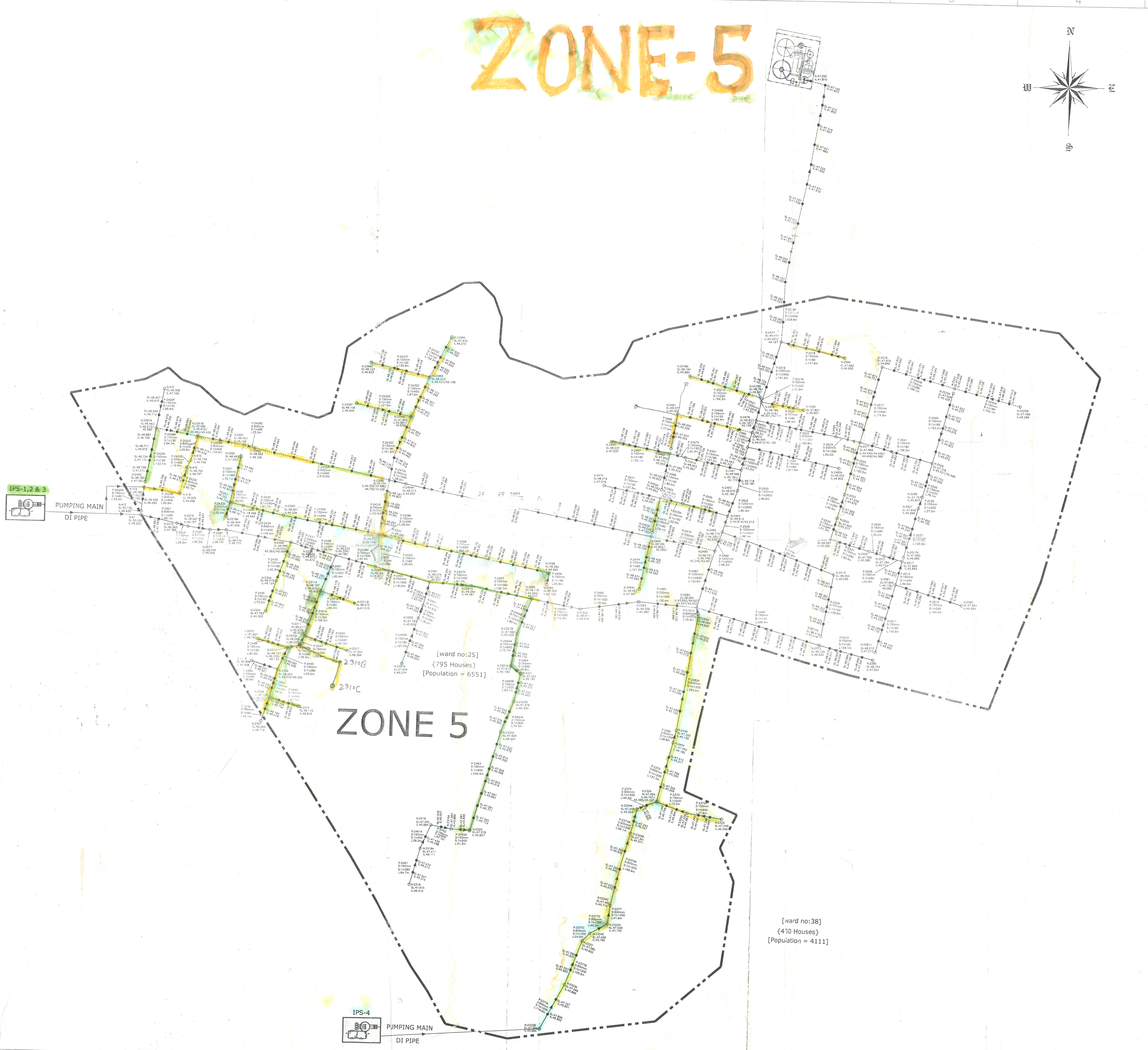
APPD.:- A. DUTT

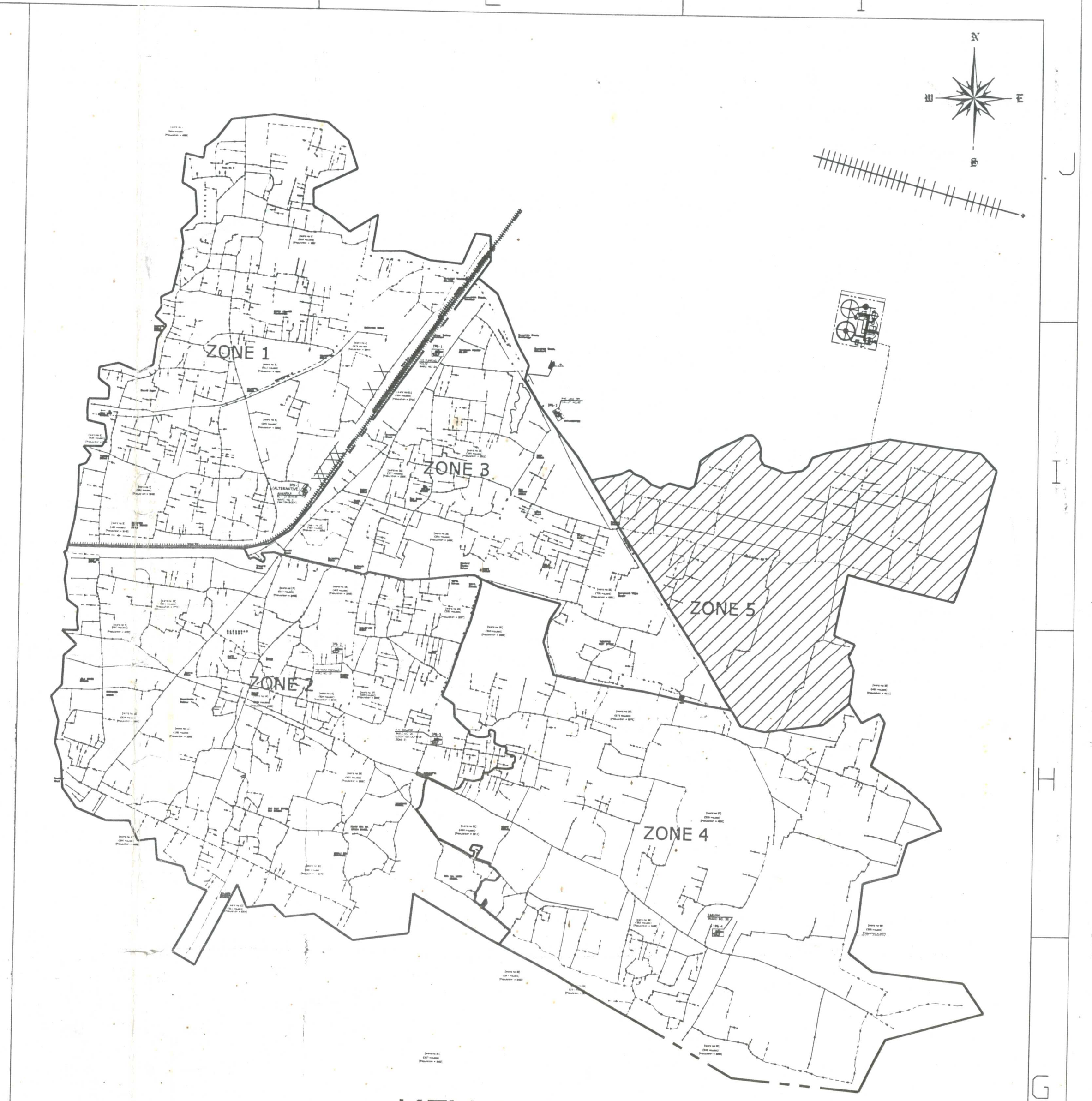
DRAWING TITLE:- SEWERAGE NETWORK CONSTUCTION DRAWING FOR ZONE-IV

SCALE: 1:7150

SHEET: 1 OF 1

DRAWING NO. HJ/1051/SEW/CONST./04





KEY PLAN

LEGEND

1. SEWER PIPE
2. NEW SEWER LINE
3. SEWER NODE
4. INSERT NODE
5. FLOW DIRECTION
6. PIPE ID — P.2384
7. PIPE DIAMETER — D:200mm
8. PIPE SLOPE — S:1in 420
9. PIPE LENGTH — L:101.5m
10. ZONE BOUNDARY

PIPE DIAMETER

(A) PIPE Ø 150
(B) PIPE Ø 200
(F) PIPE Ø 600
(G) PIPE Ø 700
(I) PIPE Ø 1200

PIPE COLORS

REV.	DATE	DESCRIPTION	DRN.	CHKD	REVIEW	APPD.
5	03.10.13	REVISED AS PER BUIDCO COMMENTS ON DT. 26.09.13	PKB	SHIV	SHIV	ARUN
4	05.09.13	REVISED AS PER BUIDCO COMMENTS ON DT. 26.08.13	PKB	SHIV	SHIV	ARUN
3	27.02.13	REVISED AS PER DISCUSSED WITH BUIDCO COMMENTS ON DT. 26.02.13	MS	SBN	SHIV	RKS
2	01.02.13	REVISED AS PER BUIDCO COMMENTS	PB	SBN	SHIV	A. DUTT
1	28.12.12	ISSUED FOR GFC APPROVAL	PB	SBN	SHIV	A. DUTT

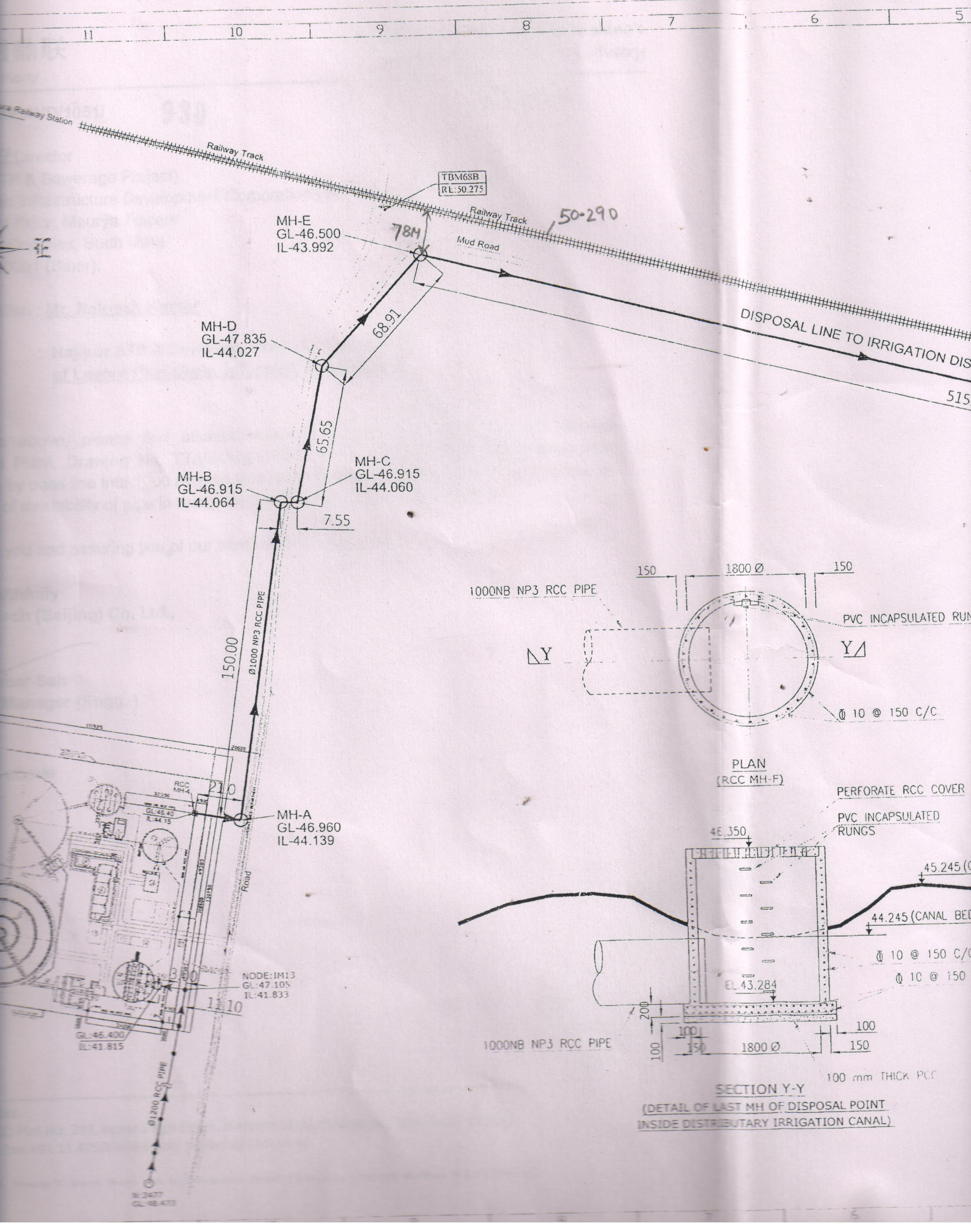
CLIENT:- BIHAR URBAN INFRASTRUCTURE DEVELOPMENT CORPORATION LTD., PATNA

PROJECT:- SEWERAGE NETWORK & 22 MLD STP PLANT FOR HAJIPUR TOWN

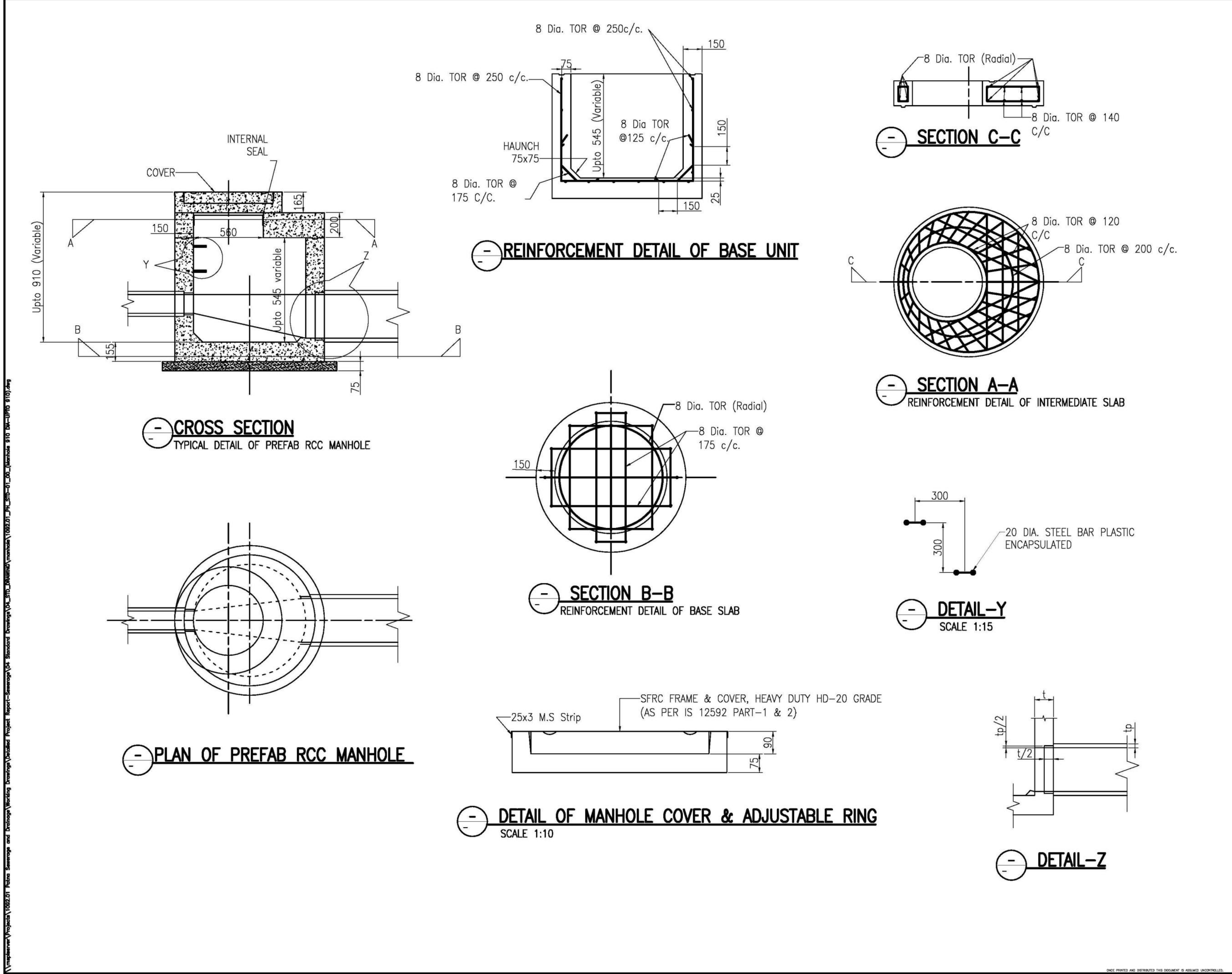
BIDDERS NAME:- TRI-TECH (BEIJING) COMPANY LTD. BEIJING, NEW DELHI

DRAWING TITLE:- SEWERAGE NETWORK CONSTUCTION DRAWING FOR ZONE-V

SCALE	SHEET	DRAWING NO.	REV.
1:1000	1 OF 1	HJ/1051/SEW/CONST./05	5



11
10
9
8
7
6
5
Railway Station
Railway Track
TBM6SB
RL:50.275
Railway Track
50-290
78M
Mud Road
MH-E
GL-46.500
IL-43.992
DISPOSAL LINE TO IRRIGATION DIS
515
68.91
MH-D
GL-47.835
IL-44.027
65.65
MH-C
GL-46.915
IL-44.060
MH-B
GL-46.915
IL-44.064
7.55
150.00
Ø1000 NP3 RCC PIPE
21.0
RCC MH-4
GL-46.40
IL-44.15
MH-A
GL-46.960
IL-44.139
Road
NODE:IM13
GL:47.105
IL:41.833
3.00
11.10
GL:46.400
IL:41.815
Ø1200 RCC PIPE
N:2477
GL:48.473
150
1800 Ø
150
1000NB NP3 RCC PIPE
PVC INCAPSULATED RUN
Y
Y
Ø 10 @ 150 C/C
PLAN
(RCC MH-F)
PERFORATE RCC COVER
PVC INCAPSULATED RUNGS
46.350
45.245 (C
44.245 (CANAL BED
Ø 10 @ 150 C/C
Ø 10 @ 150
EL 43.284
200
100
100
150
1800 Ø
100
150
1000NB NP3 RCC PIPE
100 mm THICK PCC
SECTION Y-Y
(DETAIL OF LAST MH OF DISPOSAL POINT INSIDE DISTRIBUTARY IRRIGATION CANAL)



NOTES:-

1. ALL DIMENSIONS ARE IN MM.
2. MINIMUM CLEAR COVER 37 MM, EXCEPT BASE SLAB, WHERE MINIMUM CLEAR COVER IS 25 MM.
3. GRADE OF CONCRETE M30.
4. GR. OF STEEL Fe 415, CONFIRMING TO IS 1786
5. MAXIMUM BEARING PRESSURE 6.94 T/SQ.M.
6. SCALE 1:20, UNLESS OTHERWISE STATED

CLIENT:-

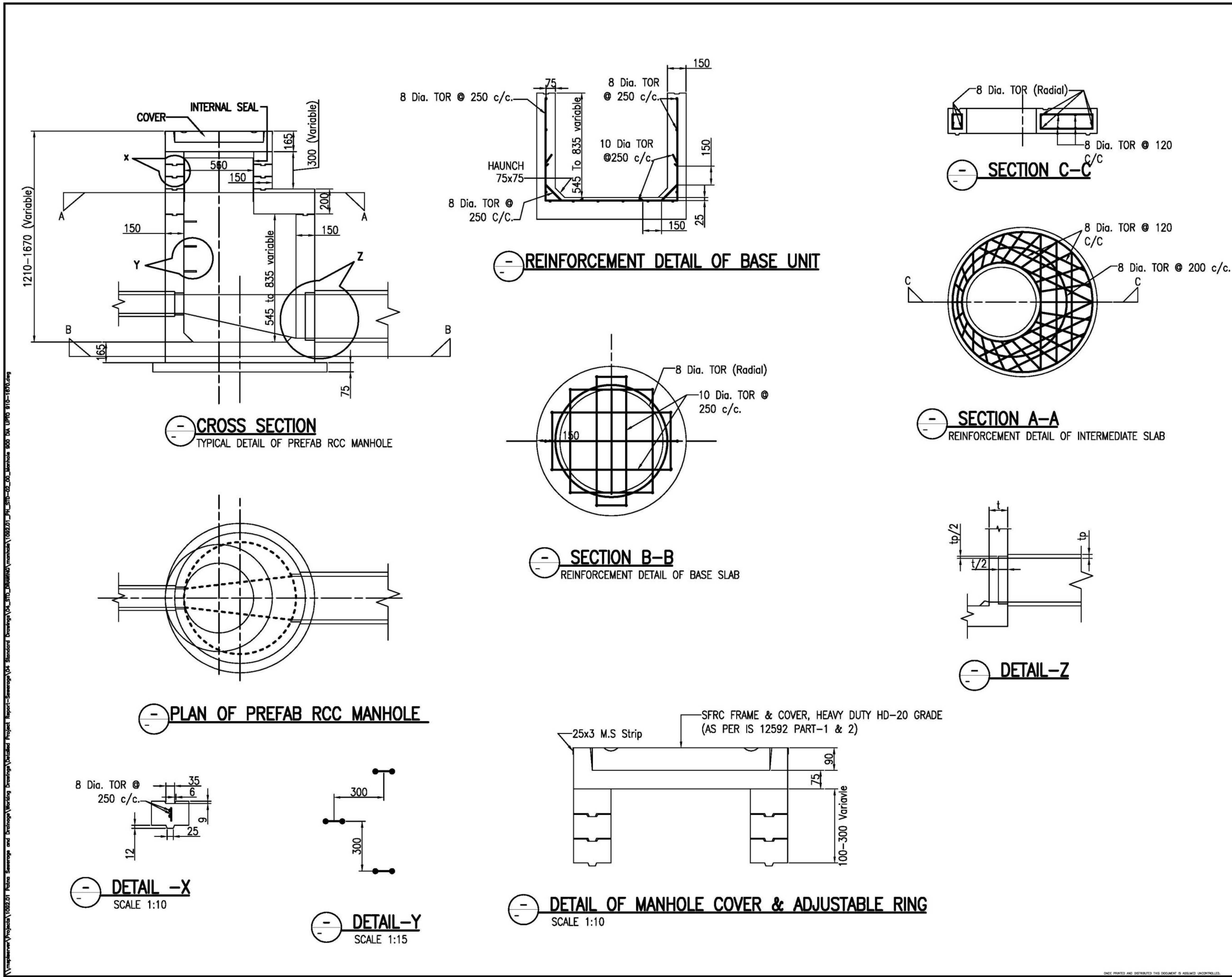
BIHAR
URBAN INFRASTRUCTURE
DEVELOPMENT CORPORATION

303,Maurya Tower,
Budh Marg, Patna - 800 001
Phone - (0612) 2210101, Fax - (0612) 2210103
Website:- http://www.buidco.in.

DRAWING TITLE

910 DIA. MANHOLE,DEPTH UPTO 0.91 M, MAX.SIZE OF OUT GOING PIPE 350 NP-2

PURPOSE OF ISSUE		SCALE :- 1 : 20	
DRAFT DETAILED PROJECT REPORT		SHEET SIZE :-A3	
	BY	DATE OF FIRST ISSUE	
DRAWN	SKS	MAY 2013	
DESIGNED	JR	MAY 2013	
CHECKED	RP	MAY 2013	
APPROVED	CRR	MAY 2013	
JOB NO.	DISCIPLINE	DRAWING NO.	REVISION
1092.01	PH	STD-01	00



NOTES:-

1. ALL DIMENSIONS ARE IN MM.
2. MINIMUM CLEAR COVER 37 MM, EXCEPT BASE SLAB, WHERE MINIMUM CLEAR COVER IS 25 MM.
3. GRADE OF CONCRETE M30.
4. GR. OF STEEL Fe 415, CONFIRMING TO IS 1786
5. MAXIMUM BEARING PRESSURE 6.94 T/SQ.M.
6. SCALE 1:20, UNLESS OTHERWISE STATED

CLIENT:-

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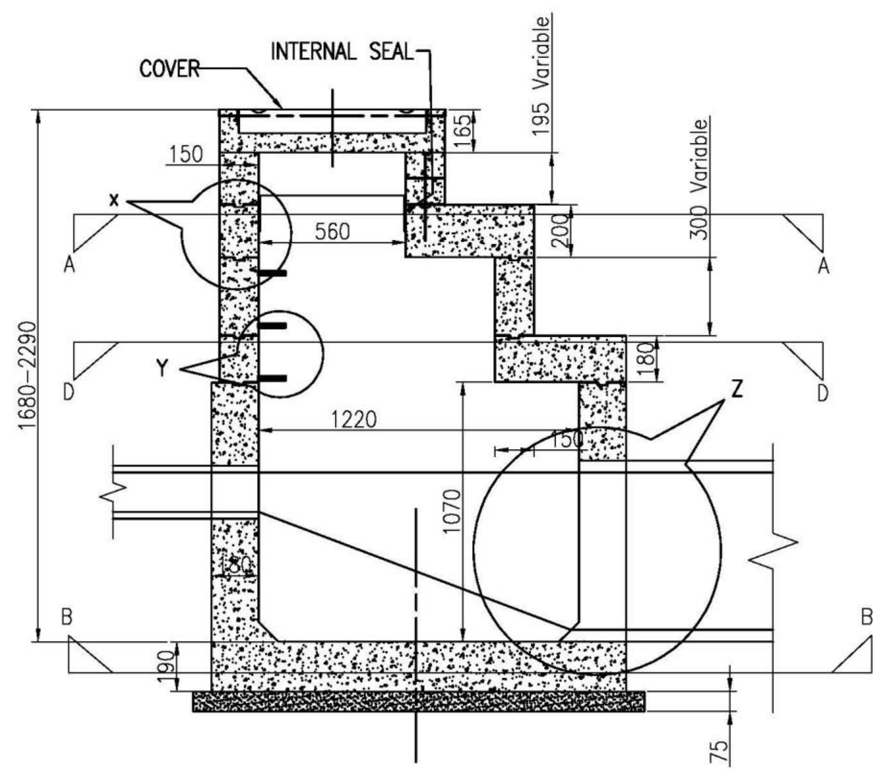
Phone - (0612) 2210101, Fax - (0612) 2210103
Website:- http://www.buidco.in.

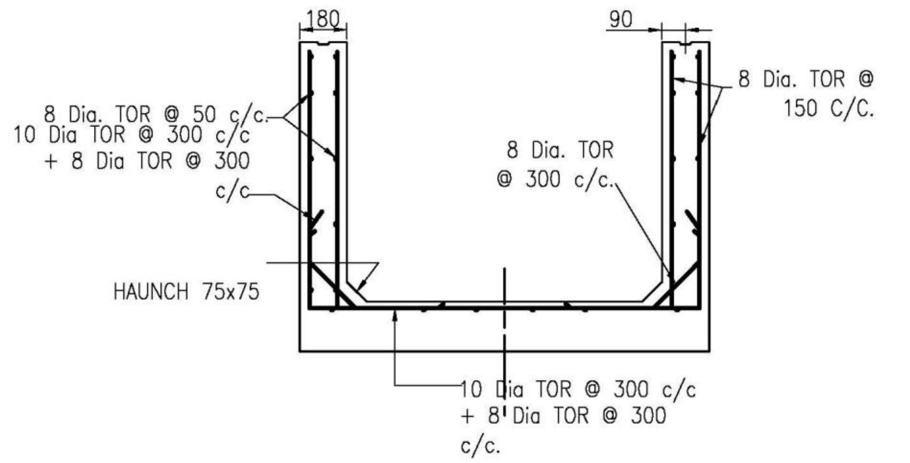
DRAWING TITLE

910 DIA. MANHOLE, DEPTH 0.91–1.67 M, MAX.SIZE OF OUT GOING PIPE 400 NP–2

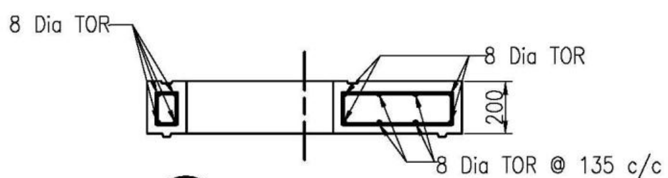
PURPOSE OF ISSUE		SCALE :- 1 : 20	
DRAFT DETAILED PROJECT REPORT		SHEET SIZE :- A3	
	BY	DATE OF FIRST ISSUE	
DRAWN	SKS	MAY 2013	
DESIGNED	JR	MAY 2013	
CHECKED	RP	MAY 2013	
APPROVED	CRR	MAY 2013	
JOB NO.	DISCIPLINE	DRAWING NO.	REVISION
1092.01	PH	STD–02	00



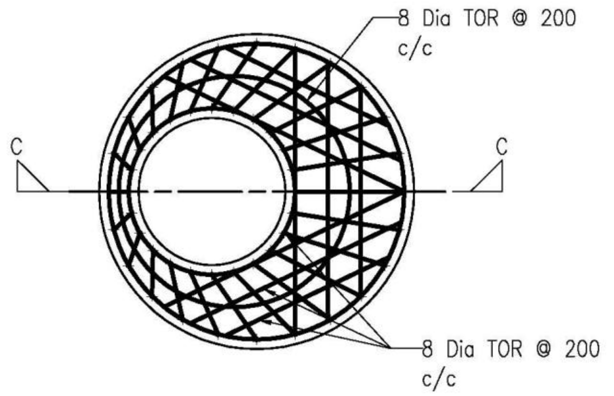
CROSS SECTION
TYPICAL DETAIL OF PREFAB RCC MANHOLE



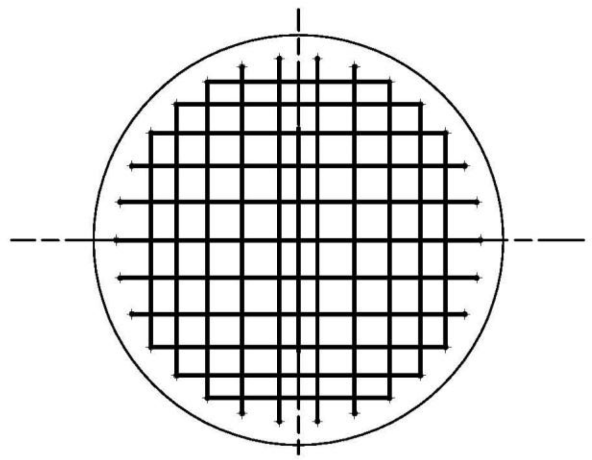
REINFORCEMENT DETAIL OF BASE UNIT



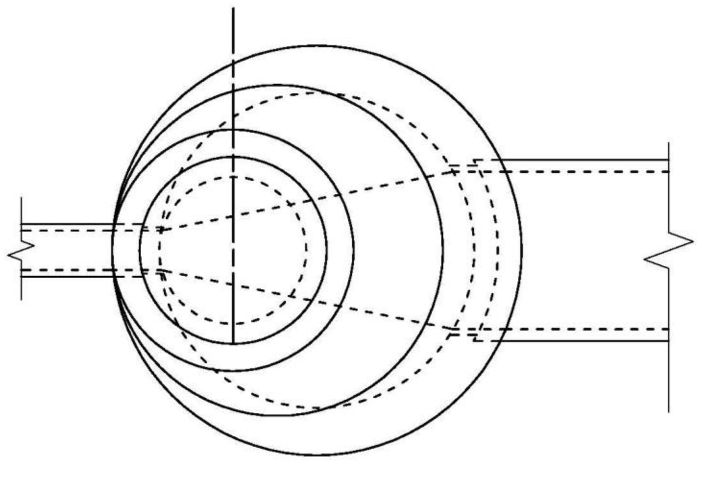
SECTION C–C



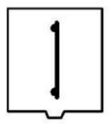
SECTION A–A
REINFORCEMENT DETAIL OF INTERMEDIATE SLAB



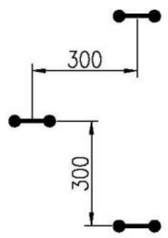
SECTION B–B
REINFORCEMENT DETAIL OF BASE SLAB



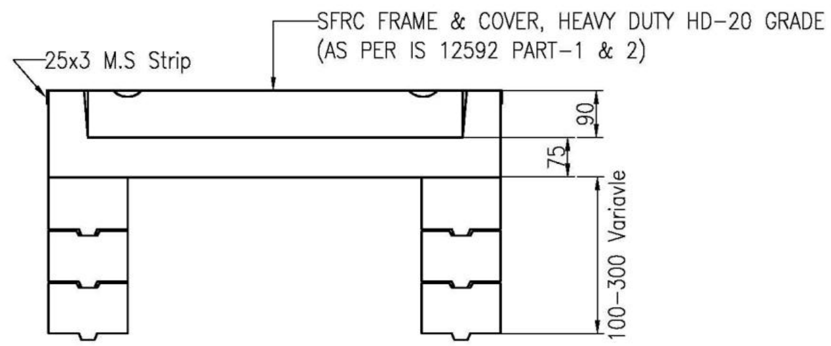
PLAN OF PREFAB RCC MANHOLE



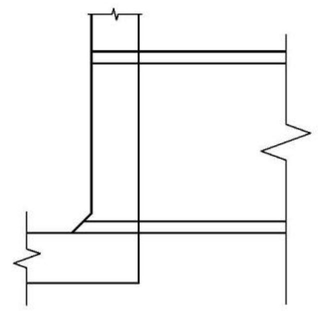
DETAIL –X
SCALE 1:10



DETAIL–Y
SCALE 1:15



DETAIL OF MANHOLE COVER & ADJUSTABLE RING
SCALE 1:10



DETAIL–Z

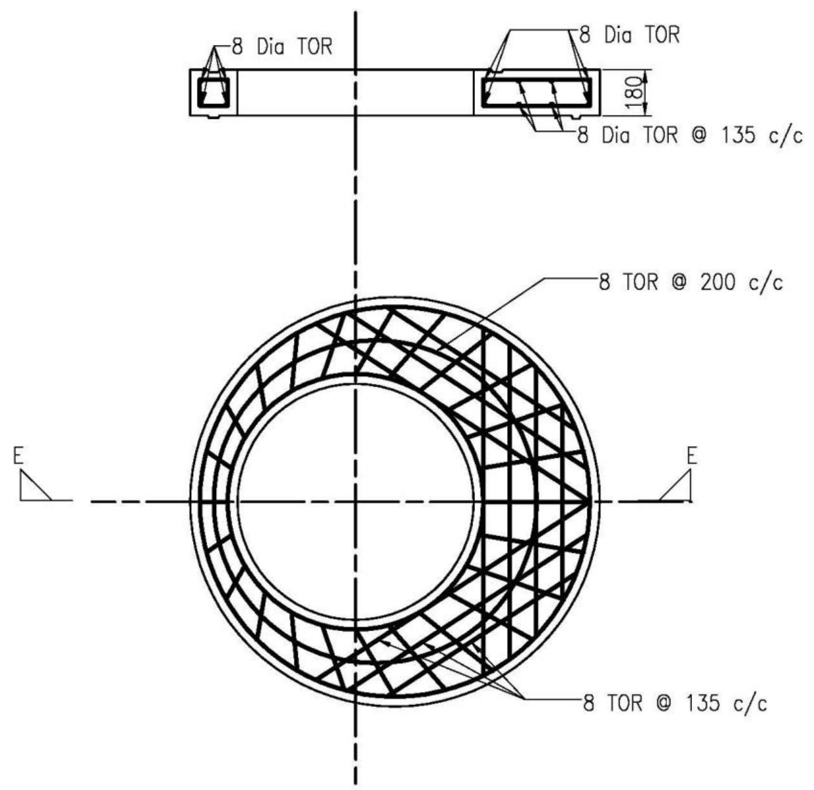
NOTES:–
1. ALL DIMENSIONS ARE IN MM.
2. MINIMUM CLEAR COVER 37 MM, EXCEPT BASE SLAB, WHERE MINIMUM CLEAR COVER IS 25 MM.
3. GRADE OF CONCRETE M30.
4. GR. OF STEEL Fe 415, CONFIRMING TO IS 1786
5. MAXIMUM BEARING PRESSURE 6.94 T/SQ.M.
6. SCALE 1:20, UNLESS OTHERWISE STATED

CLIENT:-
BIHAR
URBAN INFRASTRUCTURE
DEVELOPMENT CORPORATION
303,Maurya Tower,
Budh Marg, Patna - 800 001
Phone - (0612) 2210101, Fax - (0612) 2210103
Website:- http://www.buidco.in.

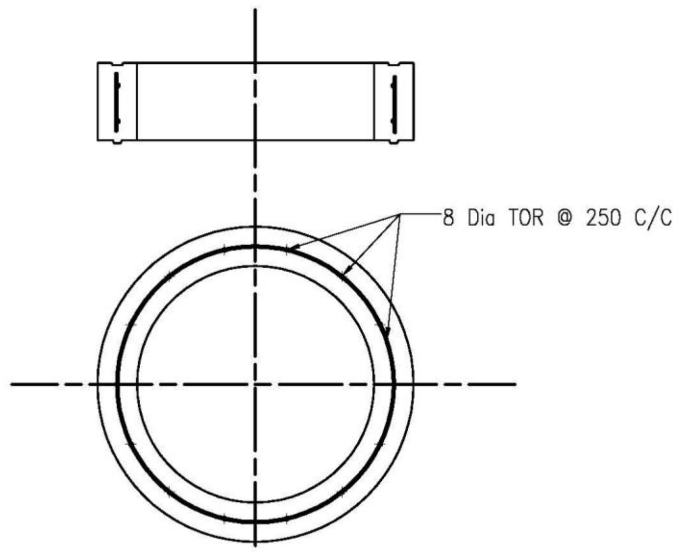
DRAWING TITLE
1220 DIA. MANHOLE, DEPTH UPTO 1.68 M, MAX.SIZE OF OUT GOING PIPE 600 NP–3
SHEET – 1/2

PURPOSE OF ISSUE		SCALE :- 1 : 20
DRAFT DETAILED PROJECT REPORT		SHEET SIZE :- A3
	BY	DATE OF FIRST ISSUE
DRAWN	SKS	MAY 2013
DESIGNED	JR	MAY 2013
CHECKED	RP	MAY 2013
APPROVED	CRR	MAY 2013

JOB NO.	DISCIPLINE	DRAWING NO.	REVISION
1092.01	PH	STD–03	00



SECTION D–D
REINFORCEMENT DETAIL OF BOTTOM INTERMEDIATE SLAB



REINFORCEMENT DETAIL OF INTERMEDIATE RING

NOTES:–

1. ALL DIMENSIONS ARE IN MM.
2. MINIMUM CLEAR COVER 37 MM, EXCEPT BASE SLAB, WHERE MINIMUM CLEAR COVER IS 25 MM.
3. GRADE OF CONCRETE M30.
4. GR. OF STEEL Fe 415, CONFIRMING TO IS 1786
5. MAXIMUM BEARING PRESSURE 6.94 T/SQ.M.
6. SCALE 1:20, UNLESS OTHERWISE STATED

CLIENT:-

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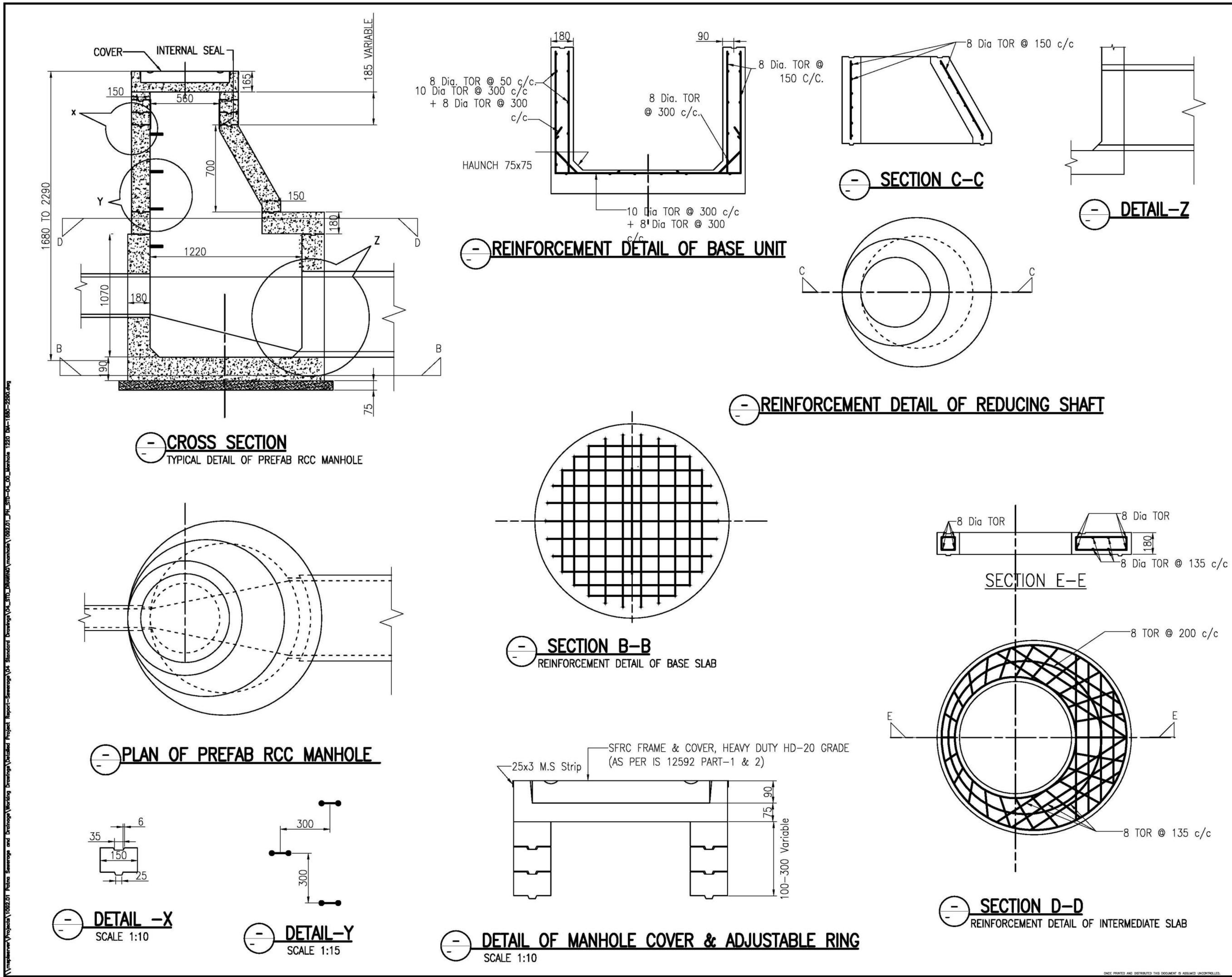
Phone - (0612) 2210101, Fax - (0612) 2210103
Website:- http://www.buidco.in.

DRAWING TITLE

1220 DIA. MANHOLE, DEPTH UPTO 1.68 M, MAX.SIZE OF OUT GOING PIPE 600 NP–3
SHEET – 2/2

PURPOSE OF ISSUE		
DRAFT DETAILED PROJECT REPORT		SCALE :- 1 : 20
		SHEET SIZE :- A3
	BY	DATE OF FIRST ISSUE
DRAWN	SKS	MAY 2013
DESIGNED	JR	MAY 2013
CHECKED	RP	MAY 2013
APPROVED	CRR	MAY 2013
JOB NO.	DISCIPLINE	DRAWING NO. / REVISION
1092.01	PH	STD–03 / 00

\\mepleserver\Projects\1092.01 Patna Sewerage and Drainage\Working Drawings\Detailed Project Report-Sewerage\04 Standard Drawings\04_STD_DRAWING\manhole\1092.01_PH_STD-03_00_Manhole 1220 DIA-UPTO 1680.dwg



NOTES:-

1. ALL DIMENSIONS ARE IN MM.
2. MINIMUM CLEAR COVER 37 MM, EXCEPT BASE SLAB, WHERE MINIMUM CLEAR COVER IS 25 MM.
3. GRADE OF CONCRETE M30.
4. GR. OF STEEL Fe 415, CONFIRMING TO IS 1786
5. MAXIMUM BEARING PRESSURE 6.94 T/SQ.M.
6. SCALE 1:20, UNLESS OTHERWISE STATED

CLIENT:-

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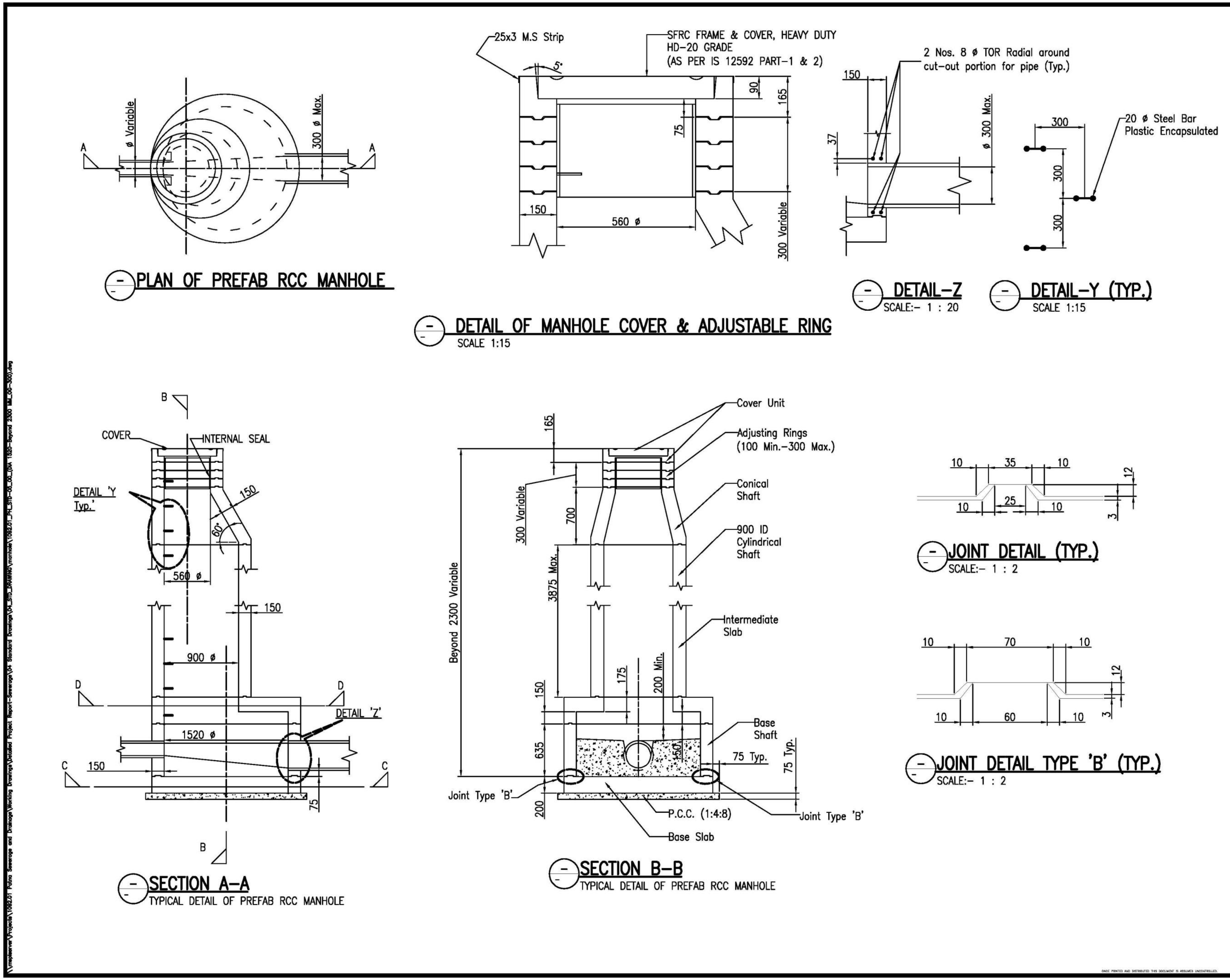
Website:- http://www.buidco.in.

