PROJECT INFORMATION MEMORANDUM

INTRODUCTION

Background

Namami Gange is a flagship Programme of Government of India launched in 2014 to accomplish the twin objectives of effective abatement of pollution, conservation and rejuvenation of River Ganga. The Programme is being carried out in five states of the country - Uttarakhand, Bihar, Uttar Pradesh, Jharkhand and West Bengal by the National Mission for Clean Ganga (NMCG). An outlay of INR 20,000 crore was approved for the Clean Ganga Mission by the Centre in 2014.

To facilitate its mission in Bihar, NMCG has sanctioned the construction of two STPs along with the Sewerage Network to treat the sewage received from Digha and Kankarbagh sewerage zones of Patna District.

The proposed project is to be funded by the World Bank under the National Ganga River Basin Project (NGRBP), and will be implemented and monitored by the Bihar Urban Development Infrastructure Development Corporation Ltd (BUIDCO).

Project Overview

Need for new infrastructure to treat the wastewater generated in Patna

Patna is the capital city of the Indian state of Bihar, with a population of 25,14,590 (Urban population as per 2011 Census) making it the second largest city of Eastern India. Situated on the banks of River Ganga, the Patna Municipal Corporation covers an area of approximately 99.45 sq km. The strategic location of the city has made it an important urban centre in the eastern region leading to rapid urbanization in the last few decades. This unprecedented growth has put tremendous pressure on the existing infrastructure including city's water supply, sewerage and drainage sectors.

The city has only 20% of physical coverage of the underground sewer network, with minimal records on the details and number of households connected to the sewers. The rest of the city, (~80% area) is dependent on an open drain network, which collects both sewage and drainage. The sewage thus collected, is then conveyed through the natural drains to river Ganga or river Pun Pun, thereby resulting in excessive pollution. To facilitate the national mission for a Clean Ganga and, to create a sustainable and healthy environment, the Government of India along with the Government of Bihar and the Patna Municipal Corporation is making continuous efforts to improve the current sewerage infrastructure.

Efforts for improving the Sewerage system of the Patna city

The Patna Municipal Corporation has divided the city into six sewerage zones namely,

(1) Zone I – Digha
(2) Zone II – Beur
(3) Zone III and Zone IV North – Saidpur
(4) Zone IV – Kankarbagh
(5) Zone IV South and Zone V – Pahari
(6) Zone VI – Karmalichak

with clear demarcation of boundaries within the adjacent zone, as shown in the diagram below.

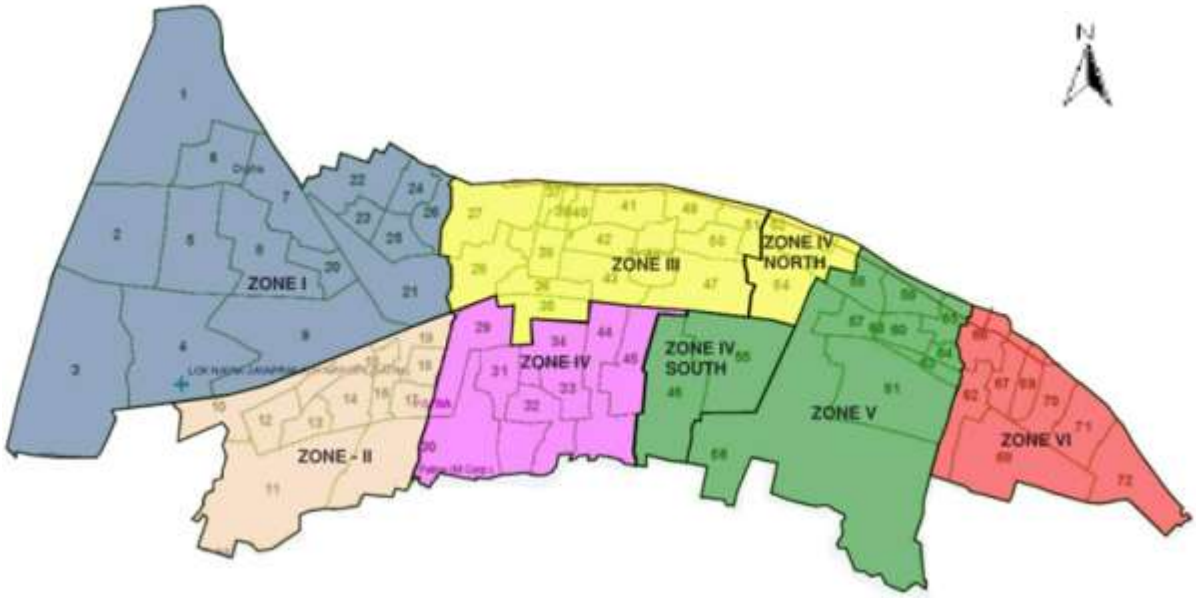


Figure 1: Sewerage Zones of Patna District

In an effort to divert the untreated waste water from discharging into the river, six Interception and Diversion (I&D) works along with Intermediate Pumping Stations have been constructed. These collect wastewater from the open drains and divert them to the existing STPs of the city. In total, there are four STPs that are operational in Beur, Saidpur, Pahari and Karmalichak zones of Patna. Additionally, to improve the sewage collection system and enhance scale of treatment, underground sewer network and new STPs are being constructed in these four zones of the district, through central and state government schemes. The table below depicts the reach and extent of the existing sewerage infrastructure in brief.

Name of the Zone	**Sewerage Infrastructure details (existing + under construction)**
Zone I : Digha	No Network and No STP
Zone II : Beur	~187km Network and 58 MLD STP
Zone III and Zone IV North: Saidpur	~183km Network and 45 MLD STP
Zone IV: Kankarbagh	No Network and No STP
Zone V and Zone IV South : Pahari	~228km Network and 60MLD STP
Zone VI: Karmalichak	~108km Network and 41MLD STP

It is evident from the table, that there is a pressing need for developing STPs in the remaining zones of the district, namely Digha and Kankarbagh along with a well-connected underground sewer network.

Two Patna STPs of 100 MLD and 50 MLD to be developed at Digha and Kankarbagh to ensure treatment of sewage from these zones

To enable proper collection, conveyance and treatment of the sewerage from Digha and Kankarbagh Zone, the following project has been proposed under the "Namami Gange Programme".

- Sewage Treatment Plant (100 MLD) and Sewerage Network (303 km) in Digha, Patna
- Sewage Treatment Plant (50 MLD) and Sewerage Network (150 km) in Kankarbagh, Patna

The STPs in both Digha and Kankarbagh will be developed in a Hybrid Annuity Model, while the construction of the Sewerage Network shall be in the Design, Build, Operate and Transfer (DBOT) Model. The proposed project includes the construction of 4 key components – (i) Digha STP including

Interception and Diversion Works (I&D Works), (ii) Kankarbagh STP including I&D Works, (iii) Digha Sewerage Network and associated infrastructure, and (iv) Kankarbagh Sewerage Network and associated infrastructure. The Concessionaire may construct the Digha I&D by either of the two options presented below, (1) Option 1 – Connecting rising main from Digha I&D SPS A to Digha STP directly; (2) Option 2 – Connecting rising main from Digha I&D SPS A to the trunk sewer, which connects to the Digha SPS A;

The overview of the project is presented in the exhibit below:

Figure 2: Diagram of the proposed Sewerage System in Digha Zone – Option 1

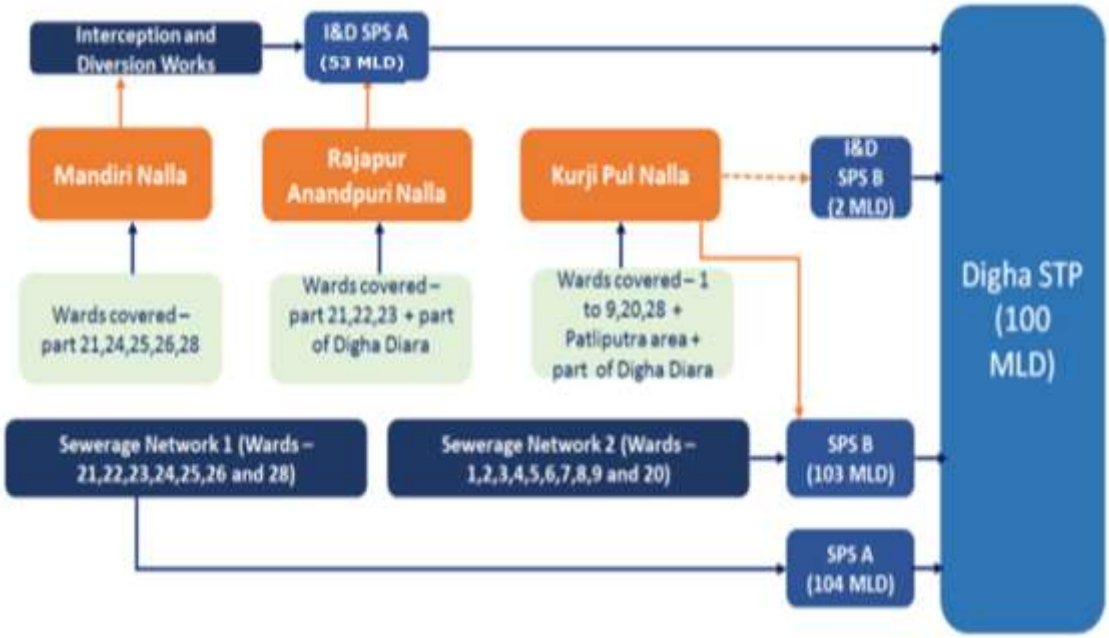


Figure 3: Diagram of the proposed Sewerage System in Digha Zone – Option 2

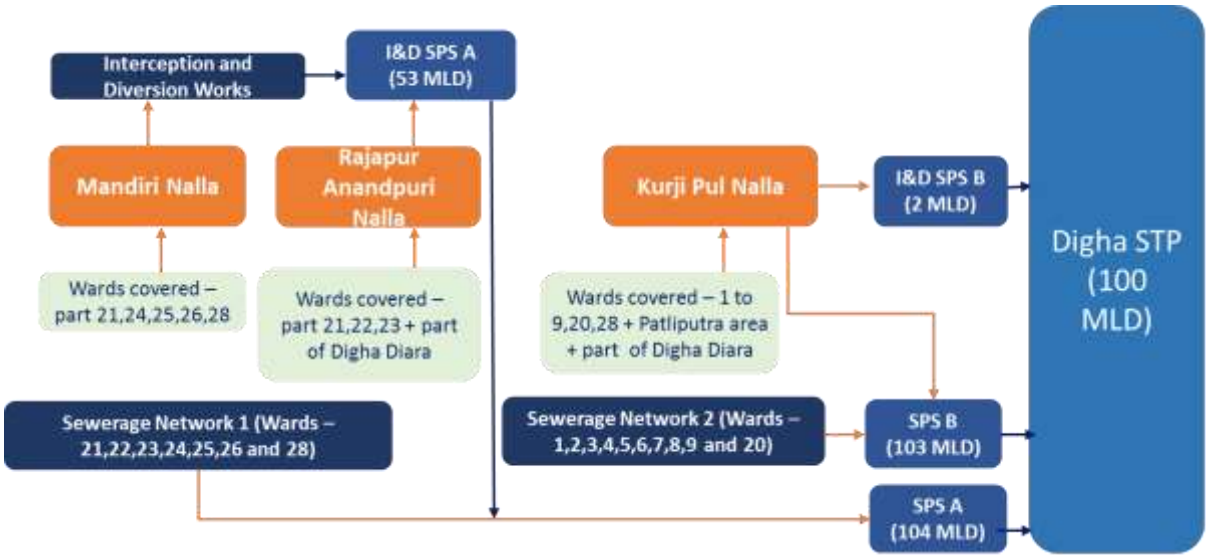
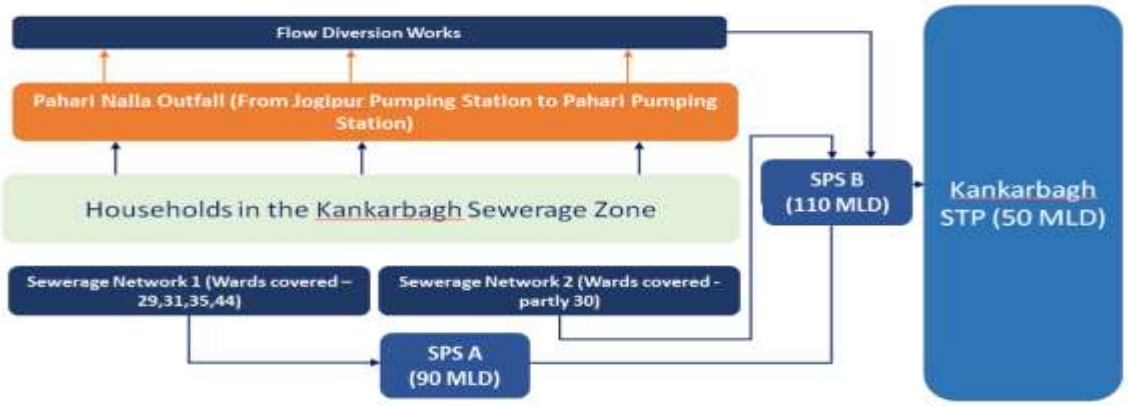


Figure 4: Diagram of the proposed Sewerage System in Kankarbagh Zone



PROJECT DETAILS

Project scope

As stated in the Administrative Approval and Expenditure Sanction, the proposed project is a combination of both Hybrid Annuity Model and DBOT model. Accordingly, the project has been categorized into two parts for each location as (i) STP Facilities including I&D Works, and (ii) Sewerage Network Facilities. The STP Facilities shall be constructed under the Hybrid Annuity Model, while the Sewerage Network Facilities shall be through the Design, Build Operate and Transfer Model.

For the I&D Works to be constructed as part of the Digha STP Facilities, the bidder may choose to bid, design and construct for either of the following two options:

- Option 1 – Connecting rising main from Digha I&D SPS A to Digha STP directly;
- Option 2 – Connecting rising main from Digha I&D SPS A to the trunk sewer, which connects to the Digha SPS A

The timelines for construction completion and operations and maintenance shall vary depending on the option chosen by the bidder. The following table shows the key assets that are to be developed as part of the proposed project along with the timelines, as bundled in the Agreement

No	Asset Details	Capacity*	Scheduled Construction Completion Date	O&M Period
Digha STP Facilities				
1	Digha STP	100 MLD	21 months from Effective Date of STP Facilities	15 years from COD
2	Digha I&D SPS A including Nala Tapping Works(Rajapur Nallah)	53 MLD	21 months from Effective Date of STP Facilities	2 years from COD mandated O&M, after that as per notice from BUIDCO
3	Digha I&D SPS B including Nala Tapping Works (For Kurji Nalla, Inside STP Premises)	2 MLD	21 months from Effective Date of STP Facilities	

Digha Sewerage Network Facilities				
4	Digha Sewerage Network	303 km	32 months from the Effective Date of Sewerage Network Facilities	
5	Digha SPS A	104 MLD	Option 1 – 32 months from the Effective Date of Sewerage Network Facilities Option 2 - 21 months from Effective Date of STP Facilities	Option 1 - From OSD till End of Concession Option 2- From COD of Digha STP till End of Concession
6	Digha SPS B	103 MLD	21 months from Effective Date of STP Facilities	From COD of Digha STP till End of Concession
Kankarbagh STP Facilities				
7	Kankarbagh STP	50 MLD	21 months from Effective Date of STP Facilities	15 years from COD
8	Kankarbagh I&D Works including weir arrangement			2 years from COD mandated O&M, after that as per notice from BUIDCO
Kankarbagh Sewerage Network Facilities				
9	Kankarbagh Sewerage Network	150 km	32 months from the Effective Date of Sewerage Network Facilities	From OSD till End of Concession
10	Kankarbagh SPS A	90 MLD		
11	Kankarbagh SPS B	110 MLD	21 months from Effective Date of STP Facilities	From COD of Kankarbagh STP till End of Concession

