



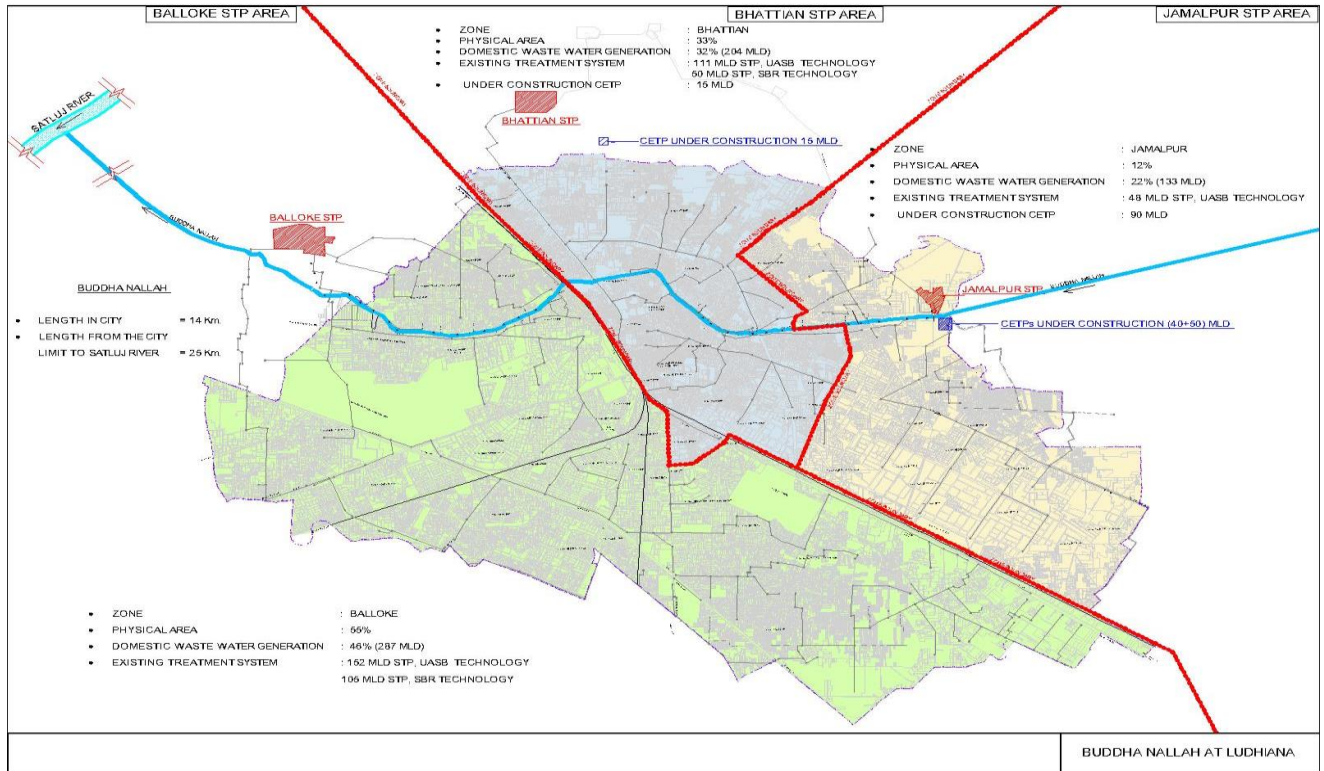
Government of Punjab, India

Punjab Municipal Infrastructure Development Company



Rejuvenation of Buddha Nallah at Ludhiana District Ludhiana, Punjab

Feasibility Report



JANUARY- 2020

Preface

Buddha Nallah is a seasonal tributary of Sutlej which emanates from the confluence of Kum Link Drain and Neelon Drain near village Ghumait and KumKalan, and flows in an east-west direction south of Sutlej River. It runs almost parallel to the Sutlej through most of Ludhiana district, and ultimately merges with the River at Walipur Kalan in the north-western corner of the district.

Based on records obtained from the Drainage department, Ludhiana, total length of the Nallah for its entire stretch is 47.55 km. The Nallah passes through Ludhiana City and bisects it into two. For classification, the Nallah has been divided into three stretches. From its origin to RD 55,000 (16.76 km) is classified as "Upper Reach". From RD 55000 to 99620 (14 km) the Nallah passes through Ludhiana city and therefore, this stretch is classified as "City Reach". From RD 99620 to 156,000 (17.2 km), which is the point of its merging with Sutlej, is known as "Outer Reach" of the Nallah.

This report focuses on dealing with the problem of water pollution in the "City Reach" part of the Nallah which is caused mainly due to untreated industrial and domestic waste being directly discharged into the Nallah.

The project is proposed to be implemented in three phases after deployment of a Project Management Unit which involves all stake holders from key departments i.e. MC Ludhiana, PPCB, Drainage and Revenue.

Phase-I:

1. Augmentation and Refurbishment of Sewage Treatment Facilities.
2. Solid Waste Management

Phase-II:

1. Reuse of treated effluent

Phase-III:

1. Landscaping and Beautification along the Buddha Nallah.

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TECHNICAL FEASIBILITY REPORT

Phase – I Augmentation and Rejuvenation of Buddha Nallah in Ludhiana

1.0 Background: Ludhiana is the largest city in the State of Punjab which is having 1,618,879 populations as per census of year 2011. Total area of the city is 159.37 Sq. km. Projected population of the town for year 2030 is 23.46 Lakh and 30.27 Lakh in 2045. The whole city is presently covered with 100% sewerage and water supply facilities. The city is divided into two parts by the Jalandhar-Delhi railway line passing through the city. The sewerage system of the town on the North side of the railway line is covered under Zone A and B whereas the town on the South side is covered under Zone C as detailed below:-

- Zone A: (Jamalpur) about 12% of the total area.
- Zone B: (Bhattian) about 33% of the total area.
- Zone C: (Balloke) about 55% of the total area.

