Concept Note on the Renovation Up-gradation of BEUR STP

submitted to

BUIDCO
Bihar Urban Infrastructure Development Corporation

A Project Under Namami Gange

By

Concept and Design

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1. INTRODUCTION:

The existing STP at the Beur, Patna is an old STP which is based on aerobic biological treatment process. It uses surface aerators to supply dissolved oxygen to the microbial biomass. At the time of its construction, this STP was designed to achieve 30 mg/L BOD. Besides, it was not designed to remove nitrogen and phosphorus. Microbial quality of the treated sewage was also not a criteria when this STP was constructed.

Presently, Namami Gange is implementing stricter effluent discharge norms so as to maintain good water quality in river Ganga.

This work is to be undertaken by BUIDCO, Patna, Bihar. A&A Infra has prepared the concept note to upgrade and modify this STP to meet the new NGT norms for treated sewage which are strictly implemented by the Namami Gange.

This report details the concept how each unit is modified. This report also includes all new machines, equipments and automation to be procured and installed.

2. TREATMENT PHILOSPHY:

Sewage treatment unit processes are selected to meet the revised NGT standards for treated sewage. Denitrification shall be achieved in the anoxic zone of the aeration tank, while further removal of nitrogen and phosphorus shall be achieved in the Sub Surface Flow (SSF) Constructed Wetland (CW). CW is specially designed to make the effluent from Secondary Settling Tank suitable for treatment by UV system.

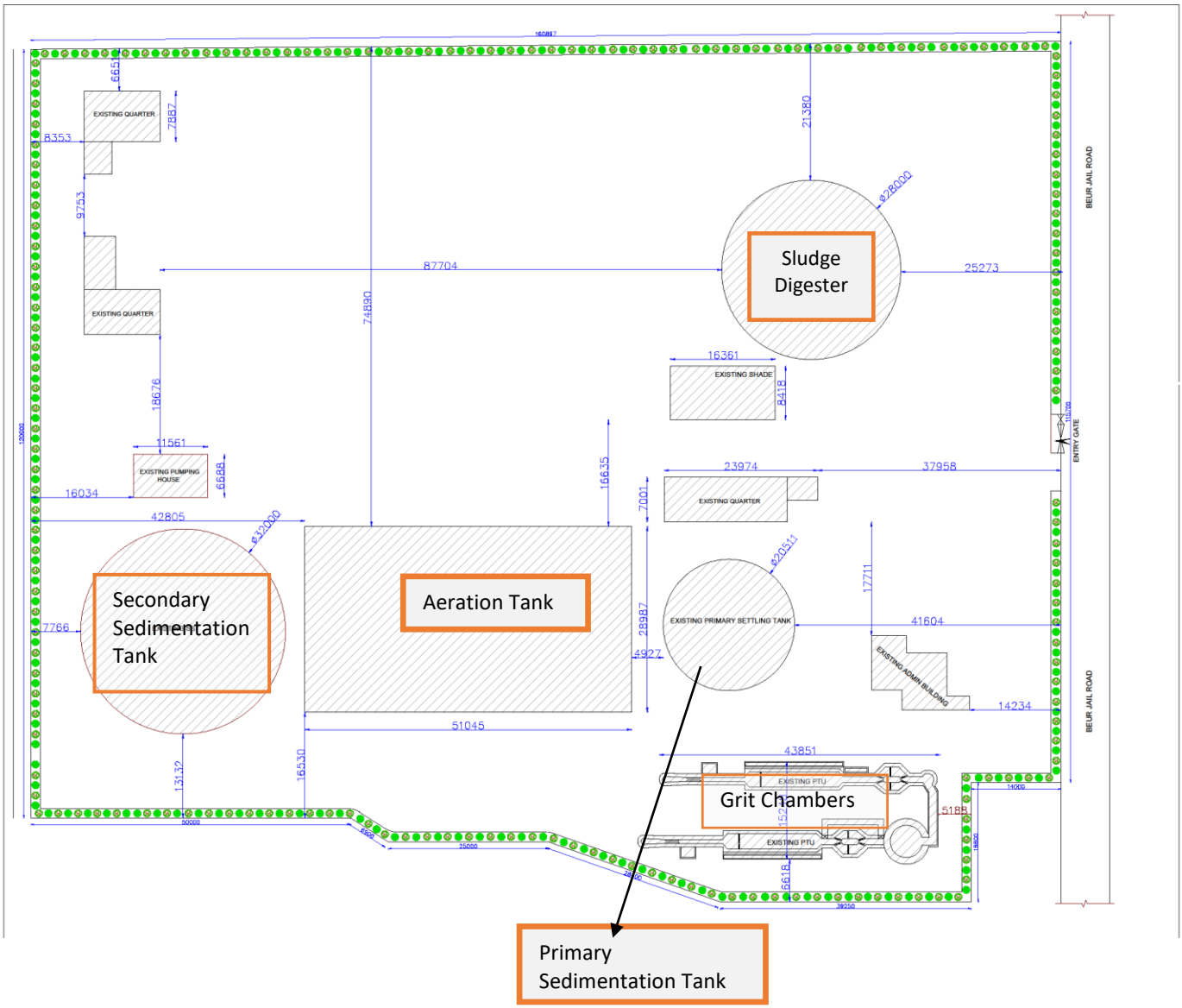
Nobility of the proposed upgradation is minimal use of chemicals. Chlorine shall not be used. Besides, $FeCl_3$ is also not required. It is almost chemical free system.