DRAWING TITLE

1220 DIA. MANHOLE, DEPTH 1.68 TO 2.29 M, MAX.SIZE OF OUT GOING PIPE 800 NP-3

PURPOSE OF ISSUE		SCALE :- 1 : 20
DRAFT DETAILED PROJECT REPORT		SHEET SIZE :- A3
	BY	DATE OF FIRST ISSUE
DRAWN	SKS	MAY 2013
DESIGNED	JR	MAY 2013
CHECKED	RP	MAY 2013
APPROVED	CRR	MAY 2013

JOB NO.	DISCIPLINE	DRAWING NO.	REVISION
1092.01	PH	STD-04	00



NOTES:-

1. ALL DIMENSIONS ARE IN MM.
2. MINIMUM CLEAR COVER 37 MM, EXCEPT BASE SLAB, WHERE MINIMUM CLEAR COVER IS 25 MM.
3. GRADE OF CONCRETE M30.
4. GR. OF STEEL Fe 415, CONFIRMING TO IS 1786
5. ALL JOINTS ARE JOINT TYPE A EXCEPT JOINTS MARKED AS JOINT TYPE 'B' IN SECTION 'B-B'
6. SCALE 1:30, UNLESS OTHERWISE STATED

CLIENT:-

BIHAR
URBAN INFRASTRUCTURE
DEVELOPMENT CORPORATION

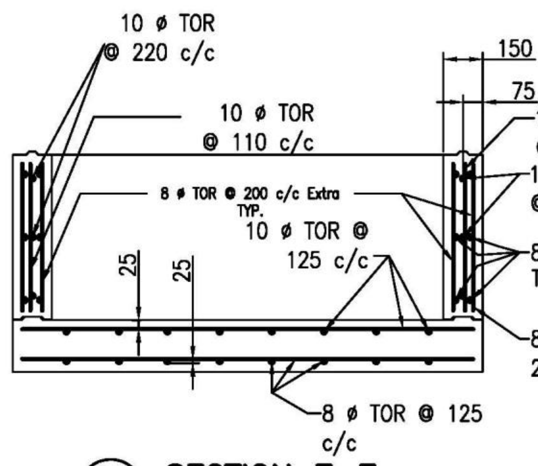
303,Maurya Tower,
Budh Marg, Patna - 800 001
Phone - (0612) 2210101, Fax - (0612) 2210103
Website:- http://www.buidco.in

DRAWING TITLE

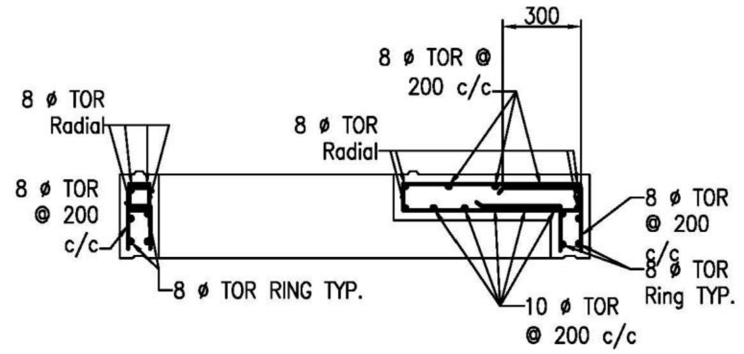
ø 1520 Manhole, Depth beyond 2.30 M, Max. Size of Outgoing Pipe ø 300 NP-2 with 60° Conical Shaft
SHEET - 1/2

PURPOSE OF ISSUE: DRAFT DETAILED PROJECT REPORT		SCALE:- 1 : 30
		SHEET SIZE:- A3
	BY	DATE OF FIRST ISSUE
DRAWN	SKS	MAY 2013
DESIGNED	JR	MAY 2013
CHECKED	RP	MAY 2013
APPROVED	CRR	MAY 2013

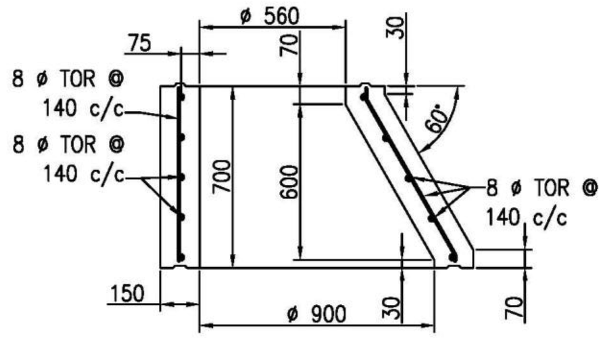
JOB NO.	DISCIPLINE	DRAWING NO.	REVISION
1092.01	PH	STD-05	00



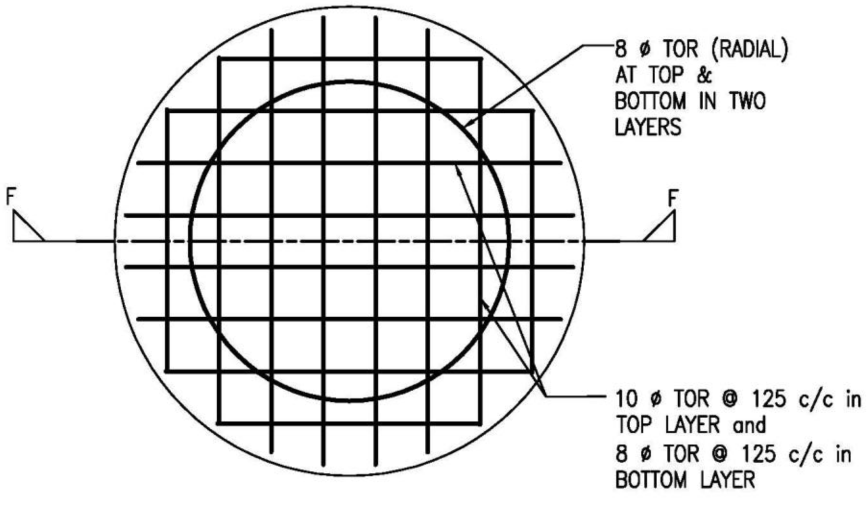
SECTION F–F



SECTION E–E

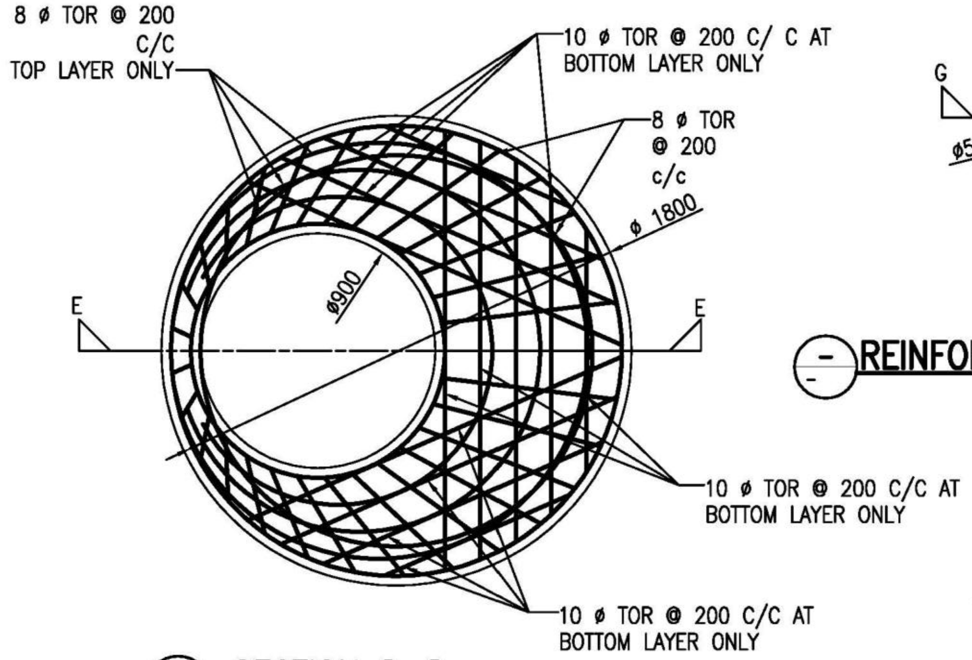


SECTION G–G



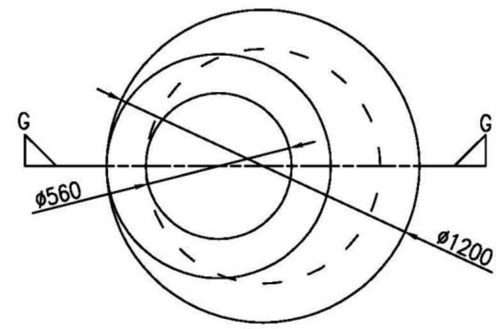
SECTION C–C

REINFORCEMENT DETAIL OF BASE SLAB & BASE SHAFT

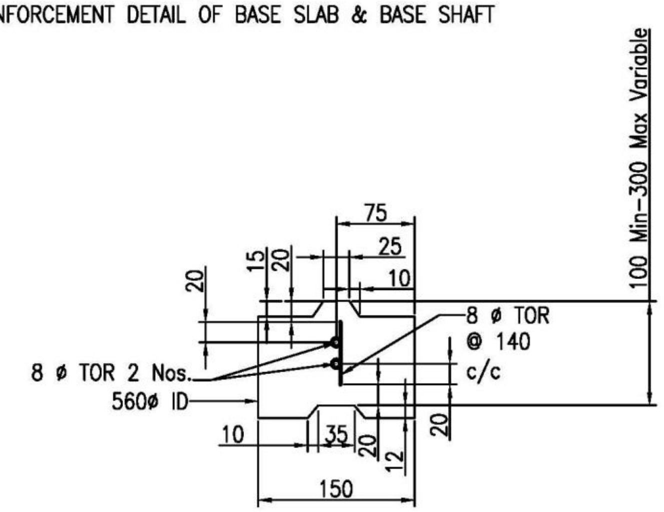


SECTION D–D

REINFORCEMENT DETAIL OF INTERMEDIATE SLAB

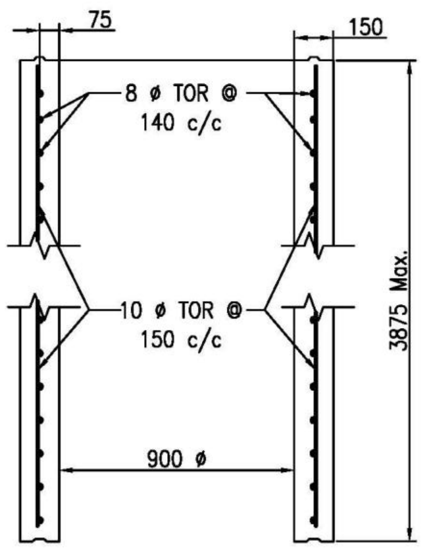


REINFORCEMENT DETAIL OF CONICAL SHAFT



REINFORCEMENT DETAIL OF ADJUSTING RING

SCALE:– 1 :5



REINFORCEMENT DETAIL OF 900 ID CYLINDRICAL SHAFT

SCALE 1:20, UNLESS OTHERWISE STATED

NOTES:–

1. ALL DIMENSIONS ARE IN MM.
2. MINIMUM CLEAR COVER 37 MM, EXCEPT BASE SLAB, WHERE MINIMUM CLEAR COVER IS 25 MM.
3. GRADE OF CONCRETE M30.
4. GR. OF STEEL Fe 415, CONFIRMING TO IS 1786
5. ALL JOINTS ARE JOINT TYPE A EXCEPT JOINTS MARKED AS JOINT TYPE 'B' IN SECTION 'B-B'
6. SCALE 1:20, UNLESS OTHERWISE STATED

CLIENT:-

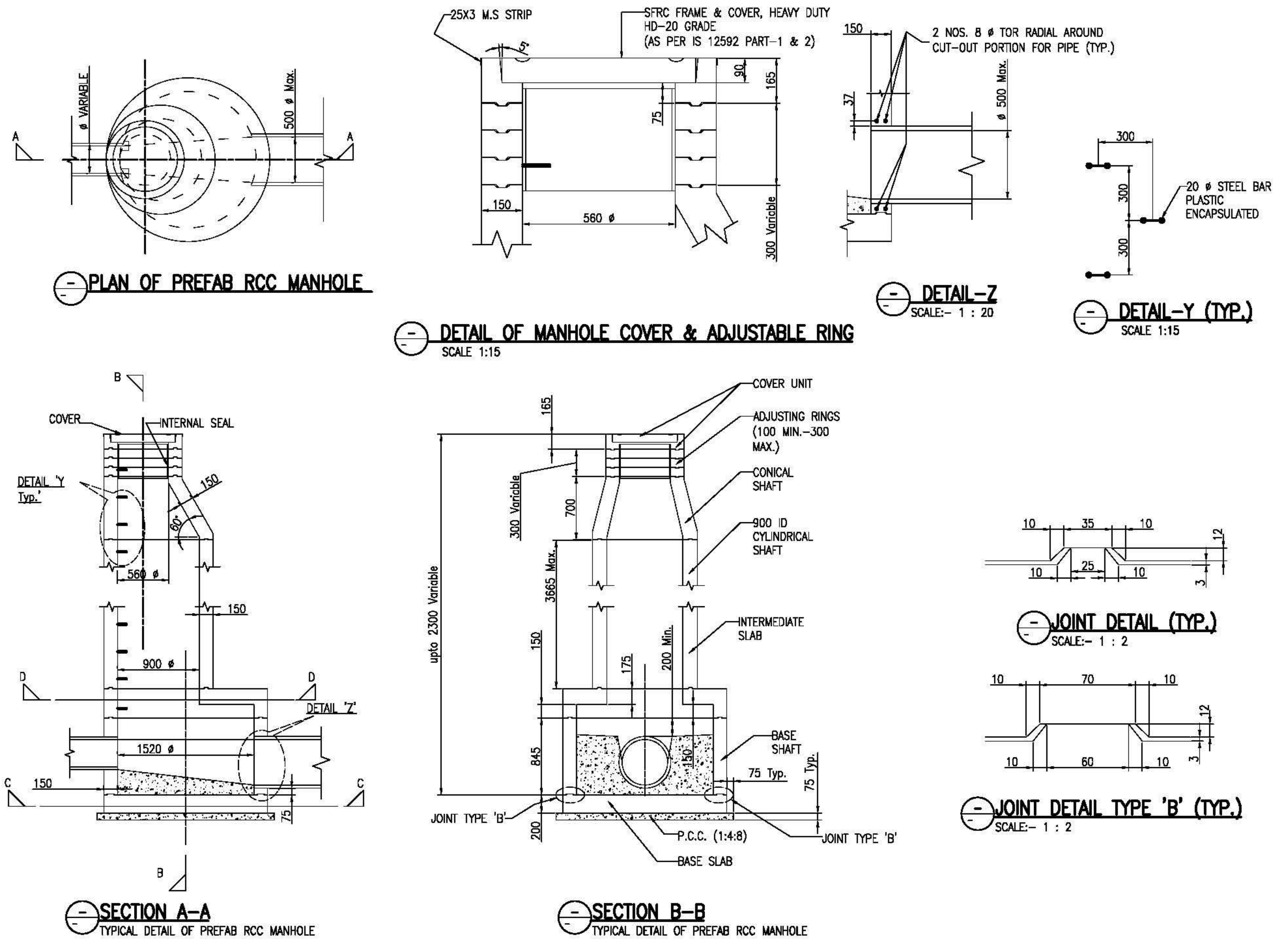
BIHAR
URBAN INFRASTRUCTURE
DEVELOPMENT CORPORATION

303,Maurya Tower,
Buch Marg, Patna - 800 001
Phone - (0612) 2210101, Fax - (0612) 2210103
Website:- http://www.buidco.in.

DRAWING TITLE

ø 1520 Manhole, Depth beyond 2.30 M, Max. Size of Outgoing Pipe ø 300 NP-2 with 60° Conical Shaft
SHEET – 2/2

PURPOSE OF ISSUE		SCALE:- 1 : 20	
DRAFT DETAILED PROJECT REPORT		SHEET SIZE:- A3	
	BY	DATE OF FIRST ISSUE	
DRAWN	SKS	MAY 2013	
DESIGNED	JR	MAY 2013	
CHECKED	RP	MAY 2013	
APPROVED	CRR	MAY 2013	
JOB NO.	DISCIPLINE	DRAWING NO.	REVISION
1092.01	PH	STD–05	00



NOTES:-

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3. GRADE OF CONCRETE M30.
4. GR. OF STEEL Fe 415, CONFIRMING TO IS 1786
5. ALL JOINTS ARE JOINT TYPE A EXCEPT JOINTS MARKED AS JOINT TYPE 'B' IN SECTION 'B-B'
6. SCALE 1:30, UNLESS OTHERWISE STATED

Drawing Base Reference:-
PMC WORK ORDER 3480, DATED 15 DECEMBER 2009.

REV	DATE	NAME	DESCRIPTION	CHKD
00	MAY'13	SKS	DRAFT DPR SUBMISSON	RP

AMENDMENTS

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CLIENT:-
BIHAR URBAN INFRASTRUCTURE DEVELOPMENT CORPORATION

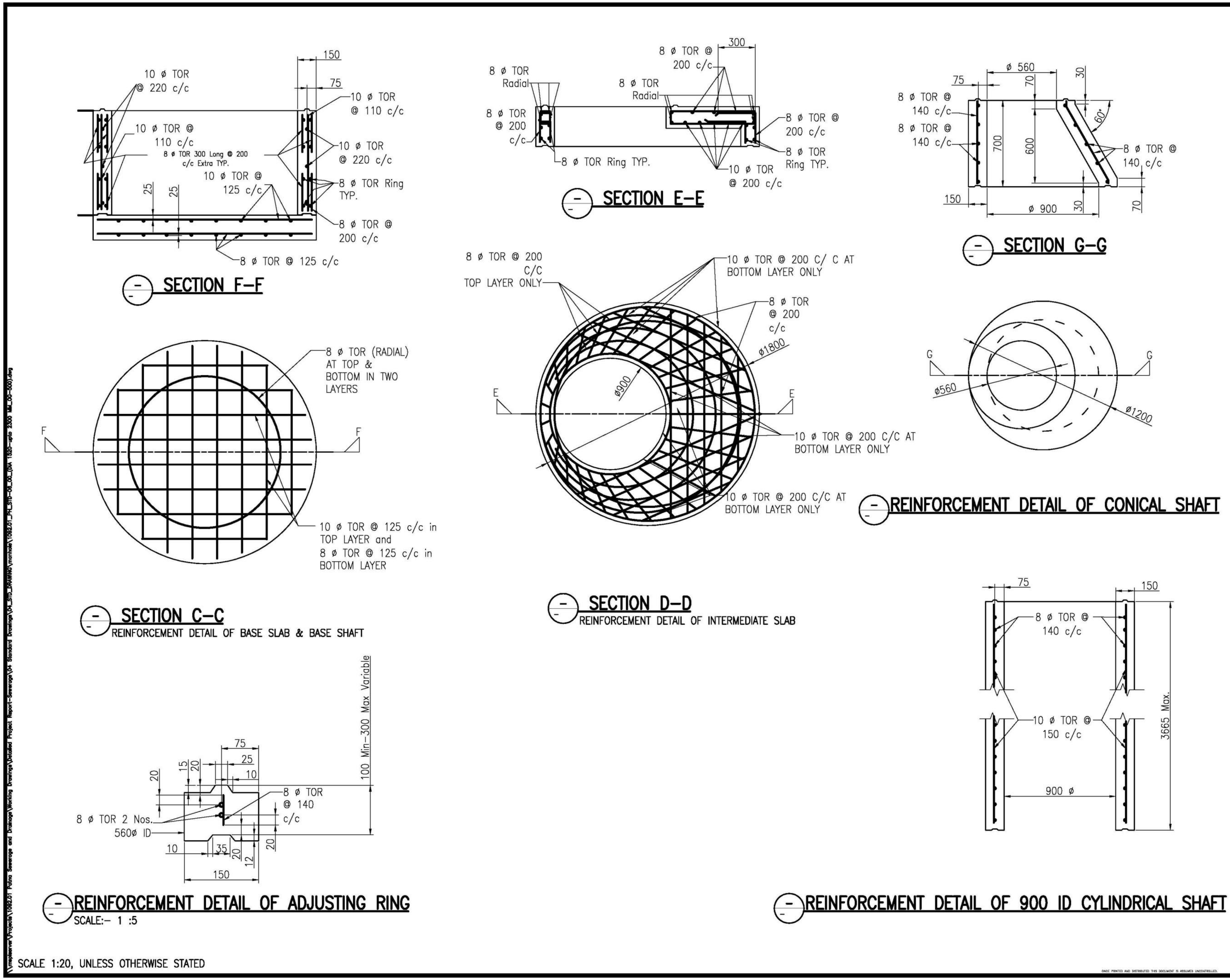
PROJECT:-
PREPARATION OF DETAILED PROJECT REPORTS (DPRs) & BID DOCUMENTS; TENDERING FOR EXECUTION; CONSTRUCTION SUPERVISION & QUALITY CONTROL OF SEWERAGE & DRAINAGE PROJECTS OF PATNA UNDER JNNURM

CONSULTANT:-
MEINHARDT
MEINHARDT (SINGAPORE) PTE. LTD.
A-8, Sector-16, Noida-201301, India
Ph.:- +91 120 2516165, Fax No.:- +91 120 2515745
www.meinhardtgroup.com, Email:-info@meinhardtindia.com

DRAWING TITLE
ø 1520 Manhole, Depth upto 2.30 M, Max. Size of Outgoing Pipe ø 500 NP-2 with 60° Conical Shaft
SHEET - 1/2

PURPOSE OF ISSUE		SCALE:- 1 : 30
DRAFT DETAILED PROJECT REPORT		SHEET SIZE :- A3
	BY	DATE OF FIRST ISSUE
DRAWN	SKS	MAY 2013
DESIGNED	JR	MAY 2013
CHECKED	RP	MAY 2013
APPROVED	CRR	MAY 2013

JOB NO.	DISCIPLINE	DRAWING NO.	REVISION
1082.01	PH	STD-06	00



NOTES:-

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4. GR. OF STEEL Fe 415, CONFIRMING TO IS 1786
5. ALL JOINTS ARE JOINT TYPE A EXCEPT JOINTS MARKED AS JOINT TYPE 'B' IN SECTION 'B-B'
6. SCALE 1:20, UNLESS OTHERWISE STATED

CLIENT:-

BIHAR URBAN INFRASTRUCTURE DEVELOPMENT CORPORATION

303,Maurya Tower, Budh Marg, Patna - 800 001
Phone - (0612) 2210101, Fax - (0612) 2210103
Website:- http://www.buidco.in

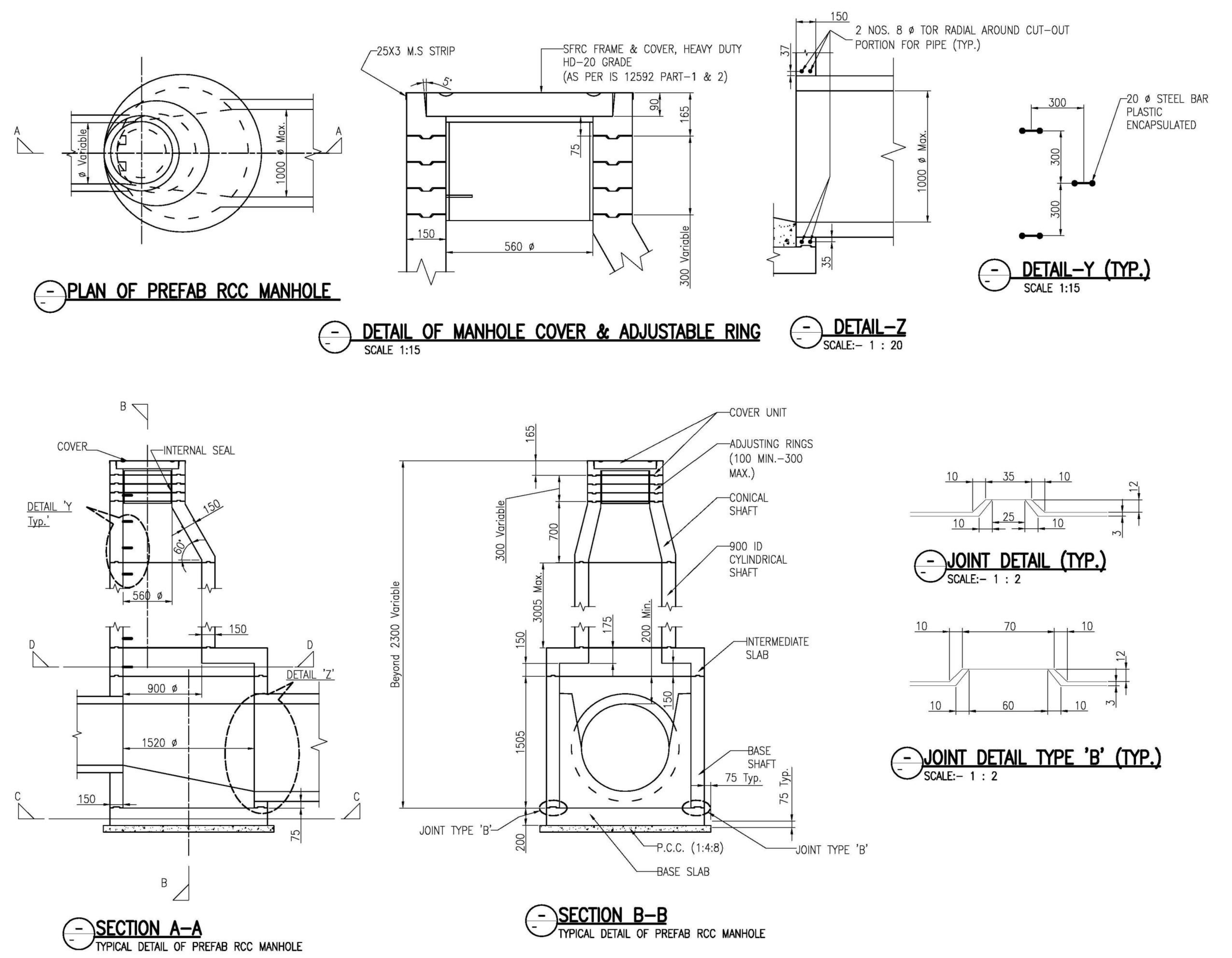
DRAWING TITLE

ø 1520 Manhole, Depth beyond 2.30 M, Max. Size of Outgoing Pipe ø 500 NP-2 with 60° Conical Shaft

SHEET - 2/2

PURPOSE OF ISSUE		SCALE:- 1 : 20
DRAFT DETAILED PROJECT REPORT		SHEET SIZE:- A3
	BY	DATE OF FIRST ISSUE
DRAWN	SKS	MAY 2013
DESIGNED	JR	MAY 2013
CHECKED	RP	MAY 2013
APPROVED	CRR	MAY 2013

JOB NO.	DISCIPLINE	DRAWING NO.	REVISION
1092.01	PH	STD-06	00



NOTES:-

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6. SCALE 1:30, UNLESS OTHERWISE STATED

CLIENT:-

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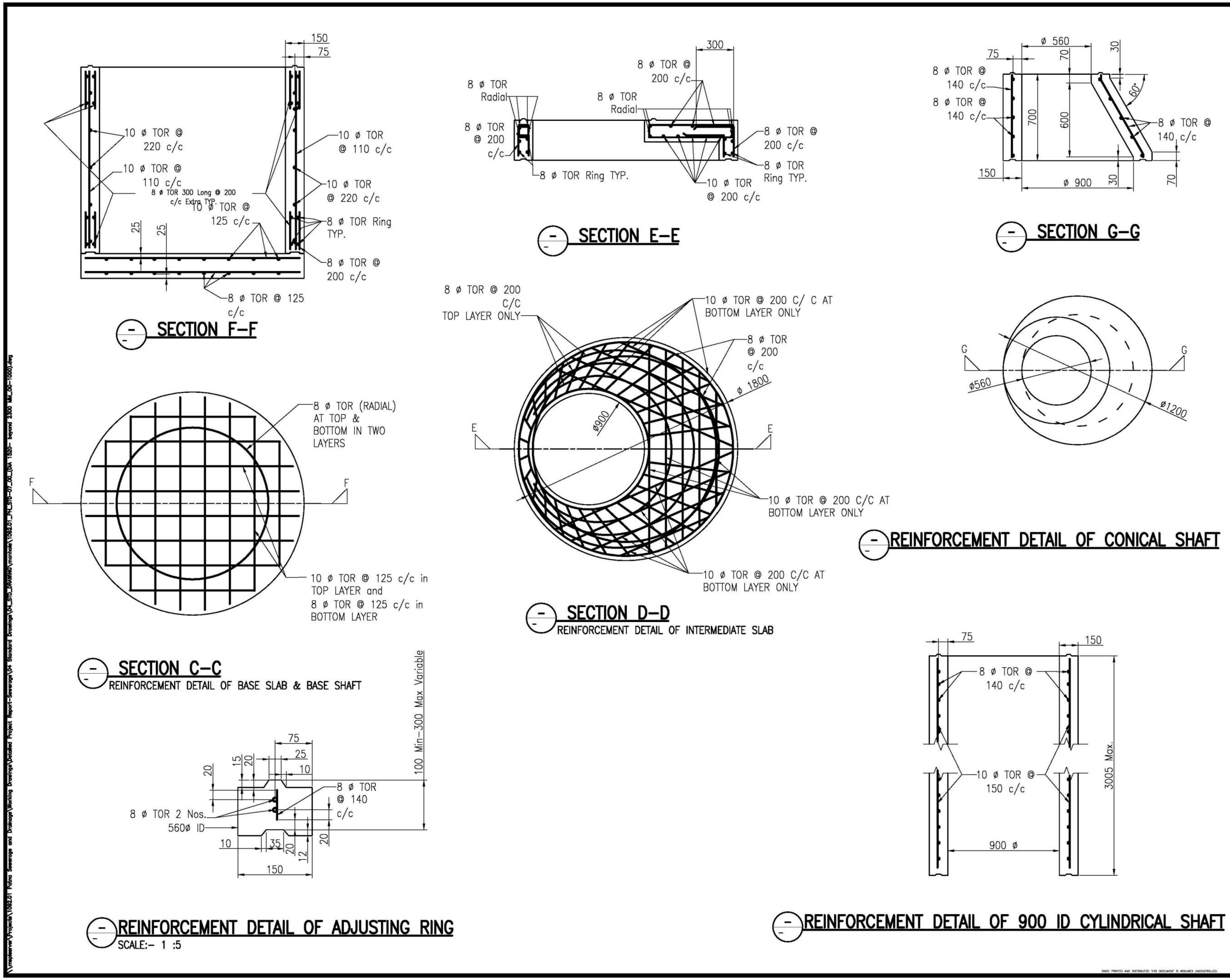
Website:- http://www.buidco.in

DRAWING TITLE

ø 1520 Manhole, Depth beyond 2.30 M, Max. Size of Outgoing Pipe ø 1000 NP-3 with 60° Conical Shaft
SHEET - 1/2

PURPOSE OF ISSUE: DRAFT DETAILED PROJECT REPORT		SCALE:- AS SHOWN
		SHEET SIZE:- A3
	BY	DATE OF FIRST ISSUE
DRAWN	SKS	MAY 2013
DESIGNED	JR	MAY 2013
CHECKED	RP	MAY 2013
APPROVED	CRR	MAY 2013

JOB NO.	DISCIPLINE	DRAWING NO.	REVISION
1092.01	PH	STD-07	00



NOTES:–

1. ALL DIMENSIONS ARE IN MM.
2. MINIMUM CLEAR COVER 37 MM, EXCEPT BASE SLAB, WHERE MINIMUM CLEAR COVER IS 25 MM.
3. GRADE OF CONCRETE M30.
4. GR. OF STEEL Fe 415, CONFIRMING TO IS 1786
5. ALL JOINTS ARE JOINT TYPE A EXCEPT JOINTS MARKED AS JOINT TYPE 'B' IN SECTION 'B-B'
6. SCALE 1:20, UNLESS OTHERWISE STATED

CLIENT:-

BIHAR
URBAN INFRASTRUCTURE
DEVELOPMENT CORPORATION

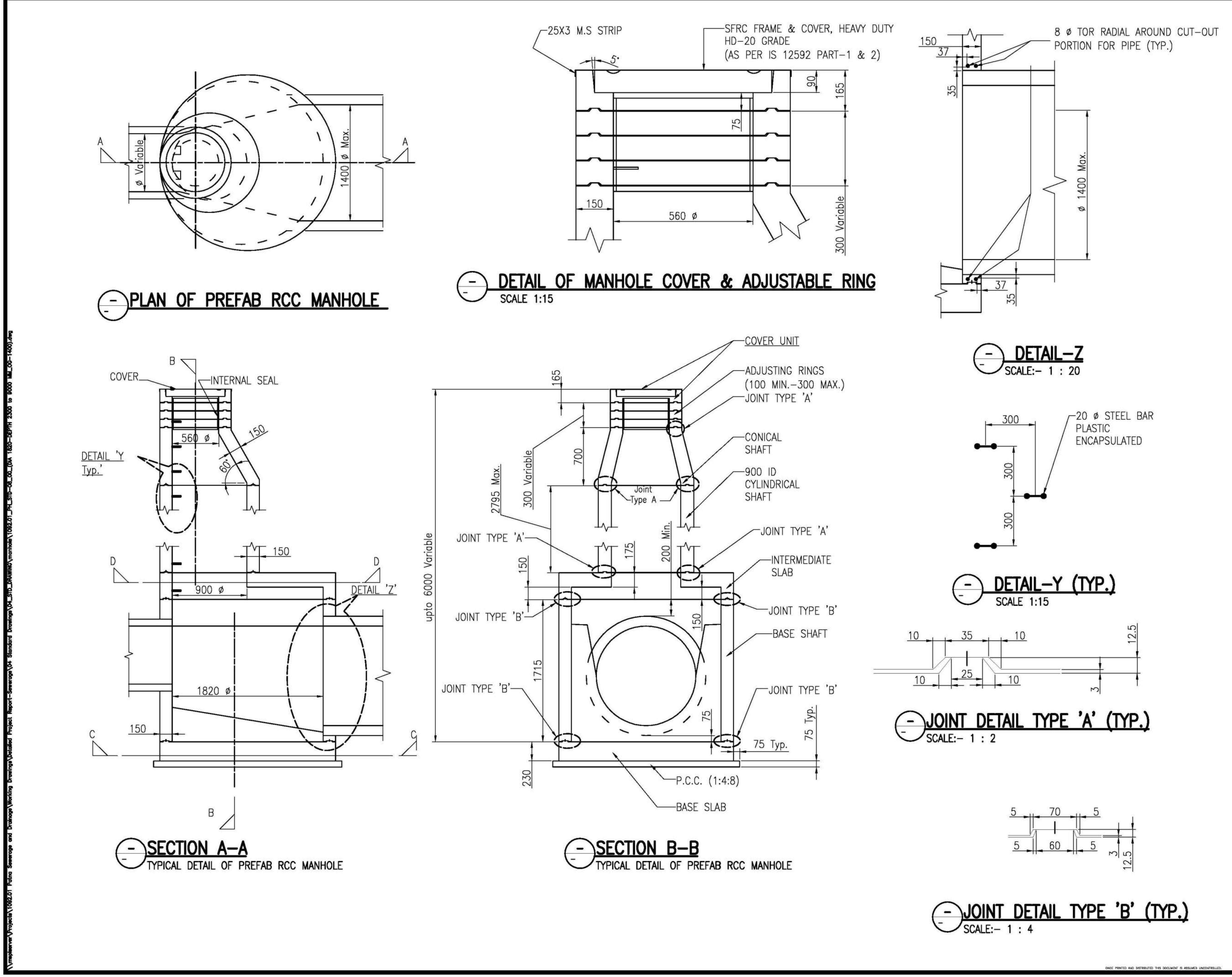
303,Maurya Tower, Budh Marg, Patna - 800 001
Phone - (0612) 2210101, Fax - (0612) 2210103
Website:- http://www.buidco.in

DRAWING TITLE

ø 1520 Manhole, Depth beyond 2.30 M, Max. Size of Outgoing Pipe ø 1000 NP–3 with 60° Conical Shaft

SHEET – 2/2

PURPOSE OF ISSUE		SCALE :- 1 : 20	
DRAFT DETAILED PROJECT REPORT		SHEET SIZE :- A3	
	BY	DATE OF FIRST ISSUE	
DRAWN	SKS	MAY 2013	
DESIGNED	JR	MAY 2013	
CHECKED	RP	MAY 2013	
APPROVED	CRR	MAY 2013	
JOB NO.	DISCIPLINE	DRAWING NO.	REVISION
1092.01	PH	STD–07	00



NOTES:-

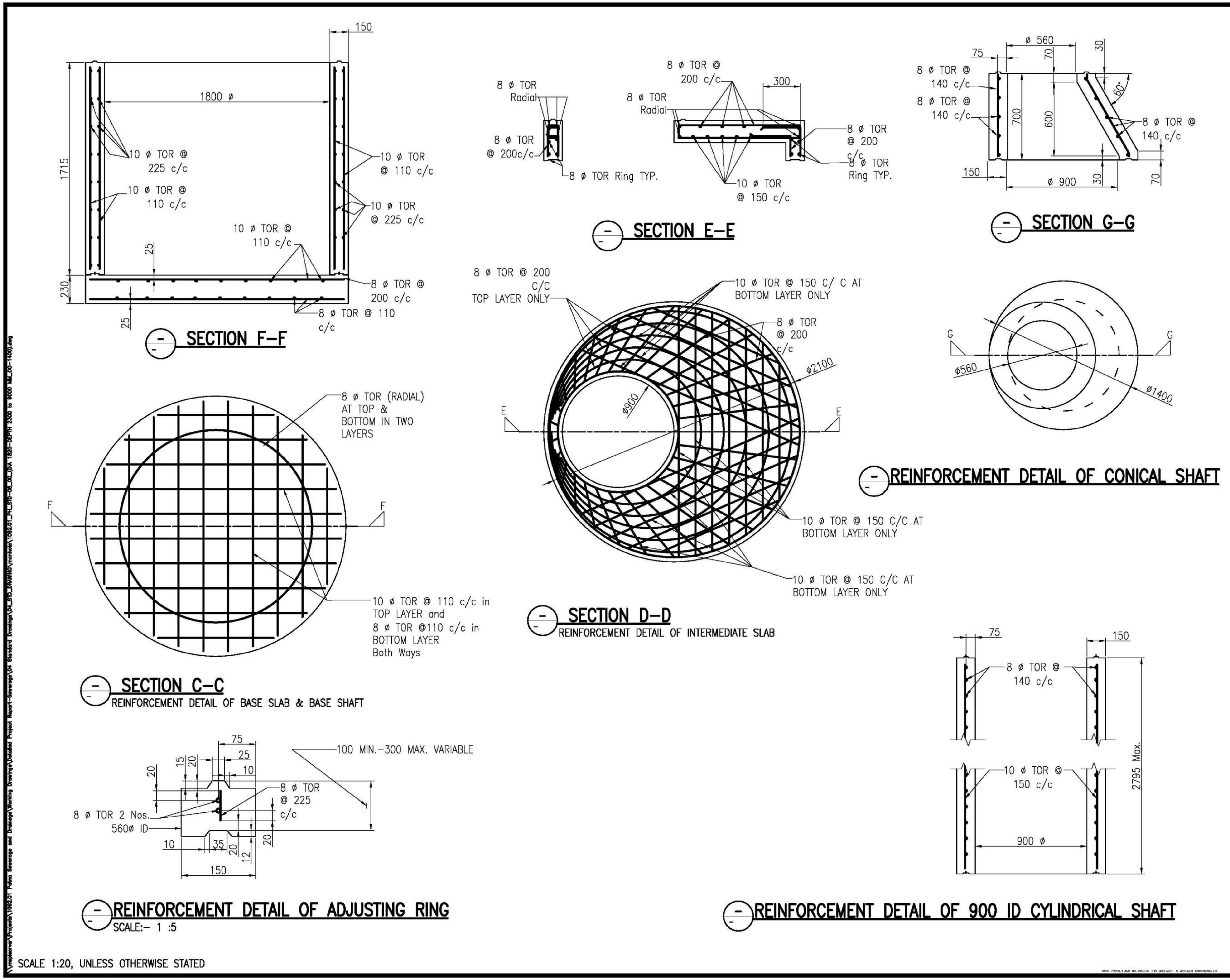
1. ALL DIMENSIONS ARE IN MM.
2. MINIMUM CLEAR COVER 37 MM, EXCEPT BASE SLAB, WHERE MINIMUM CLEAR COVER IS 25 MM.
3. GRADE OF CONCRETE M30.
4. GR. OF STEEL Fe 415, CONFIRMING TO IS 1786
5. ALL JOINTS ARE JOINT TYPE A EXCEPT JOINTS MARKED AS JOINT TYPE 'B' IN SECTION 'B-B'
6. SCALE 1:30, UNLESS OTHERWISE STATED

CLIENT:-
BIHAR
URBAN INFRASTRUCTURE
DEVELOPMENT CORPORATION
303,Maurya Tower,
Budh Marg, Patna - 800 001
Phone - (0612) 2210101, Fax - (0612) 2210103
Website:- http://www.buidco.in

DRAWING TITLE

ø 1820 Manhole, Depth 2300 to 9000 M, Max. Size of Outgoing Pipe ø 1200 NP-3 with 60° Conical Shaft
SHEET - 1/2

PURPOSE OF ISSUE		SCALE :- 1 : 30	
DRAFT DETAILED PROJECT REPORT		SHEET SIZE :- A3	
	BY	DATE OF FIRST ISSUE	
DRAWN	SKS	MAY 2013	
DESIGNED	JR	MAY 2013	
CHECKED	RP	MAY 2013	
APPROVED	CRR	MAY 2013	
JOB NO.	DISCIPLINE	DRAWING NO.	REVISION
1092.01	PH	STD-08	00



NOTES:–

1. ALL DIMENSIONS ARE IN MM.
2. MINIMUM CLEAR COVER 37 MM, EXCEPT BASE SLAB, WHERE MINIMUM CLEAR COVER IS 25 MM.
3. GRADE OF CONCRETE M30.
4. GR. OF STEEL Fe 415, CONFIRMING TO IS 1786
5. ALL JOINTS ARE JOINT TYPE A EXCEPT JOINTS MARKED AS JOINT TYPE 'B' IN SECTION 'B-B'
6. SCALE 1:20, UNLESS OTHERWISE STATED

CLIENT:-

BIHAR
URBAN INFRASTRUCTURE
DEVELOPMENT CORPORATION

303,Maurya Tower,
Budh Marg, Patna - 800 001
Phone - (0612) 2210101, Fax - (0612) 2210103
Website:- http://www.buidco.in

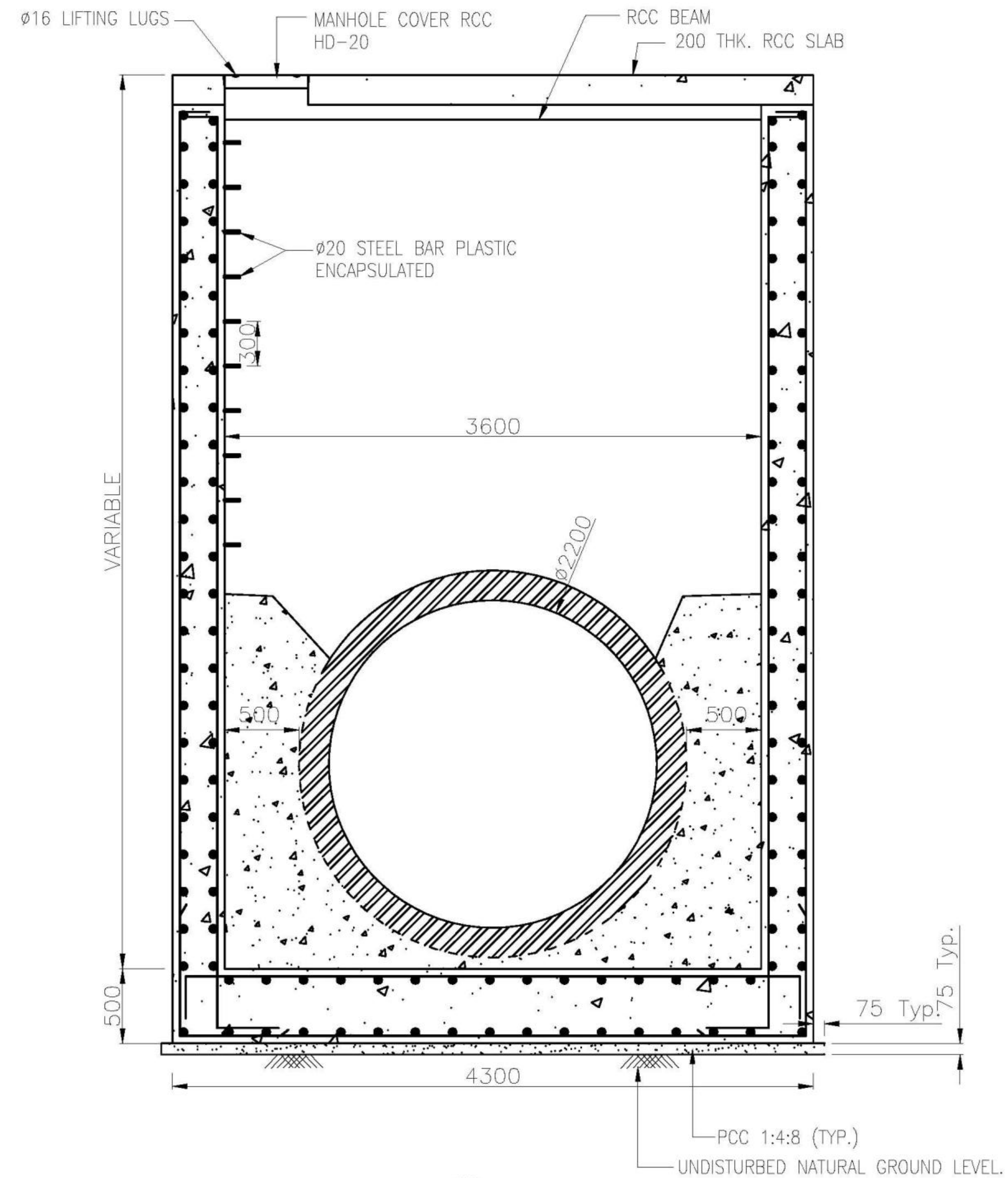
DRAWING TITLE

ø 1820 Manhole, Depth upto 2.30 M, Max. Size of Outgoing Pipe ø 1400 NP–3 with 60° Conical Shaft
SHEET – 2/2

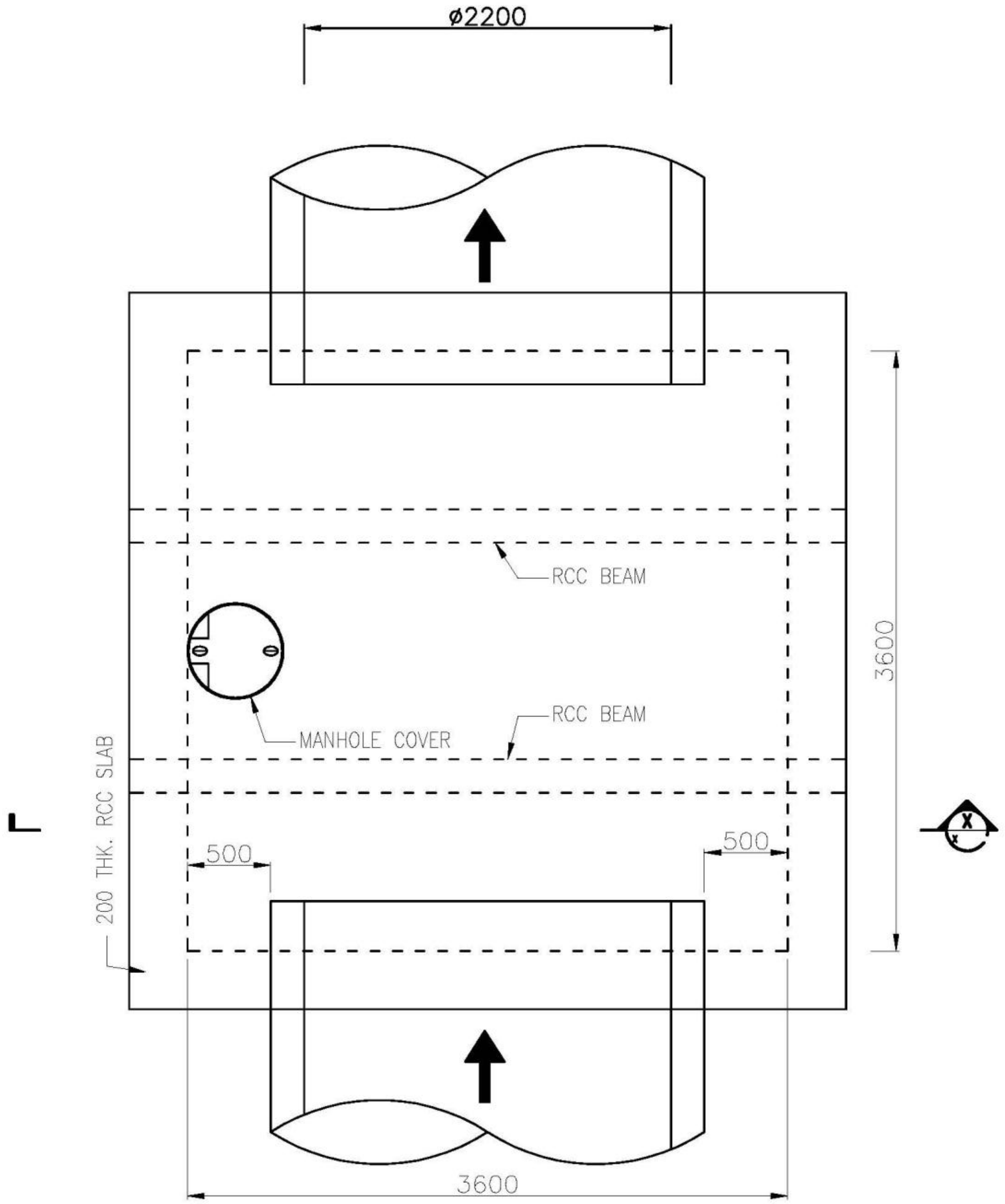
PURPOSE OF ISSUE		SCALE:- 1 : 20
DRAFT DETAILED PROJECT REPORT		SHEET SIZE :- A3
	BY	DATE OF FIRST ISSUE
DRAWN	SKS	MAY 2013
DESIGNED	JR	MAY 2013
CHECKED	RP	MAY 2013
APPROVED	CRR	MAY 2013

JOB NO.	DISCIPLINE	DRAWING NO.	REVISION
1092.01	PH	STD–08	00

\\mepleserver\Projects\1092.01 Patna Sewerage and Drainage\Working Drawings\Detailed Project Report-Sewerage\04 Standard Drawings\04_STD_DRAWING\manhole\1092.01_PH_STD-09_00.dwg



SECTION X



PLAN OF CAST IN SETU RCC MANHOLE

NOTES:-

1. ALL DIMENSION ARE IN mm. UNLESS OTHERWISE SPECIFIED.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS, ANY DISCREPANCIES, ERRORS OR OMISSIONS TO BE BROUGHT TO THE ATTENTION OF CONSULTANTS
3. ALL DIMENSIONS TO BE CHECKED BEFORE COMMENCEMENT OF WORK ON SITE

CLIENT:-

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DEVELOPMENT CORPORATION

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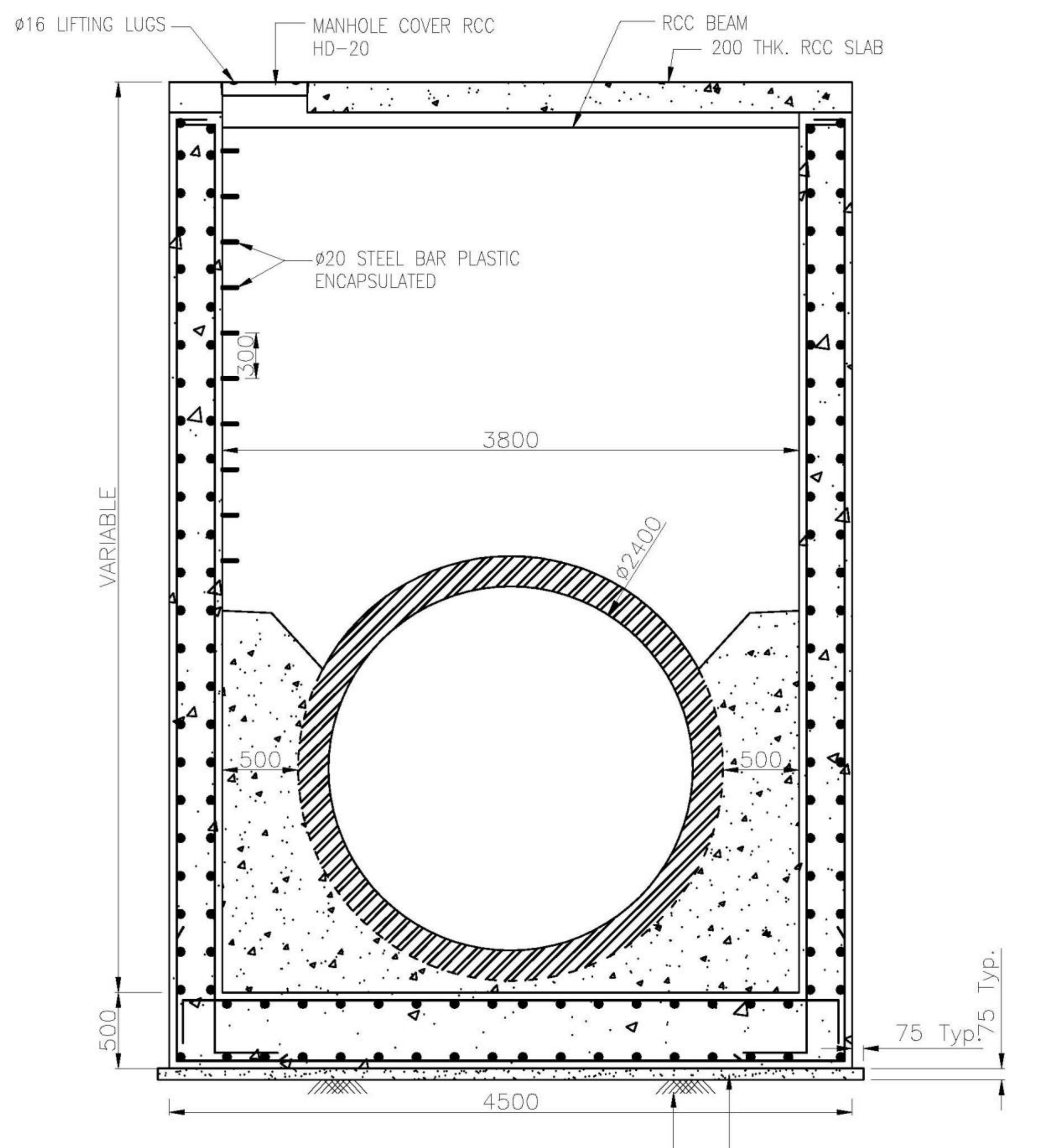
Website:- http://www.buidco.in.

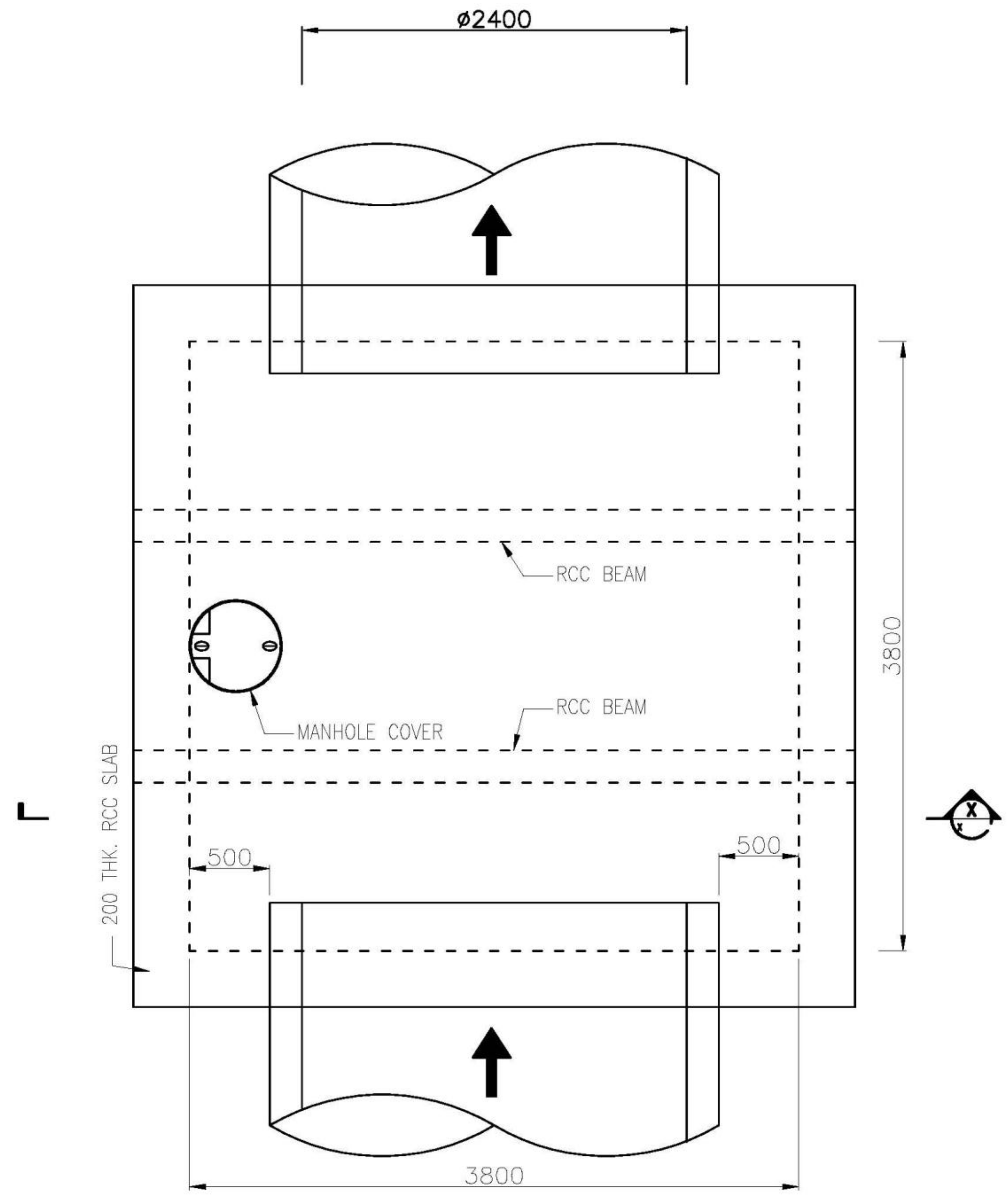
DRAWING TITLE

Rectangular Manhole, Size of Outgoing Pipe ø 2200 NP-3

PURPOSE OF ISSUE		SCALE:- 1 : 30	
DRAFT DETAILED PROJECT REPORT		SHEET SIZE:- A3	
	BY	DATE OF FIRST ISSUE	
DRAWN	SKS	MAY 2013	
DESIGNED	JR	MAY 2013	
CHECKED	RP	MAY 2013	
APPROVED	CRR	MAY 2013	
JOB NO.	DISCIPLINE	DRAWING NO.	REVISION
1092.01	PH	STD-09	00



SECTION X



PLAN OF CAST IN SETU RCC MANHOLE

NOTES:-

1. ALL DIMENSION ARE IN mm. UNLESS OTHERWISE SPECIFIED.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS, ANY DISCREPANCIES, ERRORS OR OMISSIONS TO BE BROUGHT TO THE ATTENTION OF CONSULTANTS
3. ALL DIMENSIONS TO BE CHECKED BEFORE COMMENCEMENT OF WORK ON SITE

CLIENT:-

BIHAR URBAN INFRASTRUCTURE DEVELOPMENT CORPORATION

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Phone - (0612) 2210101, Fax - (0612) 2210103
Website:- http://www.buidco.in.