Figure 5: Diagram showing STP and Sewerage Network Facilities in Digha Zone – Option 1

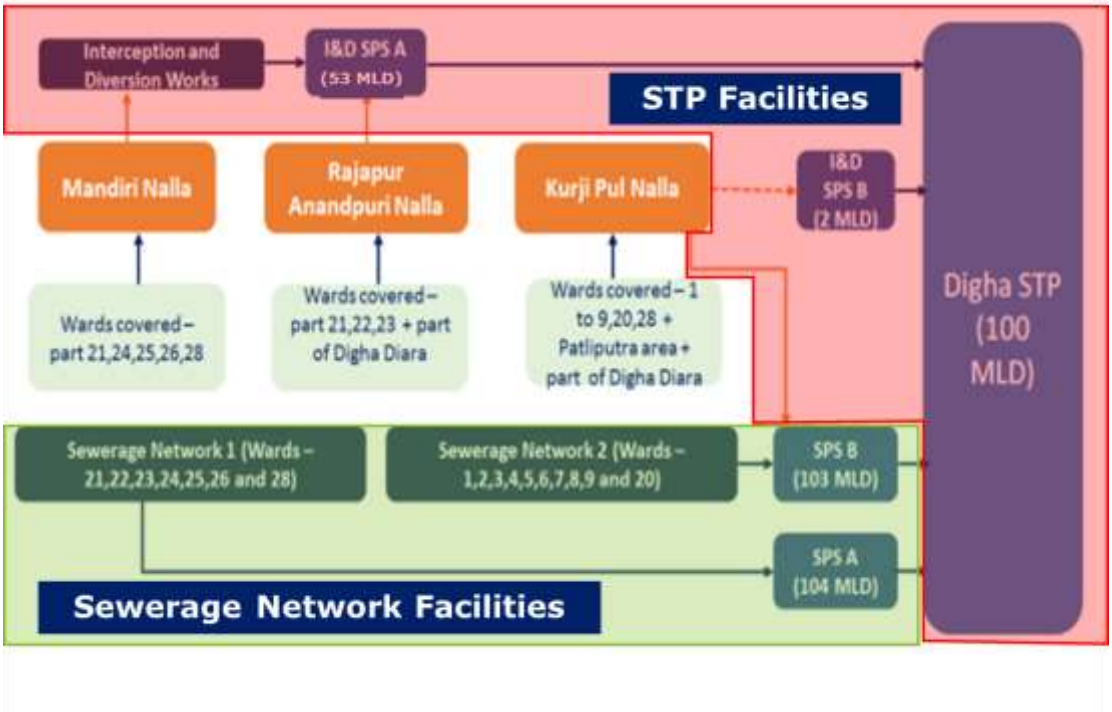


Figure 6: Diagram showing STP and Sewerage Network Facilities in Digha Zone – Option 2

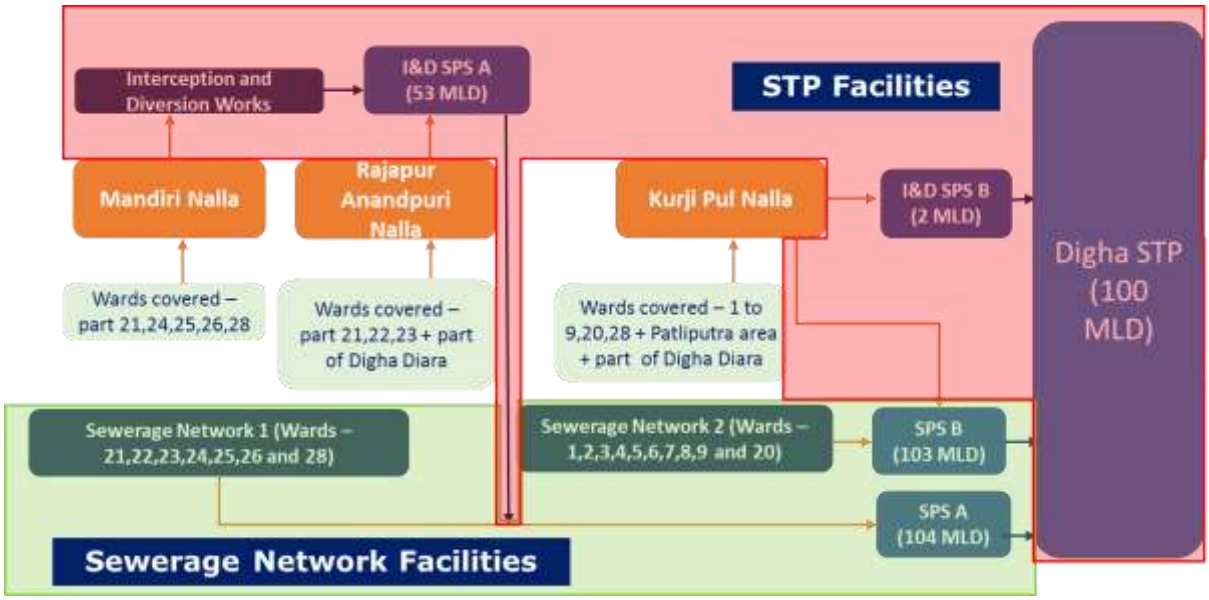
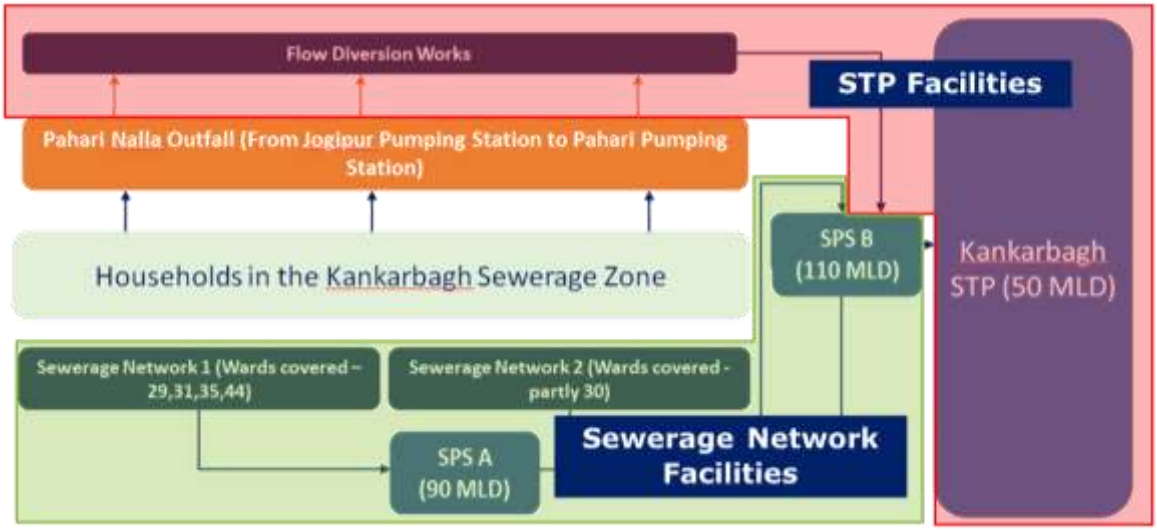


Figure 7: Diagram showing STP and Sewerage Network Facilities in Kankarbagh Zone



Project structure

STP Facilities

Overview of the Scope:

A) Construction Period: The Concessionaire will be required to design, finance, construct and complete the STP Facilities, including the I&D Works, prior to the Scheduled STP Construction Completion date, in accordance with the Concession Agreement. (Clause 7.1 to 7.13 of Concession Agreement)

B) Trial Operations Period: Upon receiving the Construction Completion Certificate, the Concessionaire shall commence the Trial Operations of the facilities to determine whether the KPIs are met on a continuous basis, and is fit for the commercial operations of the STP Facilities. To achieve successful trial operations, the STP facilities need to achieve KPIs for 21 consecutive days prior to the Scheduled COD. (Clause 7.14 and 7.15 of Concession Agreement)

C) O&M Period: From COD to the End of Concession, the Concessionaire will be required to operate and maintain the STP Facilities, such that the STP Facilities meet the key performance indicators specified in the Concession Agreement. (Article 8 of Concession Agreement)

Payments: The payments for the STP Facilities including the I&D Works shall be based on a Hybrid Annuity Model, wherein 40% of the project cost shall be reimbursed to the Concessionaire during the Construction period. The balance construction cost, along with interest, will be made as quarterly payments (Capex Annuity) during the O&M period. Additionally, the Concessionaire will also receive indexed O&M charges based on his quote and reimbursable power charges for operating and maintaining the STP Facilities, as quarterly payments during the O&M Period.