In the Initial year of the current century, three Sewage Treatment Plants were installed in the town under Sutlej Action Plan and further in the next decade more Sewage Treatment Plants were added at Bhattian and Balloke as tabulated below:-

Table 1: Existing STPs

S. No.	Location of the STP	Capacity (in MLD)	Technology	Year of Commissioning
1	Zone A: Jamalpur	48	UASB	2008
2	Zone B: Bhattian	111	UASB	2007
3	-Do-	50	SBR	2012
4	Zone C: Balloke	152	UASB	2008
5	-Do-	105	SBR	2012
Total Waste Water Treatment Capacity available in the town= 466 MLD				

2.0 Performance of existing STPs

a) Jamalpur (48 MLD UASB STP)

This plant is receiving very high volume of mixed waste water from residential and industrial area (mainly textiles) and is not performing.

b) Bhattian (111 MLD UASB STP)

The STP is receiving mixed waste water from residential and industrial area (mainly textiles) and is not performing upto the desired level on account of accumulation of Sludge in the Reactors, Ponds and Sludge drying beds.

c) Bhattian (50 MLD SBR STP)

The STP is receiving mixed waste water from residential and industrial area (mainly textiles) and is performing well and giving result near to desired levels. Pink colour is observed at the discharge, of the treated sewage.

d) Balloke (152 MLD UASB STP)

The STP is receiving mixed waste water from residential area and dairy waste, due to which it is not performing upto the desired levels on account of accumulation of Sludge along with fodder particles in the Reactors, Ponds and Sludge drying beds.

e) Balloke (105 MLD SBR STP)

The STP is receiving mixed waste water from residential area and dairy waste, due to which it is not performing upto the desired levels on account of accumulation of sludge along with fodder particles, in aeration and selector zones. Due to which number of Diffusers have been torn/choked.

3.0 Critical Issues of Waste Water Treatment and Sewerage System in Ludhiana city:

- i. Lack of adequate STP capacity for treating the entire quantum of sewage generated in the city. As a result the excess sewage is being dumped into the Nallah through temporary disposal points.
- ii. Mixing of industrial effluent in the domestic sewerage network is occurring at several places. At some temporary disposal points, industrial effluent is found being discharged. This means that domestic network has been tapped to convey industrial effluent to the Nallah.
- iii. Ingress of domestic and industrial wastewater into the traditional storm water drains. It was observed during surveys that a number of natural

drains which were flowing to Buddha Nallah have been lined and converted to carry sewage from domestic and industrial uses. Therefore, segregation of the drains into storm drains and sewage network is practically not feasible.

- iv. Some major drains and tributaries of Buddha Nallah such as Ganda Nallah (carrying wastewater from area near Gurudwara Dukhniwaran, Railway Sheds and Transport Nagar) as well as near Haibowal are now discharging polluted wastewater in Buddha Nallah.
- v. A large number of outfalls are actually a result of dairies and slums which are located along the Nallah. Two major dairy complexes are located within the city limits at both the start point and end point of the city limit.
- vi. Due to the delay in the construction of CETPs for treating industrial effluent many industrial units have been connected to the existing STP conveyance system. This has resulted in a critical situation as it has led to the STP capacity being overwhelmed due to which the treated discharge of the STP falls way short of permissible standards.
- vii. Choking/ silting of main sewers. It also came to notice that at some places due to choking of the main sewer line, sewage was diverted to the Nallah through temporary disposal points.

4.0 Domestic Waste Water Generation: - There are 821 deep tube wells and 314 shallow tube wells for supplying drinking water to public. Beside this, there are more than 12000 small bore wells installed with submersible pump sets by the private people. Some of the adjoining area and villages on the outer periphery of the town have connected their sewage lines in to municipal sewer which is estimated about 60 MLD.

5.0 Industrial waste water Generation: - Ludhiana is hub of the Dying, Cycle and Sewing machine Industry, which are also generating their waste water. For handling the waste water from Electroplating industry, a common CETP is already there in the town and to handle the Waste water from Dyeing units, three CETPs of 50 MLD, 40 MLD and 15 MLD capacities are under construction in the town. But there are many scattered, cottage small and medium industries in the city which are discharging their waste water directly in to the municipal sewers.

6.0 Waste Water flowing in Buddha Nallah: - A number of temporary Pumping Stations are being operated by MC Ludhiana due to over-flowing of sewers at different locations. These pumping stations are pumping untreated sewage directly into the Buddha Nallah. These pumping stations are described as below:

(i) Temporary Pumping Station at Transport Nagar

At this Pumping Station three pump sets are installed (150 BHP, 75 BHP and 40 BHP capacities). 150 BHP pump set runs regularly round the clock and the other two pumps are working as stand-by arrangement. From this disposal about 35 MLD waste water is lifted from the nearby passing sewer of 36" i/d and is being pumped in the adjoining drain which ultimately joins Buddha Nallah near Gaushala. This gives relief to the areas of Janak Puri, Textile Colony, and part of Kidwai Nagar etc.

(ii) Temporary Pumping Station near Shingar Cinema

This Pumping Station is being operated for giving relief to the adjoining areas like Shiva Ji Nagar, Dharampura, and Harcharan Nagar etc. Three pump sets of 120BHP, 90 BHP and 120 BHP are installed. One pump set of 120 BHP runs round the clock and the other two are kept as stand-by arrangement. This pump set lifts about 28MLD waste water directly from the 72" i/d sewer passing nearby and disposes it in to the drain coming from Transport Nagar which ultimately joins Buddha Nallah.

(iii) Temporary Pumping Station near Gaushala

This Pumping Station gives relief to the Dhokan Mohalla, Kashmir Nagar and other adjoining areas. Two pump sets each of 120 BHP are installed here. Both the pumps are running for 21 hours daily to lift about 51 MLD waste water from the junction of 72" i/d sewer coming from Samrala Chowk and 36" i/d sewer coming from Tajpur road and disposes it directly in to Buddha Nallah.

(iv) Temporary Pumping Station Sunder Nagar

From here about 8 MLD sewage is directly disposed of into Buddha Nallah. There are two pump sets of 40 each, out of which one is stand by and the other runs round the clock for lifting waste water from the 36" i/d sewer.

(v) Temporary Pumping Station Tibba Road

Two pump sets of 40 BHP and 25 BHP capacities are installed here to give relief to the area adjoining both sides of Tibba road. The pump sets lift sewage from 36” dia sewer laid along the GT Road and disposes about 12 MLD sewage direct into Buddha Nallah.