DRAWING TITLE

Rectangular Manhole, Size of Outgoing Pipe ø 2400 NP-3

PURPOSE OF ISSUE		SCALE:- 1 : 30	
DRAFT DETAILED PROJECT REPORT		SHEET SIZE:- A3	
	BY	DATE OF FIRST ISSUE	
DRAWN	SKS	MAY 2013	
DESIGNED	JR	MAY 2013	
CHECKED	RP	MAY 2013	
APPROVED	CRR	MAY 2013	
JOB NO.	DISCIPLINE	DRAWING NO.	REVISION
1092.01	PH	STD-10	00

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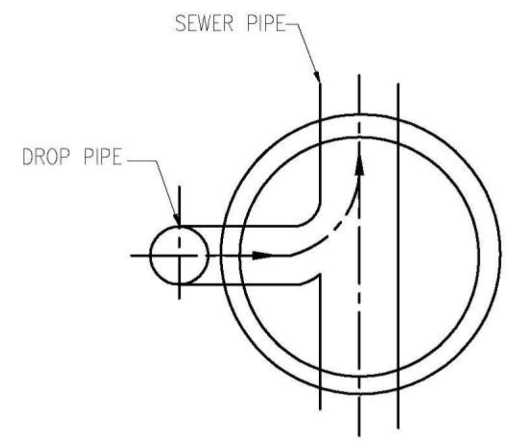
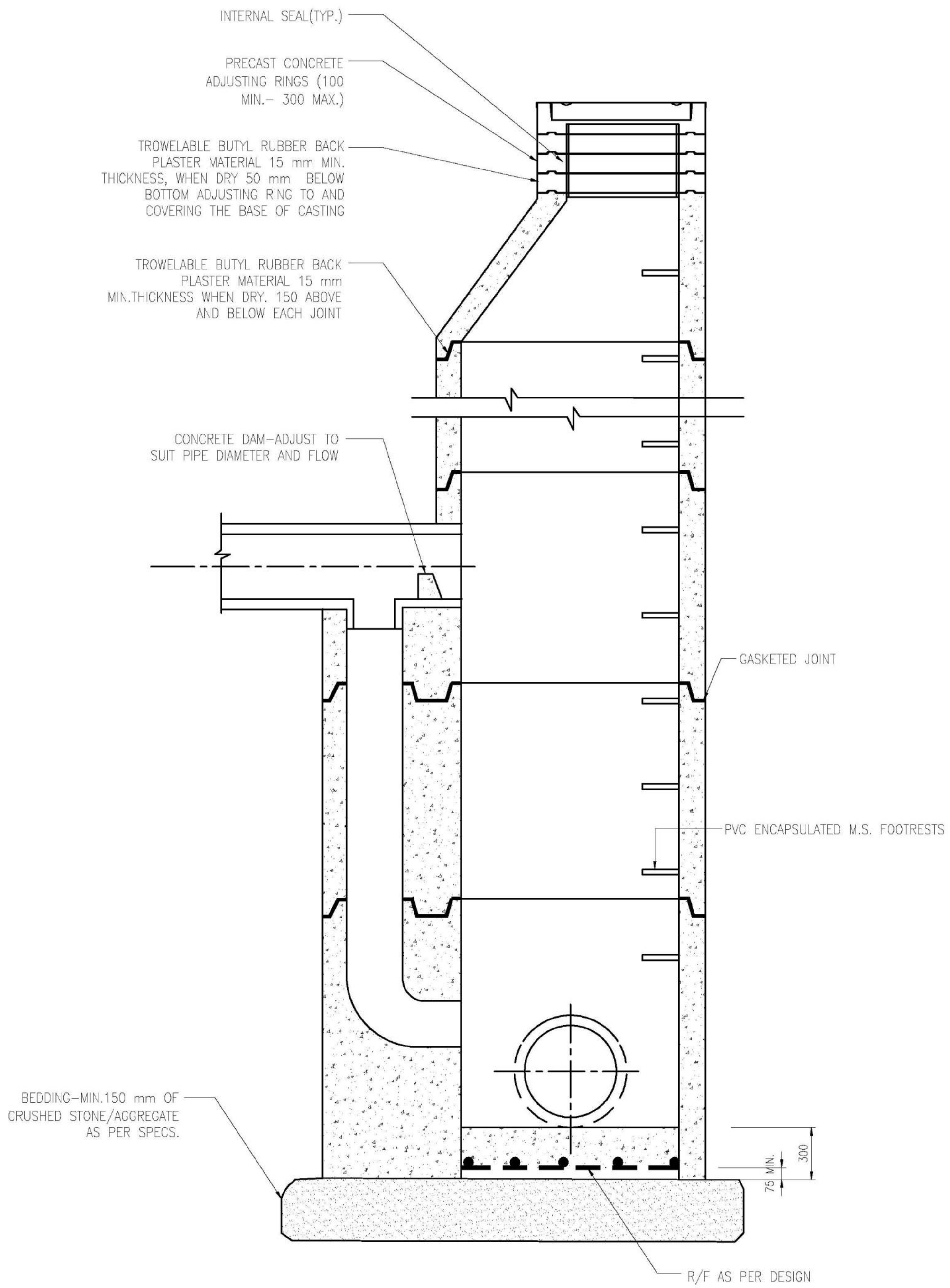


DETAIL PLAN VIEW



NOTES:–

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2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS, ANY DISCREPANCIES, ERRORS OR OMISSIONS TO BE BROUGHT TO THE ATTENTION OF CONSULTANTS
3. ALL DIMENSIONS TO BE CHECKED BEFORE COMMENCEMENT OF WORK ON SITE

CLIENT:-

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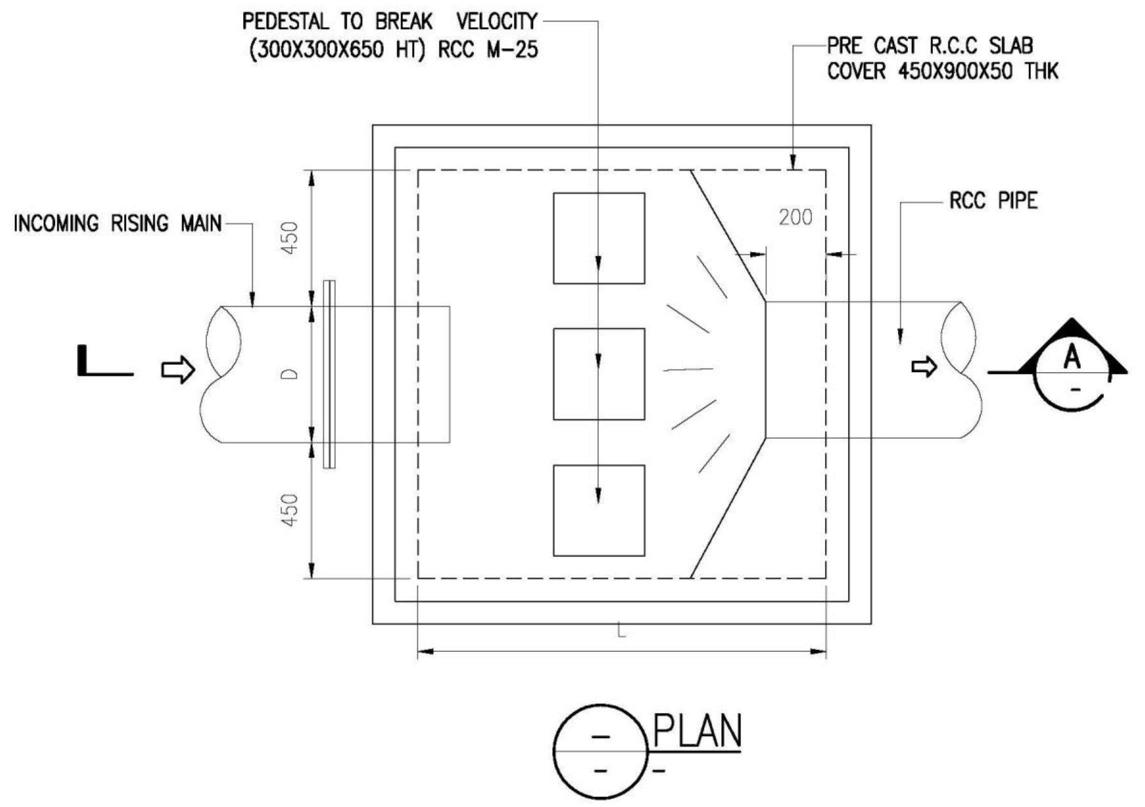
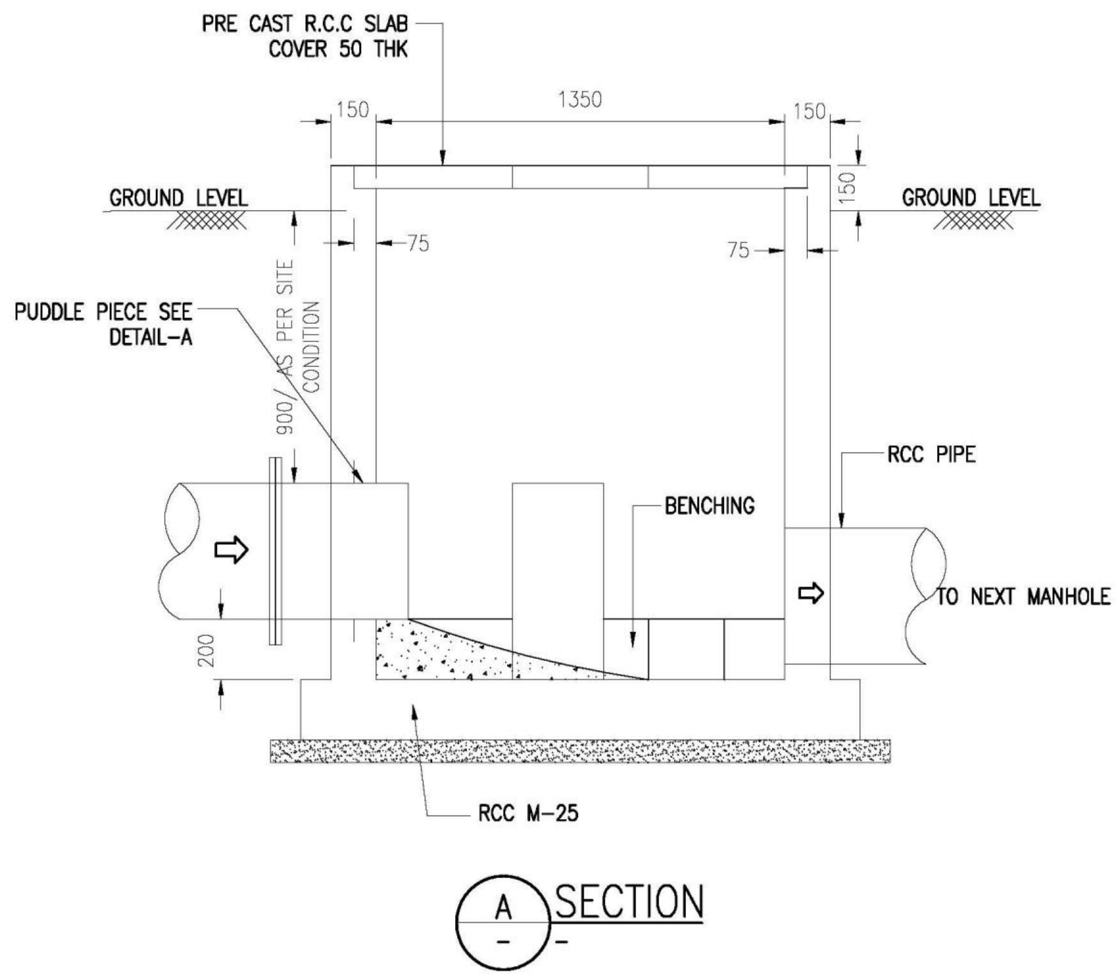
DRAWING TITLE

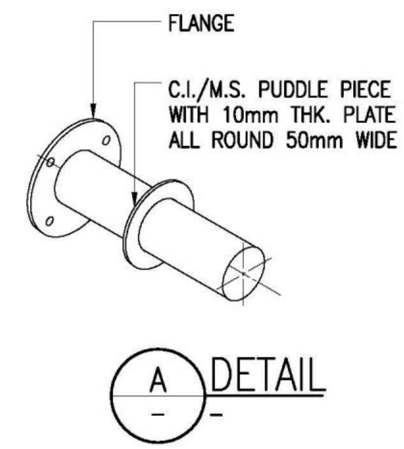
TYPICAL DETAILS OF PREFAB RCC DROP MANHOLE

PURPOSE OF ISSUE		SCALE :- 1:30
DETAILS PROJECT REPORT (SEWERAGE)		SHEET SIZE :- A3
	BY	DATE OF FIRST ISSUE
DRAWN	SA	APRIL 2013
DESIGNED	JR	APRIL 2013
CHECKED	GP	APRIL 2013
APPROVED	CRR	APRIL 2013

JOB NO.	DISCIPLINE	DRAWING NO.	REVISION
1092.01	PH	STD – 11	00







NOTES:-

1. ALL DIMENSION ARE IN mm. UNLESS OTHERWISE SPECIFIED.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS, ANY DISCREPANCIES, ERRORS OR OMISSIONS TO BE BROUGHT TO THE ATTENTION OF CONSULTANTS
3. ALL DIMENSIONS TO BE CHECKED BEFORE COMMENCEMENT OF WORK ON SITE

CLIENT:-

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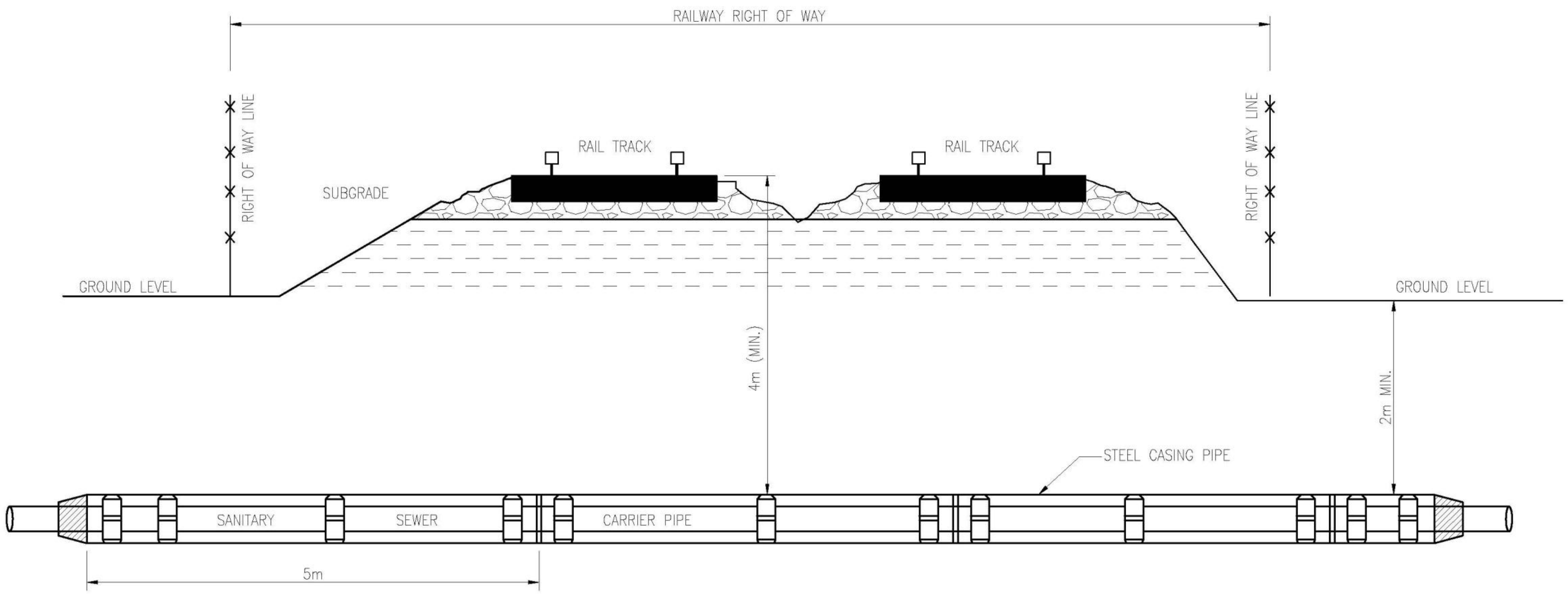
Phone - (0612) 2210101, Fax - (0612) 2210103
Website:- http://www.buidco.in

DRAWING TITLE

RISING MAIN DISCHARGE MANHOLE

PURPOSE OF ISSUE		SCALE :- 1 : 25
DRAFT DETAILED PROJECT REPORT		SHEET SIZE :- A3
	BY	DATE OF FIRST ISSUE
DRAWN	SA	MAY 2013
DESIGNED	JR	MAY 2013
CHECKED	RP	MAY 2013
APPROVED	CRR	MAY 2013

JOB NO.	DISCIPLINE	DRAWING NO.	REVISION
1092.01	PH	STD - 12	00



NOTES:-

1. ALL DIMENSION ARE IN mm. UNLESS OTHERWISE SPECIFIED.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS, ANY DISCREPANCIES, ERRORS OR OMISSIONS TO BE BROUGHT TO THE ATTENTION OF CONSULTANTS
3. ALL DIMENSIONS TO BE CHECKED BEFORE COMMENCEMENT OF WORK ON SITE

CLIENT:-

BIHAR
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DEVELOPMENT CORPORATION
303,Maurya Tower,
Budh Marg, Patna - 800 001
Phone - (0612) 2210101, Fax - (0612) 2210103
Website:- http://www.buidco.in.

DRAWING TITLE

SCHEMATIC OF RAIL TRACK CROSSING

PURPOSE OF ISSUE		SCALE :- NTS
DRAFT DETAILED PROJECT REPORT		SHEET SIZE :- A3
	BY	DATE OF FIRST ISSUE
DRAWN	SA	MAY 2013
DESIGNED	JR	MAY 2013
CHECKED	RP	MAY 2013
APPROVED	CRR	MAY 2013

JOB NO.	DISCIPLINE	DRAWING NO.	REVISION
1092.01	PH	STD - 13	00

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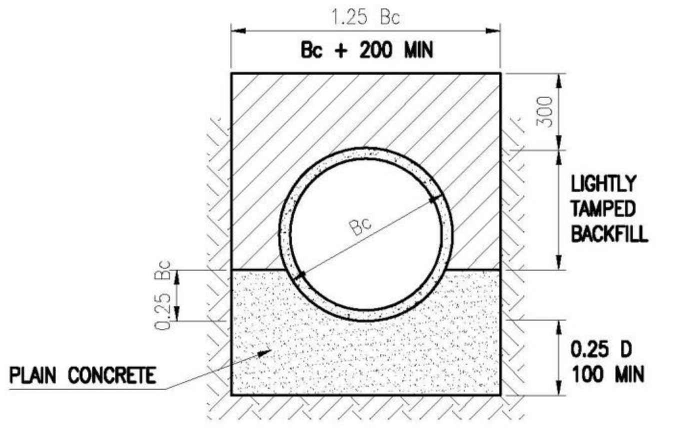
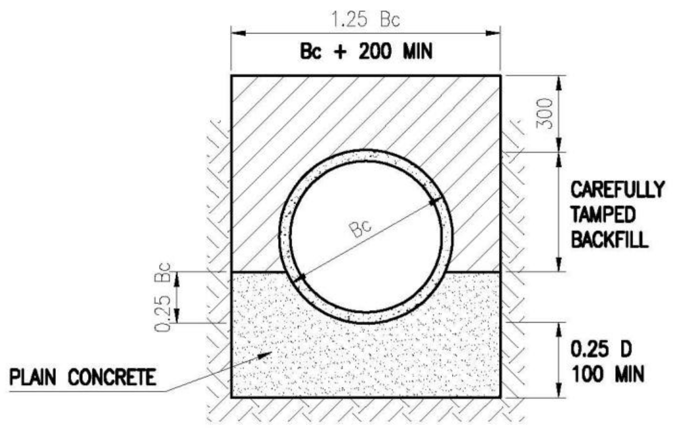
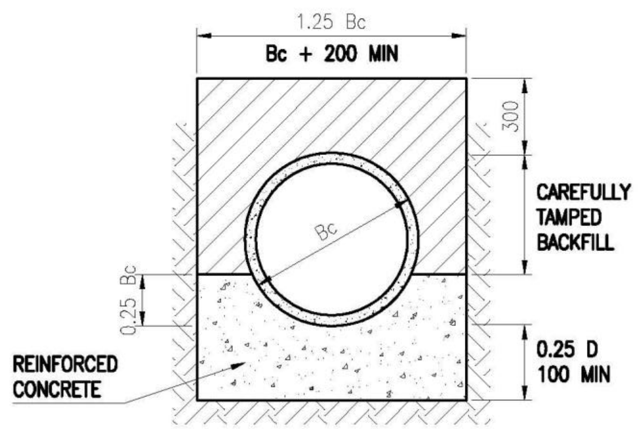
\\mapleserver\Projects\1092.01 Patna Sewerage and Drainage\Working Drawings\Detailed Project Report-Sewerage\04 Standard Drawings\04_STD_DRAWING\1092.01-PH-STD-14_0.dwg



BEDDING CLASS – Aa
(PCC CRADLE AND LIGHTLY TAMPED BACKFILL)

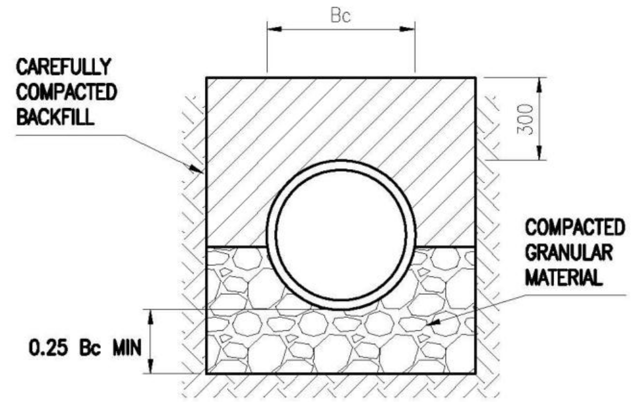


BEDDING CLASS – Ab
(PCC CRADLE AND CAREFULLY TAMPED BACKFILL)



BEDDING CLASS – Ac
(RCC CRADLE WITH P–0.4%)
'P' THE RATIO OF THE AREA OF STEEL TO THE AREA OF CONCRETE AT THE CROWN

CLASS – A



BEDDING CLASS – B
COMPACTED GRANULAR BEDDING

CLASS – B

NOTES:-

1. ALL DIMENSIONS ARE IN MM.
2. GRANULAR BEDDING AS PER APPROVAL OF ENGINEER.
3. PCC MIX AS PER APPROVAL OF ENGINEER.
4. IN ROCK, TRENCH IS EXCAVATED AT LEAST 150 MM BELOW THE BELL OF THE PIPE EXCEPT WHERE CONCRETE CRADLE IS USED.
5. WELL GRADED CRUSHED ROCK OR GRAVEL WITH THE MAX. SIZE NOT EXCEEDING 25 MM IS RECOMMENDED.
6. THE ENCASEMENT OF PIPE AND WIDTH OF EXCAVATION SHALL BE AS PER CPHEEO MANUAL ON SEWERAGE AND SEWAGE TREATMENT.

CLIENT:-

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URBAN INFRASTRUCTURE
DEVELOPMENT CORPORATION

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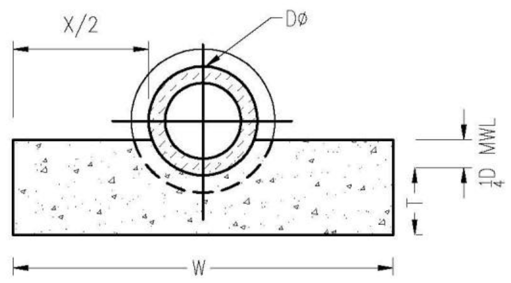
Website:- http://www.buidco.in.

DRAWING TITLE
TYPICAL DRAWING FOR DIFFERENT CLASSES OF BEDDING FOR SEWER IN TRENCHES

PURPOSE OF ISSUE: DRAFT DETAILED PROJECT REPORT		SCALE :- 1:10
		SHEET SIZE :- A3
	BY	DATE OF FIRST ISSUE
DRAWN	SA	MAY 2013
DESIGNED	JR	MAY 2013
CHECKED	RP	MAY 2013
APPROVED	CRR	MAY 2013

JOB NO.	DISCIPLINE	DRAWING NO.	REVISION
1092.01	PH	STD – 14	00



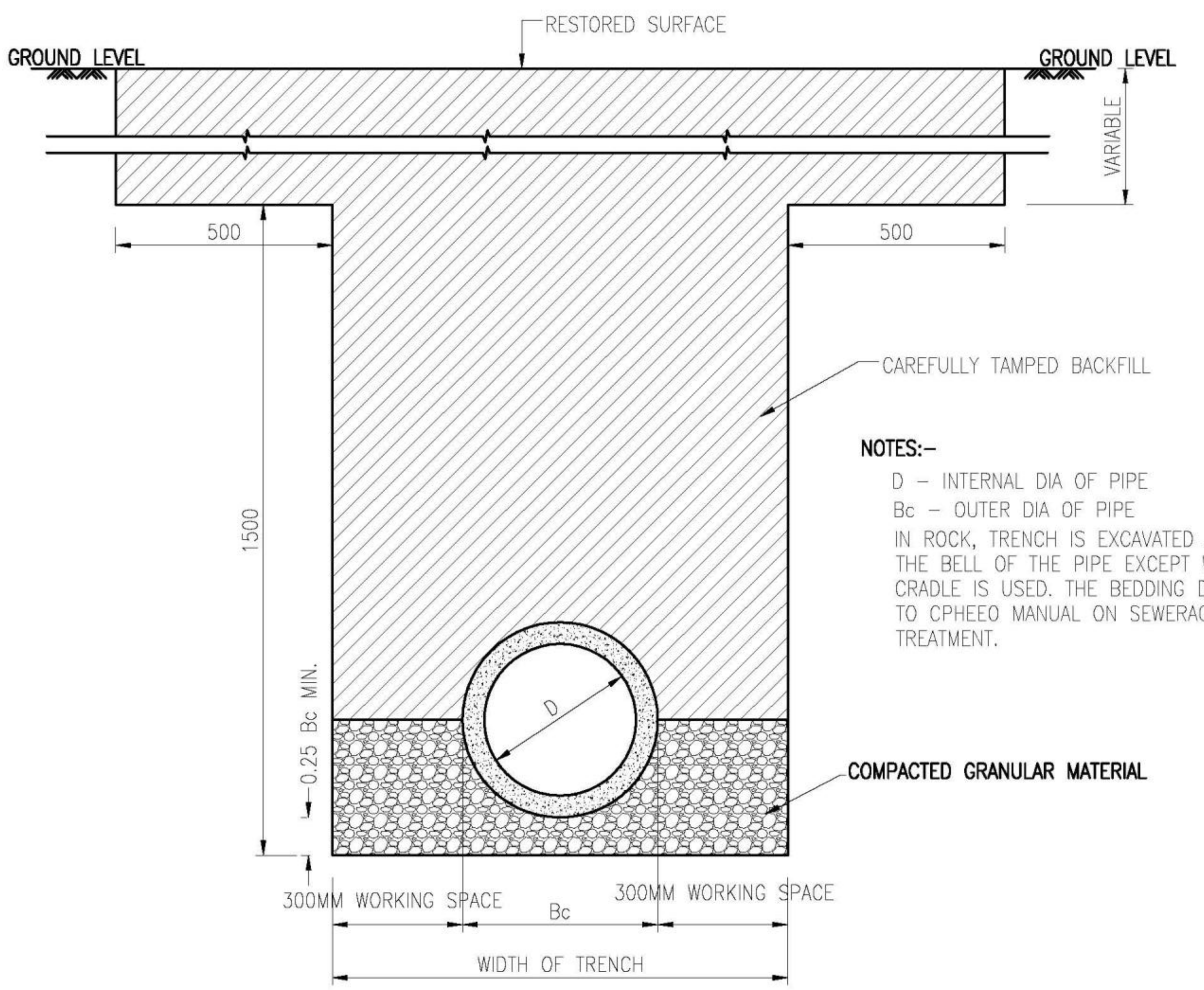
W= D+X, WHERE D IS THE EXTERNAL DIAMETER OF THE PIPE

X= 300MM, UPTO TRENCH DEPTH OF 1.2 M.
400MM, UPTO TRENCH DEPTH MORE THAN 1.2 M.

T= 100MM FOR PIPES UNDER 150MM NOMINAL DIAMETER; ONE FOURTH OF INTERNAL DIAMETER SUBJECT TO A MINIMUM OF 150MM AND MAXIMUM OF 300MM FOR PIPES OF MORE THAN 150MM DIAMETER.

MWL= MAXIMUM WATER LEVEL.

BEDDING-STONEWARE PIPE



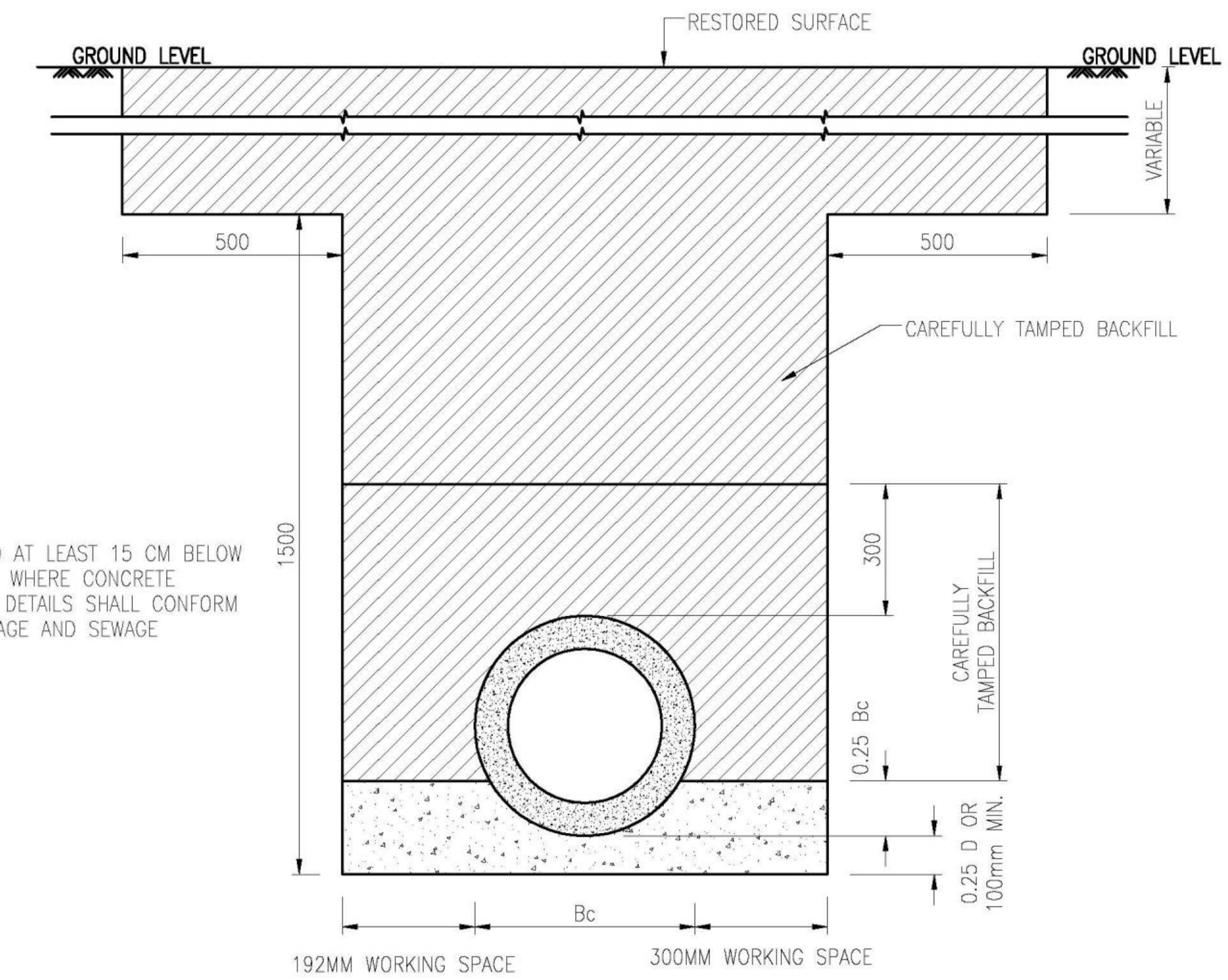
NOTES:-

D - INTERNAL DIA OF PIPE

Bc - OUTER DIA OF PIPE

IN ROCK, TRENCH IS EXCAVATED AT LEAST 15 CM BELOW THE BELL OF THE PIPE EXCEPT WHERE CONCRETE CRADLE IS USED. THE BEDDING DETAILS SHALL CONFORM TO CPHEEO MANUAL ON SEWERAGE AND SEWAGE TREATMENT.

COMPACTED GRANULAR BEDDING CLASS-B



CONCRETE CRADLE CLASS-A

NOTES:-

D - INTERNAL DIA OF PIPE

Bc - OUTER DIA OF PIPE

IN ROCK, TRENCH IS EXCAVATED AT LEAST 15 CM BELOW THE BELL OF THE PIPE EXCEPT WHERE CONCRETE CRADLE IS USED. THE BEDDING DETAILS SHALL CONFORM TO CPHEEO MANUAL ON SEWERAGE AND SEWAGE TREATMENT.

NOTES:-

1. ALL DIMENSION ARE IN mm. UNLESS OTHERWISE SPECIFIED.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS, ANY DISCREPANCIES, ERRORS OR OMISSIONS TO BE BROUGHT TO THE ATTENTION OF CONSULTANTS
3. ALL DIMENSIONS TO BE CHECKED BEFORE COMMENCEMENT OF WORK ON SITE

CLIENT:-

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URBAN INFRASTRUCTURE
DEVELOPMENT CORPORATION

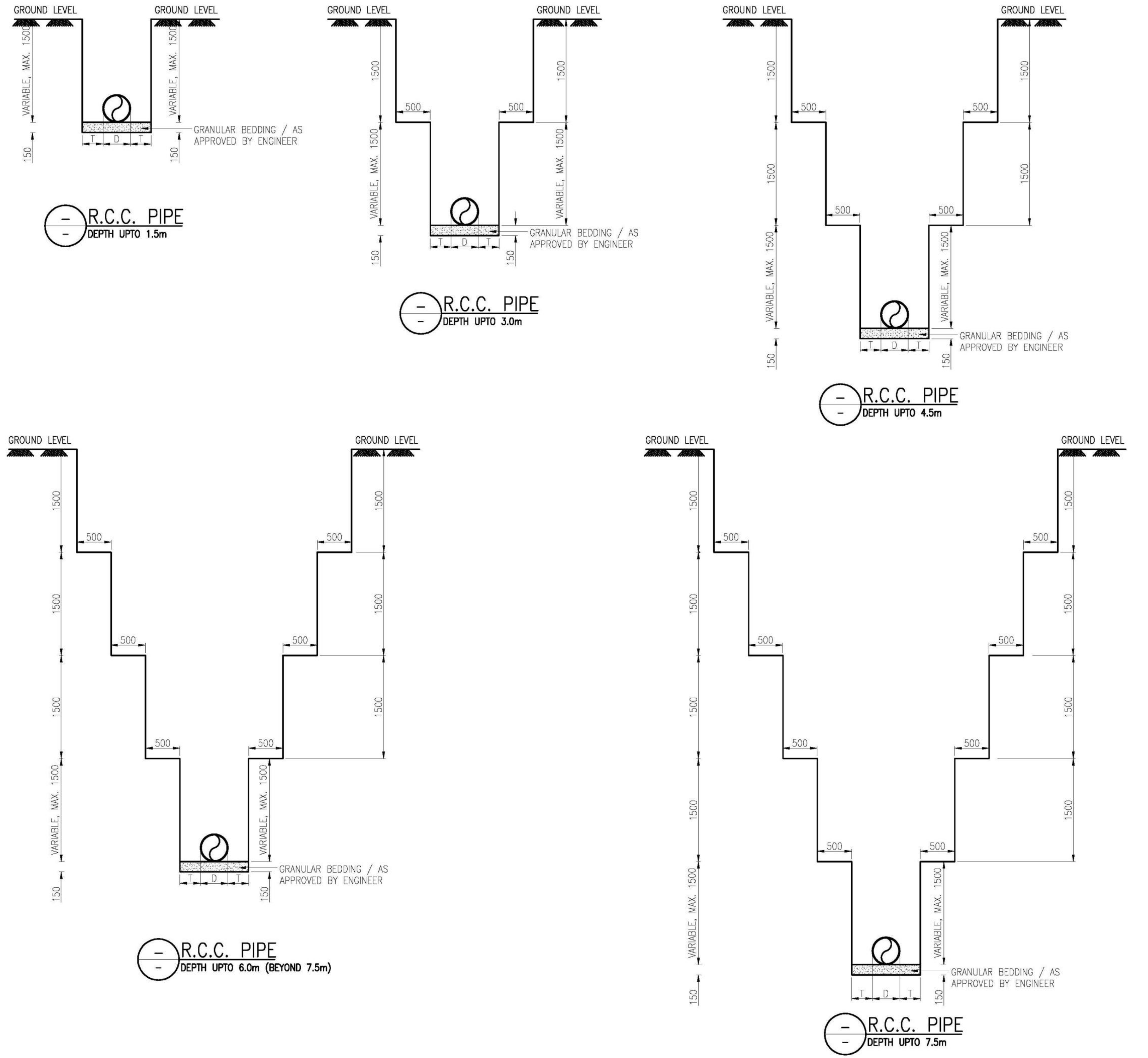
303,Maurya Tower,
Budh Marg, Patna - 800 001
Phone - (0612) 2210101, Fax - (0612) 2210103
Website:- http://www.buidco.in.

DRAWING TITLE

TYPICAL DETAILS OF BEDDING OF SEWER IN TRENCHES

PURPOSE OF ISSUE		SCALE :- NTS
DRAFT DETAILED PROJECT REPORT		SHEET SIZE :- A3
	BY	DATE OF FIRST ISSUE
DRAWN	SA	MAY 2013
DESIGNED	JR	MAY 2013
CHECKED	RP	MAY 2013
APPROVED	CRR	MAY 2013

JOB NO.	DISCIPLINE	DRAWING NO.	REVISION
1092.01	PH	STD - 15	00



NOTES:-

1. ALL DIMENSION ARE IN mm. UNLESS OTHERWISE SPECIFIED.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS, ANY DISCREPANCIES, ERRORS OR OMISSIONS TO BE BROUGHT TO THE ATTENTION OF CONSULTANTS
3. ALL DIMENSIONS TO BE CHECKED BEFORE COMMENCEMENT OF WORK ON SITE
4. D = OUTSIDE DIAMETER OF PIPE
5. T = WORKING SPACE
   300mm UPTO 900 DIA PIPE
   500mm FOR > 900 DIA PIPE
6. FOR DETAIL SPECIFICATIONS REFER PRICED BOQ OF THE CONTRACT.

CLIENT:-

BIHAR
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DEVELOPMENT CORPORATION
303,Maurya Tower,
Budh Marg, Patna - 800 001
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Website:- http://www.buidco.in

DRAWING TITLE

EXCAVATION DETAIL OF PIPE TRENCHES AT DIFFERENT DEPTHS

PURPOSE OF ISSUE		SCALE :- 1:40
DRAFT DETAILED PROJECT REPORT		SHEET SIZE :- A3
	BY	DATE OF FIRST ISSUE
DRAWN	SA	MAY 2013
DESIGNED	JR	MAY 2013
CHECKED	GP	MAY 2013
APPROVED	CRR	MAY 2013

JOB NO.	DISCIPLINE	DRAWING NO.	REVISION
1092.01	PH	STD – 16	00

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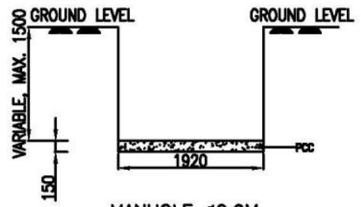
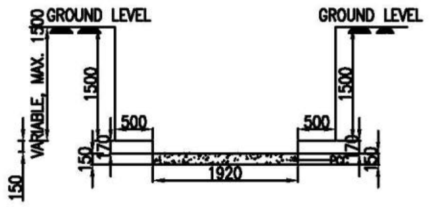
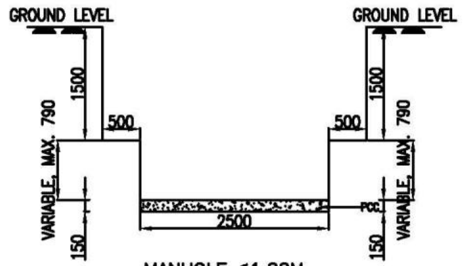
\\mapleserver\Projects\1092.01 Patna Sewerage and Drainage\Working Drawings\Detailed Project Report-Sewerage\04 Standard Drawings\04_STD_DRAWING\1092.01-PH-STD-17_0.dwg



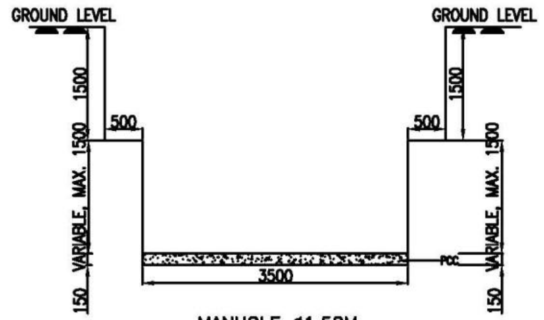
MANHOLE ø0.9M
(DEPTH UPTO 1.5M)



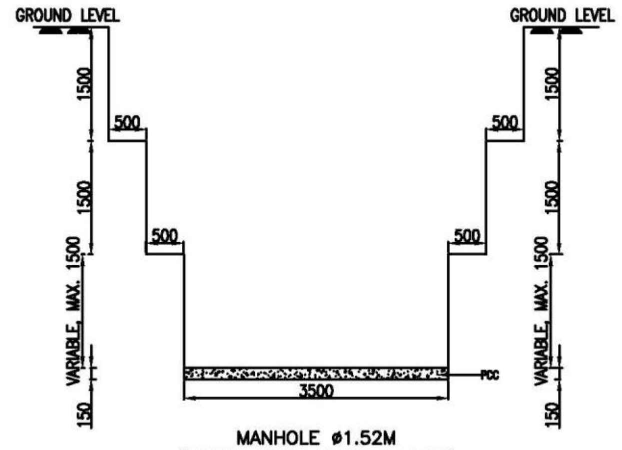
MANHOLE ø0.9M
(DEPTH FROM 1.5M TO 1.65M)



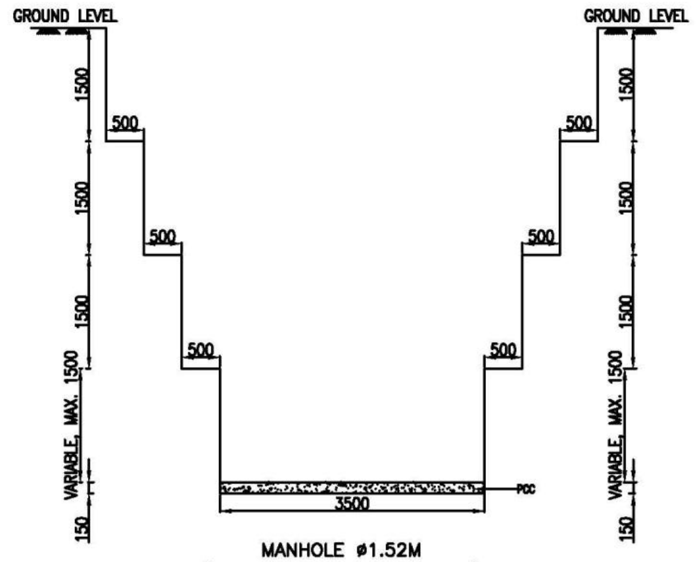
MANHOLE ø1.22M
(DEPTH FROM 1.65M TO 2.30M)



MANHOLE ø1.52M
(DEPTH FROM 2.30M TO 3.0M)



MANHOLE ø1.52M
(DEPTH FROM 3.0M TO 4.5M)



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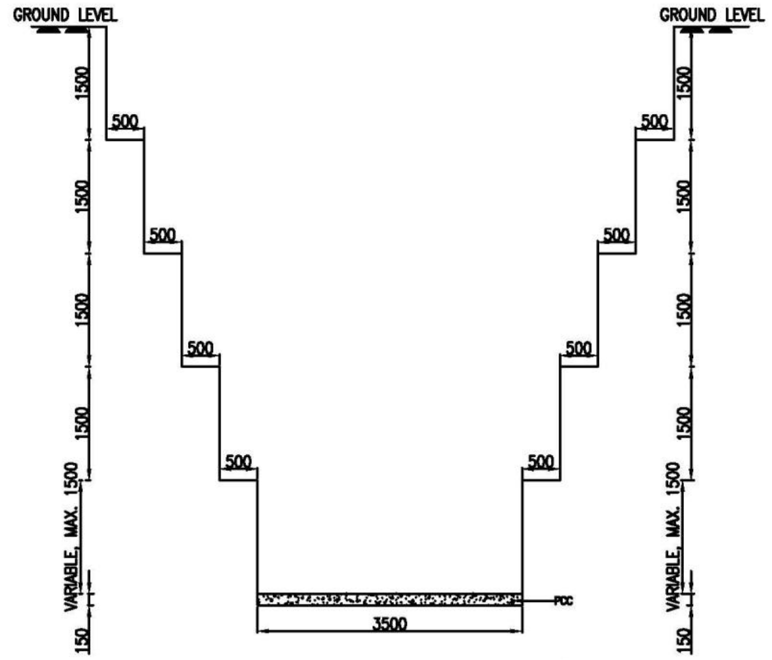
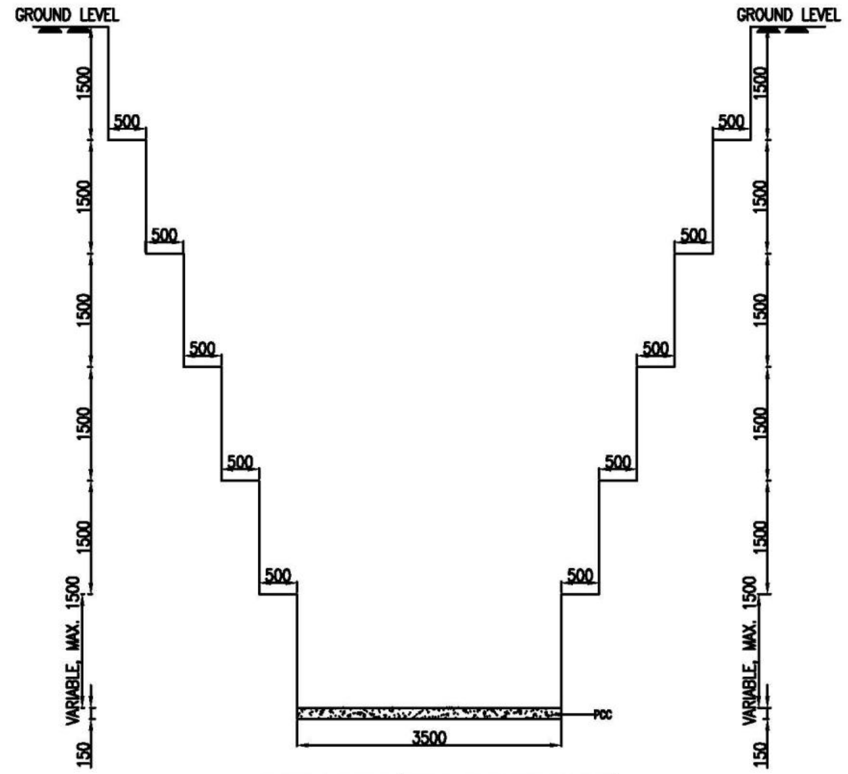
(DEPTH FROM 4.5M TO 6.0M)



MANHOLE ø1.52M (DEPTH FROM 6.0M TO 7.5M)



MANHOLE ø1.52M (DEPTH FROM 7.5M TO 9.0M)

NOTES:–
1. ALL DIMENSION ARE IN mm. UNLESS OTHERWISE SPECIFIED.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS, ANY DISCREPANCIES, ERRORS OR OMISSIONS TO BE BROUGHT TO THE ATTENTION OF CONSULTANTS
3. ALL DIMENSIONS TO BE CHECKED BEFORE COMMENCEMENT OF WORK ON SITE

CLIENT:-

BIHAR
URBAN INFRASTRUCTURE
DEVELOPMENT CORPORATION

303,Maurya Tower,
Budh Marg, Patna - 800 001
Phone - (0612) 2210101, Fax - (0612) 2210103
Website:- http://www.buidco.in

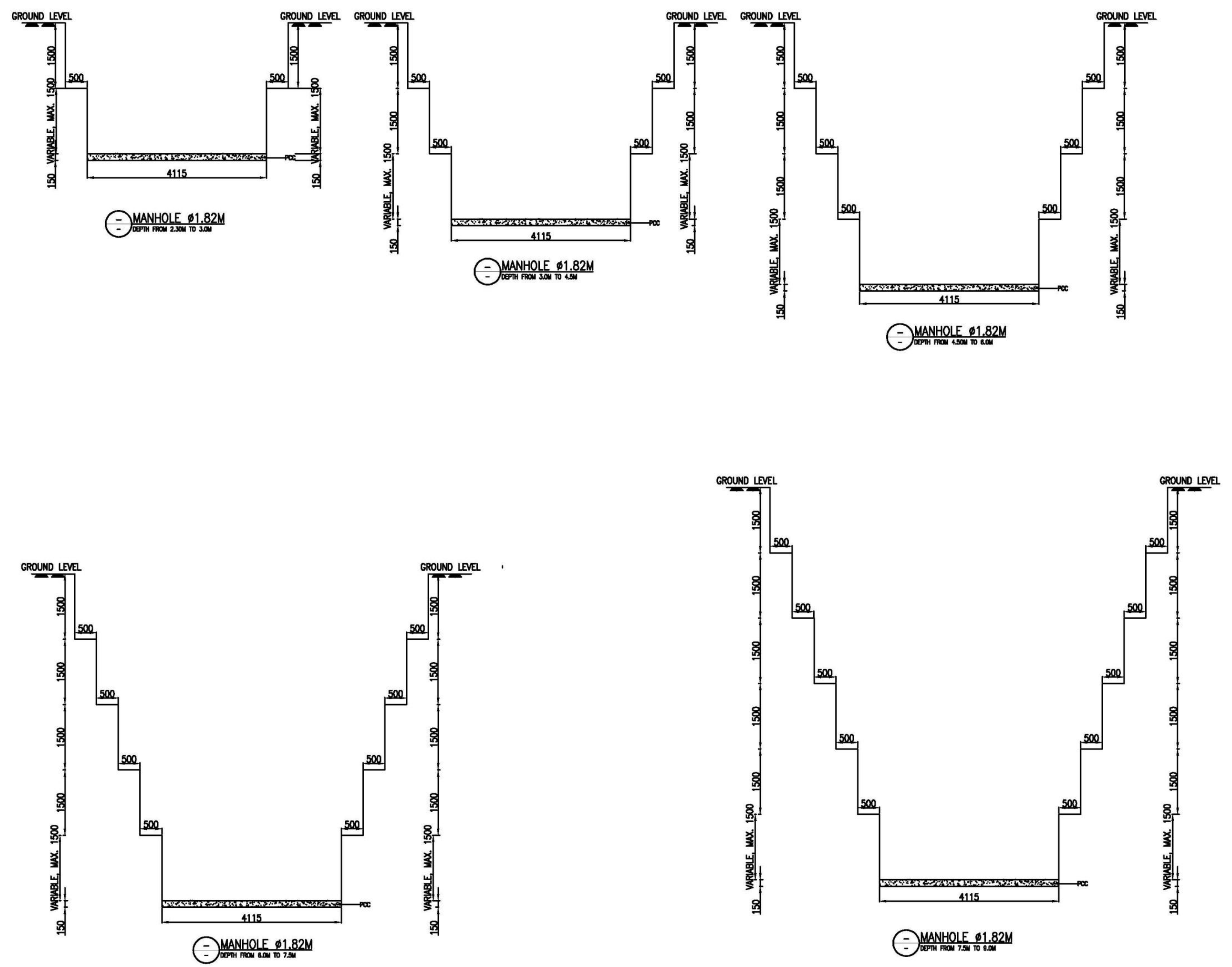
DRAWING TITLE

EXCAVATION DETAIL OF MANHOLES AT DIFFERENT DEPTHS (TYPE-1)

PURPOSE OF ISSUE		SCALE :- NTS
DRAFT DETAILED PROJECT REPORT		SHEET SIZE :- A3
	BY	DATE OF FIRST ISSUE
DRAWN	SA	APRIL 2013
DESIGNED	JR	APRIL 2013
CHECKED	RP	APRIL 2013
APPROVED	CRR	APRIL 2013

JOB NO.	DISCIPLINE	DRAWING NO.	REVISION
1092.01	PH	STD – 17	00

\\mapleserver\Projects\1092.01 Patna Sewerage and Drainage\Working Drawings\Detailed Project Report-Sewerage\04 Standard Drawings\04_STD_DRAWING\1092.01-PH-STD-18_0.dwg



NOTES:-

1. ALL DIMENSION ARE IN mm. UNLESS OTHERWISE SPECIFIED.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS, ANY DISCREPANCIES, ERRORS OR OMISSIONS TO BE BROUGHT TO THE ATTENTION OF CONSULTANTS
3. ALL DIMENSIONS TO BE CHECKED BEFORE COMMENCEMENT OF WORK ON SITE