Full automation shall enable to operate the plant using click of mouse.

3. EXISTING SEWAGE TREATMENT PLANT

Existing STP consists of a Sewage Pumping Station (SPS), Stilling Basin, Screen Chambers, two Grit Chambers, a Primary Settling Tank (PST), an Aeration Tank (AT), a Secondary Settling Tank (SST), Sludge Thickening and Recirculation System, and a Sludge Digesters. STP also has an administrative building which houses laboratory, conference room and staff offices. It is a two story building. Laboratory is located at the ground floor.

Schematic diagram of the STP is shown below (Fig. 1).



4. PRIMARY TREATMENT

Existing Structure:

The existing primary unit comprises a Flow distribution chamber that is connected to Grit Chamber 1 and a channel that extends to Grit chamber 2. The flow distribution chamber consists of two gate valves. These gate valves can selectively divert the incoming sewage to either of the two grit chambers. Fig 1 shows the existing stilling basin.

Figure 1 Existing Stilling Chamber which shall be demolished

Grit Chamber 1 has 2 mechanical screens and 2 manual screens. Four hoist operated (check nut) sliding gates. The grit removal system includes a Travelling Bridge Mechanism that scrapes the grit from the bottom of the grit chamber and pumps it out to a secondary canal made right next to it. It is shown below in Fig. 2.

Figure 2 Travelling Bridge type grit removal mechanism which is to be replaced with new one.

Grit Chamber 2 has a similar arrangement, except for the number of screens. It has one mechanical screen, three manual screens, and four sliding gates. It is shown below in Fig. 3.

Figure 3 Grit Chamber to be used after replacing the Travelling Bridge.

Proposed Alterations:

It is proposed to construct a new stilling chamber at the one end of the channel which used bring sewage from old Stilling Chamber to the Grit Chamber. It is a long channel. Depth of this channel at one end shall be suitably increased to house the new Stilling Basin to receive sewage from the Rising Basin.

Grit chamber 1 along with the old Stilling Chamber would be of no use hence it would be demolished. Proper restoration of the existing civil structure shall be carried out.