Existing Temporary Pumping Stations discharging into Buddha Nallah

S.No	Location	Flow (In MLD)
1	Transport Nagar	35
2	Shingar Cinema	28
3	Gaushala	51
4	Sunder Nagar	8
5	Tibba Road	12
	Total	134

(vi) Waste Water overflow into Buddha Nallah

In addition to above at following locations significant quantity of waste water is over flowing into Buddha Nallah:

S.No	Location	Flow (In MLD)
1	Kundan Puri	5
2	Upkar Nagar	13
3	Lifeline Hospital	23
4	Lord Mahavir Ayurveda Hospital	20
	Total	61

7.0 Flow Measurement in Buddha Nallah:-

To assess quantum of domestic waste water generation, the flow in Buddha Nallah was measured from 27th October, 2019 to 31st October, 2019 on hourly basis at four locations. The flows measured on 28th & 29th October, 2019 represent the domestic waste water generation as the industry was closed on account of Diwali and Vishavkarma Day (Details at Annexure-Flow-1). The zone wise Domestic Waste Water Generation is as under: -

S. No.	Description	Avg. flow in Buddha Nallah (MLD)	Domestic Discharge for different STP Locations (MLD)		
			Jamalpur	Bhattian	Baloke
1	Flow at the entry in city	11			
2	Flow at Vijay Nagar Pulley (Downstream of Jamalpur STP)	144	133		
3	Flow at Baba Ghor Shah (Downstream of Bhattian STP)	200		56	
4	Flow at STP being disposed of directly into river Sutlej after treatment at Bhattian			149	
5	Flow at Baranhara Bridge (Downstream of Baloke STP)	487			287
	Total Discharge		133	205	287
			625		

8.0 Proposal

The project focuses on dealing with the problem of water pollution in the “City Reach” part of the Nallah which is caused mainly due to untreated industrial and domestic waste being directly discharged into the Nallah.

The project is proposed to be implemented in three phases.

Phase-I:

1. Augmentation and Refurbishment of Sewage Treatment Facilities.
2. Solid Waste Management

Phase-II:

1. Reuse of treated effluent

Phase-III:

1. Landscaping and Beautification along the Buddha Nallah.

9.0 Augmentation and Refurbishment of Sewage Treatment Facilities (Phase-I).

A. Jamalpur Zone

- At present domestic waste water generated in the catchment area of STP Jamalpur is 133 MLD.

- A separate network for collection of industrial waste water is being laid and separate Common Effluent Treatment Plants (CETPs) of 90 MLD capacities are being constructed under the supervision of Punjab Pollution Control Board. These CETPs will cater 80 MLD industrial Waste Water from present flows to Jamalpur.
- A new ETP for catering about 2.25 MLD flow from Tajpur Dairy Complex is also being installed separately in this area.
- Existing 48 MLD STP based on UASB Technology is not performing and is proposed to be replaced.
- It is proposed to close existing pumping stations at Sunder Nagar, Gaushala, Tibba Road and construct new pumping station to divert 43 MLD waste water from these pumping stations to Jamalpur STP. Two pumping stations (Transport Nagar and Shingar Cinema) and remaining flow at Gaushala point will be taken care by the existing sewerage system.
- It is expected that even after commissioning of CETPs, about 25 MLD of industrial waste water from the scattered industry, which will not be connected to the CETPs under construction, shall continue to reach Jamalpur STP.
- Total expected flow at Jamalpur is as under:-

Sr. No.	Detail	Flow (in MLD)
1	Domestic waste water through sewers	133
2	Domestic waste water pumped from Bhattian zone	43
3	Industrial waste water from scattered industry	25
	Total	201

Considering future growth, 225 MLD STP/ETP is required at Jamalpur.

- Following works are proposed for Jamalpur zone:-
 - (i) Construction of IPS at Sunder Nagar.**
Construction of pumping station of 8 MLD average capacity, capable to cater the peak discharge of 16 MLD along with the required pumps, with suitable head, to discharge into the shaft of rising main.

(ii) Rising Main from Sunder Nagar IPS to Gaushala point

The DI-K9 rising main is to be laid and commissioned. This rising main should be of the suitable size to cater the peak discharge from Sunder Nagar pumping station. The velocity in pipe at peak flow should not be more than 1.50 mtr/sec.

(iii) Construction of IPS at Gaushala

Construction of Pumping Station at Gaushala to cater the capacity of 30 MLD average flow along with the required pumps, to cater the peak discharge of 60 MLD, with the suitable head, to discharge into the rising main.

(iv) Rising Main from Gaushala IPS to Tibba Road IPS

The DI-K9 rising main is to be laid and commissioned. This rising main should be of the suitable size to cater the peak discharge from both Sunder Nagar & Gaushala pumping stations. The velocity in pipe at peak flow should not be more than 1.50 mtr/sec.

(v) Construction of IPS at Tibba Road

Construction of Pumping Station at Tibba Road to cater the capacity of 12 MLD average flow along with the required pumps, to cater the peak discharge of 24 MLD, with the suitable head, to discharge into the rising main.

(vi) Rising Main from Tibba Road IPS to proposed MPS at Jamalpur

The DI-K9 rising main is to be laid and commissioned. This rising main should be of the suitable size to cater the peak discharge from all the three pumping stations at Sunder Nagar, Gaushala and Tibba Road. The velocity in pipe at peak flow should not be more than 1.50 mtr/sec.

(vii) Construction of 225 MLD capacity STP/ETP & MPS

A new STP/ETP upto tertiary level of 225 MLD (Average flow) capacity is to be constructed at Jamalpur site to handle the domestic flow mixed with 20% industrial flow from textile and dying industries. A new MPS of 225 MLD average flow, is also to be constructed, along with the required pumps, to cater the peak discharge of 450 MLD, with the suitable head, to discharge into the new STP/ETP.

(viii) Construction of ETP for Dairy Waste at Tajpur Road

A new ETP is to be constructed at Dairy Complex on Tajpur Road to handle the Dairy Waste i.e. cow dung and fodder waste, along with waste water generating from washing of buffaloes and floors etc. The daily flow generated from this Dairy Complex is about 2.25 MLD. Most of the flow from dairy is discharged during morning hours and evening hours, resulting into a peak factor of approximately 5 during morning flows. The ETP is to be constructed for peak flow upto primary treatment. After equalization tank, provided before secondary treatment, ETP shall be designed for average flow of 2.25 MLD. The treated water from the ETP shall be discharged into Buddha Nallah, which is passing nearby.