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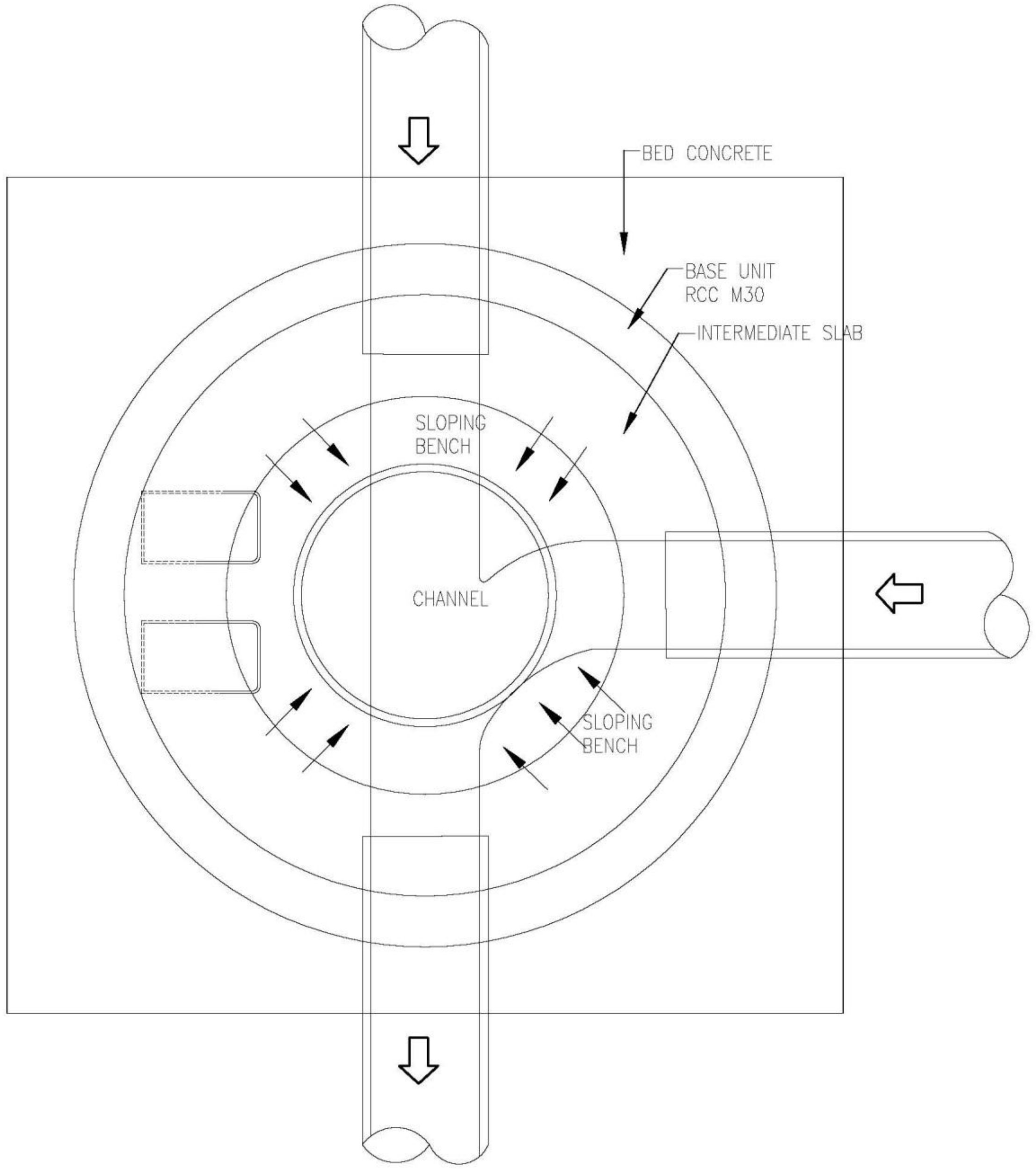
Website:- http://www.buidco.in

DRAWING TITLE

EXCAVATION DETAIL OF MANHOLES AT DIFFERENT DEPTHS (TYPE-2)

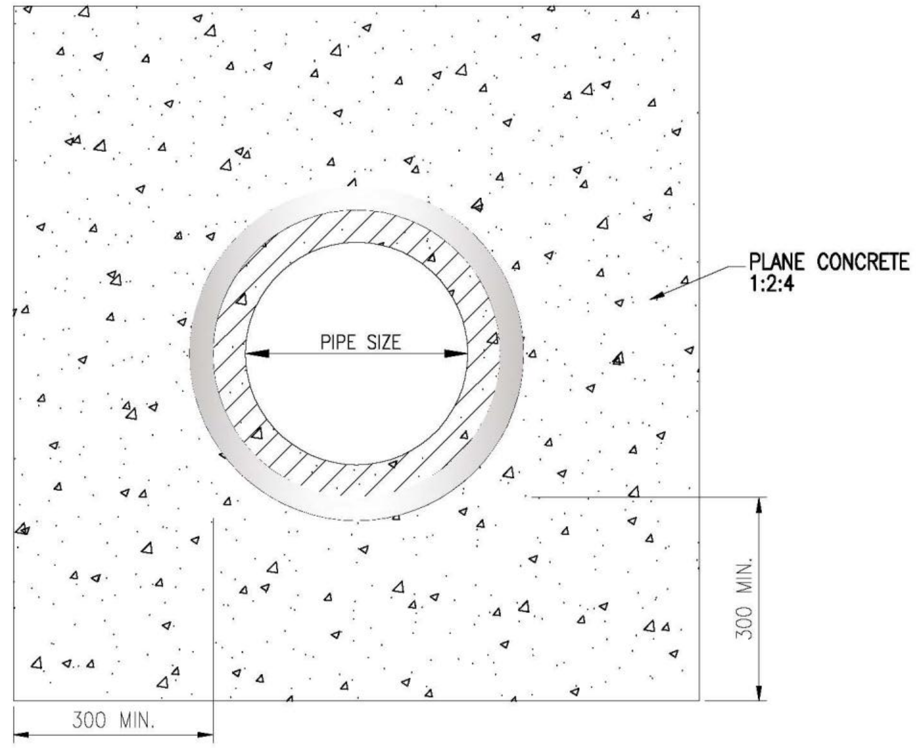
PURPOSE OF ISSUE: DRAFT DETAILED PROJECT REPORT		SCALE :- NTS
		SHEET SIZE :- A3
	BY	DATE OF FIRST ISSUE
DRAWN	SA	MAY 2013
DESIGNED	JR	MAY 2013
CHECKED	RP	MAY 2013
APPROVED	CRR	MAY 2013

JOB NO.	DISCIPLINE	DRAWING NO.	REVISION
1092.01	PH	STD – 18	00

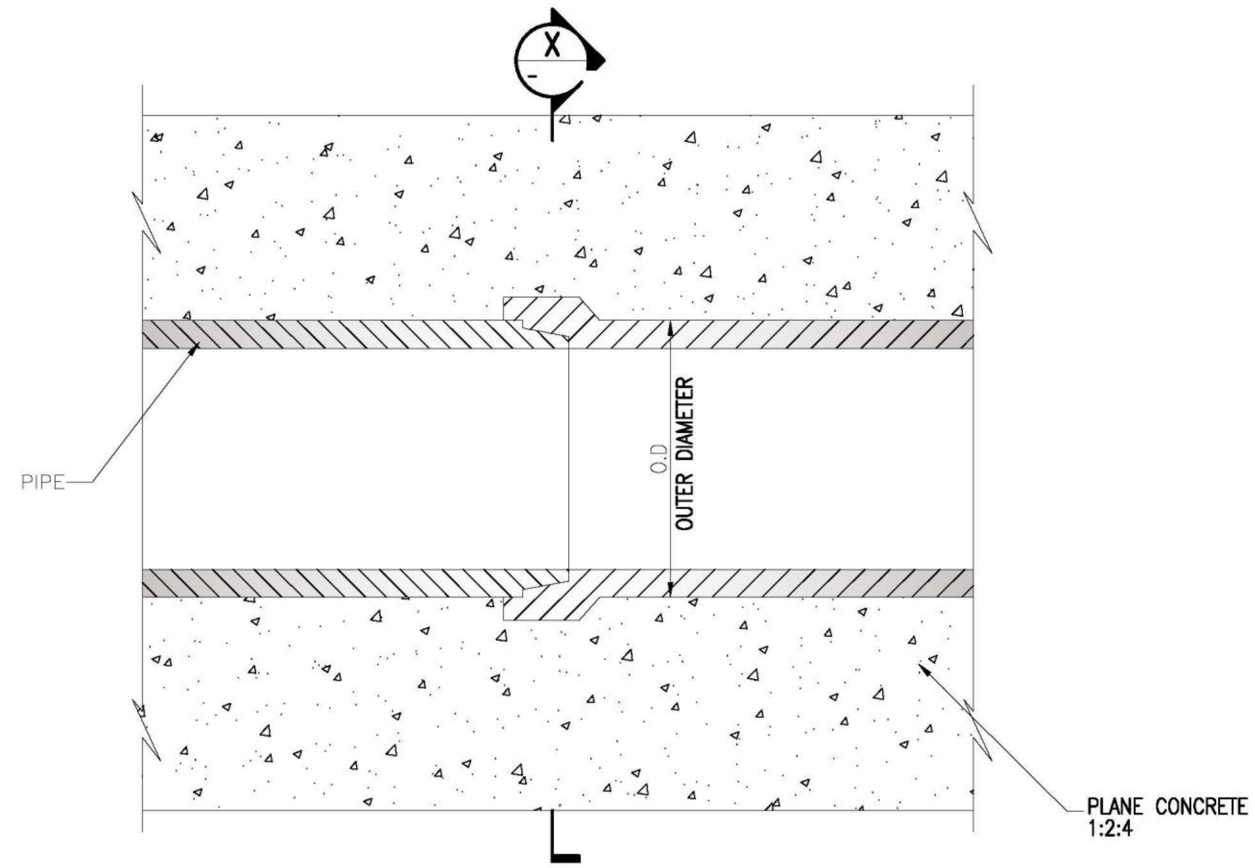


CHANNEL INVERT AT ENDS TO MATCH WITH IL OF INCOMING/OUTGOING PIPES- CHANNEL BOTTOM TO SLOPE WHERE IL OF PIPES DIFFER

MANHOLE-TYPICAL PLAN



X CROSS SECTION



LONGITUDINAL SECTION (TYPICAL ENCASING OF PIPE UNDER STREAM BED & ROADS)

NOTES:-

1. ALL DIMENSION ARE IN mm. UNLESS OTHERWISE SPECIFIED.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS, ANY DISCREPANCIES, ERRORS OR OMISSIONS TO BE BROUGHT TO THE ATTENTION OF CONSULTANTS
3. ALL DIMENSIONS TO BE CHECKED BEFORE COMMENCEMENT OF WORK ON SITE
4. ENCASEMENT TO BE USED WHERE SEWER IS CROSSING STREAM BED OR ROAD.

CLIENT:-

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DEVELOPMENT CORPORATION

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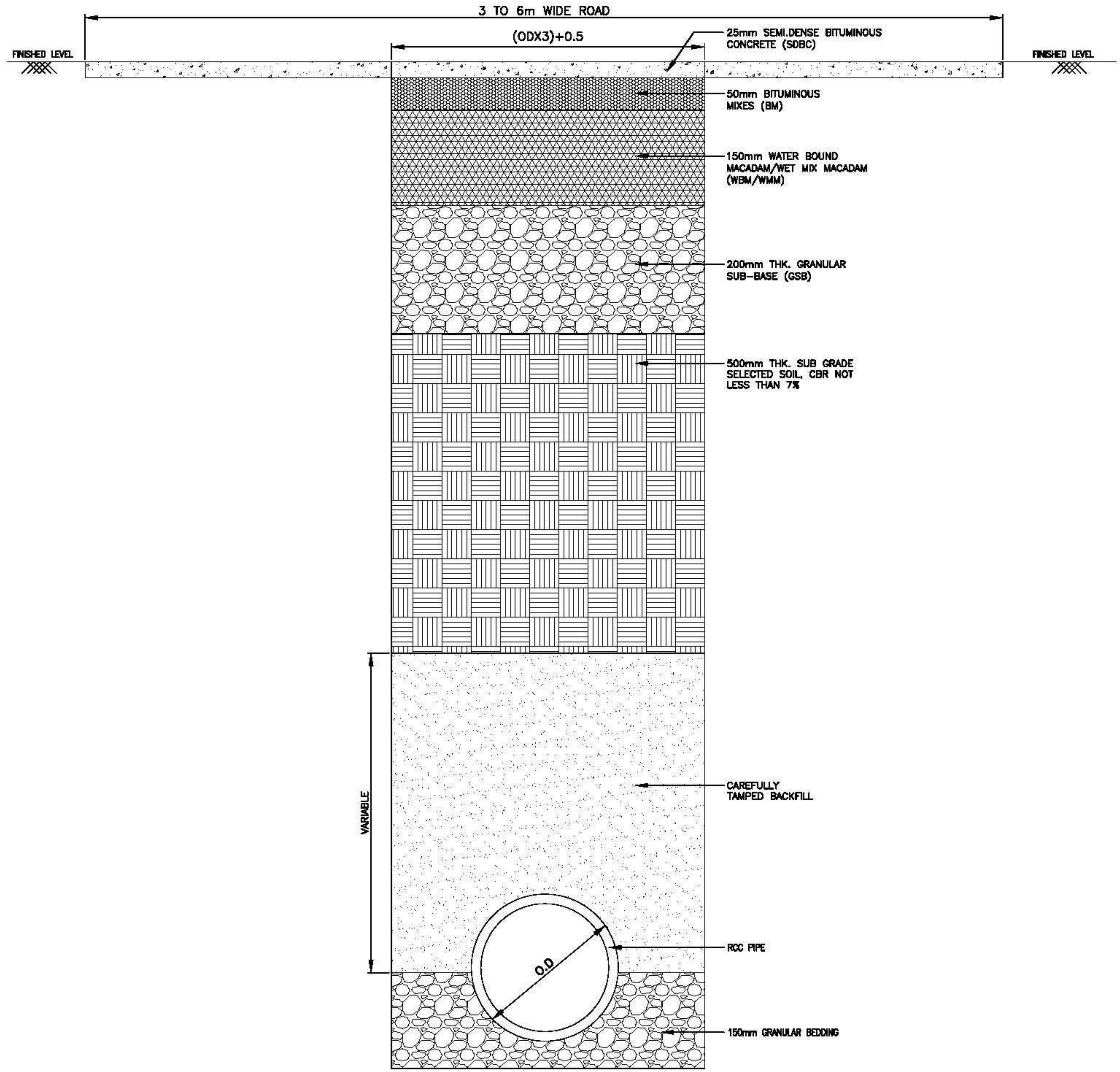
Website:- http://www.buidco.in.

DRAWING TITLE

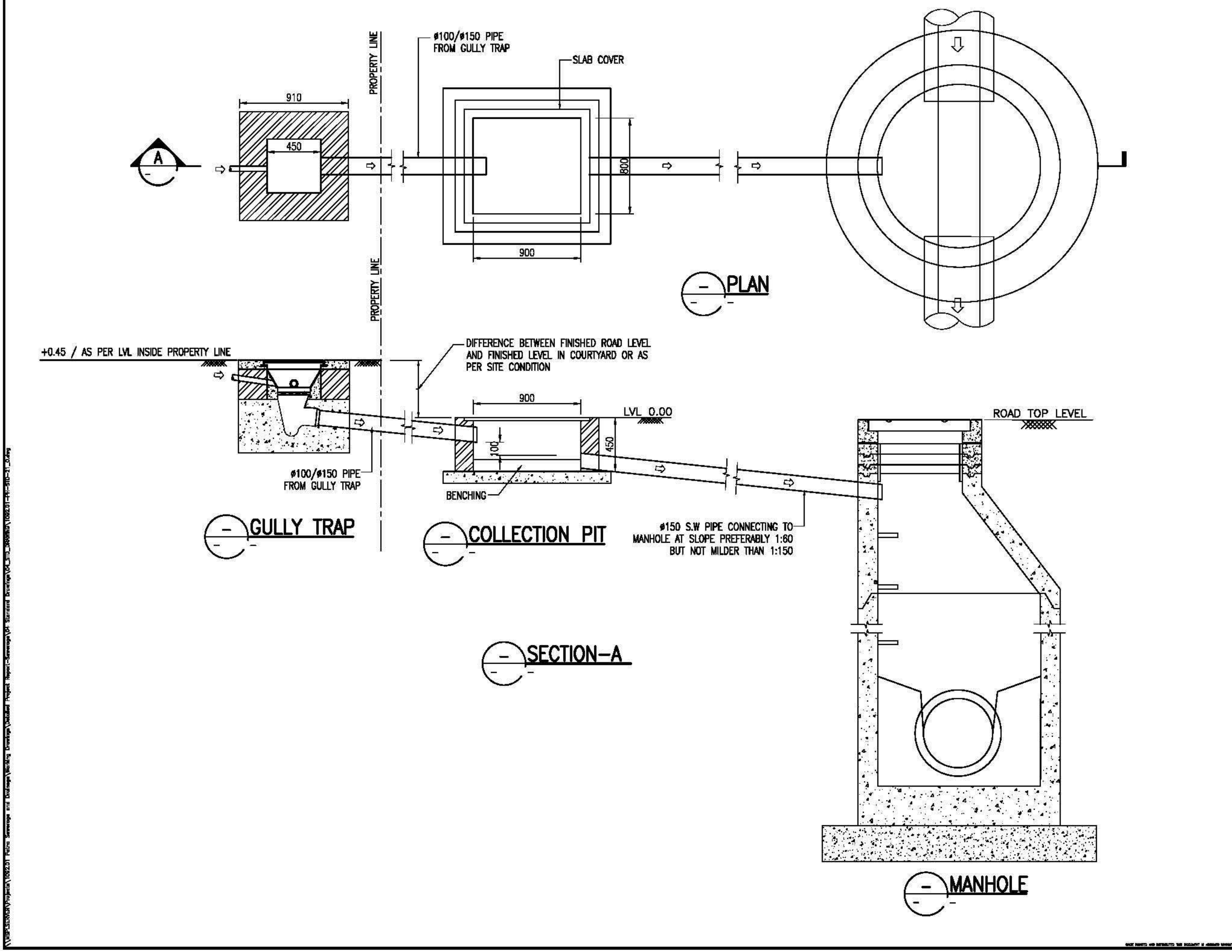
MANHOLE DETAIL AT PIPE JUNCTION & ENCASING DETAIL OF SEWER UNDER STREAM BED & ROAD CROSSING

PURPOSE OF ISSUE: DRAFT DETAILED PROJECT REPORT		SCALE:- NTS
		SHEET SIZE:- A3
	BY	DATE OF FIRST ISSUE
DRAWN	SA	MAY 2013
DESIGNED	JR	MAY 2013
CHECKED	RP	MAY 2013
APPROVED	CRR	MAY 2013

JOB NO.	DISCIPLINE	DRAWING NO.	REVISION
1092.01	PH	STD - 19	00



CROSS SECTION



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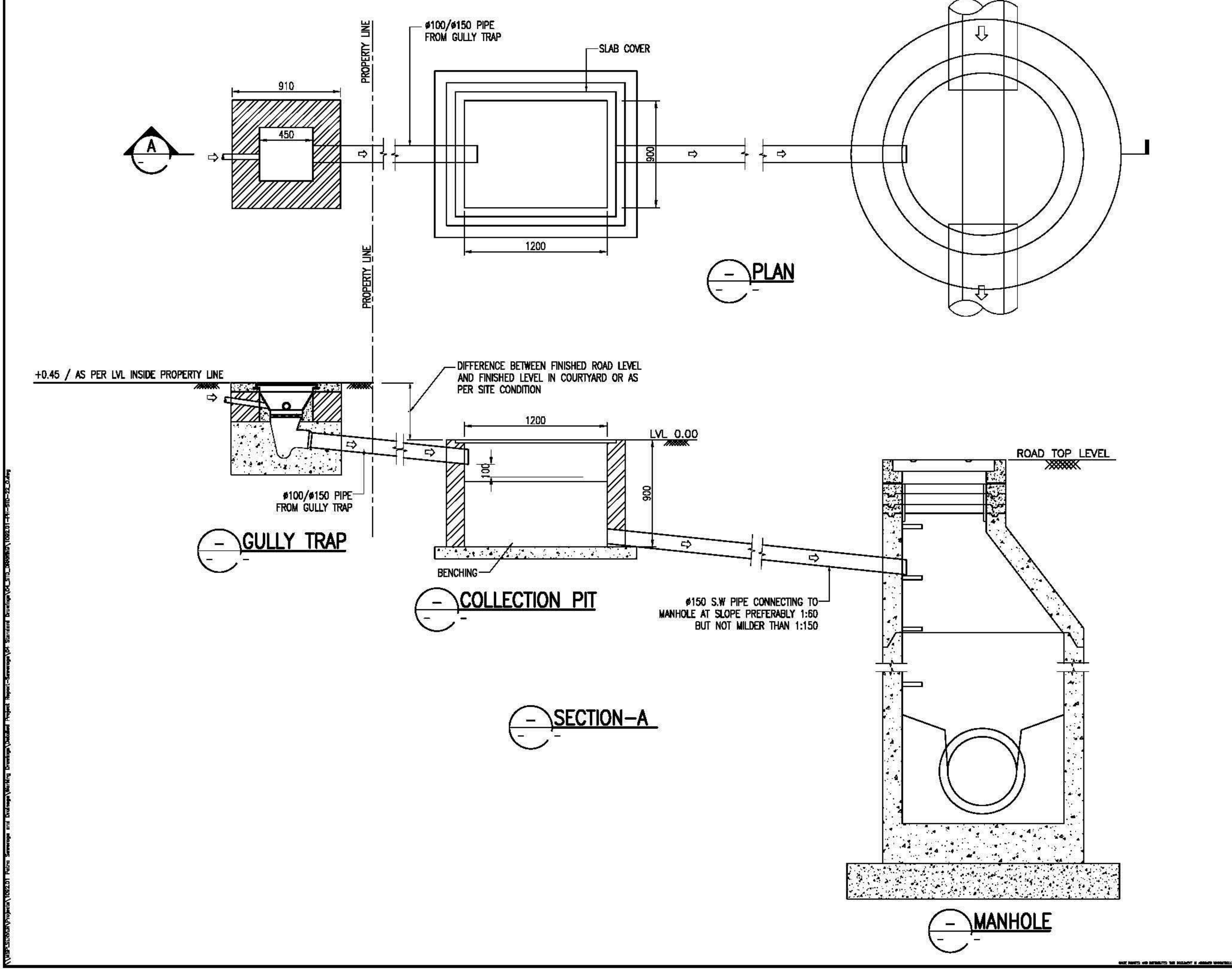
A
910
450
PROPERTY LINE
ø100/ø150 PIPE FROM GULLY TRAP
SLAB COVER
800
900
PROPERTY LINE
PLAN
+0.45 / AS PER LVL INSIDE PROPERTY LINE
DIFFERENCE BETWEEN FINISHED ROAD LEVEL AND FINISHED LEVEL IN COURTYARD OR AS PER SITE CONDITION
900
LVL 0.00
ROAD TOP LEVEL
100
450
ø100/ø150 PIPE FROM GULLY TRAP
BENCHING
GULLY TRAP
COLLECTION PIT
ø150 S.W PIPE CONNECTING TO MANHOLE AT SLOPE PREFERABLY 1:60 BUT NOT MILDER THAN 1:150
SECTION-A
MANHOLE



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PROPERTY LINE
ø100/ø150 PIPE FROM GULLY TRAP
SLAB COVER
910
450
A
900
1200
PLAN
+0.45 / AS PER LVL INSIDE PROPERTY LINE
DIFFERENCE BETWEEN FINISHED ROAD LEVEL AND FINISHED LEVEL IN COURTYARD OR AS PER SITE CONDITION
LVL 0.00
100
ROAD TOP LEVEL
BENCHING
ø150 S.W PIPE CONNECTING TO MANHOLE AT SLOPE PREFERABLY 1:60 BUT NOT MILDER THAN 1:150
GULLY TRAP
COLLECTION PIT
SECTION-A
MANHOLE

Annexure-3

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PN – 130418

REPORT ON

GEOTECHNICAL INVESTIGATIONS

FOR THE PROPOSED CONSTRUCTION OF

STP ON NEW LOCATION

IN

DIGHI KALA, HAJIPUR

Work Order No. TT/Soil-Test/BFC/Hajipur, Dated : 20.09.2012
Work order amendment no. – 1, Dated : 25.03.2013

Submitted to

Tri-Tech (Beijing) Co., Ltd.,

Plot No. 293, Kehar Singh Estate, Westend Marg, Opp. "D" Block
Saket, Saidula Jab, New Delhi – 110 030.

May, 2013

TRI-TECH (BEIJING) CO. LTD.

STU-3/82
30-05-13

BAIDYANATH FOUNDATION CONSULTANTS Pvt.Ltd.

[Unit : Bihar Foundation Consultants]
Ganga Darshan Apartment
P.O. Sadaqat Ashram
Patna – 10
[e-mail : bifcon.pat@gmail.com, Phone No: + 91612 – 6455320]

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CONTENTS

Appendix

[Containing Figures and Tables]

PN – 130418

1. INTRODUCTION

The subsoil investigations reported herein were taken up to find out the nature of subsoil at the site of the proposed construction and to recommend the capacity and type of its foundation. After certain tests on the soil, as detailed below, the desired recommendations have been made on **page 3 - 4** of this Report.

2. FIELD WORK

The fieldwork consisted of sinking bore holes, collecting soil samples and conducting the necessary field tests.

2.1. Boring

Taking guidance from IS: 1892, 150 mm diameter bore holes were sunk at locations shown in the bore hole location map.

2.2 Sampling

2.2.1 Undisturbed Soil Samples

Open drive samplers of 100-mm diameter and about 450-mm length were used for obtaining undisturbed samples of cohesive soils. The collection, sealing, labeling and transportation of the samples to the laboratory were done as per the IS guide-lines.

2.2.2 Disturbed Soil Samples

Disturbed soil samples were collected at suitable intervals of depth (not more than 2.5 m) and at all depths of change in the nature of the subsoil. These samples were sealed in polythene bags with proper identification labels.

2.3 Field Tests

2.3.1 Standard Penetration Tests (SPT)

These tests were conducted as per IS: 2131 – 1963. The depth interval between two consecutive tests was 1 to 1.5 m. The tests were located in between the levels at which undisturbed soil samples were collected.

3. LABORATORY TESTS

Some or all of the following laboratory tests, as necessary, were done on the collected soil samples. Representative soil samples were selected for this from the different soil strata encountered during boring. The tests were performed as per the relevant Indian Standard Codes of Practice.

(a) Natural moisture content

(b) Bulk density

(c) Grain size analysis (using sieves and / or hydrometer)

(d) Specific gravity of soil solids

(e) Atterberg's limit tests (liquid, plastic and shrinkage limits)

(f) Shear Tests :

- [I] Triaxial compression test (unconsolidated – undrained), generally for fine- grained soils
- [II] Unconfined compression tests, only on cohesive soils
- [III] Direct shear tests, generally for coarse-grained soils

(g) Other tests as and when required.

4. PRESENTATION OF TEST RESULTS

The field and laboratory test results are given in the **Appendix B.**

5. SOIL STRATIFICATION

The two bore holes sunk at the site and the results of field and laboratory tests conducted on the collected soil samples indicate that the soil stratification at the site is as describe below.

The sub soil up to about 7 m in BH 1 and 5.5 m in BH 2 is [a] silty clay [CL/CI]. Then follow layers of [b] sandy clayey silt/ silt [CL-ML/ ML] up to 14.5 m in BH 1 and up to the investigated depth of 20 m in BH 2 while, in BH 1, [c] sand / silty sand [SP/SP-SM] lies up to the investigated depth of 20 m below GL.

Water table was struck at about 2.5 m to 2.6 m bgl in April, 2014.

6. FOUNDATION ANALYSIS

The safe capacity of foundation of any type and size may be determined on the basis of the soil data given in this Report by using the standard methods of foundation design and following the relevant Indian Standard Codes.

7. RECOMMENDATIONS

The proposed structure may be provided with shallow foundations [strip, square or raft].

By way of example, the values of safe capacities of shallow foundations of certain sizes and depths have been calculated (vide Sample of Calculation in Appendix F 1 to F 2). The calculated values have been tabulated below.

Table 1 : Allowable Net Bearing Pressures [q_{na}] and Settlements Expected [s]

Depth (m) below Ground Level	Width (m)	Net allowable bearing pressure (t/m^2)			Maximum expected settlement (mm)
		Strip footing	Square footing	Raft footing	
2.0	2	10.3	14.4	--	75
	3	6.9	12.2	--	75
	10	--	--	11.4	125
2.5	2	11.8	15.5	--	75
	3	7.7	13.6	--	75
	10	--	--	12.0	125
3.0	2	13.3	16.8	--	75
	3	8.6	15.0	--	75
	10	--	--	12.6	125
4.5	2	17.7	29.8	--	75
	3	11.0	19.3	--	75
	10	--	--	14.4	125

Continue on next page ....

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Table 1 : Allowable Net Bearing Pressures [q_{na}] and Settlements Expected [s]

Depth (m) below Ground Level	Width (m)	Net allowable bearing pressure (t/m^2)			Maximum expected settlement (mm)
		Strip footing	Square footing	Raft footing	
6.0	2	19.0	22.3	--	50
	3	17.0	19.7	--	50
	10	--	--	17.2	100
7.5	2	24.5	28.9	--	50
	3	21.5	25.0	--	50
	10	--	--	20.6	100
10.5	2	36.4	43.1	--	50
	3	30.6	36.0	--	50
	10	--	--	27.0	100
12.0	2	69.3	82.8	--	50
	3	56.7	67.4	--	50
	10	--	--	46.7	100
15.0	2	89.6	107.0	--	50
	3	71.6	85.3	--	50
	10	--	--	55.6	100

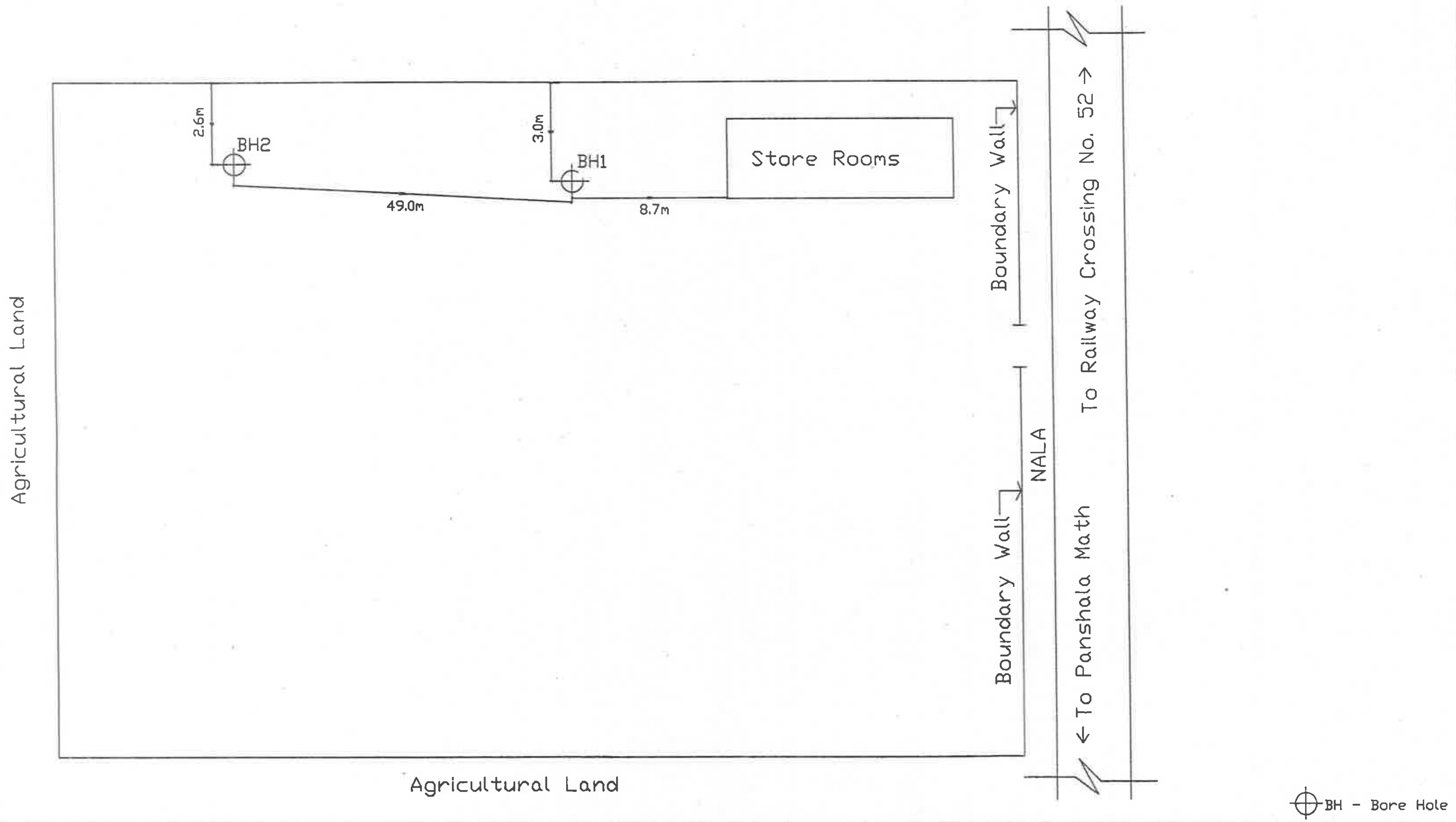
Notes :

1. If a subsoil condition much different from those reported herein is met with during foundation trenching or piling, suitable steps should be taken.
2. DMC and tremie method of pile concreting should be adopted as the water table is near the ground surface.
3. Shallow foundations or pile caps should be isolated from the surrounding expansive soil of type CI by layers of compacted local sand.

For Baidyanath Foundation Consultants Pvt. Ltd.,

(Dr. C.N. Sinha, FIE)
Chief Consultant.

BAIDYANATH FOUNDATION CONSULTANTS PVT. LTD. ★ PATNA



Appendix - A

Location Sketch of Bore Holes For
THE PROPOSED C/O
STP ON NEW LOCATION
IN DIGHI KALA, HAJIPUR

Scale = Not to Scale

Drawing No- 130418

NORTH

BAIDYANATH FOUNDATION CONSULTANTS PVT. LTD.
[Unit : Bihar Foundation Consultants]
GANGA DARSHAN APARTMENT, Patna - 10
Phone no - +91612 - 6455320

Field Work Conducted By - Mukesh Kumar

Drawn By : - Kashif Ahmad

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NAME OF WORK : Sub soil Investigation for C/O
New Location for STP in Dighi Kala, Hajipur.
BORE HOLE NO. : 1

BORING FINISH DATE : 15.04.13
BORING METHOD : Rotary
TERMINATION DEPHT : 20.0 m

WATER TABLE : 2.50 m bgl
RECORD ON : 16.04.13

Sample Depth Below GL (m)	Sample No.	SPT 'N' Value observation	Visual Description of Soil with IS Classification	Depth(m)		Thickness (m)	Liquid Limit	Plastic Limit	Bulk Density (gm/cc)	Natural Moisture Content (%)	Specific Gravity	Shear Test			Compression Index (C_c)
		Obsr.		from	to							Type of Test	Cohesion, c (kg/cm^2)	Friction Angle, ϕ °	
1.0				0.0											
1.5	S1	8					33.0	23.1	1.98	26.9	2.69	UU	0.42	4.6	
2.5															
3.0	S2	9					34.0	18.6	1.99	26.4	2.69	UU	0.46	5.0	
4.0			Reddish grey silty clay. CL			7.0									
4.5	S3	22							2.03	23.9	2.69	UU	0.80	5.9	0.120
5.5															
6.0	S4	44							2.07	21.6	2.69	UU	1.26	6.1	
7.0					7.0										
7.5	S5	55		7.0			29.4	23.6	2.00	25.8	2.69	UU	0.78	10.4	
8.5															
9.0	S6	34							1.99	26.4	2.69	UU	0.61	11.2	
10.0															
10.5	S7	40							1.99	26.1	2.68	UU	0.65	11.6	
11.5			Reddish grey sandy clayey silt. CL-ML			7.5									
12.0	S8	65					26.8	22.9	2.01	24.8	2.68	UU	0.92	9.8	
13.0															
13.5	S9	70							2.01	24.7	2.68	UU	0.98	9.6	
14.5					14.5										
15.0	S10	75		14.5					1.84	34.9	2.60	DS	0.00	35.0	
16.0															
16.5	S11	83							1.84	34.8	2.60	DS	0.00	35.1	
17.5			Reddish grey sand. SP			4.5									
18.0	S12	>50							1.84	34.8	2.60	DS	0.00	35.1	
19.0					19.0										
19.5	S13	>50	Reddish grey silty sand. SP-SM	19.0		1.0			1.84	34.8	2.60	DS	0.00	35.1	
20.0					20.0										

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NAME OF WORK : Sub soil Investigation for C/O **New Location for STP in Dighi Kala, Hajipur.**
BORE HOLE NO. : 2

BORING FINISH DATE : 16.04.13
BORING METHOD : Rotary
TERMINATION DEPHT : 20.0 m

WATER TABLE : 2.60 m bgl
RECORD ON : 17.04.13

Sample Depth Below GL (m)	Sample No.	SPT 'N' Value observation	Visual Description of Soil with IS Classification	Depth(m)		Thickness (m)	Liquid Limit	Plastic Limit	Bulk Density (gm/cc)	Natural Moisture Content (%)	Specific Gravity	Shear Test			Compression Index (C_c)
		Obsr.		from	to							Type of Test	Cohesion, c (kg/cm^2)	Friction Angle, ϕ °	
1.0			Reddish grey silty clay. CI	0.0		5.5									
1.5	S1	9					36.3	23.9	1.99	27.9	2.70	UU	0.46	5.1	
2.5															
3.0	S2	15					36.7	22.5	1.99	27.9	2.70	UU	0.60	5.6	
4.0															
4.5	S3	19							2.03	24.0	2.69	UU	0.70	5.7	0.122
5.5					5.5										
6.0	S4	20	Reddish grey sandy clayey silt. CL-ML	5.5		3.0	29.8	23.4	1.96	28.1	2.68	UU	0.22	12.5	
7.0															
7.5	S5	24							1.97	27.6	2.69	UU	0.26	12.4	
8.5					8.5										
9.0	S6	29	Reddish grey clayey silt. ML	8.5		3.0	31.4	24.6	1.98	26.9	2.69	UU	0.34	11.6	
10.0															
10.5	S7	32							1.99	26.0	2.68	UU	0.36	11.5	
11.5					11.5										
12.0	S8	60	Reddish grey sandy clayey silt. CL-ML	11.5		8.5	26.8	22.1	2.01	24.9	2.68	UU	0.88	10.1	
13.0															
13.5	S9	63							2.01	24.8	2.68	UU	0.91	9.8	
14.5															
15.0	S10	69					25.1	21.6	2.01	24.8	2.68	UU	1.00	9.6	
16.0															
16.5	S11	78							2.02	24.2	2.68	UU	1.14	9.5	
17.5															
18.0	S12	88							2.02	24.1	2.68	UU	1.29	9.4	
19.0															
19.5	S13	>50							2.02	24.1	2.68	UU	1.31	9.4	
20.0					20.0										

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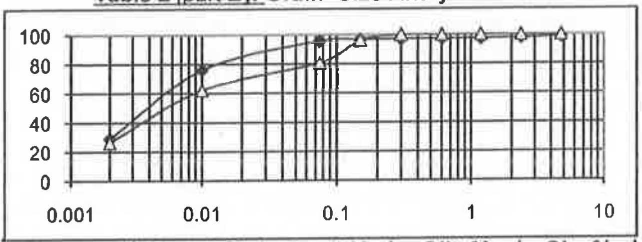
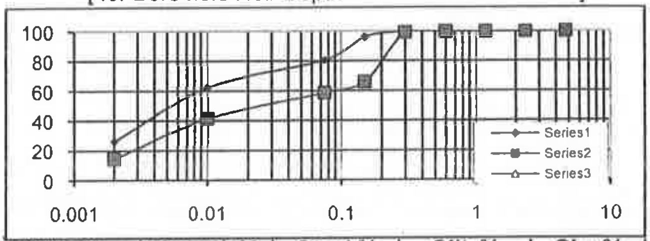
Report on Sub Soil Investigation for the proposed C/O STP On New Location in Dighi Kala, Hajipur.

Table 2 [part B]: Grain Size Analysis Results

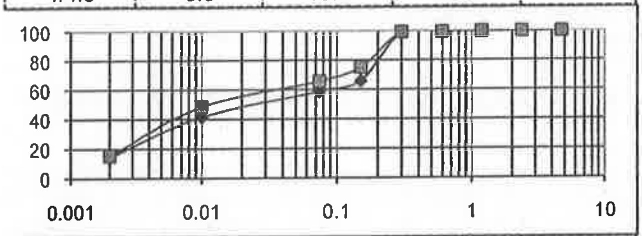
[for Bore hole No./ Depth in m shown thus: 1/1.5]



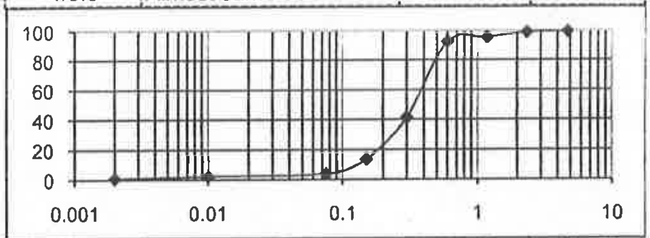
BH/depth,m	Gravel, %	Sand,%	Silt, %	Clay%
1/1.5	1.3	3.0	66.9	28.8
1/3.0	Almost same as 1/1.5			
1/4.5	0.0	19.2	54.5	26.3



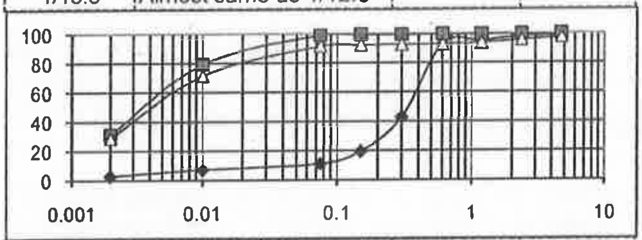
BH/depth,m	Gravel, %	Sand,%	Silt, %	Clay%
1/6.0	0.0	19.2	54.6	26.2
1/7.5	0.0	41.3	44.4	14.3
1/9.0	Almost same as 1/7.5			



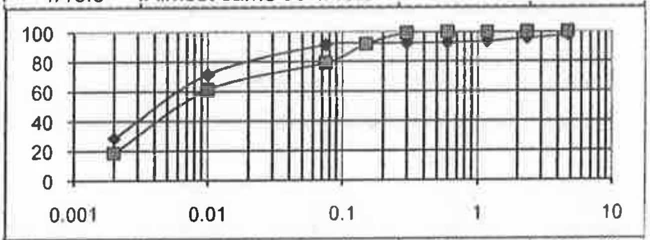
BH/depth,m	Gravel, %	Sand,%	Silt, %	Clay%
1/10.5	0.0	41.3	44.5	14.2
1/12.0	0.0	34.1	50.5	15.4
1/13.5	Almost same as 1/12.0			



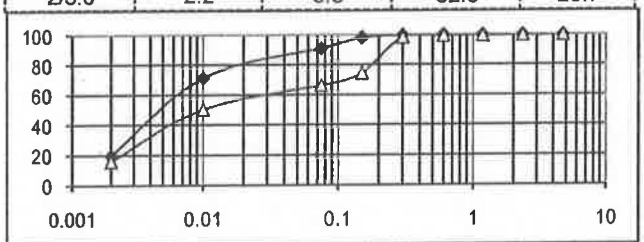
BH/depth,m	Gravel, %	Sand,%	Silt, %	Clay%
1/15.0	0.3	95.7	3.2	0.8
1/16.5	Almost same as 1/15.0			
1/18.0	Almost same as 1/15.0			



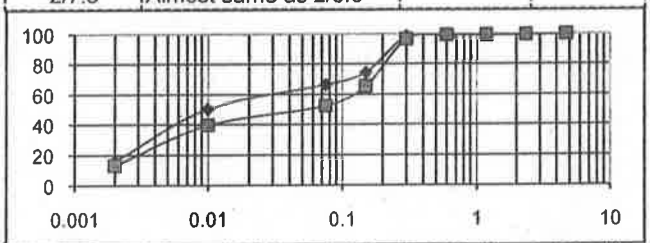
BH/depth,m	Gravel, %	Sand,%	Silt, %	Clay%
1/19.5	1.1	87.8	8.2	2.9
2/1.5	0.0	1.0	67.8	31.2
2/3.0	2.2	6.3	62.8	28.7



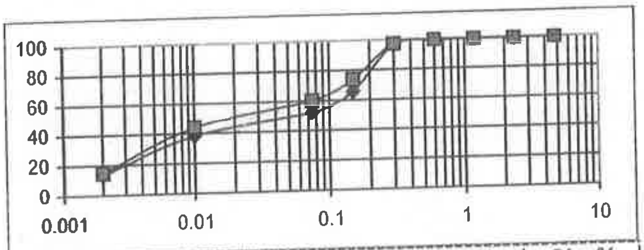
BH/depth,m	Gravel, %	Sand,%	Silt, %	Clay%
2/4.5	2.2	6.3	62.8	28.6
2/6.0	0.0	20.8	60.6	18.6
2/7.5	Almost same as 2/6.0			



BH/depth,m	Gravel, %	Sand,%	Silt, %	Clay%
2/9.0	0.0	8.6	71.7	19.7
2/10.5	Almost same as 2/9.0			
2/12.0	0.0	33.6	50.8	15.6

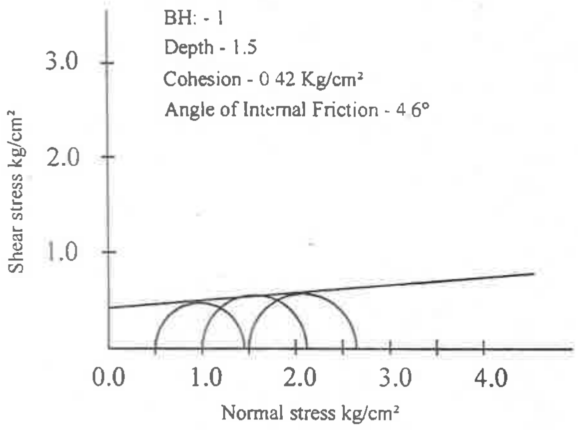


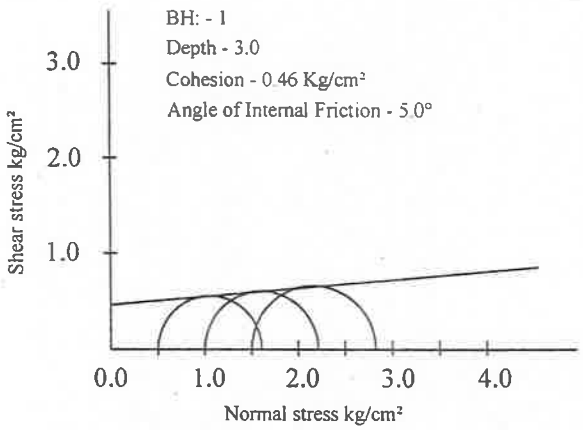
BH/depth,m	Gravel, %	Sand,%	Silt, %	Clay%
2/13.5	0.0	33.6	50.7	15.7
2/15.0	0.0	47.4	39.4	13.3
2/16.5	Almost same as 2/15.0			

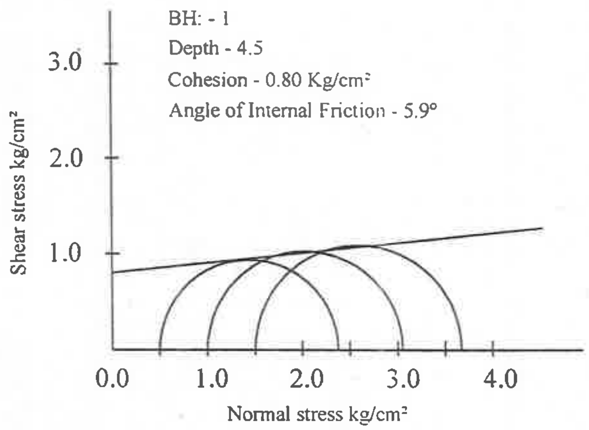


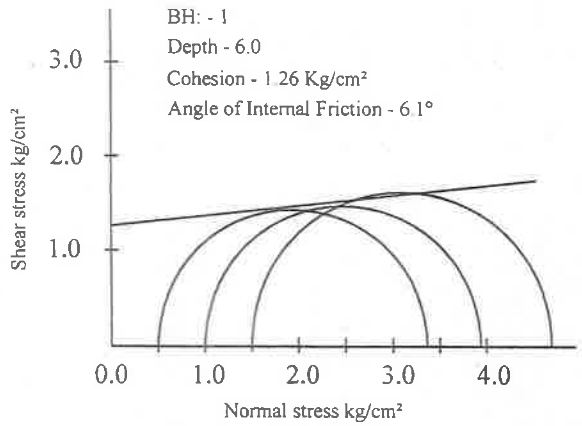
BH/depth,m	Gravel, %	Sand,%	Silt, %	Clay%
2/18.0	0.0	47.4	39.4	13.2
2/19.5	0.0	39.9	45.5	14.7

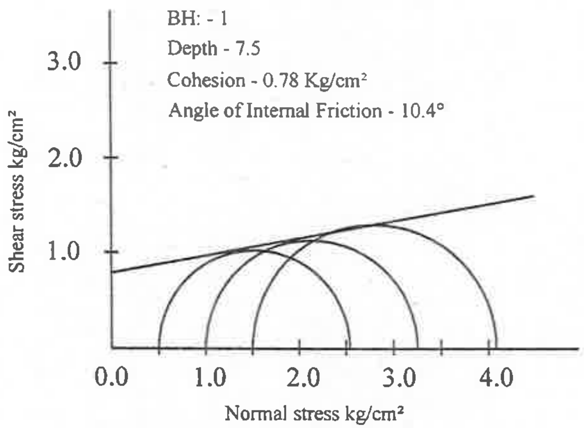
TRIAXIAL / DIRECT SHEAR TEST PLOTS

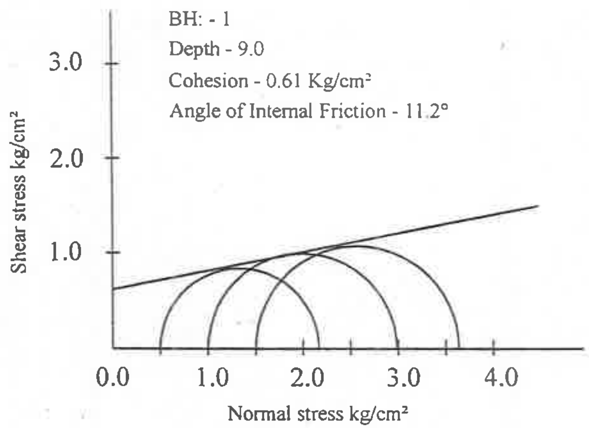












Appendix - D1

Baidyanath Foundation Consultants Pvt. Ltd.
[Unit : Bihar Foundation Consultants]
Ganga Darshan Apartment, Patna - 10
Phone No. - +91612 - 6455320

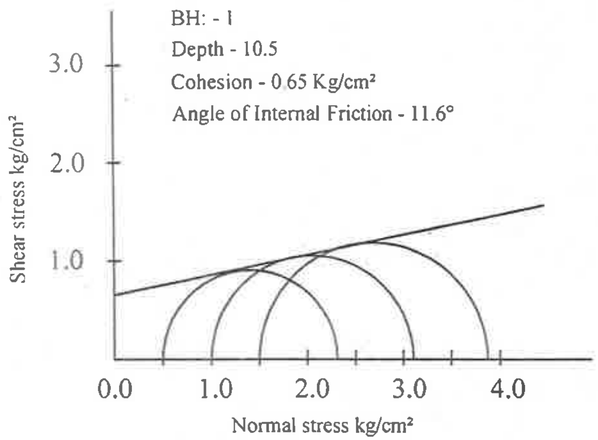
Project No. 130418

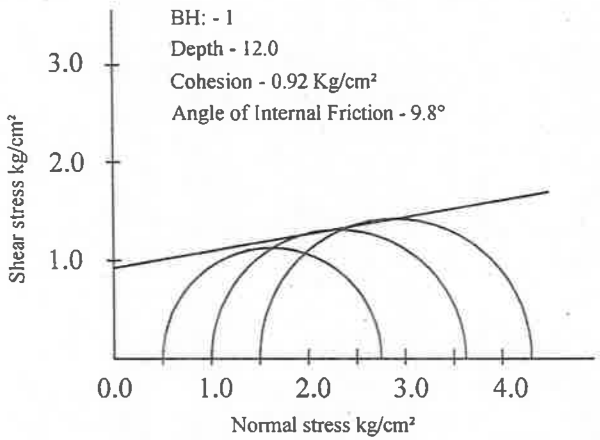
Proposed C/O

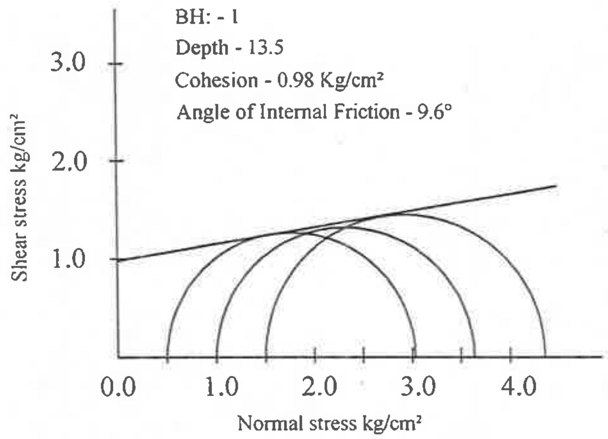
STP ON NEW LOCATION
IN
DIGHI KALA, HAJIPUR