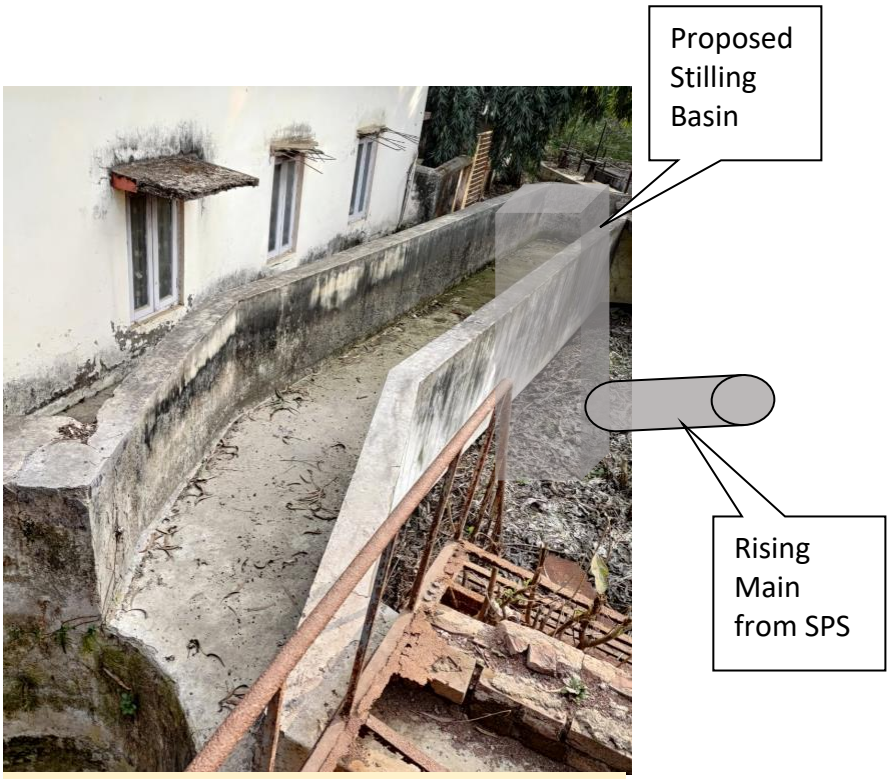


Figure 4 Proposed Stilling Chamber at the end of existing straight channel.

4.1 SCREENING:

All the existing screens shall be removed. It is proposed to two mechanical and two manual screens. One of the mechanical rake screens with 6 mm spacing shall be installed after the new Stilling Chamber in the existing straight channel. As shown below in Figure 5.

Figure 5 Proposed mechanical rake type screen after Stilling Chamber to be installed in the straight channel.

It is suggested to install a drum-type mechanical screen with a conveyor belt in place of the existing manual screen and a manual screen in place of the existing mechanical screen.

Another Drum Type Rotary fine screen having 2 mm perforation shall be installed at the mouth of the Grit Chamber. Schematic of this screen is shown below in Figure 6.

Figure 6 Proposed Drum Type Rotary mechanical fine screen at the mouth of Grit Chamber.

5. PRIMARY SETTLING TANK

PST (Figure 7) will not be a suitable component for the new sewage treatment process, therefore, it won't be used for primary clarification. It is proposed to convert it into a standby Secondary Settling Tank (SST) which shall be operated when existing SST is out of service due to various reasons.

Figure 7 Existing Primary Settling Tank (PST) to be used as standby SST.

6. SECONADARY TREATMENT /AERATION TANK:

Existing Structure:

Presently the Parshall flume is connected with PST, PST is connected with the Aeration chamber inlet. The Aeration chamber has 15 surface aerators, 4 baffle walls, and 5 walkways on which motors to run these aerators exist.

Proposed alterations:

The existing Aeration Tank is in good condition. It shall be suitably restored and reshaped according to current requirements. Surface aerators should be disassembled along with their electro-mechanical equipment and Diffused Aerators will replace the Turbine Type Surface aerators. Figures 8 and 9 presents the existing Aeration Tank. Baffle Walls are clearly visible. These won't be demolished. However, the pedestals which support the Turbine aerators will be demolished. However, the platforms which house the shafts etc will not be demolished. Rather, these will used to provide support

for down pipes carrying compressed air to the diffusers. These platforms will also act as service walkways.

Figure 8 Existing Aeration Tank showing surface aerators (red circles), pedestals in blue circles. Pedestals shall be demolished.

Figure 9 Existing Aeration Tank showing baffle walls in red marks.

7. SECONDRY SETTLING TANK (SST):

Proposed alterations:

The SST (Figure 10) would be restored and remodeled according to the current requirements. All the electro-mechanical equipment needs to be replaced with a new one.

Figure 10 Existing Secondary Settling Tank shall be used after replacing all the electro-mechanical items.

8. RETURN SLUDGE LINE:

Figure 11 below presents the Return Sludge pipe which is installed at the inlet zone of the Aeration Tank. It is proposed to install a electrically actuated valve in the Return Sludge Line with PLC control.