B. Bhattian Zone

- At present domestic waste water generated in the catchment area of STP Bhattian is 204 MLD.
- The sewerage system leading to Bhattian STP has a capacity to carry 168 MLD waste water per day. The capacity of existing STPs at Bhattian is 161 MLD. It is proposed to divert 43 MLD (204-161) flow from Sunder Nagar, Gaushala and Tibba Road pumping stations to Jamalpur STP.
- Industrial waste water generation in Bhattian zone is approx. 25 MLD. Out of this 10 MLD flow is to be tapped into CETP Jamalpur and 15 MLD into CETP under construction at Bahadurke Road.
- Following works are proposed for Bhattian Zone:-
 - (i) Rehabilitation Main Pumping Station at Bhattian.**

Complete rehabilitation of common MPS catering to both the STPs i.e. 111 MLD UASB & 50 MLD SBR, along with the required pumps, to cater the peak discharge of 222 MLD, with suitable head, to discharge into the rising mains leading to STPs.
 - (ii) One time repair of 50 MLD existing STP on SBR technology.**

The existing 50 MLD STP commissioned in 2012 is performing near to the designed efficiency. However, Refurbishment of STP, especially

with respect to the Electrical, Mechanical, Instrumentation and Chlorination System is proposed so as to improve the efficiency of plant and ensure satisfactory working in the future.

(iii) Rehabilitation of existing 111 MLD STP based on UASB

The 111 MLD UASB plant commissioned in year 2007 consists of primary treatment units, UASB reactors, polishing ponds and chlorination system. The performance of plants is not upto the mark. Complete over hauling of the plant especially Screens, Detritors, Sludge Removal System, HDPE Down Pipes, PVC Sheets, FRP Pipes/Boxes/Channels, Chlorination System, Gas Collection Dome, Gas Utilisation system, and removal of sludge from reactors, polishing ponds and sludge drying beds is proposed. Sludge is to be disposed off at Dumping Station to be earmarked by Municipal Corporation, Ludhiana. *Bidder is to service and repair the existing Flaring System. In addition proposal for Gas Utilisation system preferably for generation of electric power is to be given.*

Any other repair/painting/modification as required is also to be done.

(iv) Arrangement for mechanical dewatering of sludge from existing 111 MLD UASB Plant.

In the existing system the sludge from the reactors is collected in a sump from where it is pumped to the 72 nos. Sludge Drying Beds (SDB). It is proposed to set up new mechanical sludge dewatering unit and required allied works. Rehabilitation of Sludge Drying Beds (SDBs) for standby-use is to be done.

(v) Construction of bye-pass arrangement.

There is a one stream Final Polishing Unit (FPU). The sludge has accumulated in the FPU and the efficiency of FPU is affected. For removal of the sludge from the FPU it is necessary that the influent coming into FPU be bypassed. So a FPU bye-pass arrangement has been proposed.

To bypass entire STP (including reactors, Degritors and Fine Screens), a off take from the Raw Sewage Pumping main starting from inlet chamber of STP and delivery into the proposed FPU bypass is to be proposed.

(vi) Construction and installation of Secondary Pumping Station of 161 MLD (Average) capacity.

The treated effluent from STP Bhattian goes directly into river Satluj by gravity through 2.75 KM long twin barrels of 1500 mm internal dia each.

However, the gravity flow is not feasible during rainy season when water level in the river Satluj rises. To take care of this situation a secondary pumping station is proposed to pump the treated waste water into the elevated shaft already constructed at the beginning of barrels in the STP area. Construction of the secondary pumping station for 161 MLD is included in the scope of work.

Repair of existing system i.e. controlling gates, elevated shafts and barrels, and all the allied components, required for carrying treated effluent from STP to river Satluj.

(vii) Additional Chlorination Plant at Bhattian.

Additional New Chlorination Plant along with leak absorption system with a capacity of 40 kg per hour is to be provided. A New Chlorination Plant will have the provision to supply chlorinated water to both the Existing STPs i.e. 111 MLD UASB and 50 MLD SBR.

C. Balloke Zone

- At present domestic waste water generated in the catchment area of STP Balloke is 287 MLD. Balloke zone has negligible discharge from industries. The Haibowal Dairy Complex is discharging 3.75 MLD waste water. Keeping in view the future growth, 50 MLD new STP is proposed along with rehabilitation of existing 257 MLD STPs.
- Intermediate pumping stations are required at Kundan Puri, Upkar Nagar and Lord Mahavir Ayurveda Hospital to pump 61 MLD waste water (over flowing into Buddha Nallah) to Balloke STP.
- Following works are proposed for Balloke zone:-
 - i. **Construction of MPS at Kundan Puri**
Construction of pumping station of 5 MLD average capacity, capable to cater the peak discharge of 10 MLD along with the required pumps,

with suitable head, to discharge into the existing sewer line after crossing the Buddha Nallah.

- ii. Rising Main from Kundan Puri MPS to nearby intercepting sewer.**
The DI-K9 rising main is to be laid and commissioned. This rising main should be of the suitable size to cater the peak discharge from Kundan Puri pumping station into nearby intercepting sewer across Buddha Nallah. The approximate length of rising main shall be 100 mtr. The velocity in pipe at peak flow should not be more than 1.50 mtr/sec.
- iii. Construction of MPS at Upkar Nagar**
Construction of pumping station of 13 MLD average capacity, capable to cater the peak discharge of 26 MLD along with the required pumps, with suitable head, to discharge into the rising main.
- iv. Rising Main from Upkar Nagar to point near Lord Mahavir Ayurveda Hospital**
The DI-K9 rising main is to be laid and commissioned from Upkar Nagar to point near Lord Mahavir Ayurveda Hospital. This rising main should be of the suitable size to cater the peak discharge from the permanent pumping station at Upkar Nagar. The velocity in pipe at peak flow should not be more than 1.50 mtr/sec.
- v. Construction of IPS at Backside of Lord Mahavir Ayurveda Hospital**
New pumping station of 43 MLD at Backside of Lord Mahavir Ayurveda Hospital is to be constructed with 43 MLD average flow capacity along with the required pumps, to cater the peak discharge of 86 MLD, with the suitable head, to discharge into the common rising main coming from Upkar Nagar across Buddha Nallah to transfer the flow to Balloke STP site. At this IPS 23 MLD sewage will be received from the nearby passing 1200 mm dia sewer coming from lifeline Hospital and 20 MLD sewage will be received from the storm sewer which is carrying domestic sewer during dry weather flow. For diversion of flow, provision of adjustable gates will be made in the storm sewer line which will be lifted during storm period.