A brief overview of the timeline and payments for the STP Facilities is given in the table below for better understanding. Kindly note that the details below are indicative, and the Concessionaire may refer to Article 9 of the Concession Agreement for the exact details.

Project Details	**What?** Design, Finance, Construct, Operate and Maintain, and Transfer the STP Facilities including I&D Works, as per the Concession Agreement **Where?** At Digha and Kankaragh Sewerage zones of Patna

	How? Using any suitable technology, subject to satisfaction of the Qualification Criteria set out in this RFP	
	Timeline	Payments for each STP Facility
Construction Period	**21 months;** from Effective Date (ED) till Construction Completion Date (CCD)	40% of Bid Project Cost, in five equal instalments upon achieving each Payment Milestone certificate; after accounting for Delay Liquidated Damages, if any;
Trial Operations Period	**3 months;** from Construction Completion Date (CCD) till Scheduled COD	Bonus upon early achievement of Construction Completion Date, if any;
O&M Period	- From the Commercial Operations Date (COD) of each STP Facility, till End of Concession (15 years from the Digha COD or Kankarbagh COD, whichever is later); - For I&D Works, two years from the Commercial Operations Date (COD) of each STP Facility; After two years, the I&D works shall be operated, only whenever required during the Concession period, upon issue of notice from BUIDCO.	Quarterly payments of: (1) Capex Annuity - 60% of Completion Cost (indexed Bid Project Cost) , along with interest; (2) Indexed O&M charges for the STP Facilities and I&D Works, based on number of days of operation. (3) Power charges for STP and I&D works subject to a cap of Allowable Guaranteed Energy Consumption. I&D Power charges for operating SPS B from COD till OSD shall be given as part of O&M Payments of STP Facilities (4) after accounting for Availability Liquidated Damages, Performance Liquidated Damages and Power Consumption Liquidated Damages, if any;

Sewerage Network Facilities

Overview of the Scope:

A) Design Build Period: The construction phase of the Sewerage Network Facilities is termed as the Design Build Period, and it commences within 30 days of the Effective date of the Sewerage Network Facilities. During this period, the Operator shall survey, review the design, redesign and build the Sewerage Network Facilities including the pumping stations as per the approved monthly milestones, and facilitate testing and commissioning of the same to obtain the Operations Acceptance Certificate.

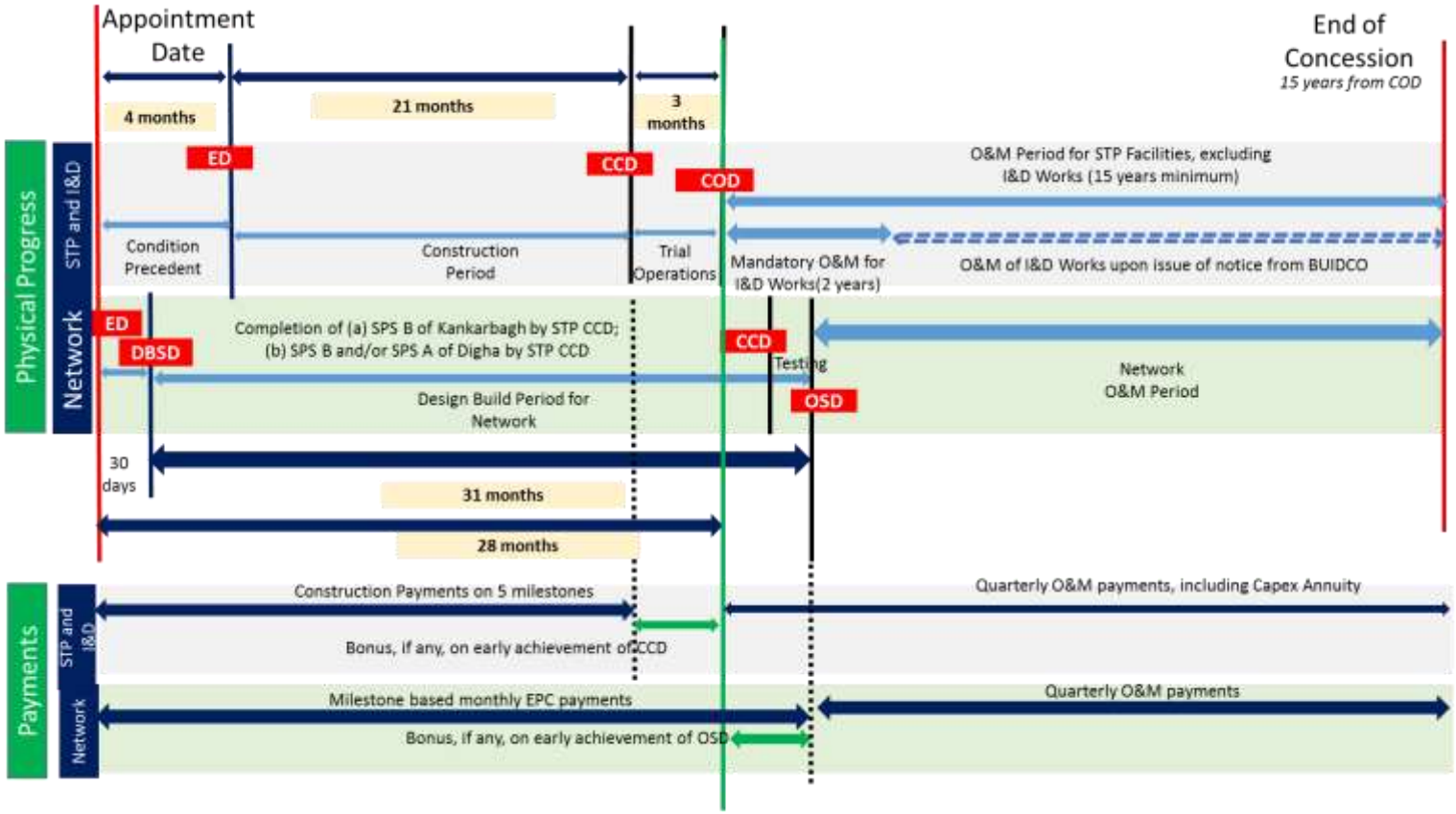
B) O&M Period: On and from the Operations Starting Date, and until the expiry of the O&M Period, the Operator will be required to operate and maintain the Network Facilities in accordance with the Supporting Volume 1 and Supporting Volume 2 of Appendage B – Concession Agreement.

Payments: During the Design Build Period, the payments shall be made against the approved invoice raised by the Operator upon achievement of pre-approved monthly milestones. During the O&M period, the Operator will receive indexed O&M charges based on his quote and reimbursable power charges for operating and maintaining the Sewerage Network Facilities, as quarterly payments.

A brief overview of the timeline and payments for the Sewerage Network Facilities is given in the table below for better understanding. Kindly note that the details below are indicative, and the Concessionaire may refer to Article 9 of the Concession Agreement for the exact details.