Figure 11 Existing Return Sludge Line

9. UV STERILISATION SYSTEM:

Existing Condition:
There are four sludge drying beds of size 59.5 m x 29.5 m available on the site. It is proposed to install a new open channel UV system with PLC/SCADA system over here.

Proposed alterations:
A connection between SST and Sludge drying beds need to be established, this can be achieved by construction of a channel or laying a pipelines. One of the sludge drying bed needs to be prepared by raising the ground level by 1 m.

9. CONSTRUCTED WETLAND:

It is proposed to construct a new Constructed Wetland. It would be a Sub Surface Flow (SSF) type. It will not only further remove nitrogen and phosphorus but will also greatly help in removing turbidity from the treated sewage from the SST to make suitable to feed into the UV channels.

Figure 12 Land for the construction of Constructed Wetland

10. BOUNDARY WALLS AND ROADS:

Existing condition:

The boundary wall of about 301 m is in very bad shape and of insufficient height.

Proposed alterations:

The height of the boundary should be increased and barbed wire fencing should be provided on top of it.

The main road which has an area of about 600 m^2 needs to be restored, and new roads along with side drains should be constructed to provide proper connectivity.

11. SLUDGE PUMP HOUSE AND SWITCH ROOM :

Proposed alterations: It is suggested that the existing sludge pump house and switch room can be used as Blower House and Electrical Control Building.

12. RETURN SLUDGE PUMP HOUSE :

Observation and Suggestion:
The return sludge pump house has two wells, wet well and dry well. Centrifugal Pumps are installed in the dry well. This orientation can be used in the new plan.

The entire building needs restoration, and the existing CF pumps should be replaced with new once with PLC/SCADA.

13. FILTERATE PUMP HOUSE :

Observation and Suggestion:
The filtrate pump house is of no use for the new plan so it must be demolished. But Centrifuge building can be built over it.

14. STAFF QUATERS:

Observation and Suggestion:
New staff quarters shall be constructed as per the contract.

15. SECURITY CABIN and GATE

Observation and Suggestion:
New security cabin and a new gate is to be constructed.

16. BLOWER HOUSE:

A new blower house is to be constructed which will have provision for electrical panels in the adjoin room. Its location has been identified close to the aeration tank to minimize the piping required to carry compressed air from blowers to the points of application.

17. SCREW PRESS BUILDING:

New Centrifuge building shall be constructed which will house Screw Press and polymer dosing system.

Figure 13 Proposed Screw Press in the new Centrifuge building.

18. OFFICE AND LABORATORY BUILDING

Observation and Suggestion:
Existing office complex which has Laboratory space, offices and conference hall is in good condition and the structure can be of use, but the equipment's along with the working benches needs to be provided. List of laboratory equipment to be procured is given below in Table 1.

Figure 14: Existing administrative building which shall house laboratory, offices, and conference room.

Table 1 List of Laboratory Equipments

S. No.	Item
1	BOD Incubator
2.	Closed reflux COD apparatus
3.	Laminar Flow Chamber
4.	Muffle Furnace
5.	Electrical Oven
6.	Microbiological Water Bath
7.	Water Purification System
8.	TKN Digestion and Distillation Unit
9.	Turbidity meter
10.	pH meter
11.	Spectrophotometer
12.	Autoclave
13.	Vacuum Pump
14.	Auto/Micro Pipettes
15.	Chemicals and biological media
16.	Work benches
17.	Laboratory safety devices

TABLE 2 SUMMARY OF MAJOR MACHINERY TO BE PROCIRED

S. No.	Item
1.	Mechanical Automatic Rake Type Screen with 6 mm spacing
2.	Mechanical Automatic Drum Type Screen with 2 mm spacing
3.	Grit Scrapping Mechanism/Travelling Bridge
4.	Diffused Aeration System
5.	Manual Screen
6.	Mechanical systems for SSTs
7.	Blowers
8.	PLCs
9.	SCADA System

10.	Yard Piping
11.	Compressed air pipe
12.	Screw press
13.	Pumps for Return Sludge and Waste Sludge
14.	Open Channel UV System
15.	Mechanical Mixers
16.	DO Sensors
17.	pH Sensors
18.	Flow Totalizer
19.	Level Sensors for screen chamber and UV chamber
20.	Electrical Panels and cables
21.	DG Set