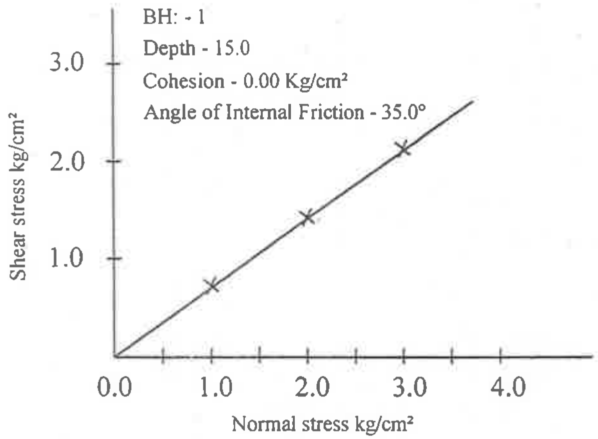
862

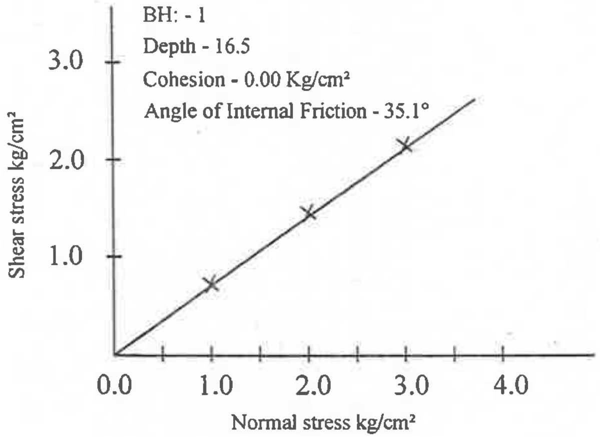
TRIAXIAL / DIRECT SHEAR TEST PLOTS

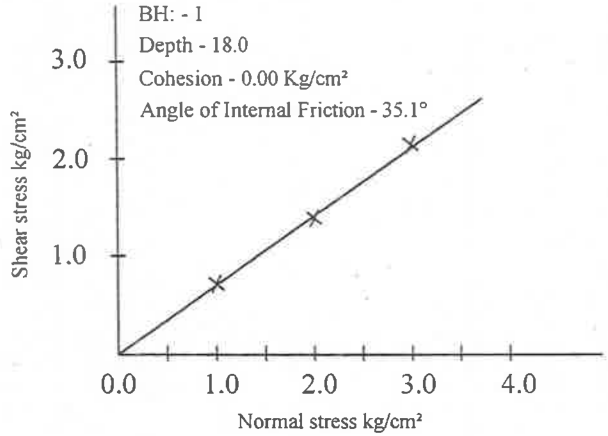












Appendix - D2

Baidyanath Foundation Consultants Pvt. Ltd.
[Unit : Bihar Foundation Consultants]
Ganga Darshan Apartment, Patna - 10
Phone No. - +91612 - 6455320

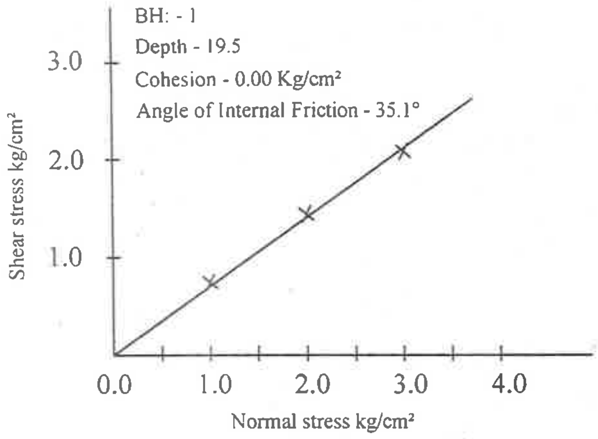
Project No. 130418

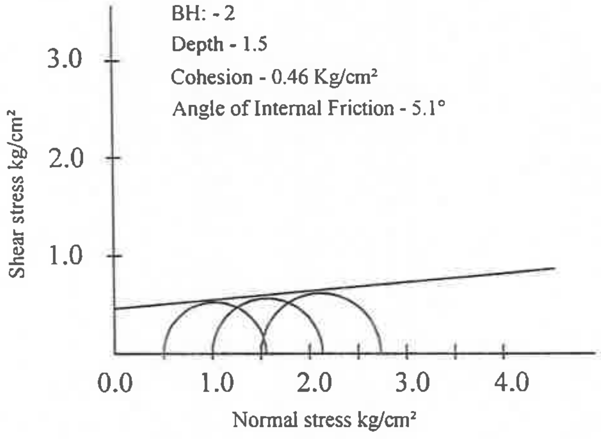
Proposed C/O

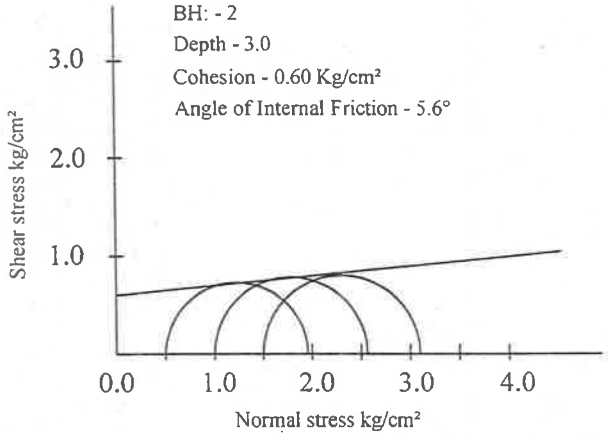
STP ON NEW LOCATION
IN
DIGHI KALA, HAJIPUR

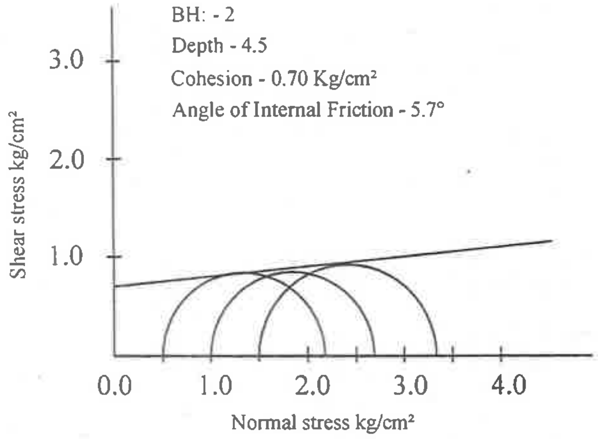
1650

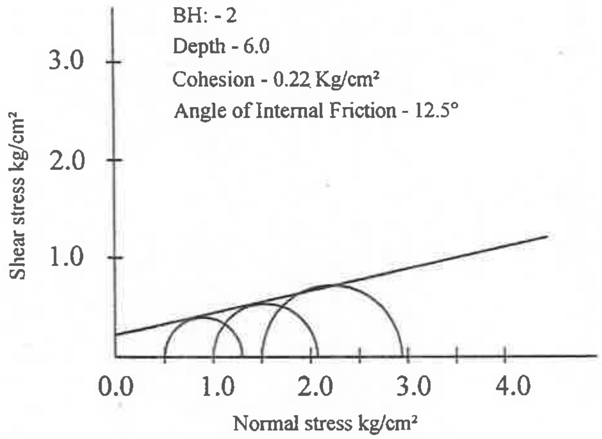
TRIAXIAL / DIRECT SHEAR TEST PLOTS

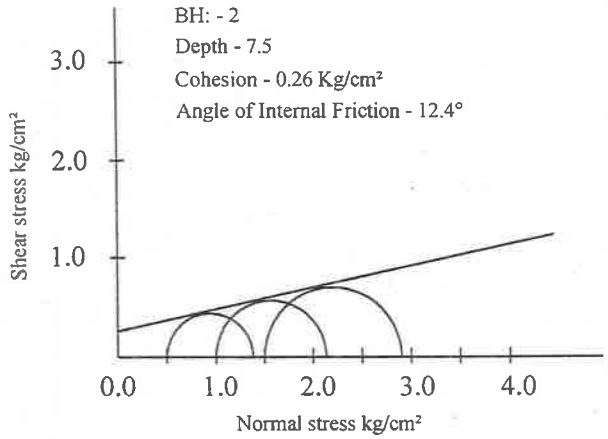












Appendix - D3

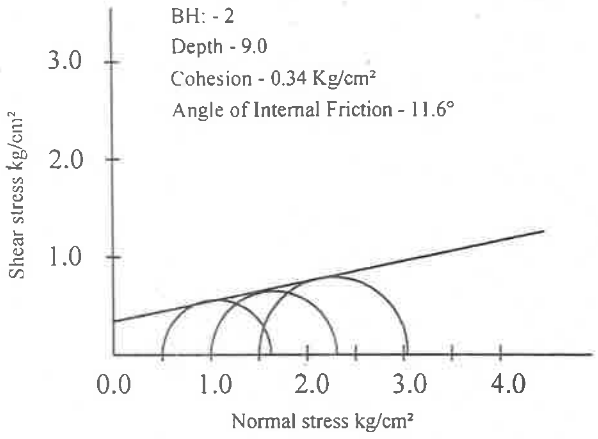
Baidyanath Foundation Consultants Pvt. Ltd.
[Unit : Bihar Foundation Consultants]
Ganga Darshan Apartment, Patna - 10
Phone No. - +91612 - 6455320

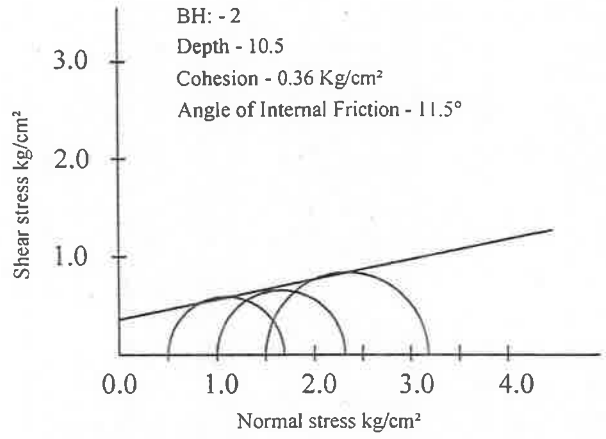
Project No. 130418

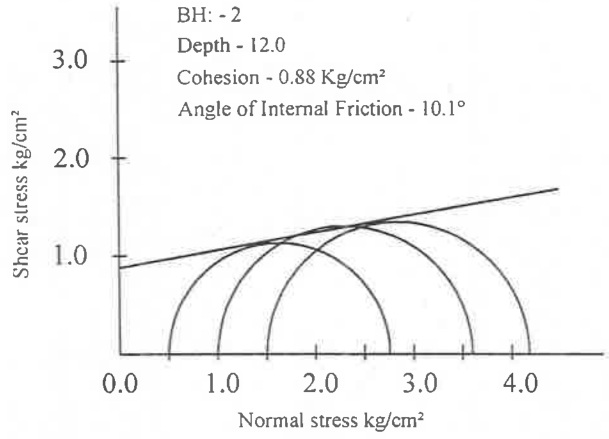
Proposed C/O

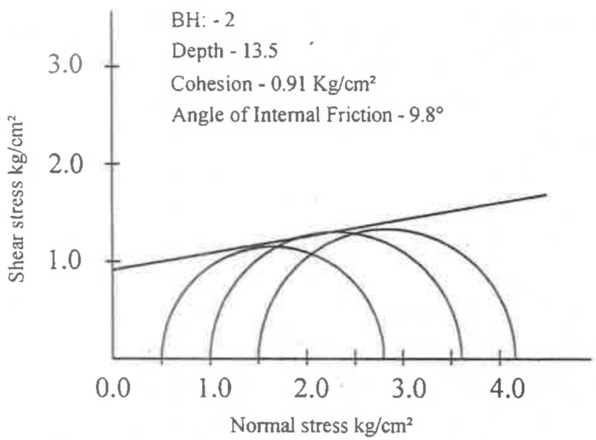
STP ON NEW LOCATION
IN
DIGHI KALA, HAJIPUR

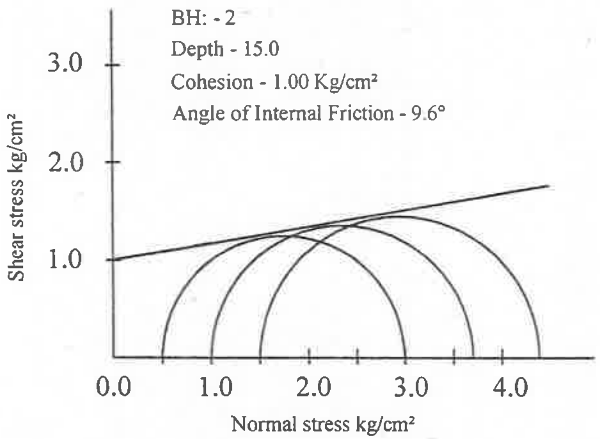
TRIAXIAL / DIRECT SHEAR TEST PLOTS

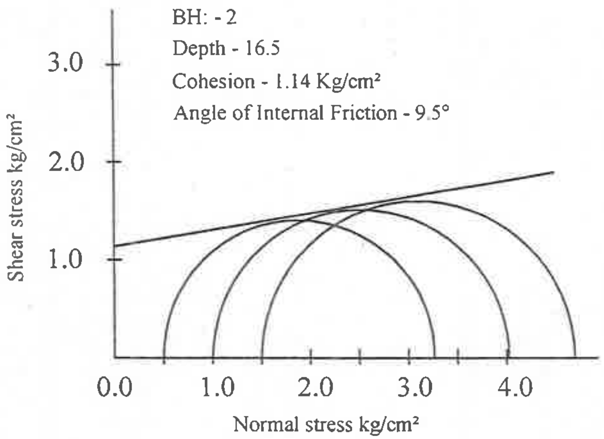












Appendix - D4

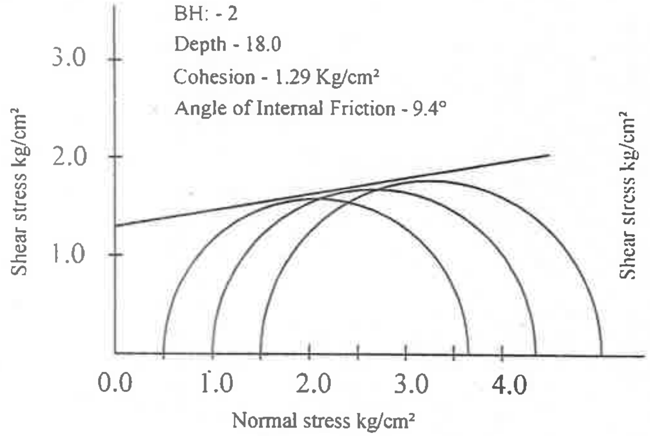
Baidyanath Foundation Consultants Pvt. Ltd.
[Unit : Bihar Foundation Consultants]
Ganga Darshan Apartment, Patna - 10
Phone No. - +91612 - 6455320

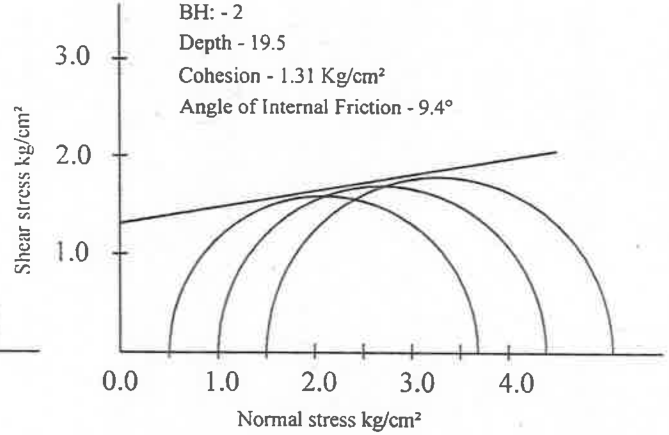
Project No. 130418

Proposed C/O

STP ON NEW LOCATION
IN
DIGHI KALA, HAJIPUR

TRIAXIAL / DIRECT SHEAR TEST PLOTS





Appendix - D5

Baidyanath Foundation Consultants Pvt. Ltd.
[Unit : Bihar Foundation Consultants]
Ganga Darshan Apartment, Patna - 10
Phone No. - +91612 - 6455320

Project No. 130418

Proposed C/O

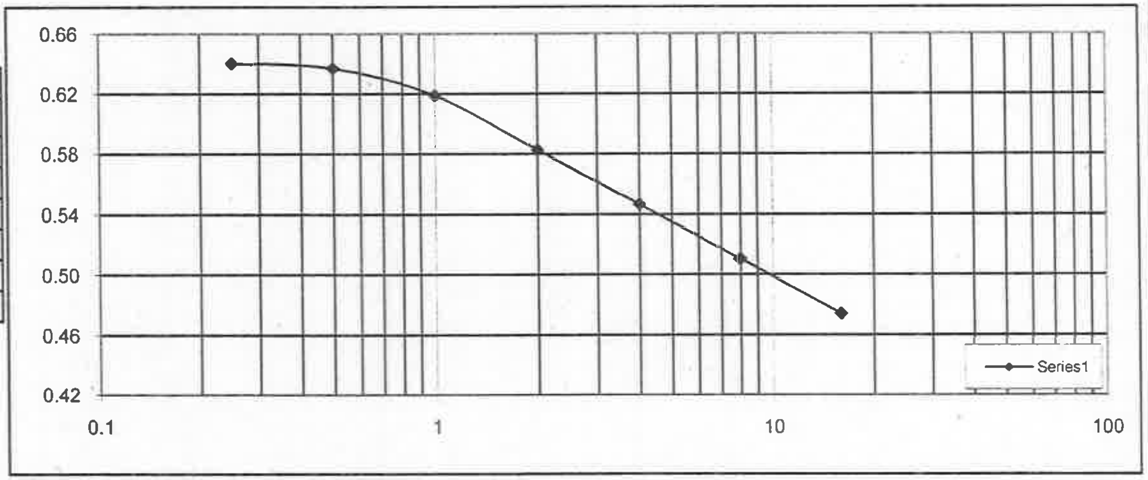
STP ON NEW LOCATION
IN
DIGHI KALA, HAJIPUR

(2094)

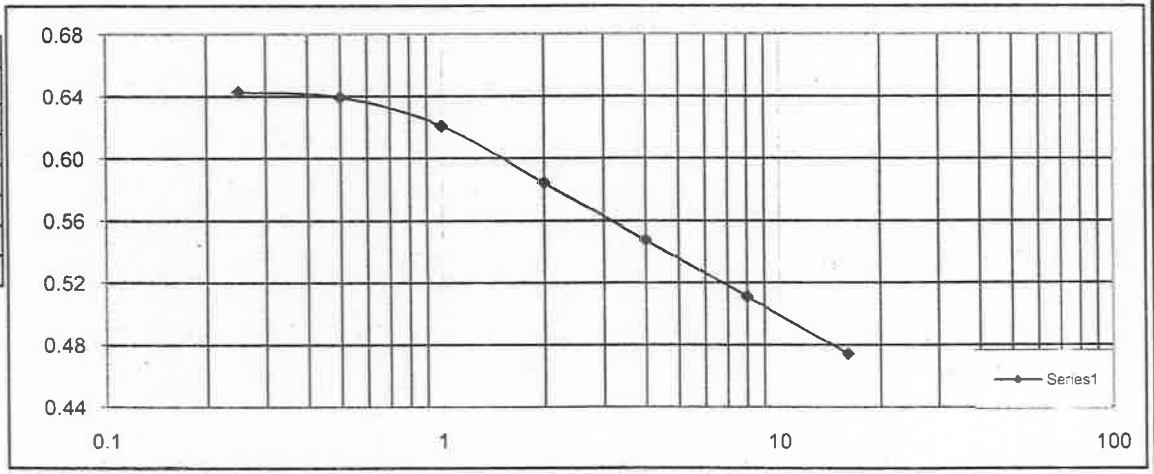
Fig. e - log p Plots from Consolidation Tests

X-axis : Pressure, p (kg/cm^2) on log scale. **Y-axis :** Void ratio, e

BH No./		Initial V.R.	
Depth (m)	Cc	e_0	CURVE
1/4.5	0.120	0.6429	Series1



BH No./		Initial V.R.	
Depth (m)	C_c	e_0	CURVE
2/4.5	0.122	0.6456	Series1



SAMPLE CALCULATION OF BEARING CAPACITY OF SHALLOW FOUNDATION

The determination of the **net safe bearing capacity, q_{ns},** is done on the basis of the shear failure criterion after dividing the value of the **net ultimate bearing capacity q_{nf}**, calculated as described below, by a suitable factor of safety. The **net soil pressure, q_s**, for a given permissible settlement is then calculated as explained in the next section. The lower of the two values, **q_{ns}** and **q_s**, thus determined is taken as the **allowable bearing capacity** of the soil.

1. Shear Failure Criterion :

The **net ultimate bearing capacity q_{nf}** (t/m^2) of a shallow foundation of breadth B (m) and depth D (m) is given as per IS:6403-1981 (Sec.5.1.2) by the following equation :

$$q_{nf} = c\,N_c\,s_c\,d_c\,I_c + q\,(N_q - 1)\,s_q\,d_q\,I_q + 0.5\,\gamma\,B\,N_\gamma\,s_\gamma\,d_\gamma\,I_\gamma\,w$$

where c = cohesion (t/m^2)

γ = unit weight of subsoil (t/m^3) [submerged unit weight, γ', is taken where so applicable]

q = effective surcharge (t/m^2) = γ D

N_c, N_γ, N_q = bearing capacity factors, which are functions of ϕ, **the angle of internal friction of the soil.**

s_c, s_q, s_γ = shape factors
d_c, d_q, d_γ = depth factors
I_c, I_q, I_γ = inclination factors
} related to cohesion, surcharge and density of subsoil respectively

w = water table factor (= 0.5 to 1.0) depending on the depth, D_w of water table [vide Table below].

The bearing capacity factors (N's) are functions of ϕ, the angle of internal friction of the soil. The values of these factors are found for general shear failure by referring to standard tables. If subsoil conditions are such as to lead to local shear failure, the values of these factors are found for a reduced value of angle of internal friction (ϕ') given by the equation : $\tan \phi' = 0.67 \tan \phi$. The value of cohesion is also reduced to $c' = 0.67\,c$.

The values of the other factors in the above equation for usual conditions are as tabulated below :

s_c =	1.3	1+0.2B/L	1	d_c = 1+ 0.2 $(N\varphi)^{0.5}$ D/ B			D_w at	G.L.	Fou'dn.Level
s_q =	1.2	1+0.2B/L	1	$d_q = d_\gamma$ = 1	for	$\varphi < 10°$	w =	0.5	1
s_γ =	0.8//0.6	1-0.4B/L	1	$d_q = d_\gamma$ = 1+ 0.1$(N\varphi)^{0.5}$ D/ B		$\varphi > 10°$	Interpolation	between	
FOR	sq.// O	Rect.	STRIP	I_c, I_q, I_γ = 1 for vertical load			these values	is linear.	

In the present case, the representative values of cohesion © and angle of internal friction (ϕ) may be obtained from the soil data given earlier. Full submergence of the soil has been assumed. **The safe bearing capacity, q_{ns}** has been obtained by dividing **q_{nf}** by a **safety factor, 3.**

One example of calculation of safe bearing capacity for a certain shape, depth and width of a footing is given in **Table A** on the next page. The net safe bearing capacity for the footing is entered in the last column of Table A. Calculations for other depths and widths of footings are done similarly.

The value of net safe bearing capacity (q_{ns}) calculated for each set of values of B and D is used for calculating the consolidation settlement s as explained in Sec. 2 below.

2. Settlement Criterion for Foundation on cohesive soil.

As per IS:8009(Part I)-1976, Sec. 9.2.2.2, the settlement s (in mm) is given by the equation :

$$s = [1000\ H\ C_c\ \log\ (1 + \Delta p/ p_o)\,] / (1 + e_o)\ \lambda$$

where H = thickness (in m) of the compressible layer

C_c = compression index of the soil

e_o = initial void ratio at mid-height of compressible soil layer = its m/c (m) x sp. Gravity

p_o = initial effective pressure at mid-height of the layer (t/m^2)

Δp = pressure increment at the mid-height of the layer due to the foundation (t/m^2).

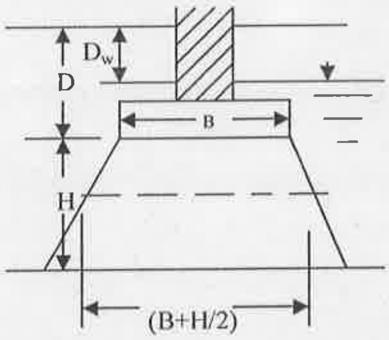
λ = correction factor

If there are different layers with different compression indices and void ratios, s is calculated for each one of these and then added together to get the settlement.

The pressure increment at any plane due to the footing load may be calculated by assuming the dispersion of load at a slope of 1 horizontal to 2 vertical. Hence the load applied over a width B of a foundation (vide the Fig. below) is spread at a depth H/2 below it over a width (B + H/2).

A correction factor λ = 0.80 is used as per IS Code to find the corrected settlement. If this value of corrected s is within the permissible limit specified in the Code, the corresponding value of q_{ns} is also the net allowable bearing capacity q_{na}. If not, trials give the desirued value of q_{na} . One example of this settlement analysis is given below the **Table B** in Sec. 3.

If $D_w > (D + 1.5\,B/2)$, $p_o = \gamma\,(D+1.5\,B/2)$ t/m², otherwise, $p_o = \gamma D_w + (\gamma - 1)(D - D_w + H/2)$ t/m²



D_w = depth of water table below ground level
D = depth of foundation
B = breadth of foundation
H = 1.5 x B = thickness of compressible soil layer in the zone of influence of the loaded foundation.
Breadth of the influence zone at the mid-plane of the compressible layer, of thickness H = (B + H/2).
In case of a rectangular or square footing a similar dispersion of load takes place along the other side of footing.

3. SAMPLE CALCULATION

Table A Calculation of Net Safe Bearing Capacity

Shape of Foundation:		STRIP	F.S.= 3	γ, t/m³= 2.03		c = 4.4	φ = 4.8	Nc = 6.43	Nq = 1.54	Nγ = 0.43
D [m]	B [m]	dc	dq = dg	c	q	I Term	II Term	III Term	qnf	qnf /F
2	2	1.22	1.109	4.4	2.03	34.44	1.22	0.48	36.13	12.04

The net safe bearing capacity for the footing is to be seen in the last column of the above Table A. This value is checked for settlement as shown below.

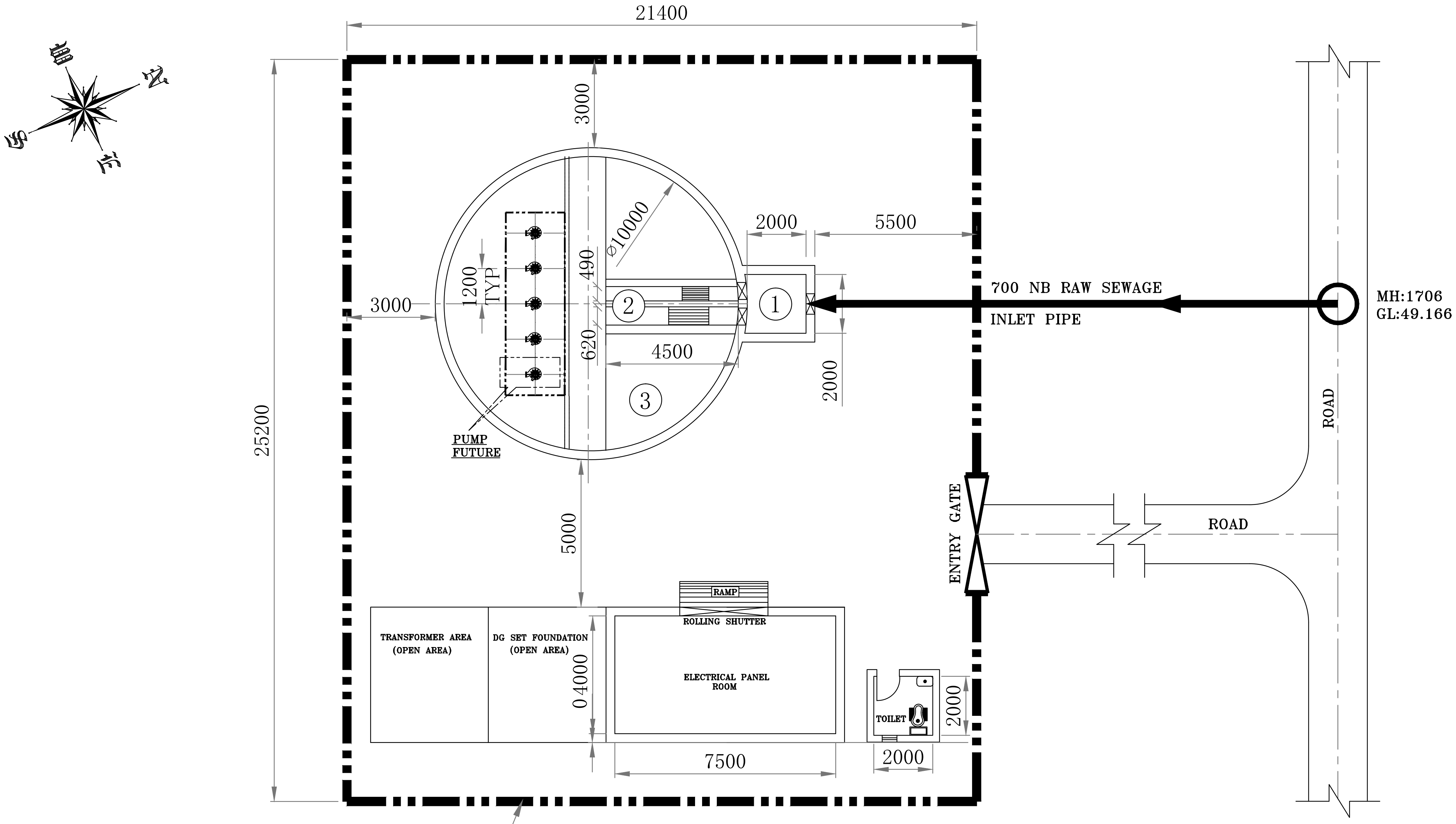
Table B Calculation of Settlement

m = 0.24		Gs = 2.69		eo = 0.6456		Cc = 0.122		Dw = 0	
Depth D [m]	Width B [m]	qnf /F t/m²	po t/m²	H m	Δp t/m²	log (1+ Δp/po)	s [mm] mm	λs mm mm	Remarks
2.0	2.0	12.0	3.6	3.0	6.9	0.5	103.1	82.5	Not Ok
2.0	2.0	10.3	3.6	3.0	5.9	0.4	93.5	74.8	OK

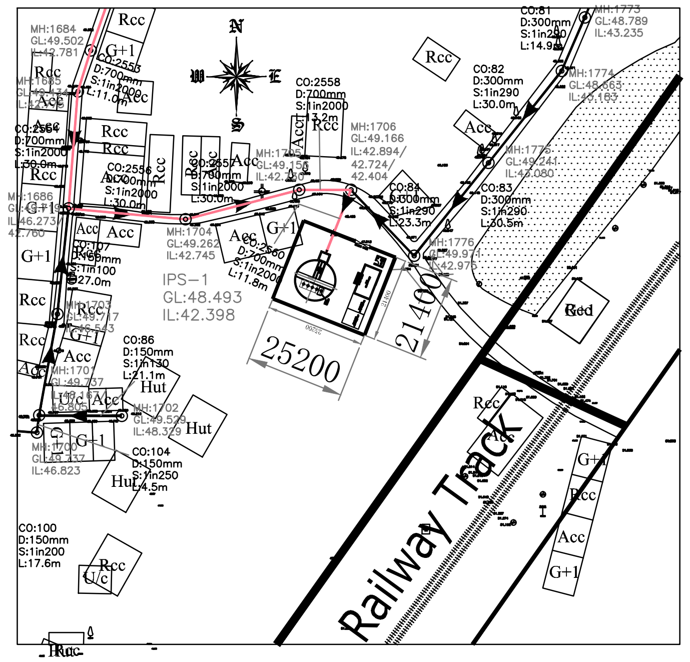
Hence the **net allowable bearing pressure** for a strip footing of width 2.0 m and depth 2.0 m below ground level will be 10.3 t/m².

The calculations for footings of other sizes and depths are done similarly.

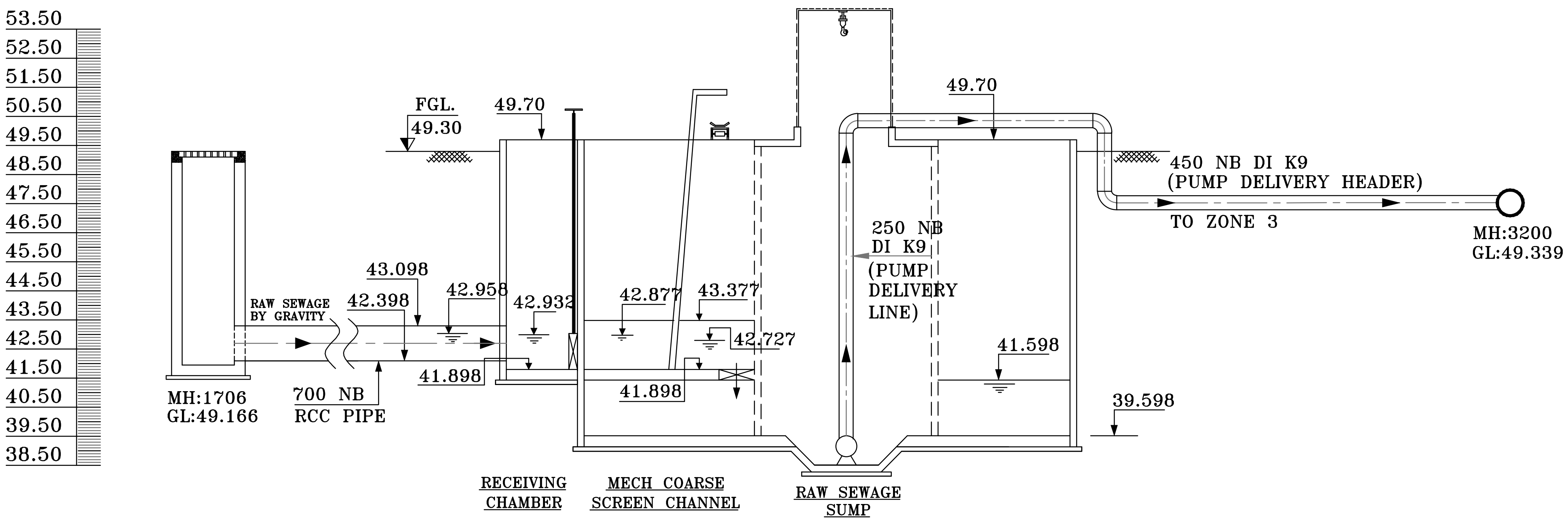
IPS BEP



LAYOUT PLAN



KEY PLAN



HYDRAULIC FLOW DIAGRAM

UNIT LIST

S.NO.	DESCRIPTION	SIZE IN METERS
1	RECEIVING CHAMBER	2.0 x 2.0
2	COARSE SCREEN CHANNELS	4.5
3	WET WELL	10.0 ⌀ x 2.0 SWD
4	TRANSFORMER AREA	4.0 x 4.0
5	ELECTRICAL PANEL ROOM	4.0 x 7.5
6	DG SET FOUNDATION	4.0 x 4.0
7	TOILET	2.0 x 2.0

NOTE:-

1.) BUIDCO TO PROVIDE AND TERMINATE 11.0 KV HT POWER SUPPLY AT HT SIDE OF TRANSFORMER.

REV.	DATE	DESCRIPTION	DRN.	CHKD.	APPD.
0	12.08.14	SUBMISSION FOR APPROVAL	M.S.	AKS	AKS

CLIENT:- BIHAR URBAN INFRASTRUCTURE DEVELOPMENT CORPORATION LTD., PATNA

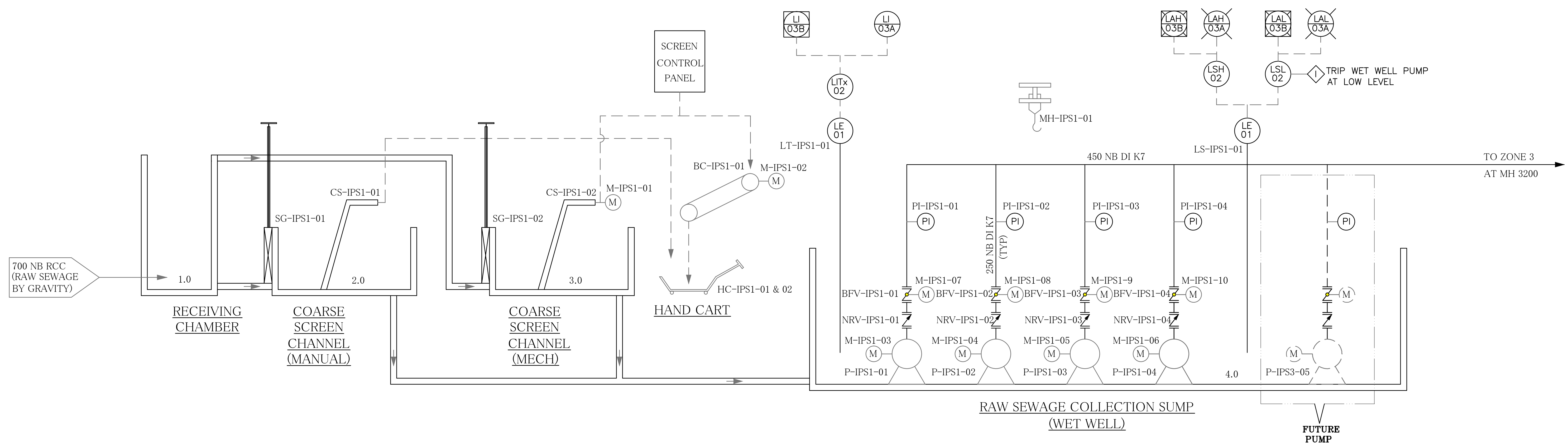
PROJECT:- 22 MLD SEWAGE TREATMENT PLANT AT HAJIPUR, BIHAR

BIDDERS NAME:- TRI-TECH (BEIJING) COMPANY LTD. BEIJING, NEW DELHI

DATE:- 12.08.14
DRAWN.:- M.S.
CHKD.:- AKS
APPD.:- AKS

TITLE:- IPS 1 LAYOUT PLAN CUM HYDRAULIC FLOW DIAGRAM

SCALE	SHEET	DRAWING NO.	REV.
AS MKD.	1 OF 1	TT/BEI/HJ/1051/IPS1/A06	0



UNIT LIST

UNIT NO.	UNIT DESCRIPTION	DIMENSIONS (M)	QTY	MOC
1.0	RECEIVING CHAMBER	2.0 x 2.0 x 1.034 SWD + 6.768FB	1	RCC
2.0	MANUAL COARSE SCREEN CHANNEL	4.5 x 0.49 x 0.979 SWD + 0.5 FB	1	RCC
3.0	MECH COARSE SCREEN CHANNEL	4.5 x 0.62 x 0.979 SWD + 0.5 FB	1	RCC
4.0	RAW SEWAGE COLLECTION SUMP (WET WELL)	10.0ø x 2.0 SWD + 8.102 FB	1	RCC

EQUIPMENT LIST

TAG NO.	EQUIPMENT DESCRIPTION	SIZE (M) / CAPACITY	QTY	MOC
CS-IPS1-01	MANUAL COARSE BAR SCREEN	0.29 W x 1.55 HT	1	SS 304
CS-IPS1-02	MECH COARSE BAR SCREEN	0.33 W x 9.273 HT	1	SS 304
BC-IPS1-01	BELT CONVEYOR	0.6 W	1	MFG STD
HC-IPS1- -01/02	HAND CART	0.5 M3	2	MSEP/FRP
P-IPS1-01/ 02/03/04	RAW SEWAGE TRANSFER PUMPS (W/MOTOR)	210.0 M3/HR x 22.0 MWC	4	AS PER NIT
M-IPS1-01	MANUAL CHAIN PULLEY HOIST (W/TROLLEY)	3.0 TON	1	MFG STD

VALVE/GATE LIST

TAG NO.	VALVE/GATE DESCRIPTION	DIMENSIONS (MM)	QTY	MOC
SG-IPS1- -01/02	MANUAL SLUICE GATE, FLANGE BACK FRAME, WALL THIMBLE	450 x 450	2	CI (AS PER NIT)
NRV-IPS1-01 /02/03/04	NON RETURN VALVE, D/F, PN 1.0, SWING CHECK	250 NB	4	CI (AS PER NIT)
BFV-IPS1-01/ 02/03/04	BUTTERFLY VALVE, D/F, PN 1.0, ELECTRICALLY ACTUATED	250 NB	4	CI (AS PER NIT)

INSTRUMENTATION LIST

TAG NO.	INSTRUMENT DESCRIPTION	SIZE (MM)	QTY	MOC
PI-IPS1-01/ 02/03/04	PRESSURE INDICATOR, DIAPHRAGM	150/100 NB	4	MFG STD
LS-IPS1-01	LEVEL SWITCH, CONDUCTIVITY TYPE		1	MFG STD
LT-IPS1-01	LEVEL TRANSMITTER, ULTRASONIC		1	MFG STD

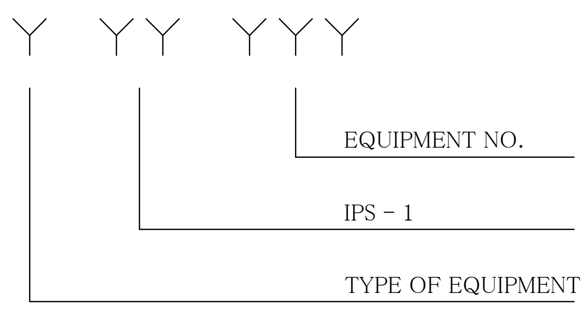
LEGENDS:-

	NON RETURN VALVE
	MOTORIZED BUTTERFLY VALVE
	GATE
	SUBMERSIBLE PUMP
	LOCAL INSTRUMENT
	PANEL ALARM
	SCADA INDICATION
	SCADA ALARM
	HARD WIRE INTERLOCK
	SEWAGE/WATER LINE
	SLUDGE LINE
LSH	LEVEL SWITCH HIGH
LSL	LEVEL SWITCH LOW
LAH	LEVEL ALARM HIGH
PI	PRESSURE INDICATOR

LEGENDS:-

LAL	LEVEL ALARM LOW
LE	LEVEL ELEMENT
LI	LEVEL INDICATOR
LITx	LEVEL INDICATOR CUM TRANSMITTER

EQUIPMENT TAG:-



0	12.08.14	SUBMISSION FOR APPROVAL	MS	MB	AKS
REV.	DATE	DESCRIPTION	DRN.	CHKD.	APPD.

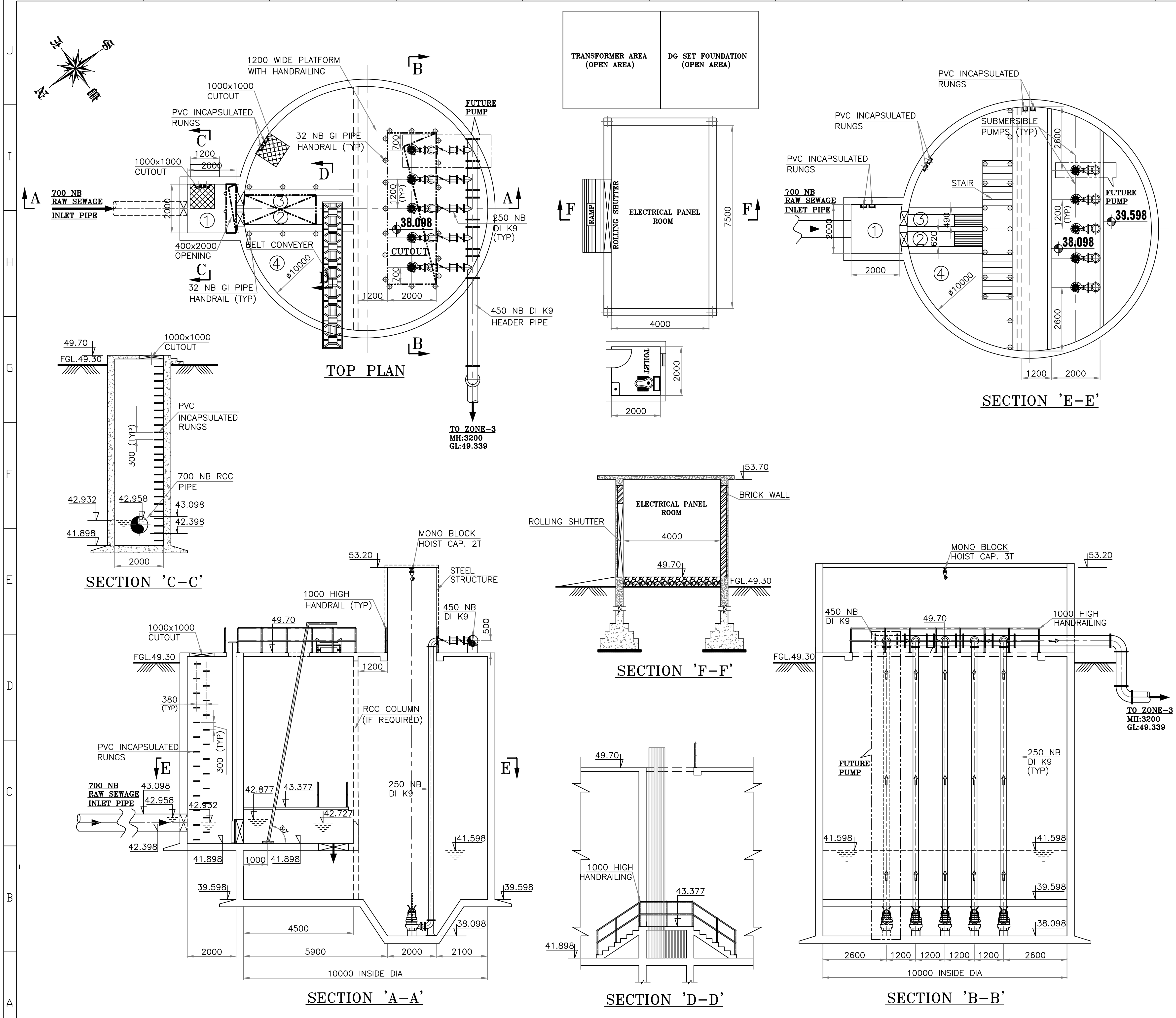
CLIENT:- BIHAR URBAN INFRASTRUCTURE DEVELOPMENT CORPORATION LTD., PATNA

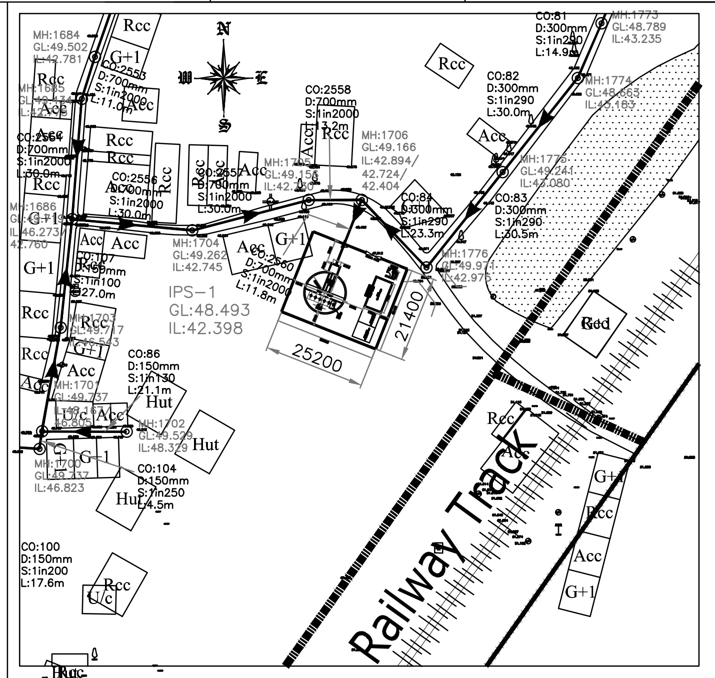
PROJECT:- 22 MLD SEWAGE TREATMENT PLANT AT HAJIPUR, BIHAR

BIDDERS NAME:- TRI-TECH (BEIJING) COMPANY LTD. BEIJING, NEW DELHI

TITLE:- PROCESS & INSTRUMENTATION DIAGRAM IPS-1

SCALE	SHEET	DRAWING NO.	REV.
AS MKD.	1 OF 1	TT/BEI/HJ/1051/IPS1/A07	0





KEY PLAN

S.NO.	DESCRIPTION	SIZE IN METERS
1	RECEIVING CHAMBER	2.0 x 2.0
2	MECHANICAL COARSE SCREEN CHANNEL	4.5 x 0.62
3	MANUAL COARSE SCREEN CHANNEL	4.5 x 0.49
4	RAW SEWAGE SUMP WET WELL	10.0 ø x 2.0 SWD
5	TRANSFORMER AREA	4.0 x 4.0
6	ELECTRICAL PANEL ROOM	4.0 x 7.5
7	DG SET FOUNDATION	4.0 x 4.0
8	TOILET	2.0 x 2.0

NOTES:–

1.) ALL DIMENSIONS ARE IN MM. & LEVELS ARE IN METRES.
2.) FINISHED GROUND LEVEL CONSIDERED 49.30 M.