vi. Rising Main from Backside Lord Mahavir Ayurveda Hospital to STP Balloke

The DI-K9 rising main is to be laid and commissioned from Backside Lord Mahavir Ayurveda Hospital to STP Balloke (In the new proposed chamber for receiving sewage from this rising main and existing 90" as well as 60" sewer. This rising main should be of the suitable size to cater the peak discharge from the pumping stations at Upkar Nagar and Lord Mahavir Ayurveda Hospital. The velocity in this pipe should not increase 1.50 mtr/sec at peak flow.

vii. Construction of New STP & MPS at Balloke

A new STP of 50 MLD capacity is to be constructed at Balloke site to augment the capacity of existing SBR Plant. A new MPS of suitable capacity is also to be constructed, along with the required pumps, to cater the peak discharge with the suitable head, to discharge required flow into the new STP. The interconnection/extension of incoming sewer lines into the STP along with provision of required diversion chambers/gates is also included in the scope.

viii. Construction of ETP for Dairy waste at Haibowal Village

A new ETP is to be constructed at Dairy Complex at Haibowal Village to handle the Dairy Waste i.e. cow dung and fodder waste, along with waste water generating after washing of buffaloes and floors etc. The daily flow generated from this Dairy Complex is about 3.75 MLD. Most of the flow from dairy is discharged during morning hours and evening hours, resulting into a peak factor of approximately 5 during morning flows. The ETP is to be constructed for peak flow upto primary treatment. After equalization tank, provided before secondary treatment, ETP shall be design for average flow of 3.75 MLD. The treated water from the ETP shall be discharged into Buddha Nallah, which is passing nearby.

ix. One time repair of 105 MLD existing STP on SBR technology.

The existing 105 MLD STP commissioned in 2012 needs refurbishment especially with respect to the Electrical, Mechanical,

Instrumentation and Chlorination System to improve the efficiency of plant and ensure satisfactory working.

- x. Rehabilitation Main Pumping Station at Balloke for SBR Plant.**
Complete rehabilitation of MPS catering to 105 MLD SBR based STP, to cater the capacity up to 105 MLD average flow, along with the required pumps, to cater the peak discharge up to 210 MLD, with suitable head, to discharge into the rising main leading to STP.
- xi. Rehabilitation Main Pumping Station at Balloke for UASB Plant.**
Complete rehabilitation of MPS UASB Plant to cater the capacity of 152 MLD average flow, along with the required pumps, to cater the peak discharge of 304 MLD, with the suitable head, to discharge into the rising mains leading to STP.
- xii. Rehabilitation of existing 152 MLD STP based on UASB**
The 152 MLD UASB plant commissioned in year 2008 consists of primary treatment units, UASB reactors, polishing ponds and chlorination system. The performance of plants is not upto the mark. Complete over hauling of the plant especially Screens, Degritters, Sludge Removal System, HDPE Down Pipes, PVC Sheets, FRP Pipes/Boxes/Channels, Chlorination System, Gas Collection Dome and removal of sludge from reactors, polishing ponds and sludge drying beds is proposed. Sludge Drying Beds (SDB). Sludge is to be disposed off at Dumping Station to be earmarked by Municipal Corporation, Ludhiana. Bidder is to service and repair the existing Flaring System. In addition proposal for Gas Utilisation system preferably for generation of electric power is to be given.
Any other repair/painting/modification as required is also to be done.
- xiii. Arrangement for mechanical dewatering of sludge from existing 152 MLD UASB Plant.**
In the existing system the sludge from the reactors is collected in a sump from where it is pumped to the 96 nos. Sludge Drying Beds (SDB). It is proposed to set up new mechanical sludge dewatering unit and required allied works. Rehabilitation of Sludge Drying Beds (SDBs) for stand-bye-use is to be done.

xiv. Additional chlorination plant at Balloke.

Additional new chlorination plant along with leak absorption system with a capacity of 60 kg per hour is to be provided for additional chlorination of effluent from UASB Plant.

10.0 Cost: Approximate Capital Cost for the proposal for Phase-I is Rs. 650 Cr.

S.No.	Description	Amount (In Rs. Cr)
1	Jamalpur STP	369
2	Bhattian STP	65
3	Balloke STP	154
4	Construction of two CETPs for Dairy Waste	38
5	Provisional sum for laying dedicated conveyance system for Industrial Waste Water, if required.	24
	Total	650 Cr.

The capacities, sizes and availability of routes need to be confirmed during detailed engineering.

Flow of Capital Funds for Rejuvenation of Buddha Nallah, Ludhiana (Details at Annexure- Graph-1).

11.0 Solid Waste Management

- a. Solid Waste Management along the Nallah is key to tackling pollution in it.
- b. Voyants report deals with the beautification of the Nallah in a comprehensive manner.
- c. In short term MC Ludhiana must take the following measures to ensure menace of solid waste is tackled effectively:
 - i. Stakeholder consultations and awareness among residents living near the Nallah about the importance of maintaining cleanliness along the Nallah.
 - ii. Proper mechanism for collection and transportation of Solid waste from areas along the banks of the Nallah.
 - iii. Effective surveillance along the Nallah by covering the stretch using CCTV cameras so that defaulters may be penalized.
 - iv. Fencing at vulnerable areas to prevent the dumping of Solid Waste.
 - v. The solid waste management component is being got done by Municipal Corporation, Ludhiana from other own resources.

Drawing

Phase –II: Reuse of treated water

1. Introduction :

Ludhiana is generating 765 Million liter of waste water daily, which is at present treated partially and being discharged in to Buddha Nallah. The partially treated waste water is ultimately discharged in to Sutlej River. Sutlej water is being used for drinking needs of residents of southern Punjab. Mixing of partially treated waste in Sutlej river contaminates drinking water sources of southern Punjab.

Therefore, It has been proposed to treat entire quantity of waste water being generated by Ludhiana city, by enhancing existing waste water treatment capacity .Establishment of new Sewage Treatment Plants / Trade Effluent Treatment Plants and up-gradation of existing STPs/ETPs has been proposed. It is further proposed that treated waste water should be used for irrigation of crops and plantation and other purposes and no TWW shall be discharged into Buddha Nallah.