Project Details	**What?** Survey, Review the designs, Redesign where necessary and Build, Operate and Maintain, and Transfer the Sewerage Network Facilities including the Pumping Station, as per the Concession Agreement **Where?** At Digha and Kankaragh Sewerage zones of Patna **How?** As per the approved drawings and BOQ provided for the Sewerage Network Facilities	
	Timeline	Payments for each Sewerage Network Facility
Design Build Period	**31 months;** from Design Build Start Date (DBSD) till Time of Completion (i.e. receiving Operations Acceptance Certificate) or Operations Starting Date (OSD)	Construction payments against invoice upon achieving each monthly milestone, as approved ; after accounting for Liquidated Damages - Delay, if any; Bonus upon early Time of Completion, if any;
O&M Period	From the Operations Starting Date (OSD) of each Sewerage Network Facility, till the End of Concession. SPS B of both Digha and Kankarbagh will be required to be operated from the STP COD, while SPS A of Digha will be operated from STP COD in case of Option 2.	Quarterly payments, from OSD, of: (1) Indexed O&M charges (2) Power charges for the Pumping stations subject to a cap of Guaranteed Energy Consumption (3) after accounting for Liquidated Damages - Operations, if any; Prior to OSD, payments for operating pumping stations shall be based on Guaranteed Energy Consumption quoted as part of I&D Works in the Bid.

An overview of the Project Structure, including all works of STP Facilities and Sewerage Network Facilities has been depicted below.



TECHNICAL OVERVIEW

Demographic details of the Sewerage Zones

Digha Sewerage Zone

Digha zone (Zone I) is located on the western part of the Patna City. This zone is bounded on the north by River Ganga, on the West by the Patna – Son Canal, on the East by the Saidpur zone and Beur zone in the South. This zone consists of ward numbers 1 to 9 and 20 to 26 & 28 (partly – 50%), with 3215.12 Hectares of area of total PMC area. Total population of this zone per census 2011 data is 4,51,002.

There is no existing sewage treatment facility for this zone. The new STP of 100 MLD is proposed to be located at northern part of Digha zone near the bank of River Ganga.

The area is characterized by the presence of large number of prominent administrative offices, government buildings, and educational institutes of repute. The Chief Minister's Secreteriat, Raj Bhawan, Indira Gandhi Institute of Medical Sciences, BIT Patna campus, IIT Patna, ICAR research complex for eastern region, Patna High court are some prominent landmarks.

Digha being an highly administrative and dense populated area of Patna city, needs a special attention during design and construction. Digha Project area consist of **Patliputra Railway Junction area**, Anandpuri, Nehru Nagar, Indira Nagar, Rajapur, **Gandhi Nagar**, Mandiri Area, **Raj Bhawan Area**, **Income Tax road area**, Ashiyana Nagar, Balapur, Rajbansi Nagar, Sheikpura, Indrapuri, Vyasnagar, A.G Colony, Rajeev Nagar, Shastri Nagar, Patel Nagar, Mahesh Nagar, A. N College Area, **Boring Road**, Patel Nagar, **Airport Area**.

The scope of sewerage network also includes planning, designing, construction and operation & maintenance of sewerage network for additional area of 2 km^2 in Patliputra Colony and surrounding area. The sewerage system shall be planned in such a way that the sewage generated in the catchment area shall be conveyed to SPS-A. The indicative drawings for Patliputra Colony and surrounding area are not provided as part of the bidding documents.

Kankarbagh Sewerage Zone

Kankarbagh zone (Zone IV) is newly carved out of existing Beur and Pahari zones. This zone consists of wards numbers 29, 30 (partly – 50%), 31 to 35, 44 & 45, with 886.50 Hectares of area of total PMC area. Total population for this zone per census 2011 data is 2,13,389.

There is no existing sewage treatment facility for this zone. The new STP of 50 MLD capacity is proposed for Kankarbagh zone and will be located adjacent to the existing Pahari zone STP.

This zone has historical importance as the remains of the ancient city of Pataliputra has been excavated 5 km east of Patna Junction railway station, on Kankarbagh Main Road. The major landmarks at Kankarbagh are Panch Shiv Mandir, TV Tower in Bhootnath Road and Patliputra Sports Complex etc. Today, this area is developing into an uptown area with expanding and soaring residential apartments.

Kankarbagh being dense populated area within Patna city needs a special attention during design and construction. Kankarbagh Zone consist of Kankarbagh colony, Tilak Nagar, New Chitragupt Nagar, Rajendra Nagar, Lohiya Nagar, karbigahiya, Chiriyatalpur, Indranagar Bank colony, Ram Krishna Nagar, Bhupati Nagar, Amardeep Nagar, Ashok Nagar, Khemni chak, Yogipur Gaon.

The ward-wise details of both the Sewerage zones are provided in the table below:

Digha Sewerage Zone Details			Kankarbagh Sewerage Zone Details		
Ward No.	**Area in hectare**	**Population 2011**	**Ward No.**	**Area in hectare**	**Population 2011**
1	529.80	35074	29	147.40	24863
2	269.90	33230	30 (part 50%)	94.40	19674
3	322.40	37524	31	117.10	39768
4	444.70	22509	32	102.40	25516
5	202.90	37704	33	29.60	17564
6	93.70	15277	34	79.90	17294
7	133.50	30131	35	68.40	18996
8	231.70	22634	44	163.10	22333
9	410.60	11653	45	84.20	27381
20	158.10	16752			
21	193.10	23146			
22	123.10	100261			
23	38.10	8769			
24	73.30	16299			
25	69.60	11522			
26	44.10	20515			
28 (50%)	56.90	8002			
	3395.50	**451002**		**886.50**	**213389**

Location and Site Details for the STP Facilities

The Patna urban area is entirely flat terrain, except the 8 km wide strip of high land along the southern bank of the River Ganga. The city is situated at an average altitude of 53m above Mean Sea Level (M.S.L). Because, of its location on the river bank, it has very fertile alluvial soil.

Two sites have been identified for the construction of the STP Facilities, in Digha and Kankarbagh, for which the technical details are provided in the table below:

Sr. No.	Parameters	Digha	Kankarbagh
1	Natural Ground Level at Site*	51.50 m	50.00 m
2	Finished Ground Level at Site*	HFL + 0.30m	HFL + 0.30m
3	Ground water table*	3 m to 4 m	3 m to 4 m
4	HFL*	52.72 m	50.72 m

Source of Data: Detailed Project Reports

** Bidders need to perform their own assessment and required surveys for the required levels. All levels mentioned in table above are indicative only.*

The project area falls in seismic zone – IV as per the BIS (1893, Part-1, 2002) category of seismic zoning map of India. Patna also falls in the risk zone of floods and cyclones.

The new STP for Digha is proposed towards the north-west of Digha Sewerage District in a land parcel measuring 5.5 Ha. The Digha I&D SPS B shall be built within the same premise. The ownership of the

land for Digha STP, Digha I&D SPS A and Digha I&D SPS B is with Patna Municipal Corporation which will be handed over to BUIDCO for the development of STP.

The new STP for Kankarbagh is proposed on the same land as of the existing STP for Pahari. The existing STP of 25 MLD capacity is based on aerated lagoon technology. Approximately total 5.84 Ha land is in possession of Bihar Raj Jal Parishad (BRJP) at the existing site. Further, it may be noted that the existing 25 MLD aerated lagoon STP will be dismantled and two STPs for Pahari Zone and Kankarbagh Zone will be constructed on the land. The land available for construction of Pahari STP for future flow has been reserved to the extent of 2.94 Ha, and the area available is 2.9 Ha for the Kankarbagh STP for year 2050 flows.

BUIDCO will hand over the land required for the development of STPs and SPSs free of encumbrances.

Please note that the designs, drawings, zone boundaries and any other such details provided herein are indicative only and the Bidders are required to undertake their own due diligence and prepare their own designs and drawings for the purpose of the Bid and the Project. All the images/drawings shown here are not to scale. Geotechnical Data for the STP location of Kankarbagh and Digha is not available. Maximum safe bearing capacity of soil strata and underground water table shall be taken as determined by Concessionaire through his own independent investigations.

Digha Proposed STP – Site Location

Kankarbagh Proposed STP – Site Location

Site Information about Sewerage Network

Sr. No.	Parameters	Digha	Kankarbagh
1	EL*	48-53 m above Mean Sea Level	48-53 m above Mean Sea Level
2	Nr. Of Wards*	1-9, 20-28	72
3	Area considered*	34 sq. km	9.81 sq. km
4	Total Length of Network*	303 km	150 km
5	Nr. Of Sewage Pumping Stations	2	2
6	Location of SPS-A	At Boring road opposite of AN College (at Substation Area)	At Yogipur/Ganga Bhawan
7	Location of SPS-B	Near Crossing of Kurji Drain and Railway Line	Near Khemini Chak & Ford Hospital

Source of Data: Detailed Project Reports.