REV.	DATE	DESCRIPTION	DRN.	CHKD.	APPD.
0	12.08.14	SUBMISSION FOR APPROVAL	MS	MB	AKS

CLIENT: – BIHAR URBAN INFRASTRUCTURE DEVELOPMENT CORPORATION LTD., PATNA

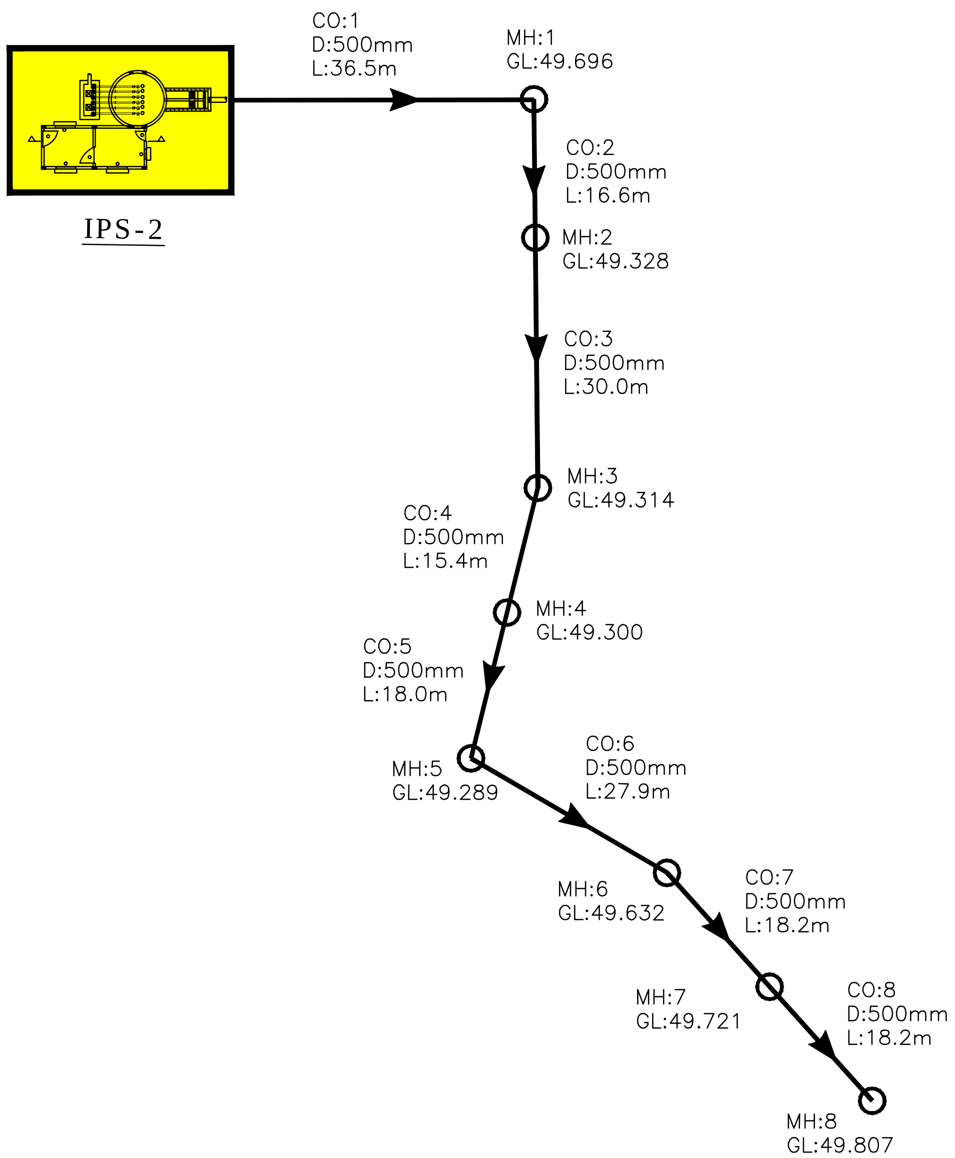
PROJECT: – 22.0 MLD SEWAGE TREATMENT PLANT AT HAJIPUR, BIHAR

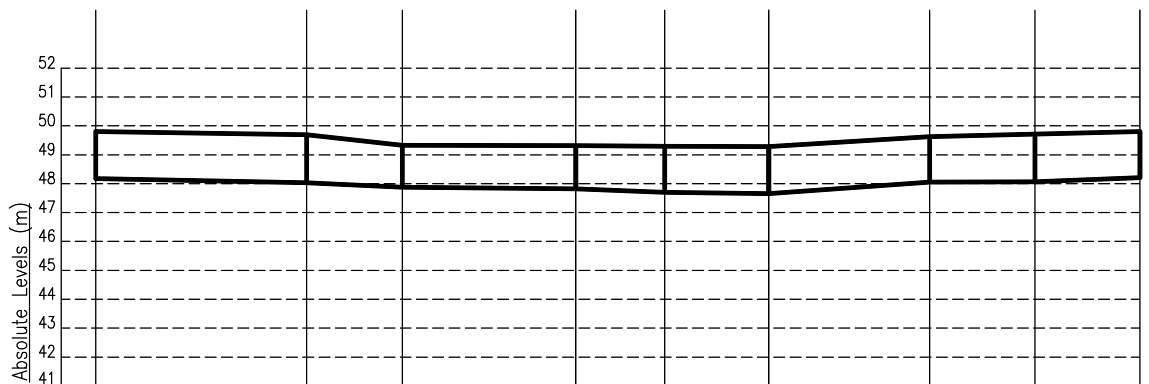
BIDDERS NAME: – TRI-TECH (BEIJING) COMPANY LTD. BEIJING, NEW DELHI

DATE: – 12.08.14
DRAWN.: – M.S.
CHKD.: – MB
APPD.: – AKS

TITLE: – MECH. GA DRG. OF INTERMEDIATE PUMPING STATION-1

SCALE	SHEET	DRAWING NO.	REV.
1:100	1 OF 1	TT/BEI/HJ/1051/IPS1/B17	0





MH. NO	IPS-2	1	2	3	4	5	6	7	8
Chainage	0	36.5	53.1	83.1	98.5	116.5	144.4	162.6	180.8
Ground Level	49.700	49.696	49.328	49.314	49.300	49.289	49.632	49.721	49.807
Pipe Invert Level	48.168	48.164	47.796	47.782	47.768	47.757	48.100	48.189	48.275
Dia of Pipe	500	500	500	500	500	500	500	500	500
Pipe Material/Class	DI K9	DI K9	DI K9	DI K9	DI K9	DI K9	DI K9	DI K9	DI K9

L-SECTION NO:-1
L.S. OF CO-1 TO CO-8
(MH NO. IPS2 TO 8)

REV.	DATE	DESCRIPTION	DRN.	CHKD	REVIEW	APPD.
0	05.06.14	SUBMISSION FOR APPROVAL	MS	MB	MB	AKS

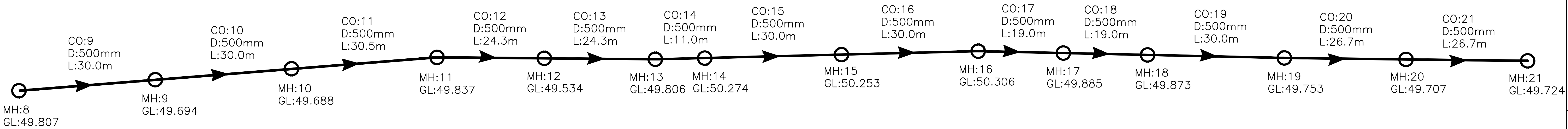
CLIENT:- BIHAR URBAN INFRASTRUCTURE DEVELOPMENT CORPORATION LTD., PATNA

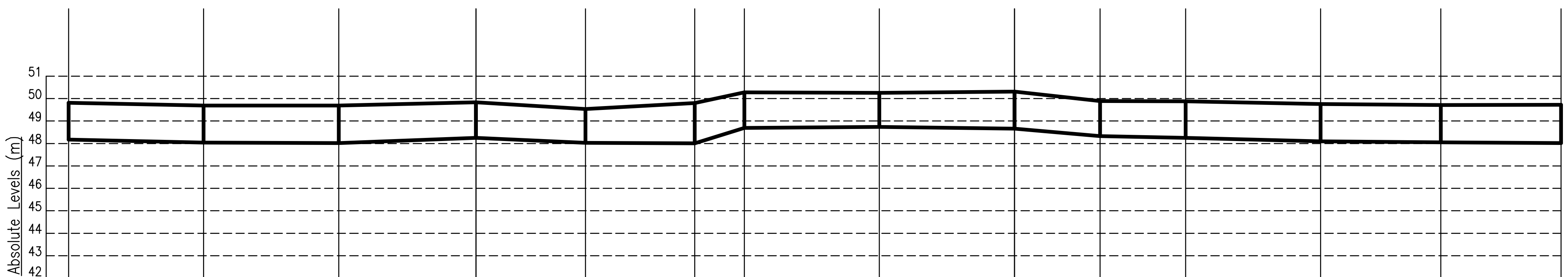
PROJECT:- SEWERAGE NETWORK & 22 MLD STP PLANT FOR HAJIPUR TOWN

BIDDERS NAME:- TRI-TECH (BEIJING) COMPANY LTD.
BEIJING, NEW DELHI

TITLE:- L-SECTION FOR RISING MAIN PIPE LINE ZONE -2

SCALE	SHEET	DRAWING NO.	REV.
1:1000	01 OF 07	HJ /1051/SEW/LS/02-A	0





MH. NO	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Chainage	180.8	210.8	240.8	271.3	295.6	319.9	330.9	360.9	390.9	409.9	428.9	458.9	485.6	512.3
Ground Level	49.807	49.694	49.688	49.837	49.534	49.806	50.274	50.253	50.306	49.885	49.873	49.753	49.707	49.724
Pipe Invert Level	48.275	48.162	48.156	48.305	48.002	48.076	48.742	48.721	48.774	48.353	48.341	48.221	48.175	48.192
Dia of Pipe	500	500	500	500	500	500	500	500	500	500	500	500	500	500
Pipe Material/Class	DI K9	DI K9	DI K9	DI K9	DI K9	DI K9	DI K9	DI K9	DI K9	DI K9	DI K9	DI K9	DI K9	DI K9

L-SECTION NO:-2

L.S. OF CO-9 TO CO-21

(MH NO. 8 TO 21)

REV.	DATE	DESCRIPTION	DRN.	CHKD	REVIEW	APPD.
0	05.06.14	SUBMISSION FOR APPROVAL	MS	MB	MB	AKS

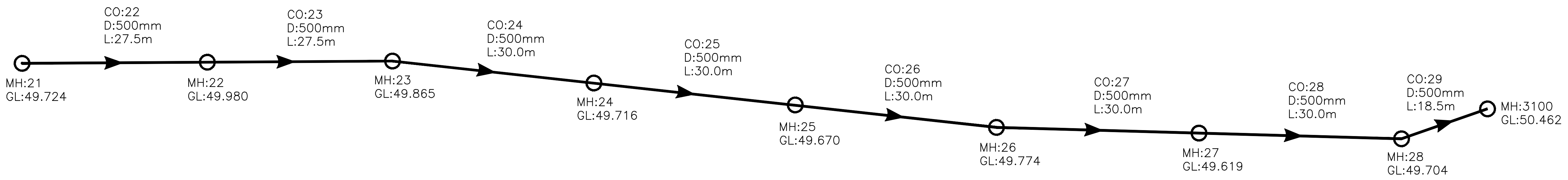
CLIENT:- BIHAR URBAN INFRASTRUCTURE DEVELOPMENT CORPORATION LTD., PATNA

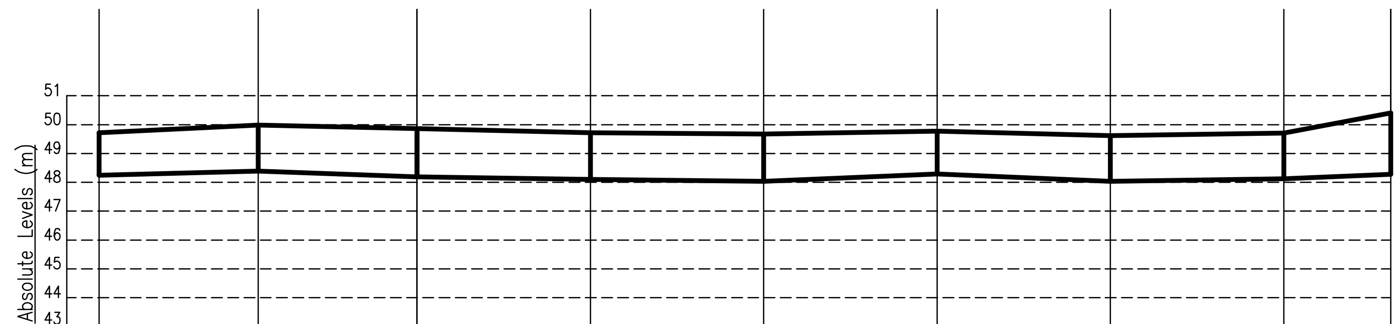
PROJECT:- SEWERAGE NETWORK & 22 MLD STP PLANT FOR HAJIPUR TOWN

BIDDERS NAME:- TRI-TECH (BEIJING) COMPANY LTD.
BEIJING, NEW DELHI

TITLE:- L-SECTION FOR RISING MAIN PIPE LINE ZONE -2

SCALE	SHEET	DRAWING NO.	REV.
1:1000	02 OF 07	HJ /1051/SEW/LS/02-A	0





MH. NO	21	22	23	24	25	26	27	28	3100
Chainage	512.3	539.8	567.3	597.3	627.3	657.3	687.3	717.3	735.8
Ground Level	49.724	49.980	49.865	49.716	49.670	49.774	49.619	49.704	50.462
Pipe Invert Level	48.192	48.448	48.333	48.184	48.138	48.242	48.087	48.172	48.330
Dia of Pipe	500	500	500	500	500	500	500	500	500
Pipe Material/Class	DI K9	DI K9	DI K9	DI K9	DI K9	DI K9	DI K9	DI K9	DI K9

L-SECTION NO:-3
L.S. OF CO-22 TO CO-29
(MH NO. 21 TO 3100)

REV.	DATE	DESCRIPTION	DRN.	CHKD	REVIEW	APPD.
0	05.06.14	SUBMISSION FOR APPROVAL	MS	MB	MB	AKS

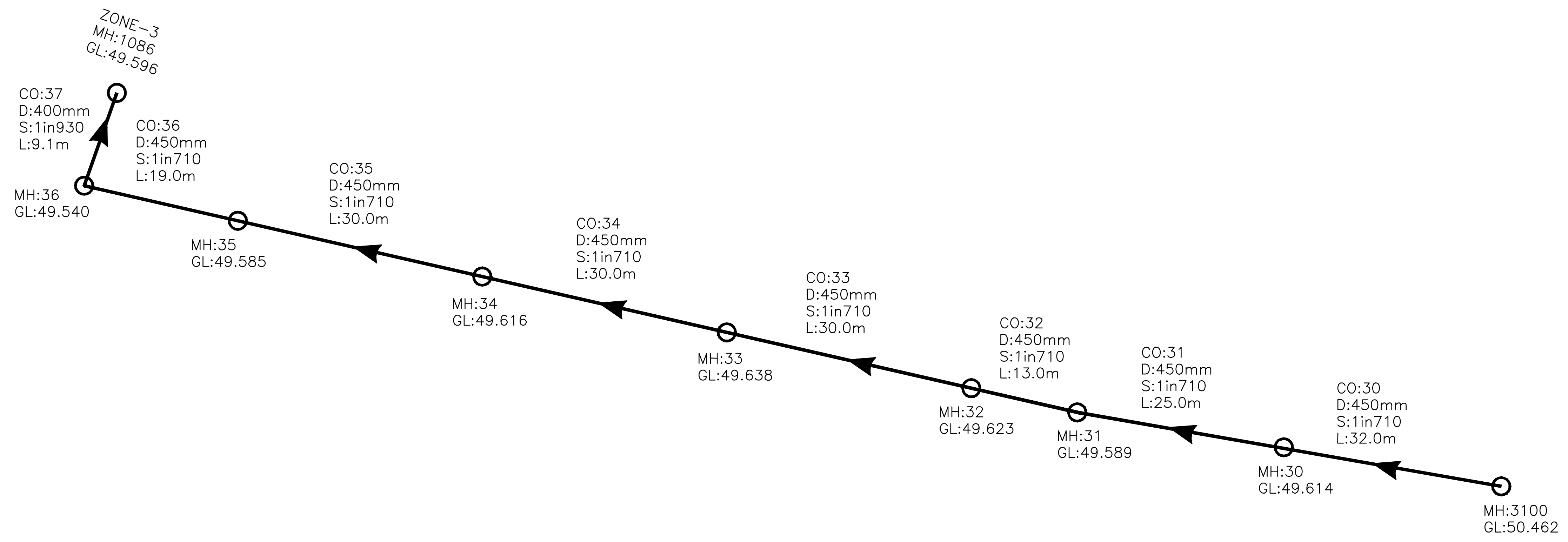
CLIENT:- BIHAR URBAN INFRASTRUCTURE DEVELOPMENT CORPORATION LTD., PATNA

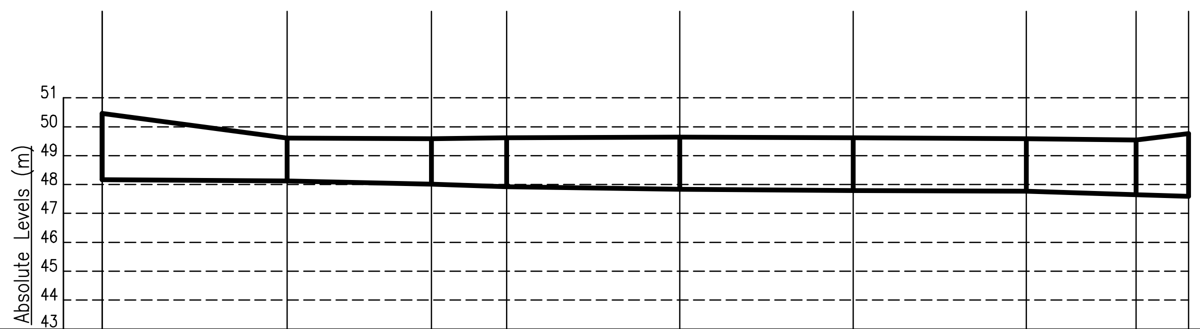
PROJECT:- SEWERAGE NETWORK & 22 MLD STP PLANT FOR HAJIPUR TOWN

BIDDERS NAME:- TRI-TECH (BEIJING) COMPANY LTD.
BEIJING, NEW DELHI

TITLE:- L-SECTION FOR RISING MAIN PIPE LINE ZONE -2

SCALE	SHEET	DRAWING NO.	REV.
1:1000	03 OF 07	HJ /1051/SEW/LS/02-A	0





MH. NO	3100	30	31	32	33	34	35	36	1086
Chainage	735.8	767.8	792.8	805.8	835.8	865.8	895.8	914.8	923.9
Ground Level	50.462	49.614	49.589	49.623	49.638	49.616	49.585	49.540	49.596
Pipe Invert Level	48.130	48.085	48.049	48.030	47.987	47.944	47.901	47.874 47.674	47.664
Cutting Depth	2.332	1.529	1.540	1.593	1.651	1.672	1.684	1.666 1.866	1.932
Slope	710	710	710	710	710	710	710	710	930
Dia of Pipe	450	450	450	450	450	450	450	450	400
Pipe Material/Class	NP4	NP4	NP4	NP4	NP4	NP4	NP4	NP4	NP4

L-SECTION NO:-4
L.S. OF CO-30 TO CO-37
(MH NO. 3100 TO 1086)

REV.	DATE	DESCRIPTION	DRN.	CHKD	REVIEW	APPD.
0	05.06.14	SUBMISSION FOR APPROVAL	MS	MB	MB	AKS

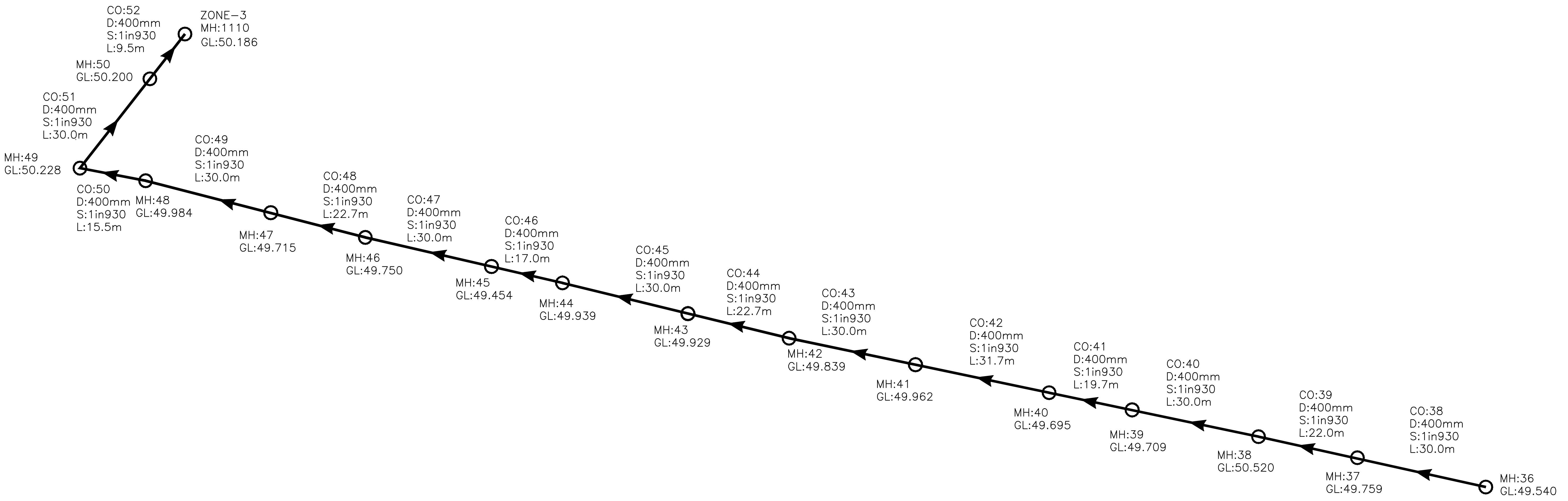
CLIENT:- BIHAR URBAN INFRASTRUCTURE DEVELOPMENT CORPORATION LTD., PATNA

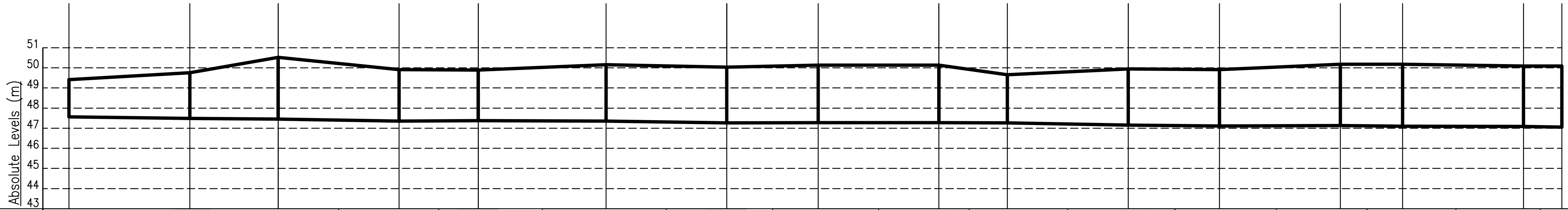
PROJECT:- SEWERAGE NETWORK & 22 MLD STP PLANT FOR HAJIPUR TOWN

BIDDERS NAME:- TRI-TECH (BEIJING) COMPANY LTD.
BEIJING, NEW DELHI

TITLE:- L-SECTION FOR RISING MAIN PIPE LINE ZONE -2

SCALE	SHEET	DRAWING NO.	REV.
1:1000	04 OF 07	HJ /1051/SEW/LS/02-A	0





MH. NO	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	1110
Chainage	914.8	944.8	966.8	996.8	1016.5	1048.2	1078.2	1100.9	1130.9	1147.9	1177.9	1200.6	1230.6	1246.1	1276.1	1285.6
Ground Level	49.540	49.759	50.520	49.709	49.695	49.962	49.839	49.929	49.939	49.454	49.750	49.715	49.984	50.228	50.200	50.186
Pipe Invert Level	47.674	47.641	47.617	47.584	47.562	47.527	47.494	47.469	47.436	47.417	47.384	47.359	47.626	47.309	47.276	47.265
Cutting Depth	1.866	2.118	2.903	2.125	2.133	2.435	2.345	2.460	2.503	2.037	2.366	2.356	2.358	2.919	2.924	2.921
Slope	930	930	930	930	930	930	930	930	930	930	930	930	930	930	930	930
Dia of Pipe	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
Pipe Material/Class	NP4	NP4	NP4	NP4	NP4	NP4	NP4	NP4	NP4	NP4	NP4	NP4	NP4	NP4	NP4	NP4

L-SECTION NO:-5
L.S. OF CO-38 TO CO-52
(MH NO. 36 TO 1110)

REV.	DATE	DESCRIPTION	DRN.	CHKD	REVIEW	APPD.
0	05.06.14	SUBMISSION FOR APPROVAL	MS	MB	MB	AKS

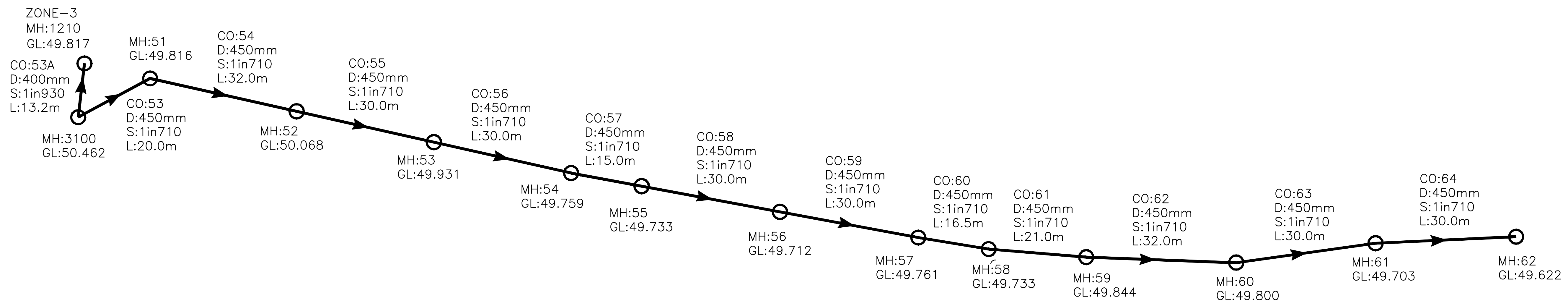
CLIENT:- BIHAR URBAN INFRASTRUCTURE DEVELOPMENT CORPORATION LTD., PATNA

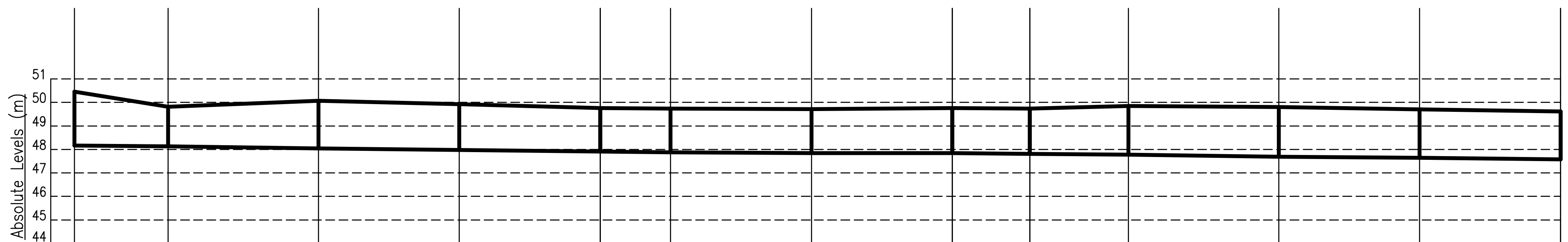
PROJECT:- SEWERAGE NETWORK & 22 MLD STP PLANT FOR HAJIPUR TOWN

BIDDERS NAME:- TRI-TECH (BEIJING) COMPANY LTD.
BEIJING, NEW DELHI

TITLE:- L-SECTION FOR RISING MAIN PIPE LINE ZONE -2

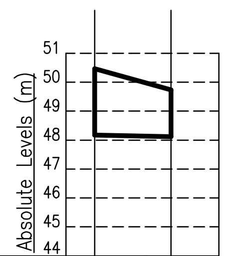
SCALE	SHEET	DRAWING NO.	REV.
1:1000	05 OF 07	HJ /1051/SEW/LS/02-A	0





MH. NO	3100	51	52	53	54	55	56	57	58	59	60	61	62
Chainage	735.8	755.8	787.8	817.8	847.8	862.8	892.8	922.8	939.3	960.3	992.3	1022.3	1052.3
Ground Level	50.462	49.816	50.068	49.931	49.759	49.733	49.712	49.761	49.733	49.844	49.800	49.703	49.622
Pipe Invert Level	48.130	48.101	48.055	48.012	47.970	47.948	47.905	47.862	47.838	47.808	47.763	47.720	47.627
Cutting Depth	2.332	1.715	2.625	1.919	1.789	1.785	1.807	1.899	1.895	2.036	2.037	1.983	1.995
Slope	710	710	710	710	710	710	710	710	710	710	710	710	710
Dia of Pipe	450	450	450	450	450	450	450	450	450	450	450	450	450
Pipe Material/Class	NP4	NP4	NP4	NP4	NP4	NP4	NP4	NP4	NP4	NP4	NP4	NP4	NP4

L-SECTION NO:-6
L.S. OF CO-53 TO CO-64
(MH NO. 3100 TO 62)



MH. NO	3100	1210
Chainage	735.8	749
Ground Level	50.462	49.817
Pipe Invert Level	48.130	48.116
Cutting Depth	2.332	1.701
Slope	930	930
Dia of Pipe	400	400
Pipe Material/Class	NP4	NP4

L-SECTION NO:-7
L.S. OF CO-53A
(MH NO. 3100 TO 1210)

REV.	DATE	DESCRIPTION	DRN.	CHKD	REVIEW	APPD.
0	05.06.14	SUBMISSION FOR APPROVAL	MS	MB	MB	AKS

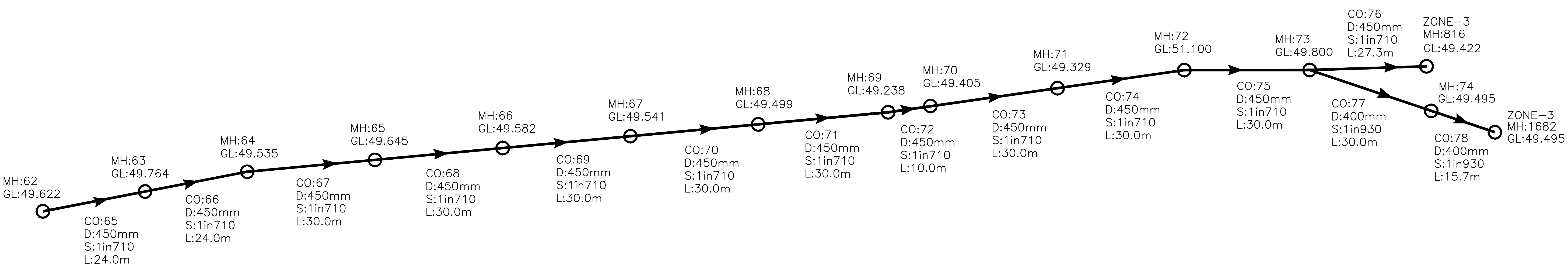
CLIENT:- BIHAR URBAN INFRASTRUCTURE DEVELOPMENT CORPORATION LTD., PATNA

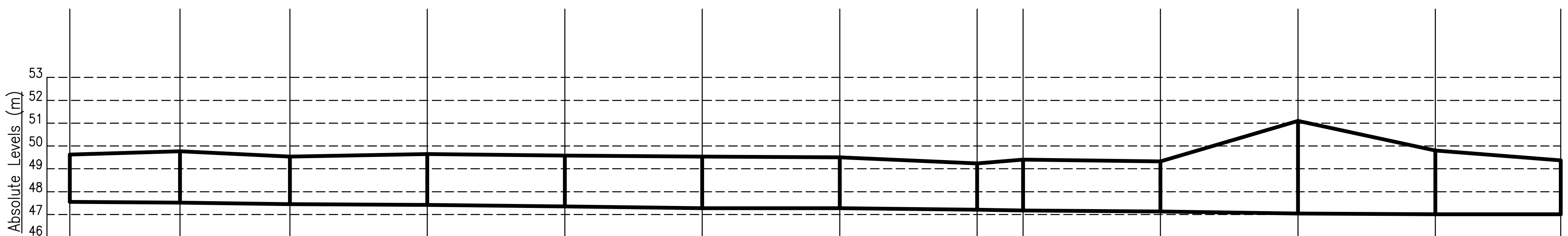
PROJECT:- SEWERAGE NETWORK & 22 MLD STP PLANT FOR HAJIPUR TOWN

BIDDERS NAME:- TRI-TECH (BEIJING) COMPANY LTD.
BEIJING, NEW DELHI

TITLE:- L-SECTION FOR RISING MAIN PIPE LINE ZONE -2

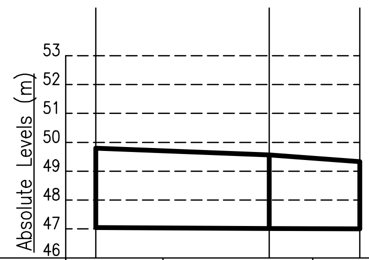
SCALE	SHEET	DRAWING NO.	REV.
1:1000	06 OF 07	HJ /1051/SEW/LS/02-A	0





MH. NO	62	63	64	65	66	67	68	69	70	71	72	73	816
Chainage	1052.3	1076.3	1100.3	1130.3	1160.3	1190.3	1220.3	1250.3	1260.3	1290.3	1320.3	1350.3	1377.6
Ground Level	49.622	49.764	49.535	49.645	49.582	49.541	49.499	49.238	49.405	49.329	51.100	49.800	49.422
Pipe Invert Level	47.627	47.643	47.609	47.566	47.523	47.480	47.437	47.394	47.379	47.336	47.293	47.250 47.050	47.020
Cutting Depth	1.995	2.121	1.926	2.080	2.059	2.061	2.062	1.844	2.026	1.993	3.807	2.550 2.750	2.402
Slope	710	710	710	710	710	710	710	710	710	710	710	710	710
Dia of Pipe	450	450	450	450	450	450	450	450	450	450	450	450	450
Pipe Material/Class	NP4	NP4	NP4	NP4	NP4	NP4	NP4	NP4	NP4	NP4	NP4	NP4	NP4

L–SECTION NO:–8
L.S. OF CO–65 TO CO–76
(MH NO. 62 TO 816)



MH. NO	73	74	1682
Chainage	1350.3	1380.3	1396
Ground Level	49.800	49.600	49.495
Pipe Invert Level	47.050	47.017	47.000
Cutting Depth	2.750	2.583	2.495
Slope	930	930	930
Dia of Pipe	400	400	400
Pipe Material/Class	NP4	NP4	NP4

L–SECTION NO:–9
L.S. OF CO–77 TO CO–78
(MH NO. 73 TO 1682)

REV.	DATE	DESCRIPTION	DRN.	CHKD	REVIEW	APPD.
0	05.06.14	SUBMISSION FOR APPROVAL	MS	MB	MB	AKS

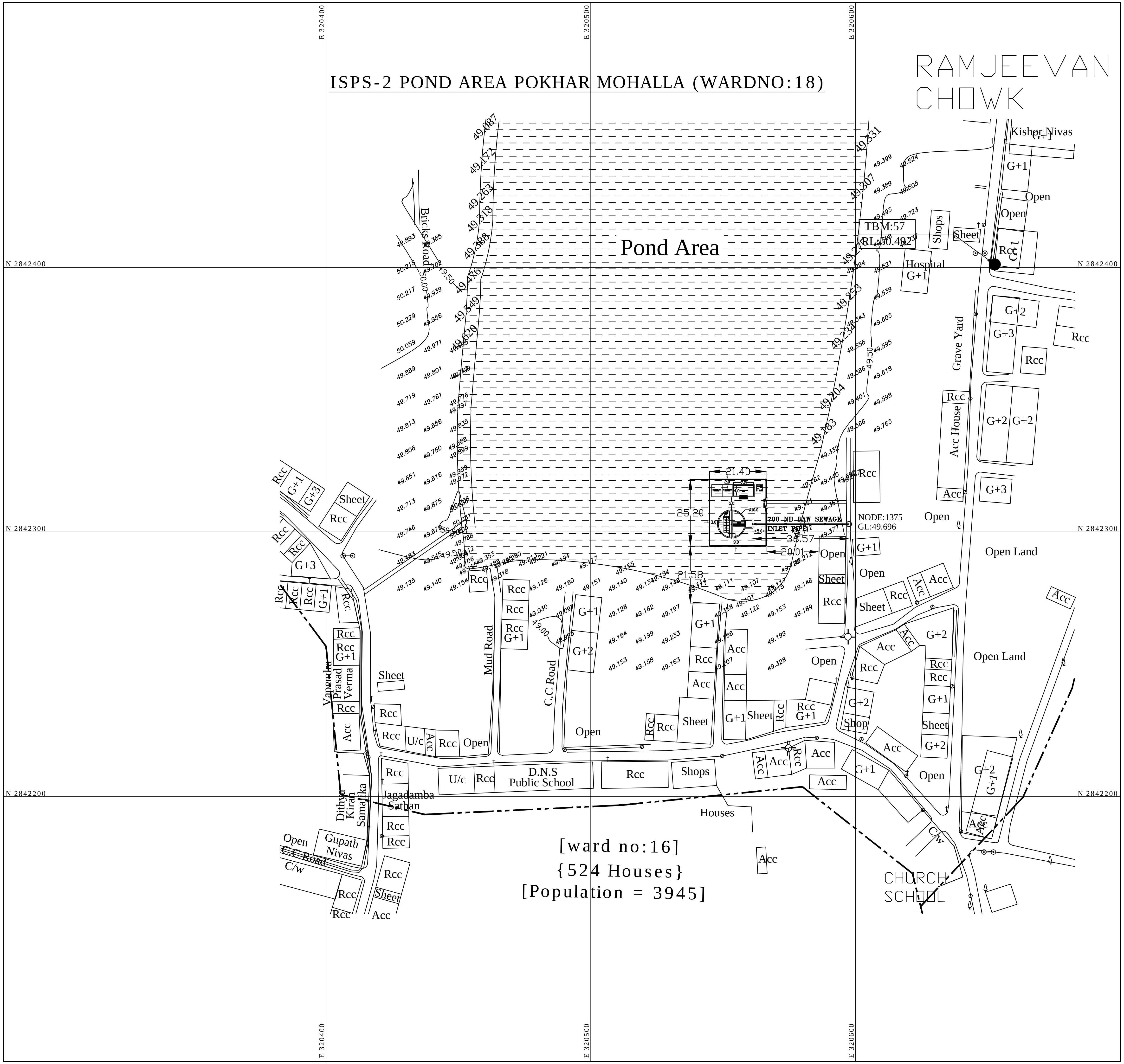
CLIENT:- BIHAR URBAN INFRASTRUCTURE DEVELOPMENT CORPORATION LTD., PATNA

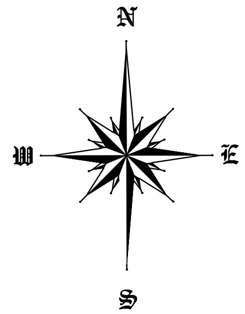
PROJECT:- SEWERAGE NETWORK & 22 MLD STP PLANT FOR HAJIPUR TOWN

BIDDERS NAME:- TRI-TECH (BEIJING) COMPANY LTD.
BEIJING, NEW DELHI

TITLE:- L-SECTION FOR RISING MAIN PIPE LINE ZONE -2

SCALE	SHEET	DRAWING NO.	REV.
1:1000	07 OF 07	HJ /1051/SEW/LS/02-A	0

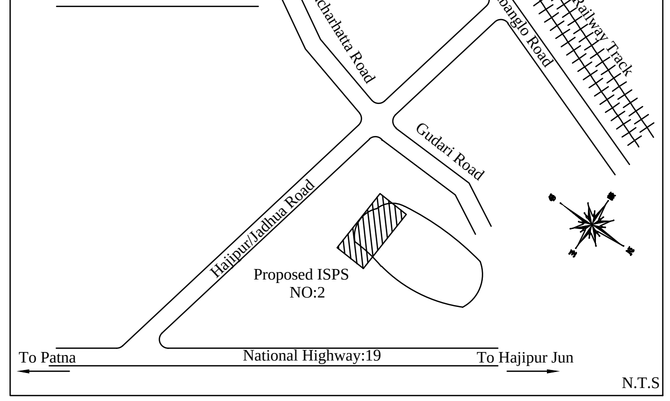




LEGEND

1. ASPHALT ROAD, MUD ROAD/METALLED ROAD.	—	
2. TREE, CULVERT, LAMP POST	—	
3. BORE WELL, MAN HOLE	—	BW
4. RIVER, STREAM, NALA, FENCE, ROW STONE	—	
5. BOULDERS, ROCKYGROUND, TRANSFORMER, TELEPHONE POLE	—	
6. POWER LINE,PYLON (HIGHTENSION LINE)	—	
7. KILOMETER & FURLONG STONE, SPOT HEIGHT.	—	
8. BUSHES, BENCH MARK, TRAVERSE POINT	—	PBM:512.826 GS-5C 626.555

KEY PLAN



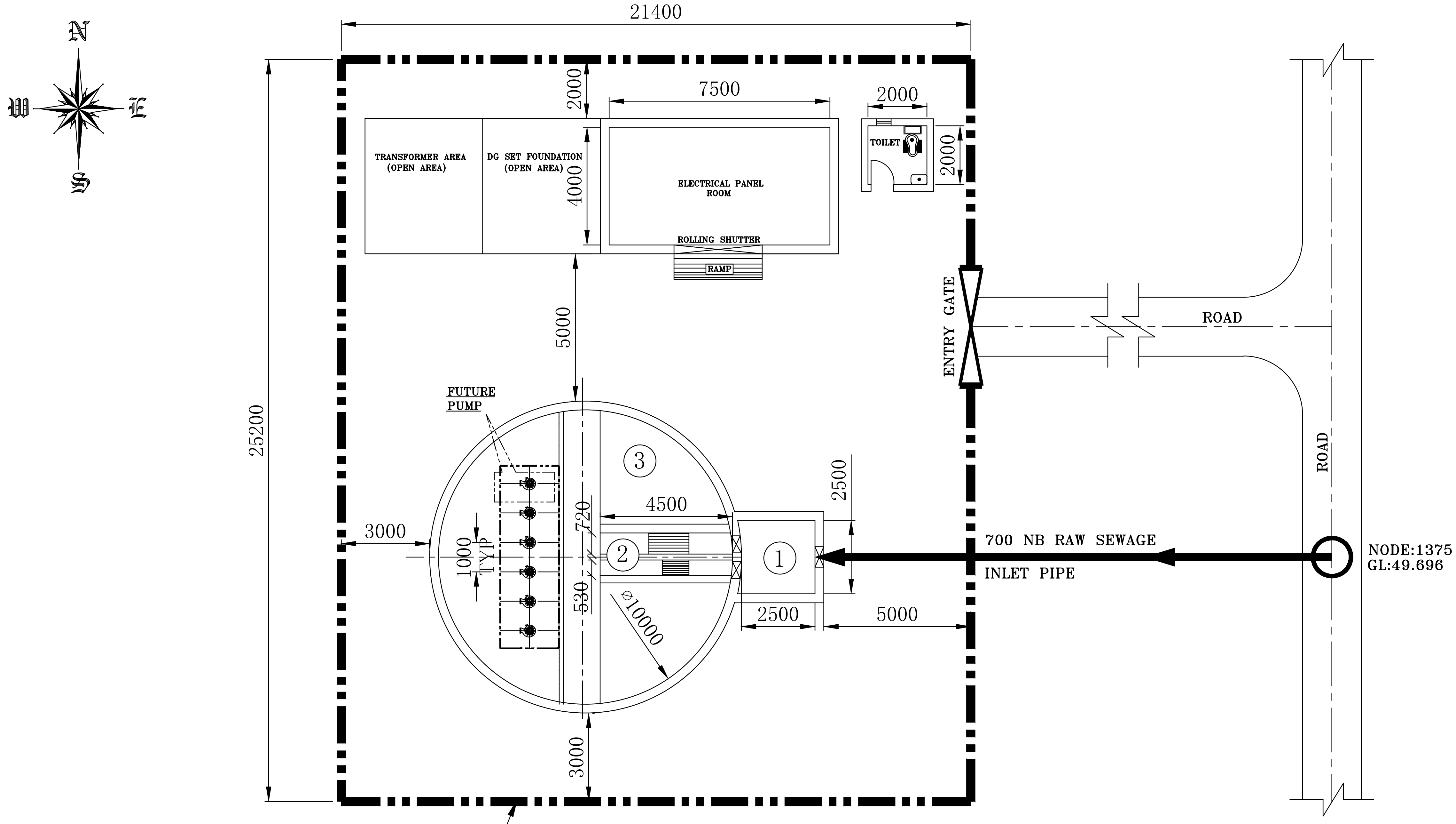
NOTE:-

1. ALL LEVELS ARE IN METERS. UNLESS OTHER WISE MENTIONED.
2. ALL LEVELS ARE CARRIED FROM THE BENCH MARK LOCATED ON SOMPUR BRIDGE OF GANDAK RIVER.

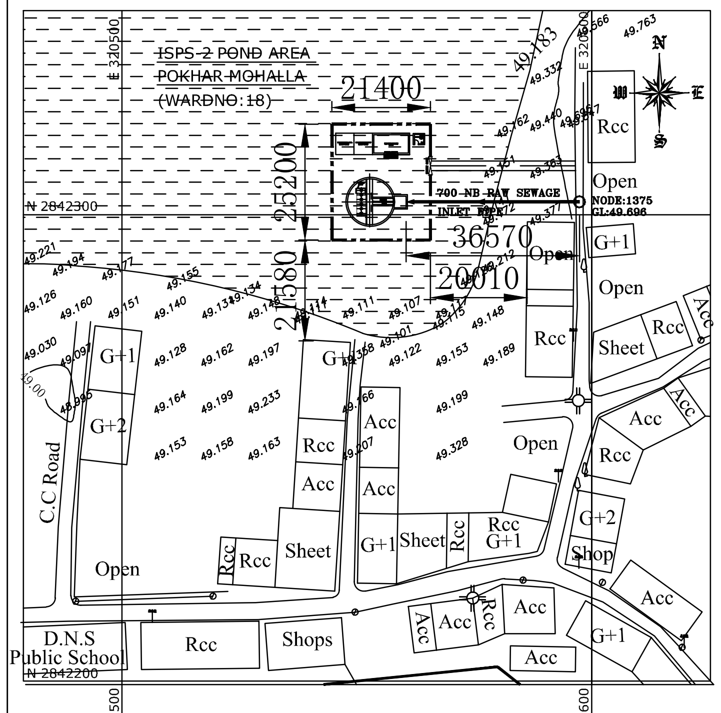
SHEET 1 OF 1

CLIENT	TRI-TECH Tri-Tech Infrastructure (India) Pvt.Ltd.
TITLE	TOPOGRAPHICAL SURVEY OF IPS-2 SITE
ORIGN CLIENT	**BIHAR URBAN INFRASTRUCTURE DEVELOPMENT CORPORATION LTD.** (A Govt. of Bihar Undertaking)
SURVEYED & PREPARED BY	RADIAN SURVEYS #715, OM PLAZA, 3RD FLOOR, 3RD MAIN DR.MODI HOSPITAL ROAD, MAHALAKSHMIPURAM,BANGALORE 86 E-mail : rdnsurveys@gmail.com PH:080-23194839

SCALE: 1:1000	SEASON : 03/06/2014	R0	DRG. NO. HJ/1051/IPS2/SURVEY/01



LAYOUT PLAN



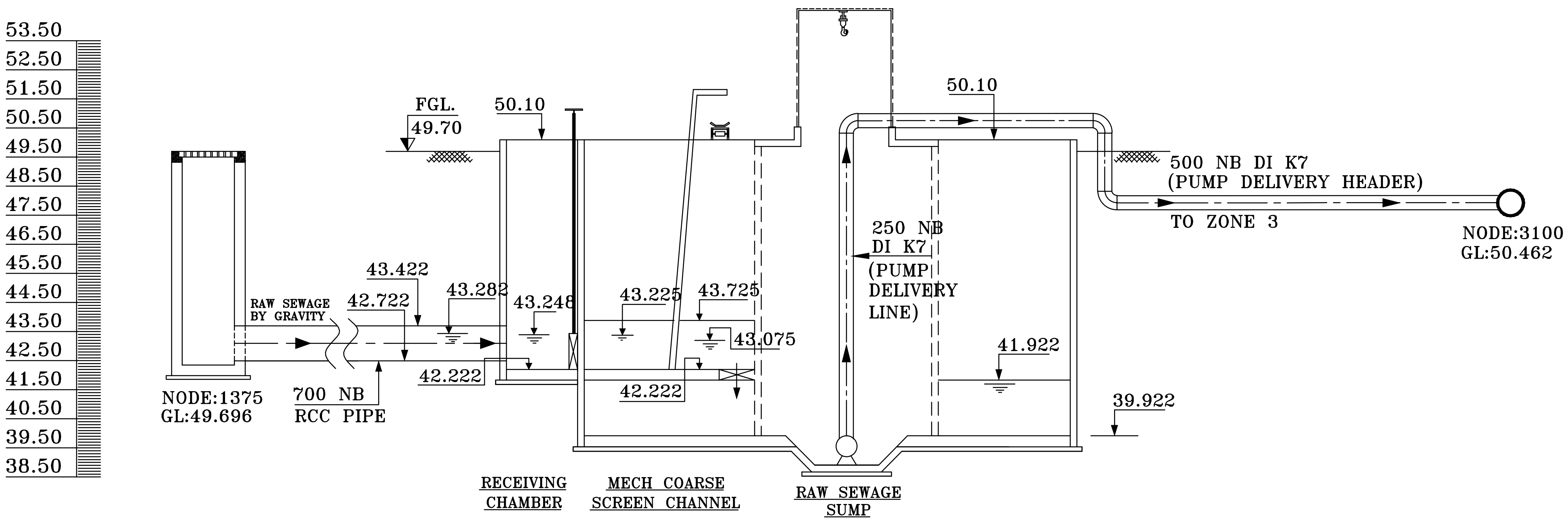
KEY PLAN

UNIT LIST

S.NO.	DESCRIPTION	SIZE IN METERS
1	RECEIVING CHAMBER	2.5 x 2.5
2	COARSE SCREEN CHANNELS	4.5
3	WET WELL	10.0 ⌀ x 2.0 SWD
4	TRANSFORMER AREA	4.0 x 4.0
5	ELECTRICAL PANEL ROOM	4.0 x 7.5
6	DG SET FOUNDATION	4.0 x 4.0
7	TOILET	2.0 x 2.0

NOTE:-

1.) BUIDCO TO PROVIDE AND TERMINATE 11.0 KV HT POWER SUPPLY AT HT SIDE OF TRANSFORMER.



HYDRAULIC FLOW DIAGRAM

REV.	DATE	DESCRIPTION	DRN.	CHKD.	APPD.
0	03.06.14	SUBMISSION FOR APPROVAL	M.S.	AKS	AKS

CLIENT: – BIHAR URBAN INFRASTRUCTURE DEVELOPMENT CORPORATION LTD., PATNA

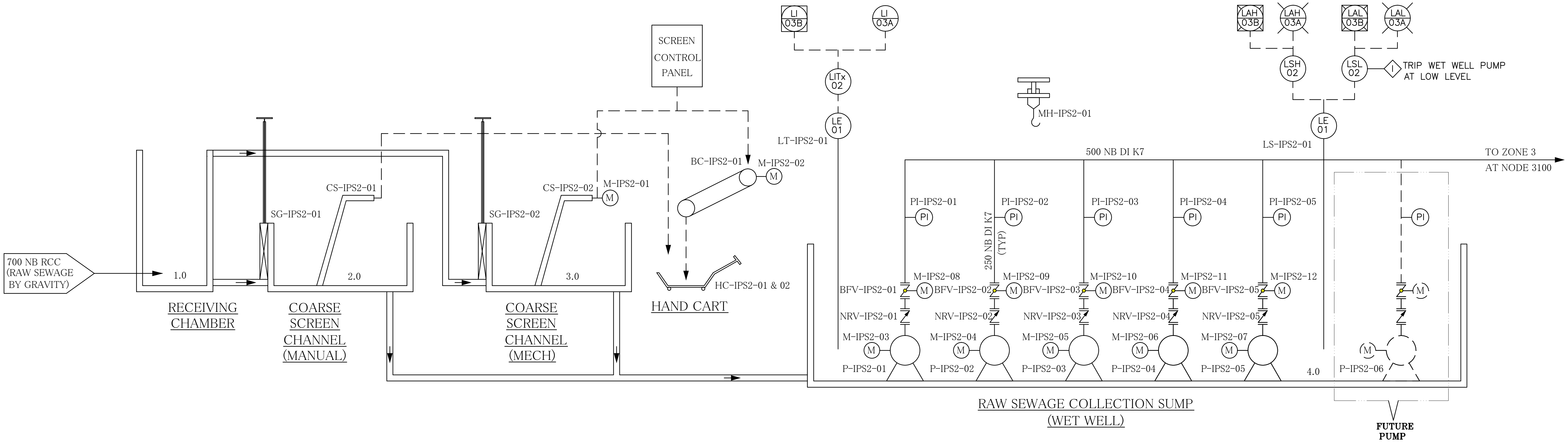
PROJECT: – 22 MLD SEWAGE TREATMENT PLANT AT HAJIPUR, BIHAR

BIDDERS NAME: – TRI-TECH (BEIJING) COMPANY LTD. BEIJING, NEW DELHI

DATE: –	03.06.14
DRAWN.: –	M.S.
CHKD.: –	AKS
APPD.: –	AKS

TITLE: – IPS 2 LAYOUT PLAN CUM HYDRAULIC FLOW DIAGRAM

SCALE	SHEET	DRAWING NO.	REV.
AS MKD.	1 OF 1	TT/BEI/HJ/1051/IPS2/A06	0



UNIT LIST

UNIT NO.	UNIT DESCRIPTION	DIMENSIONS (M)	QTY	MOC
1.0	RECEIVING CHAMBER	2.5 x 2.5 x 1.026 SWD + 6.852FB	1	RCC
2.0	MANUAL COARSE SCREEN CHANNEL	4.5 x 0.53 x 1.003 SWD + 0.5 FB	1	RCC
3.0	MECH COARSE SCREEN CHANNEL	4.5 x 0.72 x 1.003 SWD + 0.5 FB	1	RCC
4.0	RAW SEWAGE COLLECTION SUMP (WET WELL)	10.0ø x 2.0 SWD + 8.178 FB	1	RCC

EQUIPMENT LIST

TAG NO.	EQUIPMENT DESCRIPTION	SIZE (M) / CAPACITY	QTY	MOC
CS-IPS2-01	MANUAL COARSE BAR SCREEN	0.325 W x 1.55 HT	1	SS 304
CS-IPS2-02	MECH COARSE BAR SCREEN	0.43 W x 9.5 HT	1	SS 304
BC-IPS2-01	BELT CONVEYOR	0.6 W	1	MFG STD
HC-IPS2--01/02	HAND CART	0.5 M3	2	MSEP/FRP
P-IPS2-01/02/03/04	RAW SEWAGE TRANSFER PUMPS (W/MOTOR)	240.0 M3/HR x 16.0 MWC	5	AS PER NIT
M-IPS2-01	MANUAL CHAIN PULLEY HOIST (W/TROLLEY)	3.0 TON	1	MFG STD

VALVE/GATE LIST

TAG NO.	VALVE/GATE DESCRIPTION	DIMENSIONS (MM)	QTY	MOC
SG-IPS2--01/02	MANUAL SLUICE GATE, FLANGE BACK FRAME, WALL THIMBLE	300 x 1200 MM	2	CI (AS PER NIT)
NRV-IPS2-01/02/03/04/05	NON RETURN VALVE, D/F, PN 1.0, SWING CHECK	250 NB	5	CI (AS PER NIT)
BFV-IPS2-01/02/03/04/05	BUTTERFLY VALVE, D/F, PN 1.0, ELECTRICALLY ACTUATED	250 NB	5	CI (AS PER NIT)

INSTRUMENTATION LIST

TAG NO.	INSTRUMENT DESCRIPTION	SIZE (MM)	QTY	MOC
PI-IPS2-01/02/03/04/05	PRESSURE INDICATOR, DIAPHRAGM	150/100 NB	5	MFG STD
LS-IPS2-01	LEVEL SWITCH, CONDUCTIVITY TYPE		1	MFG STD
LT-IPS2-01	LEVEL TRANSMITTER, ULTRASONIC		1	MFG STD

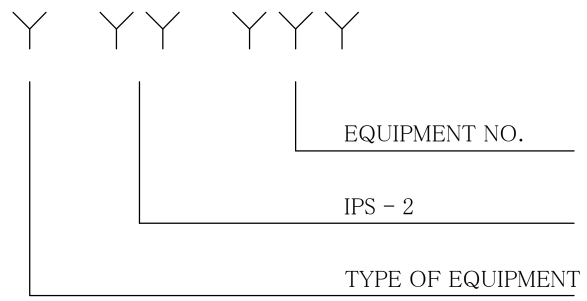
LEGENDS:-

	NON RETURN VALVE
	MOTORIZED BUTTERFLY VALVE
	GATE
	SUBMERSIBLE PUMP
	LOCAL INSTRUMENT
	PANEL ALARM
	SCADA INDICATION
	SCADA ALARM
	HARD WIRE INTERLOCK
	SEWAGE/WATER LINE
	SLUDGE LINE
LSH	LEVEL SWITCH HIGH
LSL	LEVEL SWITCH LOW
LAH	LEVEL ALARM HIGH
PI	PRESSURE INDICATOR

LEGENDS:-

LAL	LEVEL ALARM LOW
LE	LEVEL ELEMENT
LI	LEVEL INDICATOR
LITx	LEVEL INDICATOR CUM TRANSMITTER

EQUIPMENT TAG:-



REV.	DATE	DESCRIPTION	DRN.	CHKD.	APPD.
0	03.06.14	SUBMISSION FOR APPROVAL	MS	A.K.S.	A.K.S.