- a. The long term goal of waste water management in the Nallah should plan for reuse of the treated effluent.
- b. Since water scarcity is now looming large in the State (Ludhiana is already characterized as over exploited block by Central Ground Water Board), and almost 765 MLD of water flows in the Nallah, proper reuse strategies need to be worked out for optimum utilization of this natural resource.
- c. Since the quantum of water is huge and Ludhiana is an industrial hub, treated water should be made compulsory for use by the industries. Tariff rates for this treated water and distribution network for this treated water to industries needs to be worked out in discussion with all the stakeholders.
- d. The remaining water after the use in above activities needs to be utilized for agriculture. This can be implemented in villages which lie in the catchment of Buddha Nallah outside MC Limit and before its confluence with Sutlej.

2. Quantity of TWW¹ :

Approximately 765 million litre of TWW shall be generated daily from various STP's and ETP's. The annual quantity of TWW shall be 280 million cubic meter. This is huge quantity of water and if it is used for irrigation will result in to saving scarce ground water. The annual requirement of water for various crops per acre is as under

¹TWW -Treated Waste Water

S No	Name of Crop	Water requirement per hectare	Crop Area required to utilize entire quantity of TWW
1	Paddy	1. Water demand =1.4 meter for entire crop 2. Required per hectare = 14000 cum 3. Crop period 140 days 4. Average daily demand per Hectare = 100 cum	Quantity of TWW to be generated daily -765 MLD or 0.765 MCUM ² Crop Area required for reuse =7650 hectare
2	Wheat	5. Water demand =0.5 meter for entire crop 6. Required per hectare = 5000 cum 7. Crop period 140 days 8. Average daily demand per Hectare = 35 cum	Quantity of TWW to be generated daily -765 MLD or 0.765 MCUM ³ Crop Area required for reuse =21857hectares

3. Villages where TWW can be used for irrigation of crops

The TWW can be used for irrigation of crops in the villages of Ludhiana -1, Sidhwan Bet and Jagraon. The crop area in these villages as below⁴ :

Sno	Name of Block	Total area in Hectare	Area under cultivation in hectares
1	Ludhiana 1	50155	40100
2	Sidhwan Bet	43086	36600
3	Jagraon	37333	32400
	Total	130574	109100

Maximum area required for disposal of TWW = 21857 Hectares

Area under cultivation in the 3 blocks= 109100

Area required for use of TWW is 20% of total area under cultivation. Hence during cropping period entire TWW can be used for irrigation of crops in the villages of three block falling on the banks of Buddha Nallah.

4. Requirement of temporary storage

The irrigation requirement of crops is not uniform every day. There may be period where there is zero demand also, where TWW shall be generated on daily basis. Hence storage basins should be created in all the three blocks. The storage of capacity these reservoirs shall be in the range of 12 MCUM. Or 4.0

²MCUM – Million Cubic Meter

³MCUM – Million Cubic Meter

⁴As per Census 2011

MCUM per block, Five reservoirs can be created in each block. Assuming depth of each reservoir -10 meter, the area of reservoir shall be 7.5 hectares. These storage reservoirs shall be used for irrigation of crops by farmers during crop period and during no demand period water may be used for irrigation of plants which can be planted in large numbers along banks of Buddah Nallah and along roads falling in these blocks.

5. Miscellaneous uses

Ludhiana Municipal Corporation may also use TWW for fire-fighting, supply water for construction industry through tankers, paper industry.

6. Cost of Reuse plan

The TWW reuse plan may cost around Rs 150Crore.

Workability and details of plan are required to be worked out. Issues are:

- Treatment quality assurance
- Suitability of treated water for irrigation. some study was done by PAU about 10 years back for Ludhiana
- Acceptance by farmers
- Land for storage
- Pumping may be twice will be required
- Distribution system in fields pepes or channels (Soil Conservation Department as already working on many schemes
- O&M of the system

Phase–III: Landscaping and Beautification along the Nallah

A comprehensive report was got prepared by MC Ludhiana from Voyants Solutions on Master Planning and Development of Buddha Nallah. The report tackles in a holistic manner problems and solutions required for holistic development of Buddha Nallah.

The report recommended **formulation of a Master Plan** that provides both a long-term vision and implementation guidance for revitalizing the Nallah. The Master plan would serve the following goals:

- i. Provides strategic guidance for the development of the Nallah over the long term.
- ii. Gives the framework for implementing the project over the long term
- iii. Provides recommendations and possibilities to be explored further for action
- iv. Identifies opportunities to the notice of the concerned agencies for implementation in due course

It recommended that the Buddha Nallah project ROW must be declared as a special area within the master plan for the city and proposals for Nallah improvement must be given the legal backing of the master plan document. Necessary legal provisions may be included in the master plan for enabling the implementation of the master plan properly.

Some key components covered in the report regarding beautification are:

- i. Nallah widening: Proposed design of the Nallah is carried out considering 2 year return period with reduced run-off within the city reach due to active storm water detention and retrofit measures. This essentially includes a) widening of the Nallah; and b) creating a stepped section comprising of a base channel and an outer channel for carrying off-peak and peak discharge.
- ii. Roads and walkways: As part of the specific project objective to improve public access to the Nallah a project road of 11.5m ROW is proposed along the entire 14 km stretch of Buddha Nallah, on its northern bank. This proposed road will consist of 7.5m wide undivided carriageway for 2

way vehicular traffic. Provision for a 2m wide footpath and/ or covered storm drain has been given on both sides of the carriageway.

- iii. Landscaping works landscaping and greening of the Nallah ROW would be a key component which will enable the successful transformation of the project area. The proposed landscape plan introduces plants, pedestrian footpaths, bicycle tracks and pedestrian trails with other ornamental features into the Nallah ROW on either side of the base channel. Landscaping elements will be integrated with other design features such as streetscape, storm water management, erosion control measures and bank stabilisation.

1. Long term improvements

- i. Managing storm water discharge from city into the Nallah
- ii. Managing treated wastewater discharge into the Nallah within prescribed limits
- iii. Integration of the Nallah with its surrounding neighbourhoods through spatial planning
- iv. Improvement in connectivity and with provision of non-motorised transport modes also.
- v. Improvement of Nallah surroundings through enabling provisions for land use change and incentives for greening, creation of open spaces and setbacks in the adjoining properties
- vi. Exploring regional level greening interventions through creation of a Biodiversity park upstream of the city and exploring linkages with existing zones such as Mattiwara Forest.