The ownership of the land identified for SPS A of Digha and SPS B of Kankarbagh is with Patna Municipal Corporation, while SPS A of Kankarbagh lies with the Bihar Raj Jal Parisha (BRJP). A portion of land identified for SPS- B of Digha is in possession of the Patna Municipal Corporation and another portion with Irrigation Department. All area/site location identified shall be handed over to BUIDCO prior to commencement of the Project.

* Bidders need to perform their own assessment and required surveys for the required information.
All information mentioned in table above is indicative only.

Existing Power Supply

HV System	
Voltage	11kV Nominal, 12kV highest

Frequency	50Hz	
Connection	3phase, 3wire	
Other Details*	11kV system maximum fault level 500 MVA	
LV System		
Voltage	415 V Nominal	
Frequency	50Hz	
Connection	4wire	
System earthing	Solidly earthed	
415 V maximum fault level*	50kA r.m.s. maximum	
Control voltage – Instrumentation Power Supply, AC control, Lighting & space heating		
Voltage	110V	240V
Phases	1	1
Frequency	50Hz	50Hz
DC control voltage (for 11 kV switchgear and LV ACBs in main DBs)		
Voltage	110V DC	
Wires/earthing	2wire/unearthed	

** Bidders need to perform their own assessment and required surveys for the required levels. All information mentioned in table above are indicative only.*

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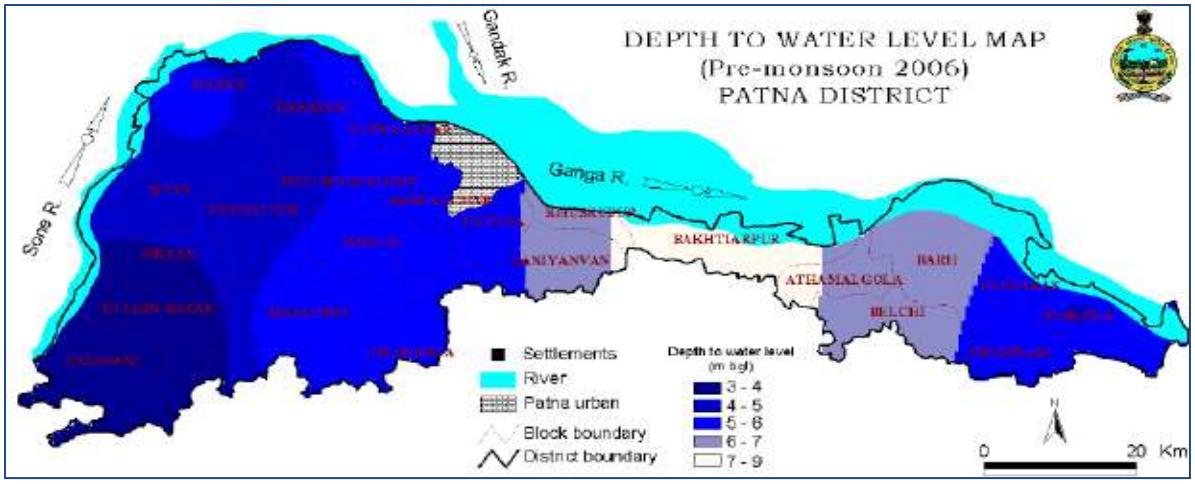
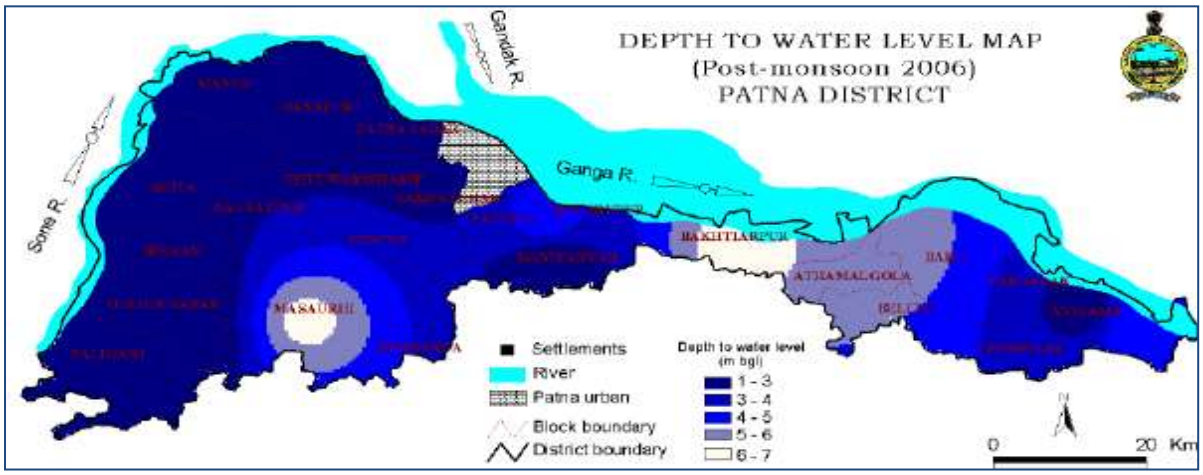
The concessionaire will be required to tap the 11 kV HT power from the metering panel and convey the same through cable to HT panel, onwards to the transformer for further distribution to all STP equipment through different LV distribution boards.

Existing Groundwater Scenario

Besides State Ground Water Investigation Department, Govt. of Bihar, CGWB has established a network of observation wells under National Hydrograph Network (HNS) programme to ascertain fluctuation and quality of groundwater in the district. There are about 12 HNS monitoring locations identified and being monitored every year regularly during January, May, August and November. During pre-monsoon season, the minimum and maximum water levels were observed as 3.00 and 8.57 m bgl respectively. About 25 % of the wells have the water level in the range of 2 – 5 m bgl. In majority of the wells (76 %), the water levels remain in the range of 5 – 10 m bgl. Below figures depict water level map of Patna district post monsoon and pre monsoon in year 2006.





Flow Details of Nala

The two proposed STPs have the following average Sewage flow rate:

Name of the Zone	Size of the projects Average Flows for Year 2035	Average Flows for Year 2050
Digha	100 MLD	116 MLD
Kankarbagh	50 MLD	75 MLD

Digha Nala details

NAME OF NALA	FLOW (IN MLD)			CONDITION
	MAXIMUM FLOW	AVERAGE FLOW	MINIMUM FLOW	
Mohmadpur Ghat	2.65	2.14	1.58	Untapped
Mainpur Raja Nala	50.54	41.6	29.55	Untapped
Kurji Pul Nala	60.93	52.87	45.27	Untapped

** Bidders need to perform their own assessment and required surveys for the required levels. All information mentioned in table above are indicative only.*

Quality Parameters of Drains in Digha Zone*

NAME OF NALA	pH	Alkalinity as CaCO3, mg/L	Total Dissolved Solids (TDS), mg/L	Total Suspended Solids (TSS), mg/L	Volatile Suspended Solids, mg/L	Bio chemical Oxygen Demand (BOD), mg/L	Chemical Oxygen Demand (COD), mg/L	Ammonical Nitrogen (AN), mg/L	Total Kjeldahl Nitrogen (TKN), mg/L	Total Phosphorus, mg/L
Mohmadpur Ghat	7.1	184	472	195	89	120	232	0.6	1.2	1.3
Mainpur Raja Nala	7.3	184	453	180	117	130	232	0.4	1.0	1.1
Kurji Pul Nala	7.5	200	480	66	51	160	310	0.9	2.2	5.1

** Bidders need to perform their own assessment and required surveys for the required levels. All information mentioned in table above are indicative only.*

Kankarbagh Nala details

Sr. No.	Drain Name	Outfall Point	Length (km)	Measured Flow (m^3 for 12 hrs.)
1	Pahari Nala Outfall	Extended part of Jogipur Pumping Station to Pahari Pumping Station	4 km	9426