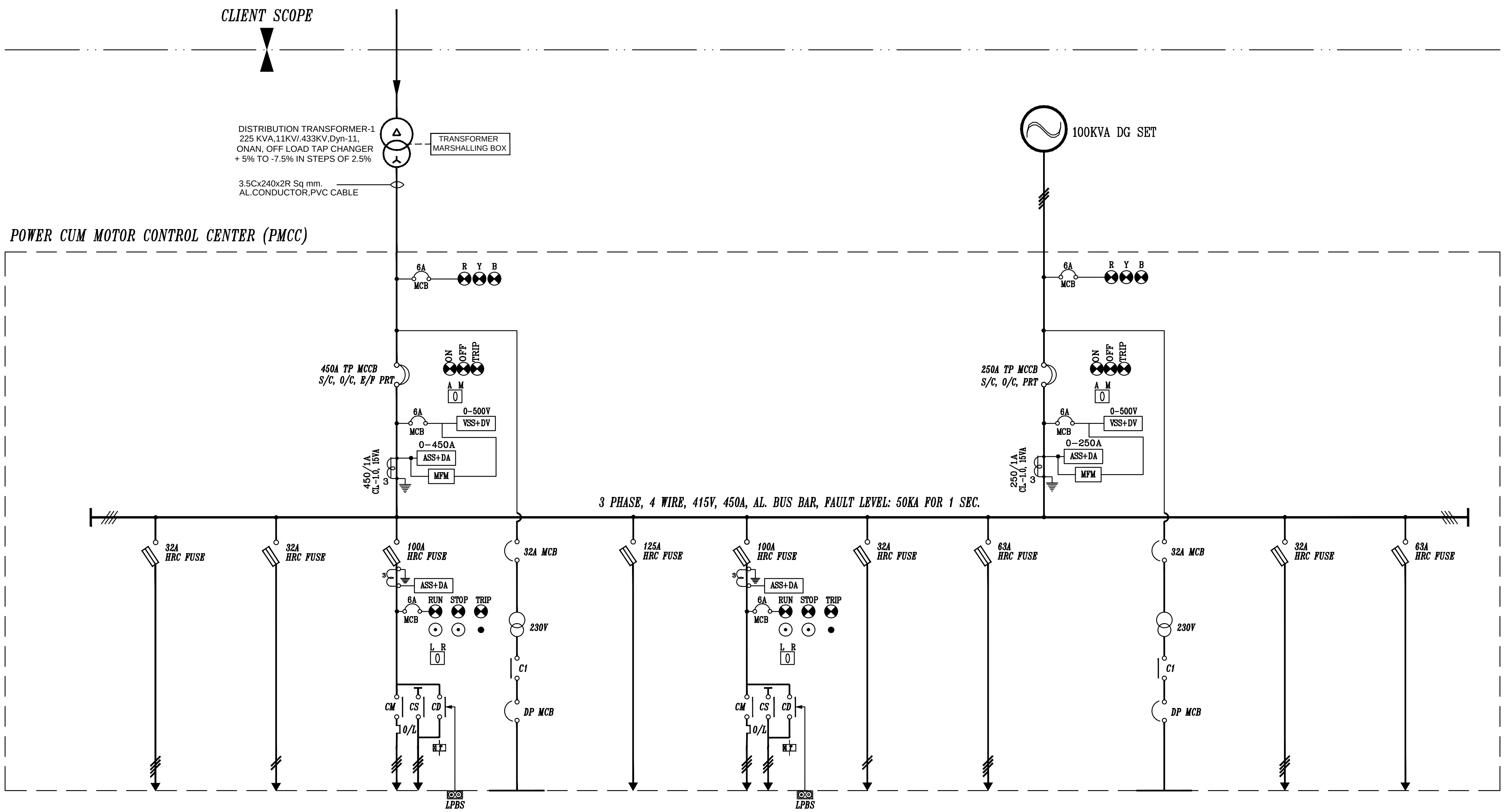
CLIENT:- BIHAR URBAN INFRASTRUCTURE DEVELOPMENT CORPORATION LTD., PATNA

PROJECT:- 22 MLD SEWAGE TREATMENT PLANT AT HAJIPUR, BIHAR

BIDDERS NAME:- TRI-TECH (BEIJING) COMPANY LTD. BEIJING, NEW DELHI

TITLE:- PROCESS & INSTRUMENTATION DIAGRAM IPS-2

SCALE	SHEET	DRAWING NO.	REV.
AS MKD.	1 OF 1	TT/BEI/HJ/1051/IPS2/A07	0



FEEDER RATING	32A	32A	37KW	32A	125A	37KW	32A	63A	32A	32A	63A
FEEDER TYPE	SFU	SFU	S/D	SFU	SFU	S/D	SFU	SFU	SFU	SFU	SFU
FEEDER DESCRIPTION	POWER SUPPLY FOR COARSE SCREEN PANEL	POWER SUPPLY FOR PLC CONTROL PANEL	RAW SEWAGE PUMP-1/2	CONTROL BUS	CAP BANK	RAW SEWAGE PUMP-3/4/5	POWER SUPPLY FOR UPS	POWER SUPPLY FOR LDB	CONTROL BUS	POWER SUPPLY FOR VENTILATION SYSTEM	SPARE
QTY. OF FEEDER	1NO.	1NO.	2NO.	1NO.	1NO.	3NO.	1NO.	1NO.	1NO.	1NO.	1NO.

NOTES:-

1. ALL METERING, PROTECTION & CONTROL SYSTEM SHALL BE AS PER NIT.
2. THE EQUIPMENT SHOWN ARE TENTATIVE AND WILL BE FINALIZED DURING DETAIL ENGINEERING.
3. BUIDCO WILL TERMINATE 33/11 KV HT CABLE CONNECTION TO HT END OF TRANSFORMER.

REV.	DATE	DESCRIPTION	DRN.	CHKD.	APPD.
0	03.06.14	SUBMISSION FOR APPROVEL	D.S.R.	A.K.SONI	A.DUTT

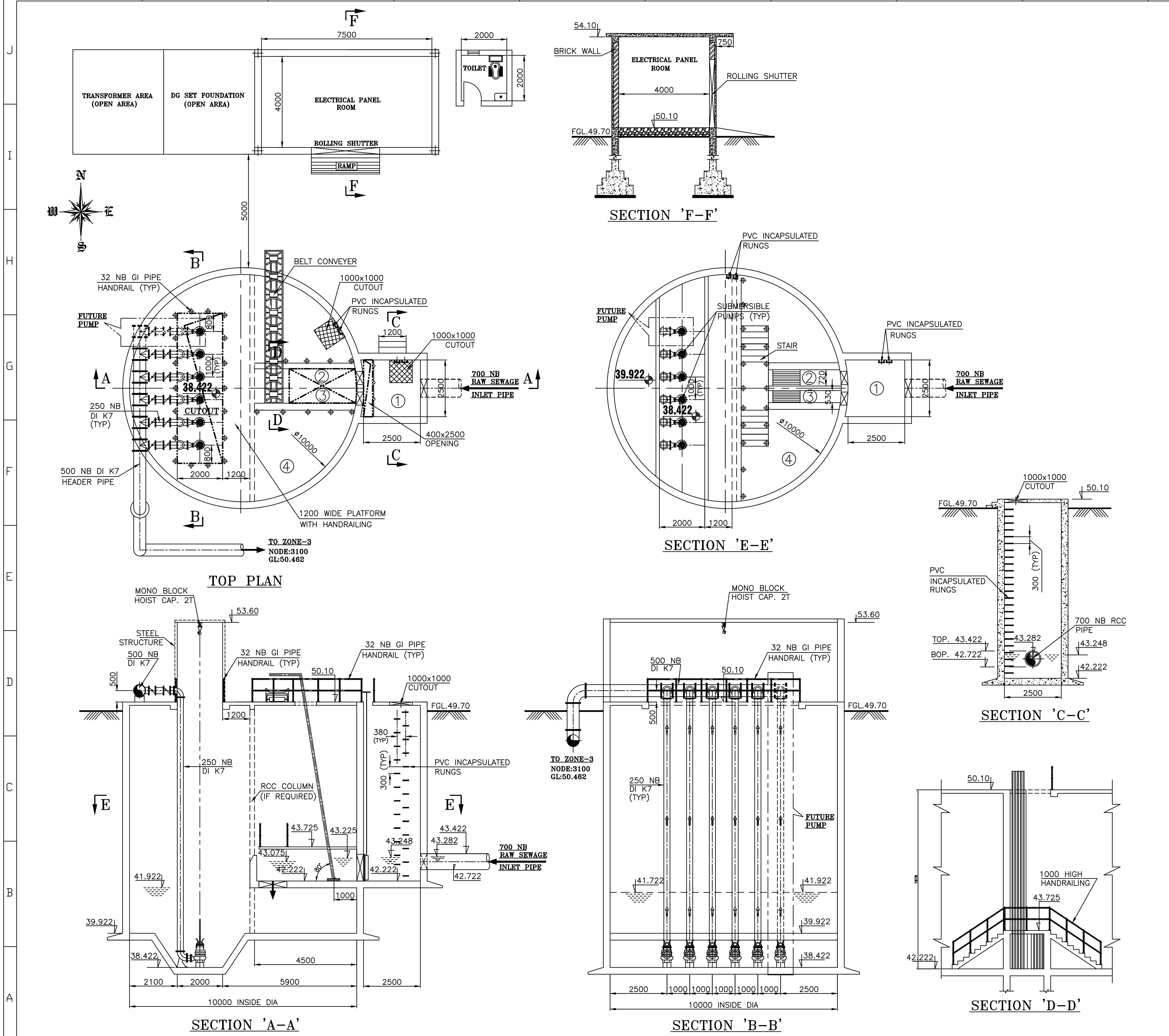
CLIENT:- BIHAR URBAN INFRASTRUCTURE DEVELOPMENT CORPORATION LTD., PATNA

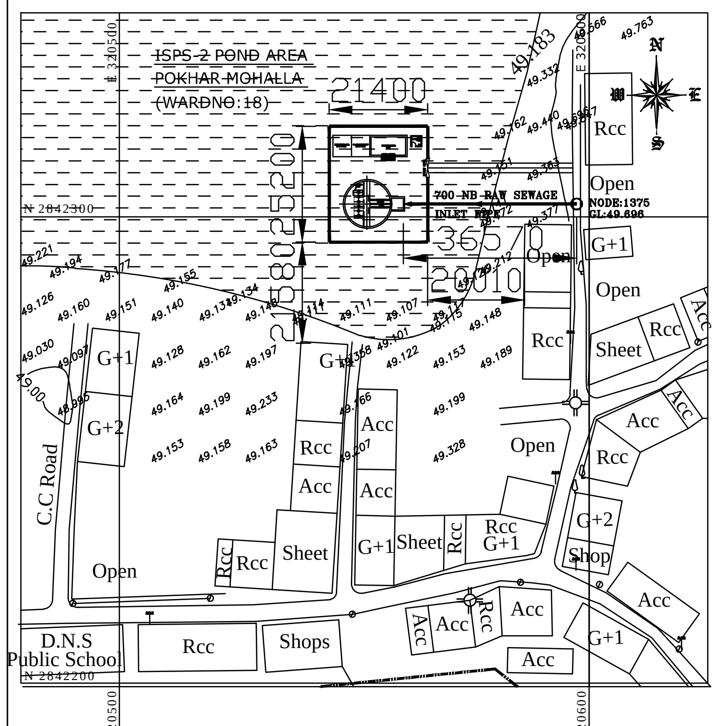
PROJECT:- SEWERAGE NETWORK & STP, HAJIPUR

BIDDERS NAME:- TRI-TECH (BEIJING) COMPANY LTD.
BEIJING, NEW DELHI

TITLE:- SINGLE LINE DIAGRAM OF POWER CUM MOTOR CONTROL CENTER IPS-2

SCALE	SHEET	DRAWING NO.	REV.
AS MKD.	1 OF 1	TT/BEI/HJ/1051/IPS2/A08	0





KEY PLAN

S.NO.	DESCRIPTION	SIZE IN METERS
1	RECEIVING CHAMBER	2.5 x 2.5
2	MECHANICAL COARSE SCREEN CHANNEL	4.5 x 0.72
3	MANUAL COARSE SCREEN CHANNEL	4.5 x 0.53
4	RAW SEWAGE SUMP WET WELL	10.0 ø x 2.0 SWD
5	TRANSFORMER AREA	4.0 x 4.0
6	ELECTRICAL PANEL ROOM	4.0 x 7.5
7	DG SET FOUNDATION	4.0 x 4.0
8	TOILET	2.0 x 2.0

NOTES:-

1.) ALL DIMENSIONS ARE IN MM. & LEVELS ARE IN METRES.
2.) FINISHED GROUND LEVEL CONSIDERED 49.70 M.

REV.	DATE	DESCRIPTION	DRN.	CHKD.	APPD.
0	03.06.14	SUBMISSION FOR APPROVAL	MS	AKS	AKS

CLIENT:- BIHAR URBAN INFRASTRUCTURE DEVELOPMENT CORPORATION LTD., PATNA

PROJECT:- 22.0 MLD SEWAGE TREATMENT PLANT AT HAJIPUR, BIHAR

BIDDERS NAME:- TRI-TECH (BEIJING) COMPANY LTD. BEIJING, NEW DELHI

DATE:- 03.06.14
DRAWN:- M.S.
CHKD.:- AKS
APPD.:- AKS

TITLE:- MECH. GA DRG. OF INTERMEDIATE PUMPING STATION-2

SCALE	SHEET	DRAWING NO.	REV.
1:100	1 OF 1	TT/BEI/HJ/1051/IPS2/B18	0

M/S TRI-TECH(BEIJING) CO. LTD.

BIHAR URBAN INFRASTRUCTURE DEVELOPMENT

CORPORATION LTD., PATNA BIHAR

DESIGN BASIS REOPRT OF IPS-3 FOR HAJIPUR

3/12/2014

Documents details the design concept and philosophy considered for IPS-3 Design of Hajipur Town.

Contents

I. Background

Hajipur is the headquarters of Vaishali district in the Indian state of Bihar, comes under the Patna Administration Division. Hajipur became the Municipality in the year 2002. The municipal area of Hajipur is about 19.64 sq. km. It is famous for producing bananas.

The town Hajipur is situated on the banks of River Gandak. The river Gandak flows from North to South Direction.

1 Topography, Rainfall, Geography and climate

The topography of the town is that of a flat plain area. The mean annual rainfall is 1203 mm mostly confined to monsoon season and with maximum temperature during summer between 41.7^{0}C and minimum temperature of 5.6^{0}C during winter season.

2 Salient Features of the project at a glance

Programme:	**National Ganga River Basin Authority (NGRBA)**		
Project:	**Sewerage Project, Hajipur**		
Project Town:	**Hajipur**	District:	**Vaisali**
Area:	**1993.23 Ha**	Population, 2001:	**119,412**
Av Annual Rainfall:	**1203 mm**	Households:	**17050**
Max Temperature:	**41.7oC**	Min Temperature:	**5.6^{o}C**

3 Proposed Network Layout

Keeping the concept of minimum depth, as per the Tender Document concept, town is divided in Five Zones. Ward wise population are given below table.

Zone 1

It will receive wastewater from whole of the north-western area and South-Western area. In node diagram, Pumping Station No 1 is proposed at node 2535. The wastewater collected from this zone is pumped to Node No 26 of zone-3. In this zone there are 8 wards are there i.e., 1, 2, 3, 4, 5, 6, 7& 8. The collected wastewater is pumped to zone 3.

Zone 2

It will receive wastewater from southern area of town. Pumping Station No 2 is proposed at node 1593. The wastewater collected from this zone is pumped to Node No 816 of zone-3. This is a big zone compare to all other zones, in this zone there are 17 wards are there i.e., 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 24, 27, 29, 30, 31 & 33.

Zone 3

It will received combined sewage generated from Zone 1/ 2/ 3. Pumping Station No 3 is proposed at node 2549. The wastewater collected from this zone is pumped to Node No 41in Zone 5. In this zone there are 6 wards are there i.e., 19, 20, 21, 22, 23, & 25

Zone-4

It will receive wastewater from southern area of town. Pumping Station No 4 is proposed at node 1869. The wastewater collected from this zone is pumped to Node No 2322B in zone no 5. In this zone there are 7 wards are there i.e., 28, 32, 34, 35, 36, 37, 38 &39

Zone-5

This zone is contains only 2 wards that is ward no: 25 and ward no: 38, the ward no:25 is partially covered in this zone. It will receive wastewater from whole of the north-East area.

4 Sewer generation

According to the CPHEO manual **Para 3.2.4,** of manual stipulate that generally 80% of the water supply may be expected to reach the sewers unless there is data available to the contrary.

- Per capita water supply figure of 135 LPCD with 80% contributing to wastewater is adopted to arrive at expected wastewater flows in sewers.

5 Contributory Population Peak flow

Sl. No	Contributing Population	Peak Factor
1	Up to 20,000	3

2	20,000 – 50,000	2.5
3	50,000 – 75,0000	2.25
4	Above 75,0000	2

6 Flow calculation:

Average flow = Total population x 135 x 0.8/3600/24

Peak flow = (Average flow*PF + GWI)

7 IPS-3 Details

Man hole No just before receiving chamber : (N-2549c)

GL of 2549c : 48.29M

GL of IPS-3 : 47.737M

GL of disposing point manhole 41B (at Zone-5) : 50.000M

Outfall Sewer to Receiving Chamber Invert Level: 42.548M

Outfall Sewer Diameter : 1000 mm

Raw Sewage Sump Invert Level : 39.948M

Population Projection:

For complete Town (Including all 5 zones)

S.N.	Year	Population projection	Factor of increment of Population
1	2011	152979	-
2	2026	217992	1.424
3	2041	305494	1.4

Multiple Factor by which population increase form year 2011 to year of 2026 = 1.424

POPULATION FOR ZONE-3:

S.N.	Year	Population (as per Approved zone-4)	GWI	Design Average flow	Design Peak flow	
1	2011	112167	5.626	141.106	323.115	Peak flow =
2	2026	**159726**	**5.626**	**199.657**	**404.94**	(Avg flow*pf+GWI)
3	2041	223708	5.626	281.978	640.077	

7.1 Ground Water Infiltration and leakage (GWI)

Some quantity of ground water or subsoil water may infiltrate into sewers through defective joints, broken pipes etc. This is significant when water table is high and head of ground water is more than the head of sewage in sewers. Some quantity of sewage may leak out from defective joints and defective pipes when head of sewage is more in sewers than head of ground water outside. Infiltration and leakage mainly depends on quality of construction and water table levels. Infiltration can be considered, **Para 3.2.7** Manual, 5000-50000 liters per day per hectare or 500-5000 liters per day per km length of sewers or 250-500 liters per day per manhole for sewers laid below ground water level.

As the project town is situated on the banks of River Ganga, the water table in the town is very much near the ground. Looking to possibility of infiltration of ground water, it is proposed to adopt strict quality control measures for material & workmanship. However, a provision of infiltration in sewers is adopted as 500 litre/manhole/day.

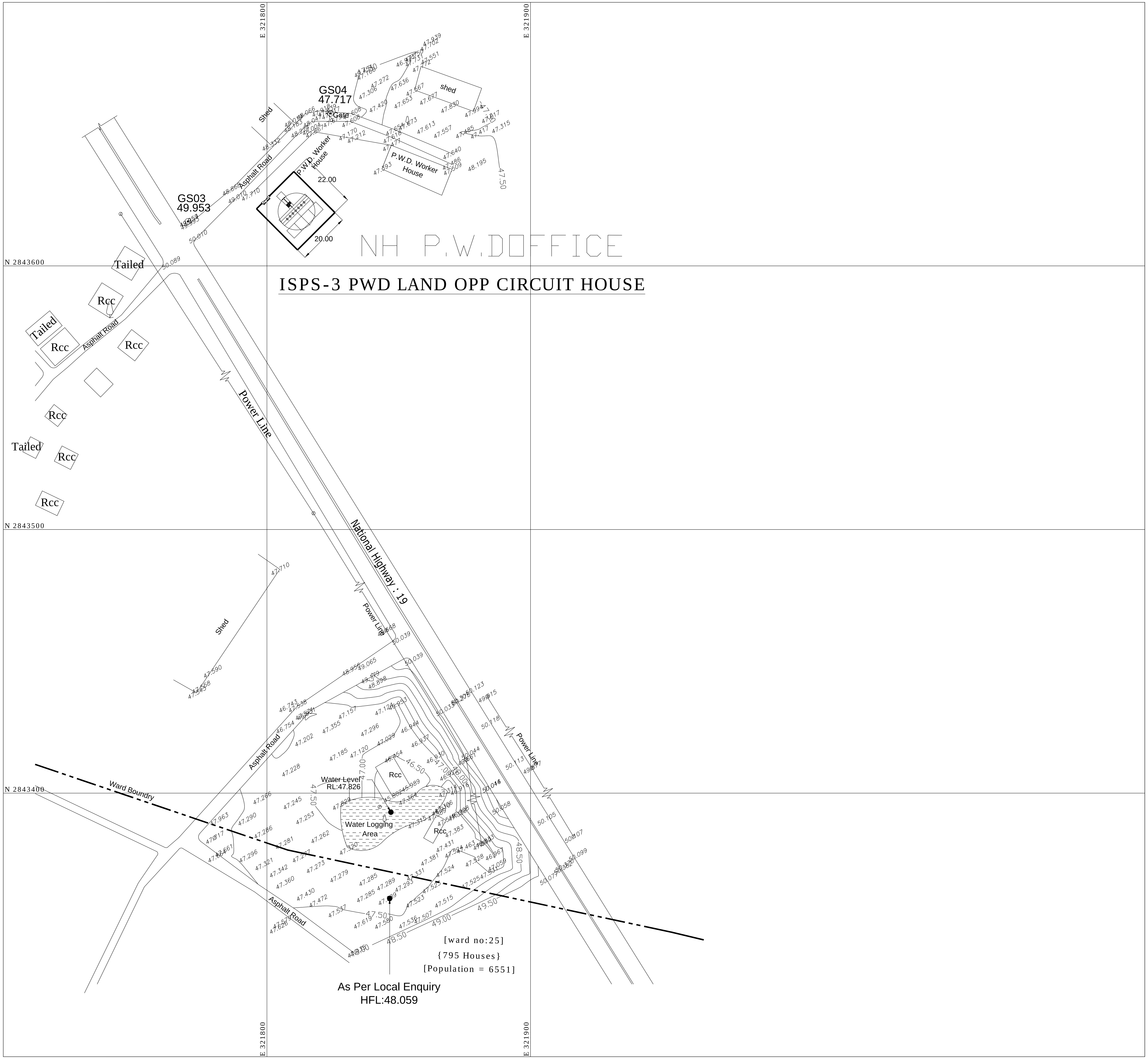
8 Design Period of Sewerage Pumping station

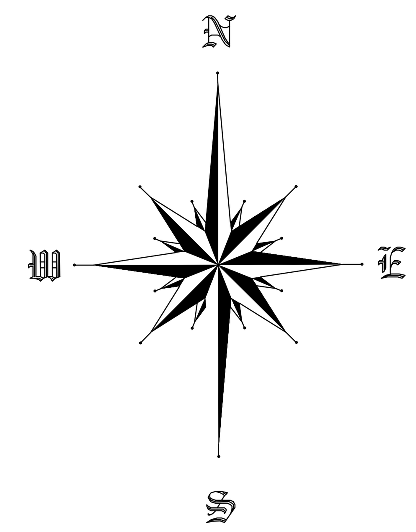
Sl. No	Design Component	Design Period	Remarks
1	Pumping mains	30 Years	Cost may be economical
2	Pumping Stations-Civil Work	30 Years	
3	Pumping Machinery	15 Years	Life of pumping machinery is 15 years

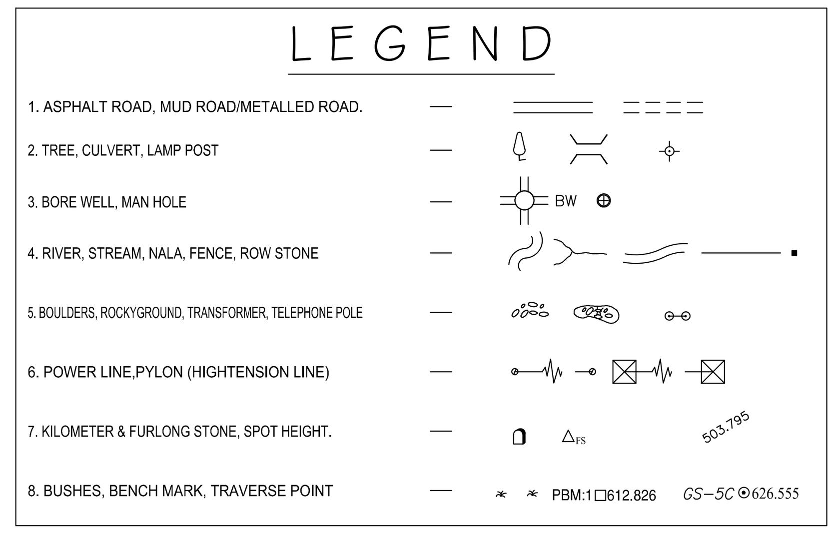
9 Coefficient of friction

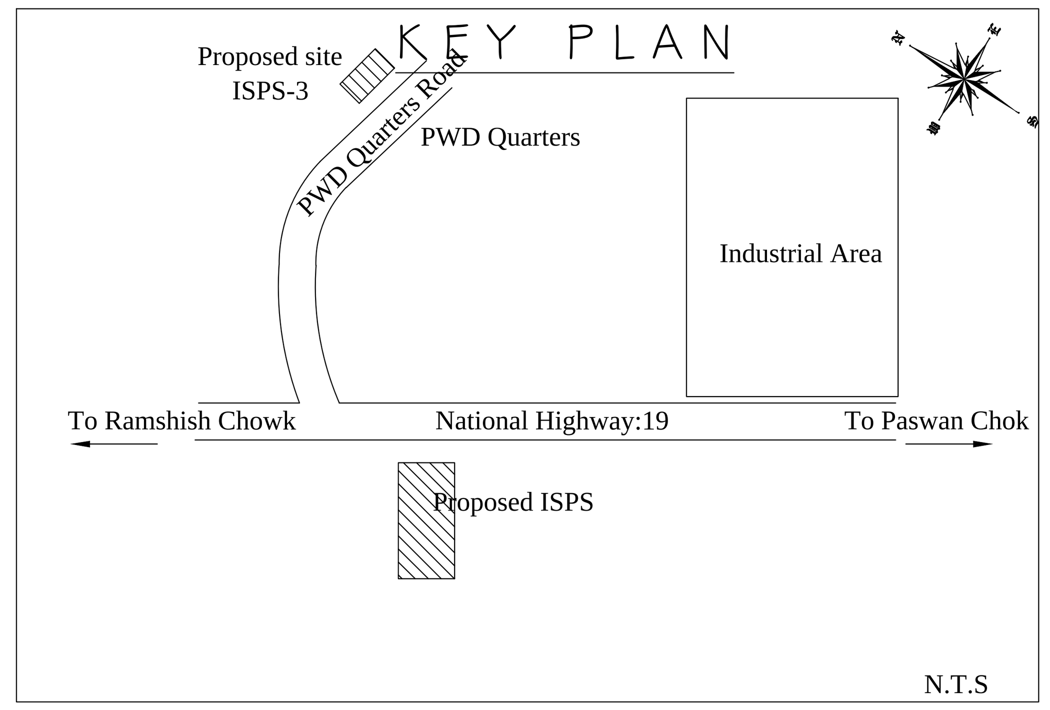
Sr. No.	Type of fitting	K value
1	Bend	**0.32**
2	NRV	**2.5**
3	VALVES	**0.8**
4	EXPANDOR	0.5

Coefficient of roughness for DI pipe (C) : 140









NOTE:-

1. ALL LEVELS ARE IN METERS. UNLESS OTHER WISE MENTIONED.
2. ALL LEVELS ARE CARRIED FROM THE BENCH MARK LOCATED ON SOMPUR BRIDGE OF GANDAK RIVER.
3. TOTAL SURVEYED = 9445.803 SQMTS
   2.334 ACRES
   2 Acres 13.36 GUNTAS
   101675.00 SQFTS

SHEET 1 OF 1

CLIENT	TRI-TECH Tri-Tech Infrastructure (India) Pvt.Ltd.
TITLE	TOPOGRAPHICAL SURVEY OF IPS-3 SITE
ORIGN CLIENT	**BIHAR URBAN INFRASTRUCTURE DEVELOPMENT CORPORATION LTD.** (A Govt. of Bihar Undertaking)
SURVEYED & PREPARED BY	RADIAN SURVEYS #715, OM PLAZA, 3RD FLOOR, 3RD MAIN DR.MODI HOSPITAL ROAD, MAHALAKSHMIPURAM,BANGALORE 86 E-mail : rdnsurveys@gmail.com PH:080-23194839

SCALE: 1:1000	SEASON : 12/11/2012	R3	DRG. NO. HJ/1051/IPS3/SURVEY/01

Owner	**: Bihar Urban Infrastructure Development Corporation Ltd. Patna**
Project	**: Sewerage Network and 22 MLD STP Plant For Hajipur Town**
Contractor	**: Tri-Tech (Beijing) Company Ltd. Beijing (New Delhi)**
Doc. Name	**: Sizing Calculation for IPS-3**
Doc. No.	**: TT/BEI/HJ/1051/IPS3/A01 REV. 03 DT. 13.03.2014**

1.0 SEWAGE GENERATION

Intermediate Pumping Station No. 3 is designed for the following sewage flow rate:

Design Year 2026

Average Flow Rate	:	(Avg. design flow + Infiltration) (199.657+5.657) LPS i.e. 0.205 M^3/s
	:	738 M^3/Hour
	:	17712 M^3/Day i.e. 17.712 MLD
Peak Flow Rate	:	(Peak design flow + Infiltration) (199.657*2.0+5.657)=404.9LPS i.e. 0.405 M^3/s
	:	**1458.0 M^3/Hour**

Design Year 2041

Average Flow Rate	:	(Avg. design flow + Infiltration) (281.98+5.626) LPS i.e. 0.288 M^3/s
	:	1036.8 M^3/Hour
Peak Flow Rate	:	(Peak design flow + Infiltration) 640.077 LPS i.e. 0.640 M^3/s
	:	2304.0 M^3/Hour
	:	M^3/Day i.e. 55.296 MLD

2.0 RECEIVING CHAMBER

No.	:	1
Material of Construction	:	RCC
Year 2041 Peak Flow Rate	:	0.640 M^3/s
Plan Dimensions	:	2.5 M x 2.5 M
Side Water Depth	:	1.24 M
Volume	:	2.5 x 2.5 x 1.24 i.e. 7.75 M^3
Hydraulic Retention Time	:	7.75 / 0.640 i.e. 12.12 s

3.0 MECHANICAL COARSE BAR SCREEN CHANNEL

No.	:	1 (Working)
Material of Construction	:	RCC, with SS 304 Coarse Bar Screen
Design Basis	:	Year 2041 Peak Flow i.e. 0.640 M^3/s
Angle of Inclination	:	80^0
Length	:	4.5 M
Side Water Depth	:	1.2 M
Inclined Submerged Screen Length	:	(1.2 / Sin 80^0) i.e. 1.22 M
Velocity (through Screen at Peak Flow, NIL Clogging)	:	1.0 M/s
Clear Width	:	0.640 M^3/s / (1.22 M x 1.0 M/s)
	i.e.	0.525 M
Clear Spacing	:	25 MM
No. of Openings	:	0.525 M/ 0.025 M
	i.e.	20.98, say 21
No. of Bars	:	21 + 1 i.e. 22
Bar Size	:	10 MM x 50 MM
Screen Channel Width (Minimum)	:	(20 x 0.025) + (21 x 0.01)
	i.e.	0.71, say **0.710 M**
Side Margin for Operating Mechanism	:	0.29 M
Screen Channel Width (Overall)	:	0.610 + 0.29 i.e. 1.**00 M**
Screen Height	:	SWD (U/s) + FB (U/s) + Conveyor Height + 0.5 M + 0.3 M (Safety Factor) i.e. 1.2+7.039 + 0.6 + 0.5 + 0.3 = 9.45 M **say 9.5 M** (Minimum)
Head Loss (Design)	:	0.15 M
Operation	:	Automatic (Timer Controlled)
Service	:	Continuous/ Intermittent
Accessory Equipment	:	Electric Motor/ Drive Mechanism w/ Mechanical Travelling Rakes/ Control Panel/ Belt Conveyor (w/ Electric Motor and Drive Arrangement)/ MSEP/ FRP Wheel Barrows (2 Nos.)

Notes:

1. Due to difficulty associated with underground construction of deep Screen Channels of narrow width, the Screen Channel will be constructed at below Ground Level on a RCC Platform covering portion of the Raw Sewage Collection Sump (Wet Well). The Conveyor Belt will be installed at the Raw Sewage

Collection Sump (Wet Well) Top of Structure Level i.e. 0.5 M above Ground Level.
2. Screenings will be mechanically collected on to a Conveyor Belt and then disposed off mechanically by gravity to Wheel Barrow at Ground Level.
3. The Belt will start automatically when the Mechanical Screen starts and will stop automatically after a lag period of 60 seconds after the Mechanical Screen stops.
4. Height of Screen/ Conveyor Belt are subject to modification depending on Manufacturer Specifications.

Inlet Isolation Sluice Gate

No.	:	1
Type	:	Flange Back Frame Thimble Mounted, Rising Spindle, Flush Bottom Closure
Design Standard	:	IS: 13349
Material of Construction	:	Cast Iron
Peak Flow Rate	:	0.640 M^3/s
Size	:	800 MM x 800 MM
Velocity (at Peak Flow)	:	0.640 / (0.8 x 0.8) i.e. 1.00 M/s
Operation	:	Manual

Note: Outlet Isolation Sluice Gates are not required as the screened sewage will directly free fall to Raw Sewage Collection Sump (Wet Well) below the Mechanical Coarse Screen Channel through bottom perforations at the outlet end of the channel.

4.0 MANUAL COARSE BAR SCREEN CHANNEL

No.	:	1 (Stand-By)
Material of Construction	:	RCC, with SS 304 Coarse Bar Screen
Design Basis	:	Year 2041 Peak Flow i.e. 0.640 M^3/s
Angle of Inclination	:	60^0
Length	:	4.5 M
Side Water Depth	:	1.2 M
Inclined Submerged Screen Length	:	(1.2 / Sin 60^0) i.e. 1.385 M
Velocity (through Screen at Peak Flow, NIL Clogging)	:	1.0 M/s
Clear Width	:	0.640 M^3/s / (1.385 M x 1.0 M/s)
	i.e.	0.462 M
Clear Spacing	:	25 MM
No. of Openings	:	0.462 M/ 0.025 M
	i.e.	18.48, say 19
No. of Bars	:	19 + 1 i.e. 20
Bar Size	:	10 MM x 50 MM

Screen Channel Width	:	(19 x 0.025) + (20 x 0.01)
	i.e.	0.675,
Consider side margin for Operation	:	0.2 M
Total Screen channel width	:	0.675 +0.2 i.e. 0.875M **say 0.88 M**
Screen Height	:	SWD (U/s) + FB (U/s) i.e. 1.2 + 0.5 = 1.7 M
Head Loss (Design)	:	0.15 M
Operation	:	Manual
Service	:	Intermittent
Accessory Equipment	:	MSEP Rakes (2 Nos.)/ Bucket Chain Pulley Screenings Removal Arrangement

Notes:

1. Due to difficulty associated with underground construction of deep Screen Channels of narrow width, the Screen Channel will be constructed at below Ground Level on a RCC Platform covering portion of the Raw Sewage Collection Sump (Wet Well).
2. Screenings will be manually raked on to a RCC Perforated Platform and then transferred to Raw Sewage Collection Sump (Wet Well) Top of Structure Level through Bucket - Chain Pulley Arrangement and disposed off manually to Hand Cart at Ground Level.

Inlet Isolation Sluice Gate

No.	:	1
Type	:	Flange Back Frame Thimble Mounted, Rising Spindle, Flush Bottom Closure
Design Standard	:	IS: 13349
Material of Construction	:	Cast Iron
Peak Flow Rate	:	0.640 M^3/s
Size	:	800 MM x 800 MM
Velocity (at Peak Flow)	:	0.640 / (0.8 x 0.8) i.e. 1.00 M/s
Operation	:	Manual

Note: Outlet Isolation Sluice Gate is not required as the screened sewage will directly free fall to Raw Sewage Collection Sump (Wet Well) below the Mechanical Coarse Screen Channel through bottom perforations at the outlet end of the channel.

5.0 RAW SEWAGE PUMPING STATION

Raw Sewage Collection Sump (Wet Well)

No.	:	1
Material of Construction	:	RCC
Peak Flow Rate	:	0.640 M^3/s
Hydraulic Retention Time (at Peak Flow)	:	7.5 Minutes
Volume (Required)	:	0.640 x 60 x 7.5 i.e. 288 M^3
Let Side Water Depth	:	2 M
Plan area required for wet well	:	144.0 M^2
Diameter required for wet well	:	13.50 M
Diameter (Provided)	:	**14.0 M**
Volume (Provided)	:	$\prod/4$ x 14.0 x 14.0 x 2 i.e. 307.8 M^3
Hydraulic Retention Time (at Peak Flow)	:	307.8/ (0.640 x 60) i.e. 8.0 Min, i.e. OK
Accessory	:	Ultrasonic Level Sensor (Linked to PLC/ SCADA)

Raw Sewage Transfer Pumps

Nos.	:	5 (4 Working + 1 Stand-By – Peak Flow)
	:	5 (2 Working + 3 Stand-By –Average Flow)
Design Basis	:	Year 2026 Peak Flow i.e. **1458.0** M^3/Hour
Capacity	:	**1458.0** / 4 i.e. 364.5 say **365.0 M^3/Hour**
Discharge Head	:	14.0 MWC
Type	:	Submersible Non Clog, Wet Well Installation
Operation	:	Automatic (Controlled by Ultrasonic Level Sensor, linked to PLC/ SCADA)
Material of Construction		
Casing	:	Cast Iron
Impeller	:	Stainless Steel ASTM A 743 CF8M
Shaft/ Fasteners/ Foundation Bolts	:	Stainless Steel 316
Guide Rail	:	Stainless Steel SS 304
Accessory Equipment	:	Submersible Electric Motors/ Lifting Chains/ Guide Rails

Individual Pump Delivery Lines

Size	:	300 NB
Design Velocity	:	365.0/3600/ ($\Pi/4$ x 0.3 x 0.3) i.e. 1.44 M/s
Material of Construction	:	DI K7
Accessory Equipment	:	Non Return Valve/ Butterfly Valve

(Electrically Actuated)/ Pressure Gauge

Combined Pump Delivery Header

Design Flow	:	365.0 x 4 i.e. 1460.0 M^3/Hour
Size	:	700 NB
Design Velocity	:	1460.0/ 3600/ (Π/4 x 0.7 x 0.7)
	i.e.	1.05 M/s
Material of Construction	:	DI K7

Dry Well

Note: The Dry Well be constructed above the Raw Sewage Collection Sump (Wet Well) and will be used for access to the Submersible Pumps for operation and maintenance as required.

No.	:	1
Material of Construction	:	RCC Slabs/ Walkways w/ Hand Railing
Accessory	:	3.0 Ton Capacity Manual Chain Pulley Hoist with ISMB

Pump House Electric Panel Room

No.	:	1
Material of Construction	:	RCC Slabs/ Columns, Brick Masonry Side
Walls as applicable		
Plan Dimensions	:	4.0 M x 7.5 M
Height	:	4.0 M

Owner	**: Bihar Urban Infrastructure Development Corporation Ltd. Patna**
Project	**: Sewerage Network and 22 MLD STP Plant For Hajipur Town**
Contractor	**: Tri-Tech (Beijing) Company Ltd. Beijing (New Delhi)**
Doc. Name	**: Hydraulic Design Calculation for IPS-3**
Doc. No.	**: TT/BEI/HJ/1051/IPS3/A02 REV. 03 DT. 12.03.2014**

S.NO.	PARAMETER		VALUE	UNIT
1.0	**DESIGN FLOWRATE**			
	Peak Flow Rate, Q_P	:	55.296	MLD
		:	2304.000	M^3/Hr
		:	0.640	M^3/s
2.0	**RECEIVING CHAMBER**			
	Outfall Sewer to Receiving Chamber Invert Level	:	42.548	M
	Say	:	42.548	M
	Outfall Sewer Diameter	:	1.000	M
	Outfall Sewer Soffit Level	:	43.548	M
	IPS 3 Finished Ground Level (Considered)	:	50.000	M
	Height, Top of Receiving Chamber	:	0.300	M
	Receiving Chamber Top of Structure Level	:	50.300	M
	Outfall Sewer Capacity, Q_P	:	2304.000	M^3/Hr
		:	0.640	M^3/s
	Sewage Level in Outfall Sewer (Considered)	:	80.000	%
		:	0.800	M
	Outfall Sewer Top Water Level	:	**43.348**	M
	Outfall Sewer Wetted Cross Section Area, A			
	Triangle Portion			
	Triangle Height, H	:	0.300	M
	Subtended Angle, θ = Cos -1 (H/ (D/2))	:	53.130	^{0}

S.NO.	PARAMETER		VALUE	UNIT
	Triangle Base, B = ((((D/2)^2) - (H^2))^0.5)*2	:	0.800	M
	Triangle Area, A_1 = 0.5 * H * B	:	0.120	M^2
	Circle Segment Portion			
	Subtended Angle, $\theta_1 = 360^0 - (\theta * 2))$	:	253.740	^{0}
	Outfall Sewer Wetted Circular Cross Section Area, A_2	:	0.554	M^2
	Outfall Sewer Wetted Cross Section Area, A = A_1+A_2	:	0.674	M^2
	Outfall Sewer Design Flow Rate, Q_D	:	0.640	M^3/s
	Outfall Sewer Velocity, V = Q_D / A	:	0.950	M/s
	Velocity Head, $V^2/2g$	:	0.046	M
	Exit Head Loss Co-Efficient, K	:	1.000	
	Exit Head Loss, K * $V^2/2g$	:	0.046	M
	Receiving Chamber Top Water Level	:	43.302	M
	Say	:	**43.302**	M
	Gap, Sewer Pipeline IL - Receiving Chamber IL	:	0.500	M
	Receiving Chamber Invert Level	:	**42.048**	M
	Receiving Chamber Side Water Depth	:	**1.254**	M
	Free Board	:	6.998	M
3.0	**MECHANICAL COARSE SCREEN CHANNEL**			
	Inlet Sluice Gate Width, W	:	0.800	M
	Inlet Sluice Gate Side Water Depth, Z	:	0.800	M
	Velocity (across Sluice Gate), V = Q_P/ W*Z	:	1.000	M/s
	Velocity Head V^2 / 2g	:	0.051	M
	kkkm	:	0.800	
	Head Loss across Sluice Gate, K * V^2 / 2g	:	0.041	M
	Say	:	0.041	M
	Coarse Screen Channel Top Water Level (U/s)	:	43.261	M
	Say	:	**43.261**	

S.NO.	PARAMETER		VALUE	UNIT
	Coarse Screen Channel Invert Level	:	**42.048**	M
	Coarse Screen Channel Side Water Depth (U/s)	:	**1.213**	M
	Head Loss across Coarse Screen (Refer Process Calculations)	:	0.150	M
	Coarse Screen Channel Top Water Level (D/s)	:	**43.111**	M
	Free Board (To Top of Screen Channel)	:	0.500	M
	Coarse Screen Channel Top of Structure Level	:	43.761	M
	Wet Well Top of Structure Level	:	50.300	M
	Free Board (To Top of Wet Well)	:	7.039	M
	Say	:	7.039	M
	IPS 3 Finished Ground Level	:	50.000	M
4.0	**RAW SEWAGE SUMP (WET WELL)**			
	Coarse Screen Channel Invert Level	:	42.048	M
	Free Fall, Fine Screen Channel IL - Raw Sewage Sump TWL	:	0.300	M
	Raw Sewage Sump Top Water Level	:	**41.748**	M
	Raw Sewage Sump Side Water Depth	:	**2.000**	M
	Raw Sewage Sump Invert Level	:	**39.748**	M
	Finished Ground Level	:	50.000	M
	Dry Well Plinth Level	:	50.300	M
	Height, Dry Well Plinth Level (Above Ground)	:	0.850	M
	Raw Water Sump Top of Structure Level	:	50.300	M
	Raw Water Sump Free Board	:	8.552	M

(Refer Process & Instrumentation Diagram Drawing No. TT/BEI/HJ/1051/IPS3/A07).

GENERAL DESCRIPTION

Each Electrical Drive of the Intermediate Pumping Station can be controlled as follows:

1.0 Through Local Push Button START/ STOP Station installed locally near the drive when in LOCAL Mode.
2.0 Through the Motor Control Center (MCC).
3.0 Through PLC/ SCADA installed in the Control Room when MCC is in REMOTE Mode. In REMOTE MANUAL Mode the Electrical Drive can be operated manually through Soft Keys on the SCADA Screen. In REMOTE AUTO Mode the Electrical Drive will START/ STOP automatically through software already installed in the PLC.

Details of Plant Automation pertaining to specific units are as follows:

MECHANICAL SCREEN CHANNEL

1.0 Inlet Gate will be manually operated.
2.0 Mechanical Coarse Screen/ Conveyor Belt will be Timer Operated. Timer setting will be 0 – 30 minutes for Cycle time 30 minutes. Conveyor Belt will automatically stop after a Lag Period of 60 seconds following Mechanical Screen Stop.

RAW SEWAGE SUMP WET WELL

1.0 Raw Sewage Transfer Pumps will be operated through PLC SCADA linked to Ultrasonic Level Sensor. During rising Sump Level 1 No. Raw Sewage Transfer Pump will come in to operation at Low Level 1 of the Sump Wet Well. A second Pump will come in to operation at Low Level 2. A third Pump will come in to operation at High Level 1. A fourth Pump will come in to operation at High Level 2. The operating sequence of the Raw Sewage Transfer Pumps will be rotated weekly through PLC SCADA. During decreasing Sump Level the operating sequence will be reversed.
2.0 Individual Pump Delivery Electrically Actuated Butterfly Valves will automatically OPEN at PUMP START and automatically CLOSE at PUMP STOP.

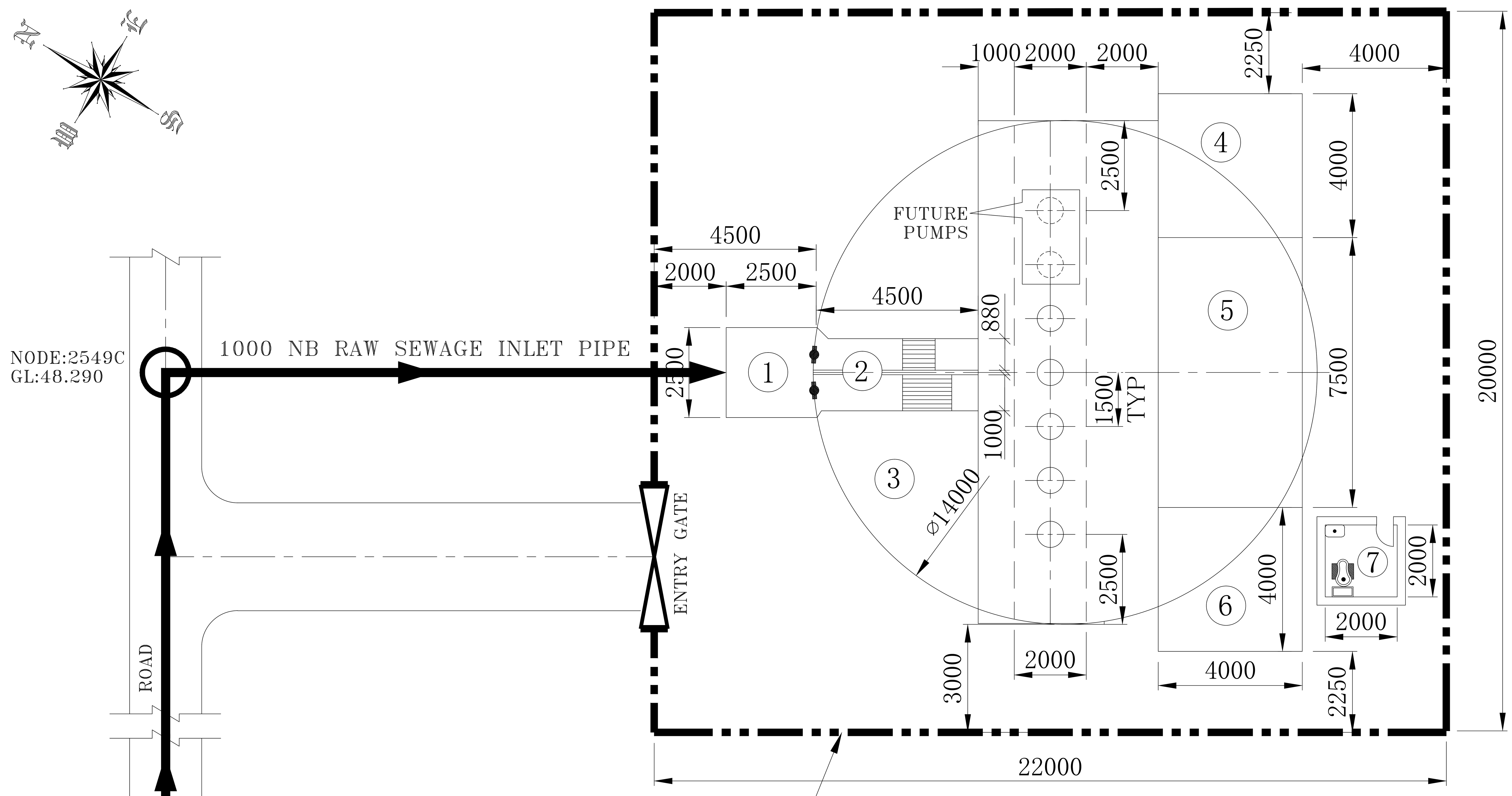
3.0 Pump(s) in operation will be tripped automatically through Level Switch Hard Wire Interlock at Low Low Level in the Sump Wet Well.
4.0 Alarm will sound in the Control Panel at Sump Wet Well High High Level and Low Low Level activated by Ultrasonic Level Sensor.
5.0 Alarm will sound in the Control Panel at Sump Wet Well High High Level and Low Low Level activated by Level Switch.