2. Land Acquisition (LA)

Due consideration has been given for minimal land acquisition. Proposed ROW of 11.5m has been considered along the entire length of the project for road work only. **Tentative quantum of land acquisition has been calculated as 0.56 ha.**

3. **Abstract of Cost For Buddha Nallah Development Work at Ludhiana**
(as per Voyants report)

S No.	Description Of Works	Amount (in Rs. Cr.)
1	Drainage Works	107.67
2	Road Works	146.34
3	Landscape Works	29.21
	Total Project Cost	283.23
	Say	Rs 283 Cr.

Phase – IV Financial Model

1. Financial Model for Phase-I: Rs. 650 Crore

Augmentation and Refurbishment of Sewage Treatment Facilities

- a. The finances for the project need to be arranged for both short term and long term planning.
- b. According to Feasibility Report, total cost required for waste water treatment is Rs 650 Cr. (CAPEX) and Rs 80 Cr. as annual OPEX cost.
- c. Initial waste water management in Phase-1, AMRUT and Smart city schemes can be used to fund part of the project, rest being arranged as grant from the Government. The exact sharing mechanism needs to be worked out once the cost and scope to be undertaken is finalized. The tentative funds sharing cost is proposed as under:-

(Rs. in Cr.)

Source	Total	Gol Share	State Share	Private Operator (30%)
AMRUT	400	133	267	
Smart City	150	75	75	
Private Operator (30%)	100			100
Total	650	208	342	100

2. Implementation Structure

- (i) The implementation of a complex, comprehensive and long drawn solution for Buddha Nallah requires a dedicated PMU for its implementation.
- (ii) The PMU should involve stakeholder from all key departments like MC Ludhiana, PPCB, Drainage, Revenue etc. It should be empowered to take and recommend all key policy decisions required for effective implementation of the solution.
- (iii) For most of the part, the problem of Buddha Nallah has evaded solution due to lack of a dedicated, empowered unit to effectively plan and then implement the solution. The problem has been discussed time and again at various levels but lack of continuity/sustained effort has resulted in measures being taken in an ad-hoc manner without a proper master plan for the same.

- (iv) Empowerment of PMU cannot be emphasized more since the comprehensive solution requires decision on a lot of policy issues some of which are highlighted below (list is indicative and many more areas are bound to be involved once implementation phase begins):
- Effective segregation of industrial waste from domestic waste for proper functioning of STPs/ CETPs,
 - Notifying Buddha Nallah area as special Master Plan area,
 - Deciding on the reuse of water policies: tariff for industries, funding mechanism for distribution network etc.
 - Regulation on the use of 'ground water' by industries in the city,
 - Land acquisition around the Nallah and establishment of clear ROW.
- (v) The project is proposed to be implemented in three phases after deployment of a Project Management Unit which involves all stake holders from key departments i.e. MC Ludhiana, PPCB, Drainage and Revenue. For timely completion of project, simultaneous action shall be initiated specially for acquisition of land along the Buddha Nallah, Solid Waste Management i.e. proper mechanism for collection and transportation of solid waste from the areas along the banks of the Nallah including effective surveillance using CCTV cameras and fencing etc.

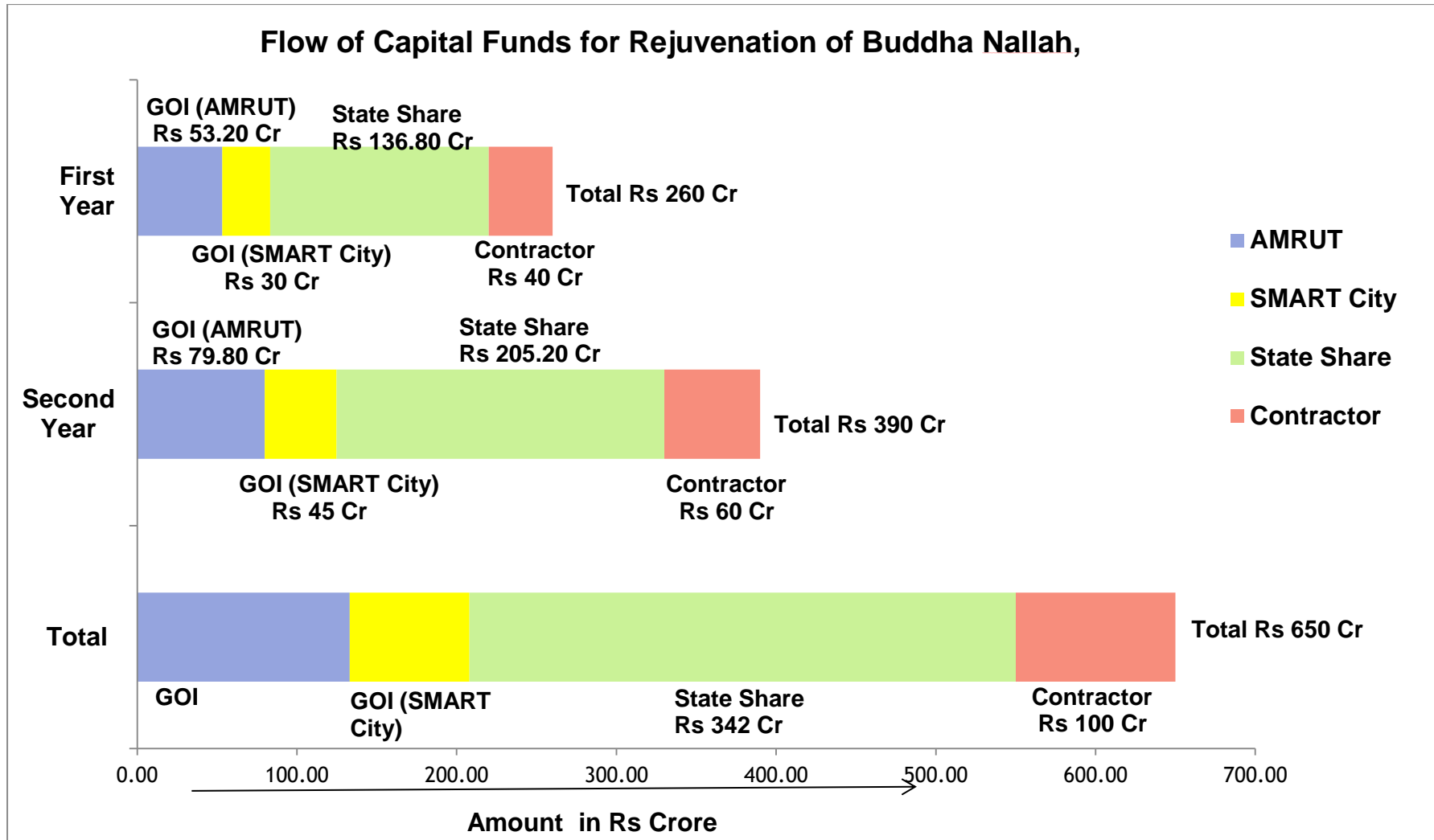
3. Conclusion

The problem of rejuvenation of Buddha Nallah is a historical one.