Quality Parameters of Drain in Pahari Outfall Zone**

NAME OF NALA	pH	Total Dissolved Solids (TDS), mg/L	Total Suspended Solids (TSS), mg/L	Volatile Suspended Solids, mg/L	Bio chemical Oxygen Demand (BOD), mg/L	Chemical Oxygen Demand (COD), mg/L	Total Kjeldahl Nitrogen (TKN), mg/L	Total Phosphorus, mg/L	Chlorides	Sulphates	Sulphides	Total Coliform	Faecal Coliform
Pahari Nalla Oufall Upstream	7	659	80	49	28	79	15	2	60	19	3	4173	823
Pahari Nalla Oufall Downstream	7	659	80	49	28	79	15	2	60	19	3	4173	823

** Bidders need to perform their own assessment and required surveys for the required levels. All information mentioned in table above are indicative only.*

Wastewater quality for the design of proposed STP for Digha & Kankarbagh zone is as tabulated below

Quality Parameters	Range (mg/l) except for pH
Ph	5.5 – 9.90
Bio chemical Oxygen Demand (BOD)	250
Chemical Oxygen Demand (COD)	450
Total Suspended Solids (TSS)	400
Total Kjeldahl Nitrogen (TKN as N)	45
Total Phosphorous (TP as P)	5

The quality parameters mentioned above are indicative for information purposes only; the Bidder will need to undertake appropriate assessments to ascertain the quality of influent wastewater.

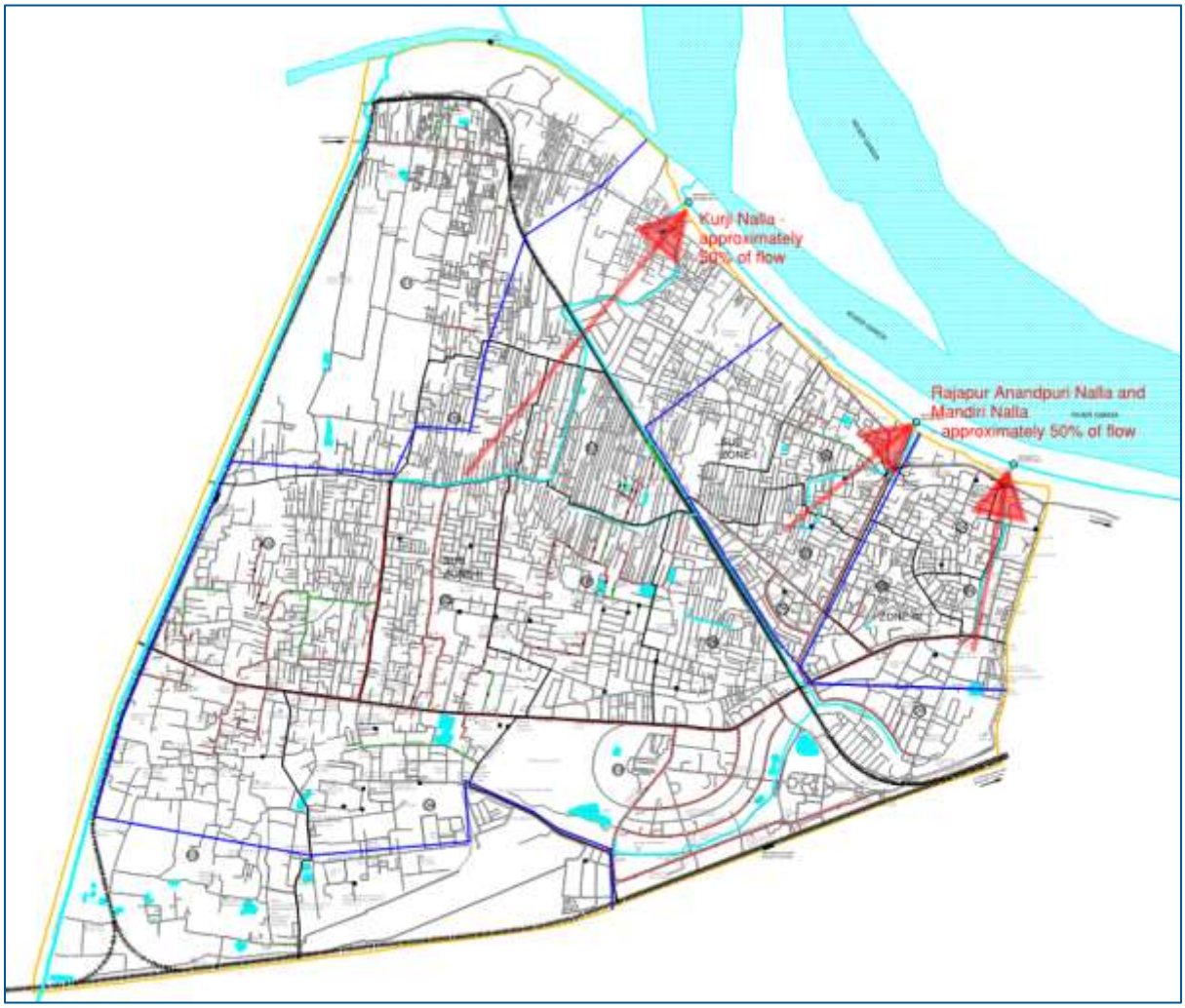
Technical Information about I&D Works and Flow Diversion Works

I&D Works for the Sewerage Zone of Digha

The figure below indicates that presently, approximately 50% of the raw sewage generated in Sewerage Zone of Digha flows through Kurji Nalla and remaining raw sewage flows through Rajapur-Anandipur Nalla and Mandiri Nalla.

It is proposed to utilize the raw sewage flows from the above mentioned nallas and divert to the new sewage treatment plant at Digha. The intention is to commission sewage treatment plant utilizing the raw sewage flowing into River Ganga, until the household connections to the new Sewerage Network are well-developed. In future, it is expected that the raw sewage will get diverted into the underground sewage collection system, once Sewerage Network and house connections are fully developed. It is also expected that the flow through various nallas will be limited to storm water flows. The I&D Works construction shall be constructed by 21 months from the Effective Date.

The figure below represents the flow paths at present:



The I&D works for Sewerage Zone of Digha includes the following components –

i. Option 1 for Interception and Diversion of Mandiri Nalla and Rajapur Anandipur Nalla –
   a. Tapping of Mandiri Nalla and tapping of Rajapur-Anandpuri Nalla at the location where these nallas meet a natural drain which runs parallel to River Ganga
   b. Laying an Intercepting Sewer along River Ganga to receive flows from Mandiri Nalla and divert to a new sewage pumping station at the location Rajapur-Anandpuri Nalla meets the natural drain which runs parallel to River Ganga
   c. Installation of a new sewage pumping station (I&D SPS-A) at Rajapur-Anandpuri Nalla including civil, mechanical and electrical works.
   d. Rising main from I&D SPS-A to new STP at Digha.
   e. Construction of permanent access road to the sewage pumping station.