Owner	**: Bihar Urban Infrastructure Development Corporation Ltd. Patna**
Project	**: Sewerage Network and 22 MLD STP Plant For Hajipur Town**
Contractor	**: Tri-Tech (Beijing) Company Ltd. Beijing (New Delhi)**
Doc. Name	**: Pumping Head Calculations for Raw Sewage Transfer Pumps IPS-3**
Doc. No.	**: TT/BEI/HJ/1051/IPS3/A05 REV. 03 DT. 12.03.2014**

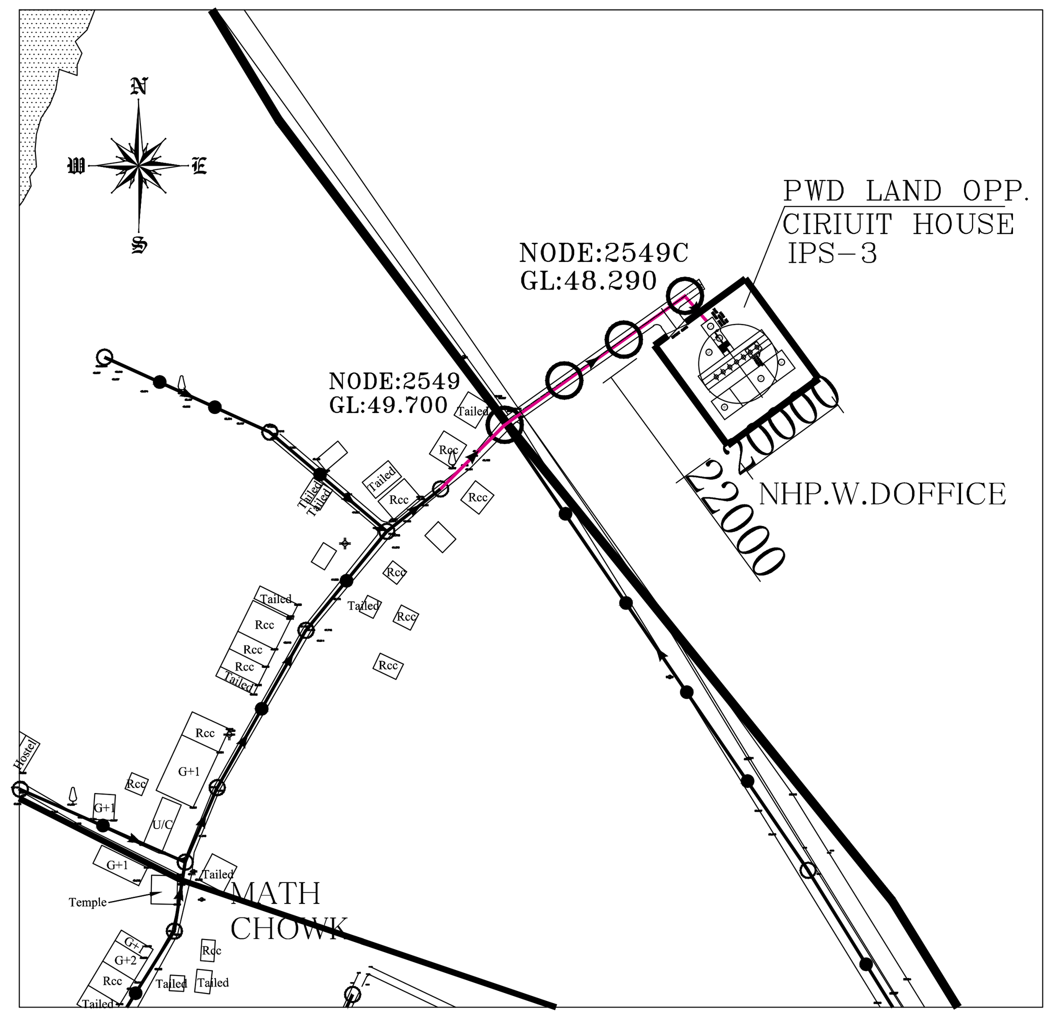
S.NO.	**PARAMETER**		**VALUE**	**UNIT**
1.0	Individual Pump Flow Rate, Q	:	365.000	M^3/Hr
		:	0.101	M^3/s
	Total Nos. Pumps	:	5.000	
	Nos. Pumps Working	:	4.000	
	Nos. Pumps Stand-By	:	1.000	
	Combined Pump Flow Rate	:	1460.000	M^3/Hr
		:	0.406	M^3/s
2.0	**STATIC HEAD CALCULATION**			
	Raw Sewage Sump IL	:	39.748	M
	Receiving Manhole N-41 Ground Level	:	50.000	M
	Static Head	:	**10.252**	M
3.0	**PIPE FRICTION LOSS - 300 NB DI K7 INDIVIDUAL DELIVERY**			
	Pump Flow Rate, Q	:	0.101	M^3/s
	Pump Delivery Pipeline Diameter, D	:	0.300	M
	Pump Delivery Pipeline Length (Max), L	:	10.000	M
	Pipe Velocity, $V = Q/ (\prod * D * D/4)$	:	1.434	M/s
	Hazen William Equation, $V = 0.849 * C * R^{0.63} * S^{0.54}$			
	Hazen William Co-Efficient, C (CPHEEO Manual)	:	100.000	
	Hydraulic Radius, R = D/4	:	0.075	M
	Friction Slope, S (by Calculation)	:	0.01072	M/M
	Pipe Friction Loss, $H_F = S * L$	:	**0.107**	M
4.0	**PIPE FRICTION LOSS - 700 NB DI K7 COMMON DELIVERY HEADER**			
	Pump Flow Rate, Q	:	0.406	M^3/s
	Pump Delivery Pipeline Diameter, D	:	0.700	M

S.NO.	PARAMETER		VALUE	UNIT
	Pump Delivery Pipeline Length (Max), L	:	**750.000**	M
	Pipe Velocity, V = Q/ (∏*D*D/4)	:	1.054	M/s
	Hazen William Equation, $V = 0.849 * C * R^{0.63} * S^{0.54}$			
	Hazen William Co-Efficient, C (CPHEEO Manual)	:	140.000	
	Hydraulic Radius, R = D/4	:	0.175	M
	Friction Slope, S (by Calculation)	:	0.00121	M/M
	Pipe Friction Loss, $H_F = S * L$	:	**0.907**	M
5.0	**FITTINGS LOSSES - PUMP SUCTION**			
	Pump Flow Rate, Q	:	0.101	M^3/s
	Pump Suction Diameter, D	:	0.300	M
	Suction Velocity V = Q/(∏/4*D*D)	:	1.434	M/s
	Velocity Head = $V^2/2g$	:	0.105	M
	Entrance Loss Co-Efficient, K	:	0.500	
	Pump Suction Fittings Losses = $K * V^2/2g$	:	**0.052**	M
6.0	**FITTINGS LOSSES - 300 NB DI K7 INDIVIDUAL PUMP DELIVERY**			
	Pump Flow Rate, Q	:	0.101	M^3/s
	Pump Delivery Pipeline Diameter, D	:	0.300	M
	Delivery Velocity V = Q/(∏/4*D*D)	:	1.434	M/s
	Velocity Head = $V^2/2g$	:	0.105	M
	Loss Co-Efficient, Reducer 200 NB - 150 NB, K_1	:	1.000	
	Loss Co-Efficient, 90^0 Bends, K_2	:	1.000	
	Nos. 90^0 Bends, N	:	2.000	
	Loss Co-Efficient Non Return Valve, K_4	:	2.500	
	Loss Co-Efficient Butterfly Valve, K_5	:	1.000	
	Total Loss Co-Efficient $K = (K_1 + N*K_2 + K4 + K5)$	:	6.500	
	Pump Delivery Fittings Losses = $K * V^2/2g$	:	**0.681**	M
7.0	**FITTINGS LOSSES - 700 NB DI K7 COMMON DELIVERY HEADER**			
	Pump Flow Rate, Q	:	0.406	M^3/s
	Pump Delivery Pipeline Diameter, D	:	0.700	M
	Delivery Velocity V = Q/(∏/4*D*D)	:	1.054	M/s
	Velocity Head = $V^2/2g$	:	0.057	M

S.NO.	PARAMETER		VALUE	UNIT
	Loss Co-Efficient, 90^0 / 45^0 Bends, K_2	:	1.000	
	Nos. 90^0 Bends, N (Max)	:	8.000	
	Exit Loss Co-Efficient, K_6	:	1.000	
	K6)	:	9.000	
	Pump Delivery Fittings Losses = K * $V^2/2g$	:	**0.509**	M
7.0	**TOTAL HEAD LOSS CALCULATION**			
	Total Head Loss = Static Head + Friction Loss + Suction Fittings Loss + Delivery Fittings Loss	:	12.509	M
	Pump Delivery Head with considering 10% margin	:	13.760	M
	Pump Delivery Head (Provided)	:	**14.000**	M



LAYOUT PLAN



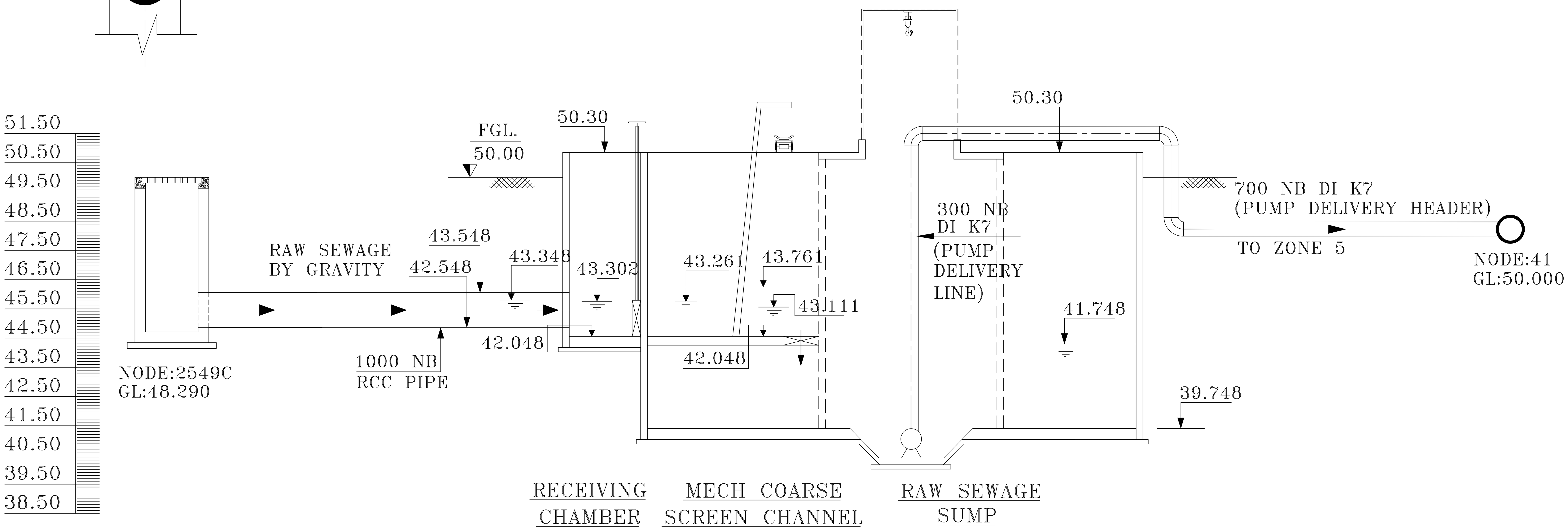
KEY PLAN

UNIT LIST

S.NO.	DESCRIPTION	SIZE IN METERS
1	RECEIVING CHAMBER	2.5 x 2.5
2	COARSE SCREEN CHANNELS	4.5
3	WET WELL	14.0 ⌀ x 2.0 SWD
4	TRANSFORMER AREA	4.0 x 4.0
5	ELECTRICAL PANEL ROOM	4.0 x 7.5
6	DG SET FOUNDATION	4.0 x 4.0
7	TOILET	2.0 x 2.0

NOTES:-

1.) BUIDCO TO PROVIDE AND TERMINATE 11.0 KV HT POWER SUPPLY AT HT SIDE OF TRANSFORMER.



HYDRAULIC FLOW DIAGRAM

REV.	DATE	DESCRIPTION	DRN.	CHKD.	APPD.
3	12.03.14	REVISED AS PER REVISED SIZING CALCULATION	M.S.	MB	AKS
2	19.09.13	REVISED AS PER REVISED SIZING CALCULATION	M.S.	SHIV	RKS
1	26.03.13	REVISED AS PER REVISED SIZING CALCULATION	M.S.	SHIV	RKS

CLIENT: – BIHAR URBAN INFRASTRUCTURE DEVELOPMENT CORPORATION LTD., PATNA

PROJECT: – 22 MLD SEWAGE TREATMENT PLANT AT HAJIPUR, BIHAR

BIDDERS NAME: – TRI-TECH (BEIJING) COMPANY LTD. BEIJING, NEW DELHI

DATE: – 27.11.12

DRAWN.: – M.S.

CHKD.: – DR. A.DUTT

APPD.: – DR. A.DUTT

TITLE: – IPS 3 LAYOUT PLAN CUM HYDRAULIC FLOW DIAGRAM

SCALE	SHEET	DRAWING NO.	REV.
AS MKD.	1 OF 1	TT/BEI/HJ/1051/IPS3/A06	3

UNIT LIST

UNIT NO.	UNIT DESCRIPTION	DIMENSIONS (M)	QTY	MOC
1.0	RECEIVING CHAMBER	2.5 x 2.5 x 1.254 SWD + 6.998FB	1	RCC
2.0	MANUAL COARSE SCREEN CHANNEL	4.5 x 0.88 x 1.213 SWD + 0.5 FB	1	RCC
3.0	MECH COARSE SCREEN CHANNEL	4.5 x 1.00 x 1.213 SWD + 0.5 FB	1	RCC
4.0	RAW SEWAGE COLLECTION SUMP (WET WELL)	14.0ø x 2.0 SWD + 8.552 FB	1	RCC

EQUIPMENT LIST

TAG NO.	EQUIPMENT DESCRIPTION	SIZE (M) / CAPACITY	QTY	MOC
CS-IPS3-01	MANUAL COARSE BAR SCREEN	0.675 W x 1.7 HT	1	SS 304
CS-IPS3-02	MECH COARSE BAR SCREEN	0.710 W x 9.65 HT	1	SS 304
BC-IPS3-01	BELT CONVEYOR	0.6 W	1	MFG STD
HC-IPS3--01/02	HAND CART	0.5 M3	2	MSEP/FRP
P-IPS3-01/02/03/04	RAW SEWAGE TRANSFER PUMPS (W/MOTOR)	365.0 M3/HR x 14.0 MWC	5	AS PER NIT
M-IPS3-01	MANUAL CHAIN PULLEY HOIST (W/TROLLEY)	3.0 TON	1	MFG STD

VALVE/GATE LIST

TAG NO.	VALVE/GATE DESCRIPTION	DIMENSIONS (MM)	QTY	MOC
SG-IPS3--01/02	MANUAL SLUICE GATE, FLANGE BACK FRAME, WALL THIMBLE	800 x 800	2	CI (AS PER NIT)
NRV-IPS3-01/02/03/04/05	NON RETURN VALVE, D/F, PN 1.0, SWING CHECK	300 NB	5	CI (AS PER NIT)
BFV-IPS3-01/02/03/04/05	BUTTERFLY VALVE, D/F, PN 1.0, ELECTRICALLY ACTUATED	300 NB	5	CI (AS PER NIT)

INSTRUMENTATION LIST

TAG NO.	INSTRUMENT DESCRIPTION	SIZE (MM)	QTY	MOC
PI-IPS3-01/02/03/04/05	PRESSURE INDICATOR, DIAPHRAGM	150/100 NB	5	MFG STD
LS-IPS3-01	LEVEL SWITCH, CONDUCTIVITY TYPE		1	MFG STD
LT-IPS3-01	LEVEL TRANSMITTER, ULTRASONIC		1	MFG STD

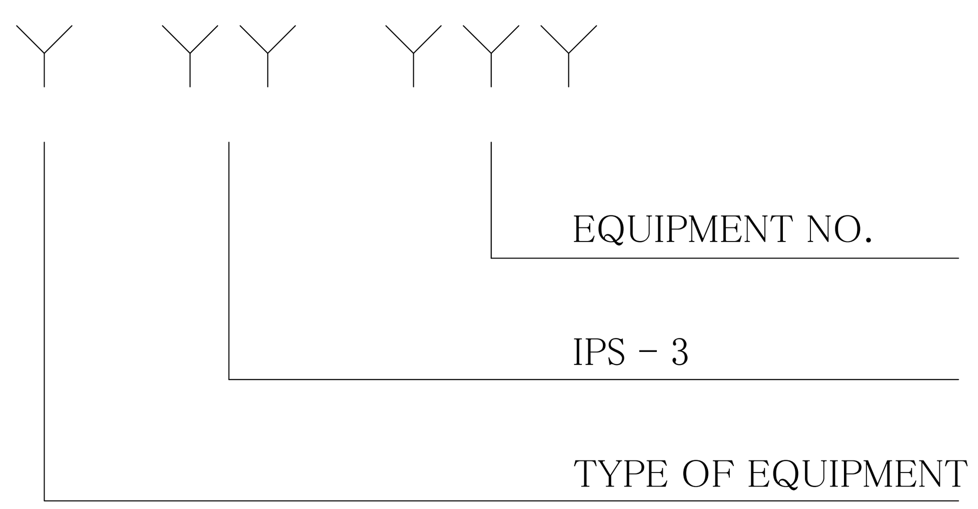
LEGENDS:-

	NON RETURN VALVE
	MOTORIZED BUTTERFLY VALVE
	GATE
	SUBMERSIBLE PUMP
	LOCAL INSTRUMENT
	PANEL ALARM
	SCADA INDICATION
	SCADA ALARM
	HARD WIRE INTERLOCK
	SEWAGE/WATER LINE
	SLUDGE LINE
LSH	LEVEL SWITCH HIGH
LSL	LEVEL SWITCH LOW
LAH	LEVEL ALARM HIGH
PI	PRESSURE INDICATOR

LEGENDS:-

LAL	LEVEL ALARM LOW
LE	LEVEL ELEMENT
LI	LEVEL INDICATOR
LITx	LEVEL INDICATOR CUM TRANSMITTER

EQUIPMENT TAG:-



REV.	DATE	DESCRIPTION	DRN.	CHKD.	APPD.
3	12.03.14	REVISED AS PER REVISED SIZING CALCULATION	MS	MB	AKS
2	19.09.13	REVISED AS PER REVISED SIZING CALCULATION	MS	SHIV	RKS
1	26.03.13	REVISED AS PER REVISED SIZING CALCULATION	MS	SHIV	RKS
0	30.11.12	SUBMISSION FOR APPROVAL	P.B.	SHIV	A.DUTT

CLIENT:- BIHAR URBAN INFRASTRUCTURE DEVELOPMENT CORPORATION LTD., PATNA

PROJECT:- 22 MLD SEWAGE TREATMENT PLANT AT HAJIPUR, BIHAR

BIDDERS NAME:- TRI-TECH (BEIJING) COMPANY LTD. BEIJING, NEW DELHI

TITLE:- PROCESS & INSTRUMENTATION DIAGRAM OF IPS-3

SCALE	SHEET	DRAWING NO.	REV.
AS MKD.	1 OF 1	TT/BEI/HJ/1051/IPS3/A07	3

Owner	**: Bihar Urban Infrastructure Development Corporation Ltd. Patna**
Project	**: Sewerage Network and 22 MLD STP Plant For Hajipur Town**
Contractor	**: Tri-Tech (Beijing) Company Ltd. Beijing (New Delhi)**
Doc. Name	**: Pumping Head Calculations for Raw Sewage Transfer Pumps IPS-4**
Doc. No.	**: TT/BEI/HJ/1051/IPS4/A05 REV. 03 DT. 09.07.2013**

S.NO.	PARAMETER		VALUE	UNIT
1.0	Individual Pump Flow Rate, Q	:	142.000	M^3/Hr
		:	0.039	M^3/s
	Total Nos. Pumps	:	5.000	nos.
	Nos. Pumps Working	:	4.000	nos.
	Nos. Pumps Stand-By	:	1.000	nos.
	Combined Pump Flow Rate (for year 2026)	:	568.000	M^3/Hr
		:	**0.158**	**M^3/s**
2.0	**STATIC HEAD CALCULATION**			
	Raw Sewage Sump IL	:	40.313	M
	Receiving Manhole N-2322B Ground Level	:	47.984	M
	Static Head	:	**7.671**	M
3.0	**PIPE FRICTION LOSS - 200 NB DI K7 INDIVIDUAL DELIVERY**			
	Pump Flow Rate, Q	:	0.039	M^3/s
	Pump Delivery Pipeline Diameter, D	:	0.200	M
	Pump Delivery Pipeline Length (Max), L	:	10.000	M
	Pipe Velocity, V = Q/ (∏*D*D/4)	:	1.255	M/s
	Hazen William Equation, $V = 0.849 * C * R^{0.63} * S^{0.54}$			
	Hazen William Co-Efficient, C (CPHEEO Manual)	:	140.000	
	Hydraulic Radius, R = D/4	:	0.050	M
	Friction Slope, S (by Calculation)	:	0.00721	M/M
	Pipe Friction Loss, $H_F = S * L$	:	**0.072**	M
4.0	**PIPE FRICTION LOSS - 400 NB DI K7 COMMON DELIVERY HEADER**			
	Pump Flow Rate, Q	:	0.158	M^3/s
	Pump Delivery Pipeline Diameter, D	:	0.400	M
	Pump Delivery Pipeline Length (Max), L	:	**1600.000**	M
	Pipe Velocity, V = Q/ (∏*D*D/4)	:	1.255	M/s
	Hazen William Equation, $V = 0.849 * C * R^{0.63} * S^{0.54}$			
	Hazen William Co-Efficient, C (CPHEEO Manual)	:	140.000	
	Hydraulic Radius, R = D/4	:	0.100	M
	Friction Slope, S (by Calculation)	:	0.00321	M/M
	Pipe Friction Loss, $H_F = S * L$	:	**5.141**	M

S.NO.	PARAMETER		VALUE	UNIT
5.0	**FITTINGS LOSSES - PUMP SUCTION**			
	Pump Flow Rate, Q	:	0.039	M^3/s
	Pump Suction Diameter, D	:	0.200	M
	Suction Velocity V = Q/(∏/4*D*D)	:	1.255	M/s
	Velocity Head = $V^2/2g$	:	0.080	M
	Entrance Loss Co-Efficient, K	:	0.500	
	Pump Suction Fittings Losses = K * $V^2/2g$	:	**0.040**	M
6.0	**FITTINGS LOSSES - 200 NB DI K7 INDIVIDUAL PUMP DELIVERY**			
	Pump Flow Rate, Q	:	0.039	M^3/s
	Pump Delivery Pipeline Diameter, D	:	0.200	M
	Delivery Velocity V = Q/(∏/4*D*D)	:	1.255	M/s
	Velocity Head = $V^2/2g$	:	0.080	M
	Loss Co-Efficient, Reducer 200 NB - 150 NB, K_1	:	1.000	
	Loss Co-Efficient, 90^0 Bends, K_2	:	1.000	
	Nos. 90^0 Bends, N	:	2.000	
	Loss Co-Efficient Non Return Valve, K_4	:	2.500	
	Loss Co-Efficient Butterfly Valve, K_5	:	1.000	
	Total Loss Co-Efficient K = (K_1 + N*K_2 + K4 + K5)	:	6.500	
	Pump Delivery Fittings Losses = K * $V^2/2g$	:	**0.522**	M
7.0	**FITTINGS LOSSES - 400 NB DI K7 COMMON DELIVERY HEADER**			
	Pump Flow Rate, Q	:	0.158	M^3/s
	Pump Delivery Pipeline Diameter, D	:	0.400	M
	Delivery Velocity V = Q/(∏/4*D*D)	:	1.26	M/s
	Velocity Head = $V^2/2g$	:	0.080	M
	Loss Co-Efficient, 90^0 / 45^0 Bends, K_2	:	1.000	
	Nos. 90^0 Bends, N (Max)	:	30.000	
	Exit Loss Co-Efficient, K_6	:	1.000	
	K5 + K6)	:	31.000	
	Pump Delivery Fittings Losses = K * $V^2/2g$	:	**2.490**	M
7.0	**TOTAL HEAD LOSS CALCULATION**			
	Total Head Loss = Static Head + Friction Loss + Suction Fittings Loss + Delivery Fittings Loss	:	15.937	M
	Pump Delivery Head with 10% margin	:	17.530	M
	Pump Delivery Head (Provided)	:	**18.000**	M
	Pumping KW rating		10.709	

Owner	**: Bihar Urban Infrastructure Development Corporation Ltd. Patna**
Project	**: Sewerage Network and 22 MLD STP Plant For Hajipur Town**
Contractor	**: Tri-Tech (Beijing) Company Ltd. Beijing (New Delhi)**
Doc. Name	**: Hydraulic Design Calculation for IPS-4**
Doc. No.	**: TT/BEI/HJ/1051/IPS4/A02 REV. 03 DT. 02.07.2013**

S.NO.	PARAMETER		VALUE	UNIT
1.0	**DESIGN FLOWRATE**			
	Peak Flow Rate, Q_P	:	16.848	MLD
		:	702.000	M^3/Hr
		:	0.195	M^3/s
2.0	**RECEIVING CHAMBER**			
	Outfall Sewer to Receiving Chamber Invert Level	:	**42.913**	M
	Say	:	42.913	M
	Outfall Sewer Diameter	:	0.700	M
	Outfall Sewer Soffit Level	:	43.613	M
	IPS 4 Finished Ground Level (Considered)	:	50.000	M
	Height, Top of Receiving Chamber (Above Ground)	:	1.000	M
	Receiving Chamber Top of Structure Level	:	51.000	M
	Outfall Sewer Capacity, Q_P	:	702.000	M^3/Hr
		:	0.195	M^3/s
	Sewage Level in Outfall Sewer (Considered)	:	80.000	%
		:	0.560	M
	Outfall Sewer Top Water Level	:	**43.473**	M
	Outfall Sewer Wetted Cross Section Area, A			
	Triangle Portion			
	Triangle Height, H	:	0.210	M
	Subtended Angle, θ = Cos -1 (H/ (D/2))	:	53.130	^{0}

	Triangle Base, B = ((((D/2)^2) - (H^2))^0.5)*2	:	0.560	M
	Triangle Area, A_1 = 0.5 * H * B	:	0.059	M^2
	Circle Segment Portion			
	Subtended Angle, $\theta_1 = 360^0 - (\theta * 2))$	:	253.740	^{0}
	Outfall Sewer Wetted Circular Cross Section Area, A_2	:	0.271	M^2
	Outfall Sewer Wetted Cross Section Area, $A = A_1+A_2$	:	0.330	M^2
	Outfall Sewer Design Flow Rate, Q_D	:	0.195	M^3/s
	Outfall Sewer Velocity, $V = Q_D / A$	:	0.591	M/s
	Velocity Head, $V^2/2g$	:	0.018	M
	Exit Head Loss Co-Efficient, K	:	1.000	
	Exit Head Loss, $K * V^2/2g$	:	0.018	M
	Receiving Chamber Top Water Level	:	43.455	M
	Say	:	**43.455**	M
	Gap, Sewer Pipeline IL - Receiving Chamber IL	:	0.300	M
	Receiving Chamber Invert Level	:	42.613	M
	Receiving Chamber Side Water Depth	:	**0.842**	M
	Free Board	:	7.545	M
3.0	**MECHANICAL COARSE SCREEN CHANNEL**			
	Inlet Sluice Gate Width, W	:	0.450	M
	Inlet Sluice Gate Side Water Depth, Z	:	0.450	M
	Velocity (across Sluice Gate), $V = Q_P/ W*Z$	:	0.963	M/s
	Velocity Head $V^2 / 2g$	:	0.047	M
	Sluice Gate Head Loss Co-Efficient	:	0.800	
	Head Loss across Sluice Gate, $K * V^2 / 2g$	:	0.038	M
	Say	:	0.050	M
	Coarse Screen Channel Top Water Level (U/s)	:	43.405	M
	Say	:	**43.405**	

Coarse Screen Channel Invert Level	:	42.613	M
Coarse Screen Channel Side Water Depth (U/s)	:	0.792	M
Say		**0.792**	
Head Loss across Coarse Screen (Maxi)	:	0.150	M
Coarse Screen Channel Top Water Level (D/s)	:	**43.255**	M
Free Board (To Top of Screen Channel)	:	0.500	M
Coarse Screen Channel Top of Structure Level	:	43.905	M
Wet Well Top of Structure Level	:	51.000	M
Free Board (To Top of Wet Well)	:	**7.595**	M
IPS 4 Finished Ground Level	:	50.000	M

4.0 RAW SEWAGE SUMP (WET WELL)

Coarse Screen Channel Invert Level	:	42.613	M
Free Fall, Fine Screen Channel IL - Raw Sewage Sump TWL	:	0.300	M
Raw Sewage Sump Top Water Level	:	**42.313**	M
Raw Sewage Sump Side Water Depth	:	2.000	M
Raw Sewage Sump Invert Level	:	**40.313**	M
Finished Ground Level	:	50.000	M
Height, Dry Well Plinth Level (Above Ground)	:	1.000	M
Raw Water Sump Top of Structure Level	:	51.000	M
Raw Water Sump Free Board	:	8.687	M

Project : DESIGNING PROVIDING LAYING TESTING & COMMISSIONING SEWERAGE PROJECT ON TURNKEY BASIS AT HAJIPUR TOWN

Client : Bihar Urban Infrastructure Development Corporation.

Head loss calculation of Mechanical Coarse screen for IPS-4

09.07.2013

Design Avg. flow for year 2041 (Qa)		327.6	m3/hr
		0.091	m3/sec
Design Peak flow for year 2041 (Qp)		702	m3/hr
		0.195	m3/sec
Maximum water depth (Wd)		**0.792**	M
Bar spacing (as per NIT) - Bs		25	mm
Bar size (Width) -Bt		10	mm
Screen inclination - θ		80	Deg
Channel width (provided) as per sizing calculation)Cw)		0.6	m
Screen Width provided (refer Sizing calculation for IPS-4) (Sw)		0.3	m
Clogging factor (Cf)		30%	
Coefficeint of discharge(C)		0.7	
Gravitational acceleration (g)		9.81	
Head loss through the clossed screen desired		150	mm

HYDRAULICS CALCULATION:

Let Velocity through screen		1	m/sec
So clear width required		0.2	m
No. of opening		9.85	nos.
	say	10.00	
No. of Bars		11.00	nos
Inclined Submerged Screen length (Li)		0.804	
Velocity in channel at avg flow (Va)		0.19	
Velocity in channel at Peak flow (Vp)		0.41	
Clear area of screen at No clogging condition (Ac)		0.20	m2
Velocity throught screen at peak flow (Vs1)		0.97	m2/sec
Head loss calculation : by using Bernoulli Equation (Hl1)			
((1/(c*2g))*(Vs12-Vp2)		0.056	m
		56	mm
Velocity through screen at 30% clogged condition (Vs2)		1.39	m/sec
Head loss calculation at 30 % clogged condition			
((1/c*2g*(Vs2^2-Vp^2))		**0.128**	m
		128	mm < 150mm
	Hence OK		

NOTE: Controlling of screen will do throught PLC accordingly so that clogging should not be more than 30%

			IPS - 4					
Head Calculation			**Inter flow**	**Ultimate Flow**	**Inter flow**	**Ultimate Flow**		
Frictional Losses due to fittings (H2) = KV2/2g			for 350		For 400		for 450	
H2 = head loss, m								
K = co-efficient for bends								
K for bends		=	0.32	0.32	0.32	0.32	0.32	0.32
K for valves		=	0.8	0.8	0.8	0.8	0.8	0.8
K for NRV		=	2.5	2.5	2.5	2.5	2.5	2.5
K for Expander		=	0.5	0.5	0.5	0.5	0.5	0.5
g = gravitational force	m/sec2	=	9.8	9.8	9.8	9.8	9.8	9.8
No. of bends		=	6	6	6	6	6	6
No. of valves		=	1	1	1	1	1	1
No. of NRVs		=	1	1	1	1	1	1
No. of Expander		=	1	1	1	1	1	1
V, velocity through pipe	m/sec	=	1.61	2.028	1.23	1.553	0.98	1.227
Total head loss for fittings (H2)	**m**	**=**	**0.758**	**1.200**	**0.444**	**0.703**	**0.277**	**0.439**
Frictional loss in pipe length (H1)		=						
FL = {6.815 x $(V/C)^{1.852}$ x $(1/D)^{1.167}$} x								
V = Velocity through pipe	m/sec	=	1.61	2.03	1.23	1.55	0.98	1.23
C = Hazen Williams co-efficient		=	140	140	140	140	140	140
D = Dia of Pipe	m	=	0.350	0.350	0.400	0.400	0.450	0.450
Frictional loss in pipe length (H1)	**m**	=	**0.006**	**0.009**	**0.003**	**0.005**	**0.002**	**0.003**

Project : **DESIGNING PROVIDING LAYING TESTING & COMMISSIONING SEWERAGE PROJECT ON TURNKEY BASIS AT HAJIPUR TOWN**

Client : **Bihar Urban Infrastructure Development Corporation.**

09.07.2013

Economic Size of Pumping Main from IPS 4 to Zone 5 Manhole No 2322B

Volume provided IPS -4 (Provided)	=	157.08 m3		
Average Flow in Present Year	=	2.88 m3/min	172.8	m3/hr
Average Flow in Intermediate Year	=	3.96 m3/min	237.6	m3/hr
Average Flow in Ultimate Year	=	5.46 m3/min	327.6	m3/hr
Peak Flow in Present Year	=	6.66 m3/min	399.6	m3/hr
Peak Flow in Intermediate Year	=	9.30 m3/min	558	m3/hr
Peak Flow in Ultimate Year	=	11.70 m3/min	702	m3/hr
Pumping Rate in the Present	=	6.66 m3/min	399.6	m3/hr
Pumping Rate in the Intermediate	=	9.30 m3/min	558	m3/hr
Pumping Rate in the Ultimate	=	11.70 m3/min	702	m3/hr

Pumping Machinery provided 2026 (Intermediate) =

	Each pump capa.	142 m3/hr	
Totol pumping capacity at avg flow		426 m3/hr	3W +2SB
		7.1 m3/min.	
Totol pumping capacity at peak flow		568.00 m3/hr	4W +1SB
		9.5 m3/min.	

Pumping Machinery provided 2041 (ultimate) =

	Each pump capa.	142 m3/hr	
Totol pumping capacity at avg flow		426 m3/hr	3W +4SB
		7.1 m3/min.	
Totol pumping capacity at peak flow		710.00 m3/hr	5W +2SB
		11.8 m3/min.	

Flows	Time of Fill (min)	Time of Empty (min)	No of Starts/Hr	No. of pumps Working	Running Time (hr)
Average Flow in Present Year	55	24	1	1.22	29.21
Average Flow in Intermediate Year	40	8	2	1.67	40.16
Average Flow in Ultimate Year	29	7	2	2.31	55.37
Peak Flow in Present Year	24	12	2	2.81	67.54
Peak Flow in Intermediate Year	17	6	3	3.93	94.31
Peak Flow in Ultimate Year	13	3	5	4.94	118.65

Flows	m3/hr	m3/s	LPS
Average Flow in Present Year	172.80	0.048	48.00
Average Flow in Ultimate Year	327.60	0.091	91.00
Average Flow in Intermediate Year	237.60	0.066	66.00
Peak Flow in present Year	399.60	0.111	111.00
Peak Flow in Intermediate Year	558.00	0.155	155.00
Peak Flow in Ultimate Year	702.00	0.195	195.00

Pipe dia Calculations

	Velocity	Flow	Area	Dia
for present flow	0.8	0.111	0.14	0.420
for Intermediate flow	1.3	0.155	0.12	0.390
for Ultimate flow	2.2	0.195	0.09	0.336

Head Calculation for Raw Sewage pumps

Raw Sewage Sump Invert Level	=	40.313	m
GL at Disposing Point (Zone 5 Manhole No 2322B)	=	47.984	m
Static head (H1)	=	7.67	m

Project : DESIGNING PROVIDING LAYING TESTING & COMMISSIONING SEWERAGE PROJECT ON TURNKEY BASIS AT HAJIPUR TOWN

Dia of Pipe in mm	**350**		**400**		**450**	
Area of the Pipe	**0.096**		**0.126**		**0.159**	
Velocity m/sec for present flow	1.15		0.88		0.698	
Velocity m/sec for int flow	1.61		1.23		0.98	
Velocity m/sec for ultimate flow	2.03		1.55		1.23	
	Int. Period	**Ult. Period**	**Int. Period**	**Ult. Period**	**Int. Period**	**Ult. Period**
Flow rate in lps	155.00	195.00	155.00	195.00	155.00	195.00
Frictional Losses in Pipe per m	0.006	0.009	0.003	0.005	0.002	0.003
Pumping Main Length in m	1600.00	1600.00	1600.00	1600.00	1600.00	1600.00
Total Frictional Loss	9.53	14.58	4.97	7.61	2.80	4.29
Static Head	7.67	7.67	7.67	7.67	7.67	7.67
Head loss due to fitting (Station Losses)	0.758	1.200	0.444	0.703	0.277	0.439
Residual Head in m	2.00	2.00	2.00	2.00	2.00	2.00
Total Head in m	19.96	25.45	**15.09**	**17.98**	**12.75**	**14.40**
Cost of Pipe in Rs.	6847.50	6847.50	7716.25	7716.25	14405.00	14278.75
Total cost of pipe Lakhs	109.56		123.46		230.48	
Kw required	46.66	74.85	35.27	52.88	29.81	42.34
cost of pump set in lakhs	14.00	22.45	10.58	15.87	8.94	12.70
Equivalent cost in 2011	14.00	8.14	10.58	5.75	8.94	4.60
Present value of Total Capitalised Pump set Cost	22.13		16.33		13.54	
Annual Electrical Charges in Lakhs considering Avg Int flow	34.19	54.85	25.85	38.76	21.84	31.03
Energy cost Capitalised in Lakhs	311.51	499.71	235.49	353.08	199.01	282.69
Present value of Total Capitalised Energy Cost	811.21		588.58		481.69	
Total cost in Lakhs	**942.90**		**728.37**		**725.72**	

Economic size of pumping main as per velocity = 400 mm

Determination of Water Hammer Pressure

Ultimate Peak Discharge (Q) = 0.195 m3/s
Diameter of Pipe (d) = 400 mm
Thickness of Pipe (t) = 6.3 mm
Modulus of Elasticity of Pipe Material (E) = 2.1E+10
Bulk Modulus of Water (k) = 207000000 kg/m3
Cross - Sectional Area of Pipe Line (a) = 0.126 m2
Normal Velocity in the pipe Line (Vo) = 1.551 m/s
Velocity of pressure Wave Travel (C.) = $\frac{1425}{1+(kd/Et)}$
Velocity of pressure Wave = 1418.03 m/s
Maximum Water hammer, Hmax = C Vo/g
224.36 m

Conclusion:

We recommend 400 mm dia K7 Pipesdue to following reasons:

1) Presently we are getting the required minimum velocity which is not possible in 450mm dia.
2) In intermediate stage we are getting the required minimum velocity which is not possible in 450mm dia.
3) Maximum Operating pressure is 1.8 Kg/cm2 in ultimate stage.
4) Class K-7 is capable to withstand the pressure upto 25 kg/cm2
5) Maximum surge coming to the systemis 22.4 kg/cm2 without any surge protection devises.
6) Comparing the maximum surge pressure and design pressure of K-7 its found ok.

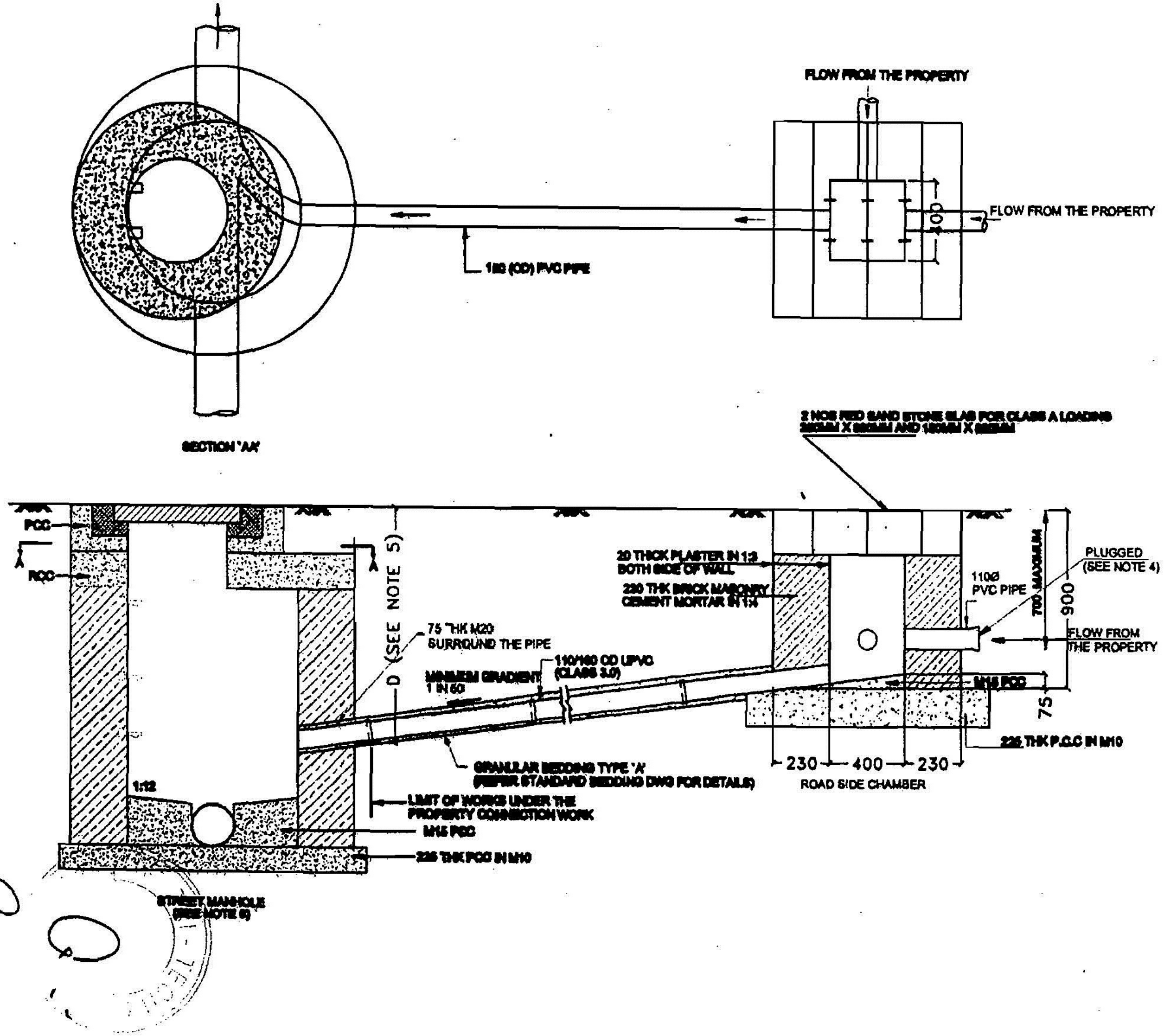
7) However we are providing 3 nos of air release valves to minimize the surge pressure that will be the extra safety of the system.

8) Prize of 450 mm dia pipe not available in bid document, how vere for 400 mm dia pipe prize is available in Bid document.

It is very difficult as well as time consuming to take approval of prise for new size of pipe line which is not include in

bid document.

9) In 400 dia pipe we can gate more optimizing velocity , As per general engineering practice velocity in rising main should not be less than 1m/sec.



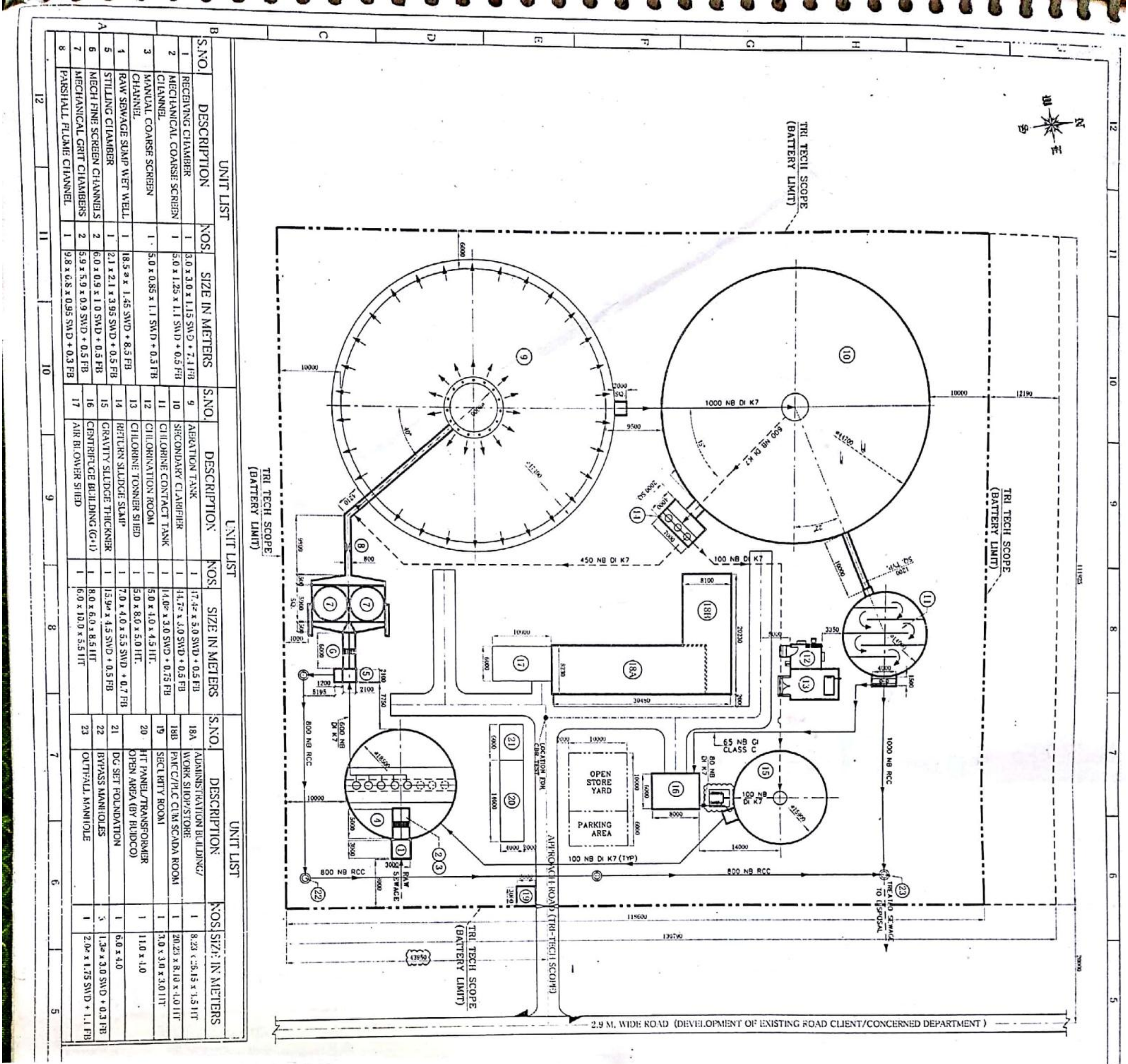
परियोजना निदेशक

NOTES:

1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE INDICATED.
2. TYPE III PROPERTY CONNECTIONS ONLY TO BE USED WITH PRIOR APPROVAL OF/AS DIRECTED BY ENGINEER.
3. SFRC MANHOLE FRAME & COVER AS PER I.S. 12592 (PART I&II)
4. DEPTH "D" SHOULD BE DECIDED BY THE ENGINEER INCHARGE TO SUIT THE DEPTH OF THE STREET MANHOLE.
5. THE STREET MANHOLE SHALL BE AS PER STANDARD DRAWINGS.

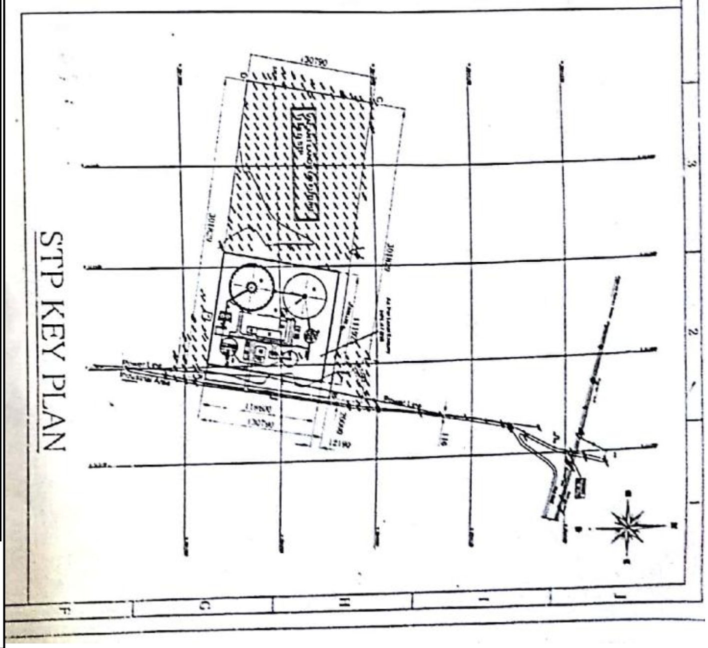
SEWERAGE PROJECT, HAJIPUR

TITLE: TYPICAL HOUSE SEWER CONECTION

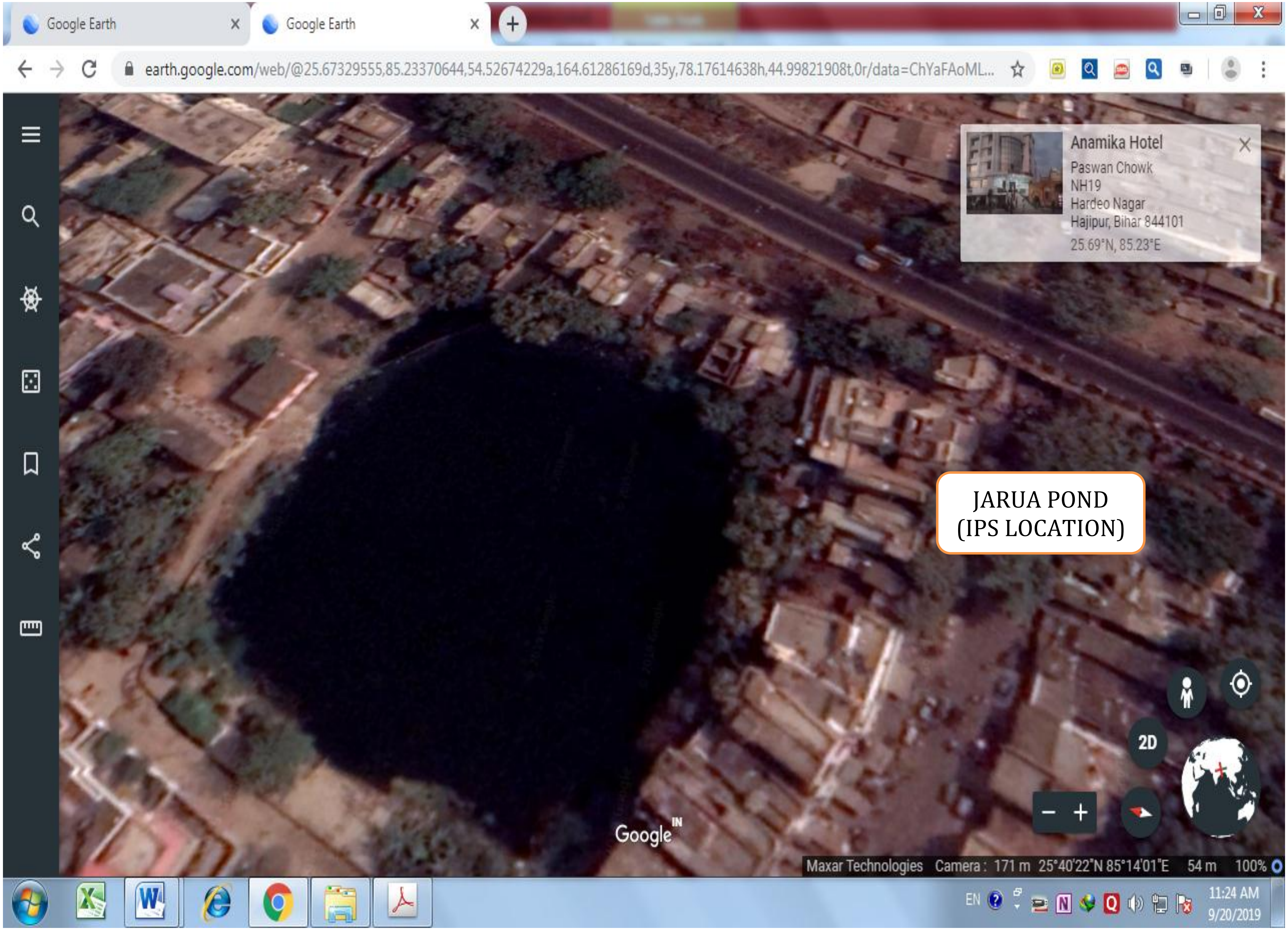


S.No	Name of Structure	Status	Remarks
1	Grit Separator	90% Civil work completed	10% Civil work, finishing and testing is remaining
2	Secondary Clarifier	100% Civil work completed	Finishing and testing is remaining
3	Chlorine contact tank	100% Civil work completed	Finishing and testing is remaining
4	Gravity sludge thickener	100% Civil work completed	Finishing and testing is remaining
5	Admin & PMC Building	70% Civil work completed	30% Civil work, finishing and testing is remaining
6	Centrifuge Building	70% Civil work completed	30% Civil work, finishing and testing is remaining
7	Chlorine Tonner Shed	70% Civil work completed	30% Civil work, finishing and testing is remaining
8	Aeration tank	Only excavation work is completed	
9	Terminal Pumping Station	Only excavation work is completed	
10	Internal Road & Drain Work	No any work is executed	
11	Boundary Wall	700 mtr Boundary Wall completed	115 mtr Boundary Wall remaining
12	Electro Mechanical Work	No any work is executed	

Note: It is advised to bidder to visit the site to access actual site condition



STP KEY PLAN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Anamika Hotel
Paswan Chowk
NH19
Hardeo Nagar
Hajipur, Bihar 844101
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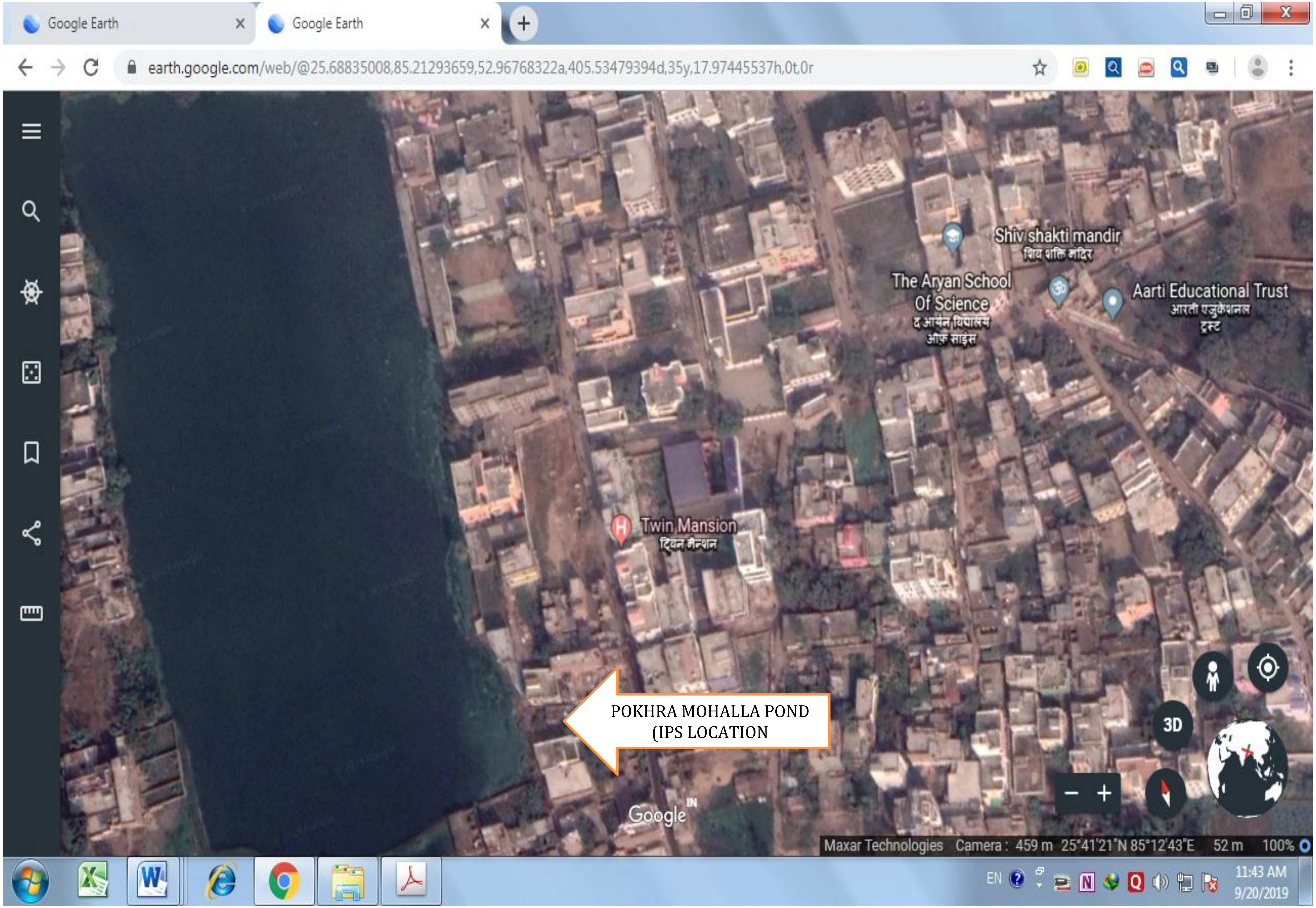

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The Aryan School
Of Science
द आर्यन विद्यालय
ऑफ़ साइंस
Aarti Educational Trust
आरती एजुकेशनल
ट्रस्ट
Twin Mansion
ट्विन मैन्शन
POKHRA MOHALLA POND
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