A lot of effective policy decisions are needed for a comprehensive solution. A dedicated PMU is one of the first steps to tackle the problem effectively. Finances are also going to be a major factor deciding the outlook on the Nallah. Land acquisition and establishing clear ROW along the Nallah is also a tedious and long drawn process.

Though it is a complex problem requiring short term, medium term and long term planning along with effective coordination between various stakeholder departments, it presents a remarkable opportunity to transform the urban landscape of the most important city of North India. Hence it should be seen as an opportunity to set an example of effective Environment management in the country.

Annexure-Graph-1



Annexure-1**Cost Estimate for Wastewater Treatment of Buddha Nallah at Ludhiana****A. Jamalpur Zone**

Sr No.	Description	Unit	Quantity	Cost Rs in Lakh
1	Augmentation of Sundar Nagar Pumping Station 8 MLD capacity	MLD	8	160
2	Augmentation of Gaushala Pumping Station 30 MLD capacity	MLD	30	600
3	Augmentation of Tibba Road Pumping Station 12 MLD capacity	MLD	12	240
4	Rising main From Gaushala Pumping Station to Tibba Road Pumping Station of 1200 mm dia DI k-9 pipe	Km	0.78	336
5	Rising Main from Sundar Nagar to Gaushala Pumping Station of 600 mm dia DI K-9	Km	0.62	78
6	Rising main From Tibba Road Pumping Station to STP Jamalpur of 1200 mm dia DI K-9 pipe	Km	3.90	1689
7	Construction of New STP/ETP at Jamalpur of 225 MLD cap including MPS	MLD	225	33750
	Total for Jamalpur			36853

B. Bhattian Zone

Sr No.	Description	Unit	Quantity	Cost Rs in Lakh
1	Rehabilitation of Existing MPS (161 MLD)	Job	1	231
2	Rehabilitation of Existing 111 MLD UASB Plant	Job	1	500
3	Construction of Channel to Bye-Pass STP	Job	1	325
4	Construction of Secondary Pumping Station at Bhattian 161 MLD	MLD	161	1932
5	Arrangement for mechanical dewatering of sludge from existing UASB Plant	MLD	111	888
6	One Time repair to existing 50 MLD SBR based STP	Job	1	630
7	Clarification arrangement (including sludge handling)	Job	161	1932
8	Chlorination Plant of 40K/hr including supply of cylinders, chlorination room complete in all respects	Job	1	40
9	Repair of Sludge Drying Beds including replenishment of filter media, gates, S.V, drains etc.	Job	1	20
10	Removal of sludge from FPU after emptying, disposal of dry sludge at a place provided by employer	Job	1	50
	Total for Bhattian			6548

C. Balloke Zone

Sr No.	Description	Unit	Quantity	Cost Rs in Lakh
1	Augmentation of Kundan Puri Pumping Station 5 MLD capacity	MLD	5	150
2	Construction of Upkar Nagar Pumping Station 13 MLD capacity	MLD	13	260
3	Construction of Lord Mahavir Ayurveda Hospital Pumping Station 43 MLD capacity	MLD	43	860
4	Rising main From Kundan Puri MPS to Nearest I/C sewer of 400 mm dia DI K-9 pipe	Km	0.30	20
5	Rising main From Upkar Nagar to B/S Life Line Hospital Point of 600 mm dia of DI K-9 pipe	Km	1.11	139
6	Rising main From Life Line point to Lord Mahavir Ayurveda Hospital Point of 1000 mm dia DI K-9 pipe	Km	0.45	125
7	Rising main From Lord Mahavir Ayurveda Hospital Point to STP Balloke of 1200 mm dia DI K-9 pipe	Km	4.40	1905
8	Rehabilitation of existing 152 MLD MPS	Job	1	1034
9	Rehabilitation of existing 152 MLD UASB Reactors	Job	1	1000
10	Arrangement for mechanical dewatering of sludge from existing UASB Plant	Job	152	1216
11	Construction of new MPS and STP (MLD)	Job	50	7000
12	One time repair of existing SBR based STP and MPS	Job	1	1500
13	Remove of sludge from FPU after emptying, disposal of dry sludge at a place provided by employer	Job	1	70
14	Repair of sludge drying beds including replenishment of filter media, gates, S.V, drains etc.	Job	1	30
15	Chlorination Plant of 40 Kg/hr including supply of cylinder, chlorination room complete in all respects	Job	1	40
	Total for Balloke			15349

Waste Water Flow in Buddha Nallah at various locations (28.10.2019)

Time	Bhammian	Vijay nagar Pulley	Baba Ghor Shah Bridge	Baranhara Bridge
00:00	9	110	198	537
01:00	9	110	198	529
02:00	9	105	191	513
03:00	9	110	184	513
04:00	9	114	176	497
05:00	9	114	169	441
06:00	9	110	169	433
07:00	9	119	162	433
08:00	9	119	162	418
09:00	9	173	162	418
10:00	10	164	169	433
11:00	10	173	191	449
12:00	10	177	205	465
13:00	10	182	220	457
14:00	10	182	227	457
15:00	10	173	234	481
16:00	10	173	234	489
17:00	10	164	234	505
18:00	10	164	227	537
19:00	10	164	220	545
20:00	10	164	220	537
21:00	10	159	220	529
22:00	11	137	213	529
23:00	9	110	205	537
Average	9	126	178	468
Max	10	173	198	537
Min	9	105	162	418
Peak	1.06	1.36	1.12	1.15