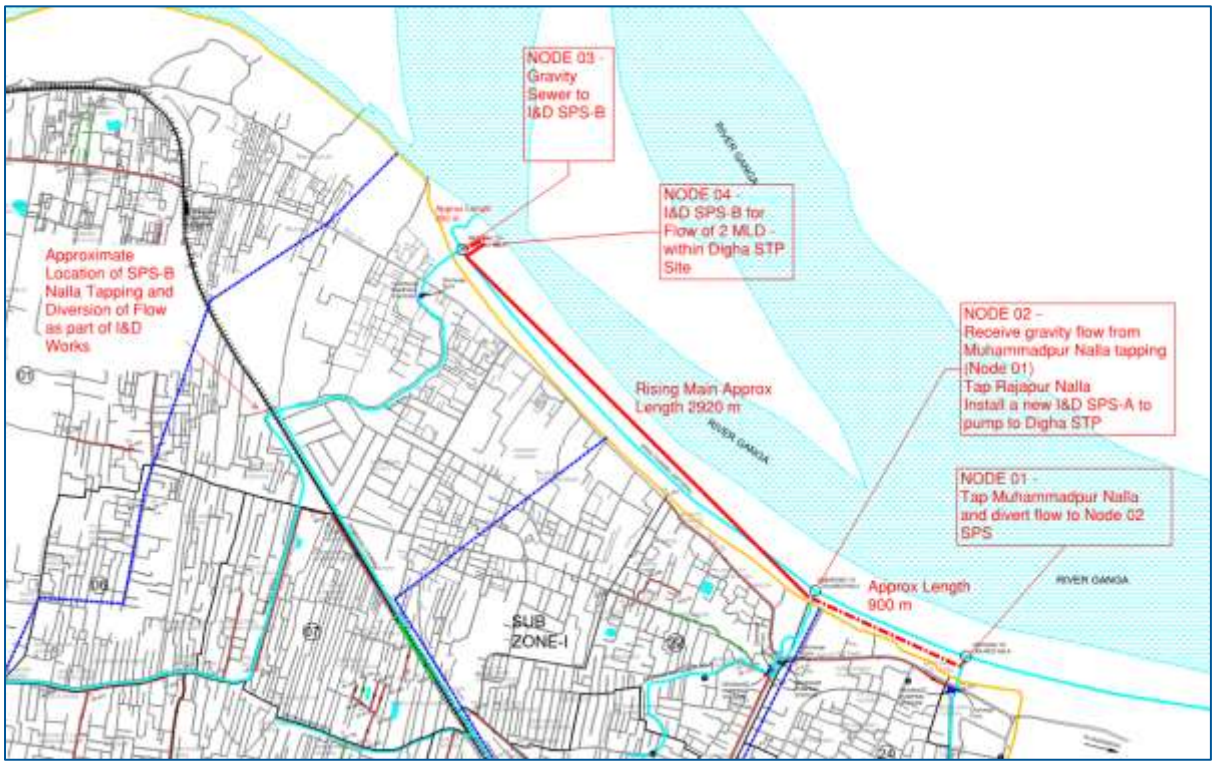
ii. Option 2 for Interception and Diversion of Mandiri Nalla and Rajapur Anandipur Nalla –
   a. Tapping of Mandiri Nalla and tapping of Rajapur-Anandpuri Nalla at the location where these nallas meet a natural drain which runs parallel to River Ganga
   b. Laying an Intercepting Sewer along River Ganga to receive flows from Mandiri Nalla and divert to a new sewage pumping station at the location Rajapur-Anandpuri Nalla meets the natural drain which runs parallel to River Ganga

c. Installation of a new sewage pumping station (I&D SPS-A) at Rajapur-Anandpuri Nalla including civil, mechanical and electrical works.
d. Rising main from I&D SPS-A to gravity network along East / West Boring Canal Road, Boring Road leading to new Sewage Pumping Station A (SPS-A)
e. Construction of SPS-A and the rising main to new STP at Digha
f. Construction of permanent access road to the sewage pumping station.
g. Option 2 includes re-design of the gravity network to accommodate flow from I&D SPS-A. It is expected that the flow from I&D SPS-A will reduce once Sewerage Network and house connections are developed. The gravity system needs to be checked for the performance of the future flows.
h. Option 2 also includes re-design of the SPS-A and the rising main, to accommodate any changes due to re-design of the gravity sewers leading to SPS-A.

iii. Interception and Diversion of Kurji Nalla –
a. Tapping of Kurji Nalla near the location of new Sewage Pumping Station B (SPS-B) which is part of Sewerage Network system
b. Diverting the Kurji Nalla sewage flow to the proposed SPS-B under Sewerage Network

iv. Interception and Diversion of Kurji Nalla (remaining flow) –
a. Tapping of Kurji Nalla at the location where Kurji Nalla meets the natural drain which runs parallel to River Ganga
b. Laying of Sewer line for untapped sewage flow of Kurji Nalla shall terminate into the land identified for Sewage Treatment Plant (STP) site at Digha.
c. Installation of a sewage pumping station (I&D SPS-B) at the STP site at Digha, including civil, mechanical and electrical works
d. Rising main from I&D SPS-B to the new STP at Digha.

The figure below represents the overall plan of I&D works, including Option 1 for the I&D SPS-A:



The figure below represents the overall plan of I&D works, including Option 2 for the I&D SPS-A:

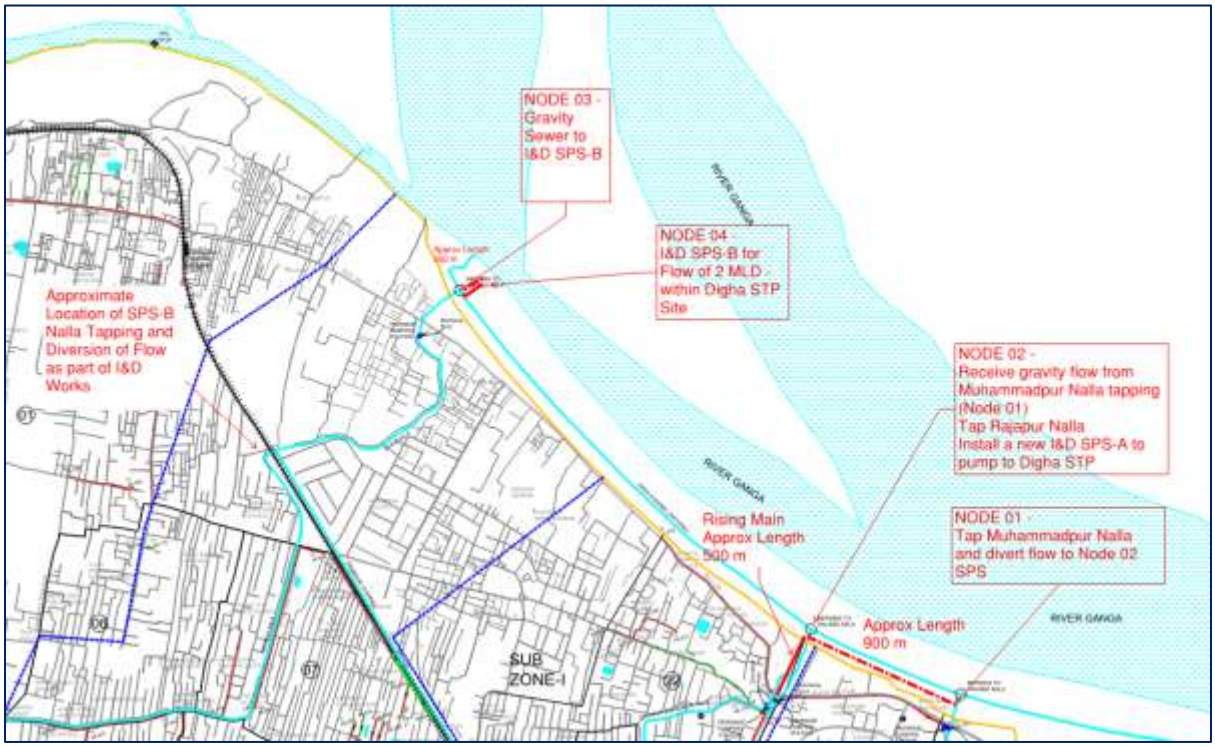


Table below indicates the flows at various nodes for Sewerage Zone of Digha:

From Node	To Node	Sectional Flow (lps) – average	Cumulative Flow (lps) – average	Peak Flow (observed by flow measurement)	Indicative Diameters (mm)
NODE 01	NODE 02	24.8	24.8	30.7	250 (Gravity)
NODE 02	Digha STP Inlet Works	Not applicable	506.25	615.625	700 (Rising Main)
NODE 03	Digha STP Inlet Works	23.1	23.1	2.25	250 (Gravity)
NODE 04	Dighat STP Inlet Works	23.1	23.1	2.25	150 (Rising Main)

The Sewage Pumping Stations shall be designed as below –

1. I&D SPS-A : Peak flow of 615 lps
2. I&D SPS-B : Peak flow of 23.15 lps

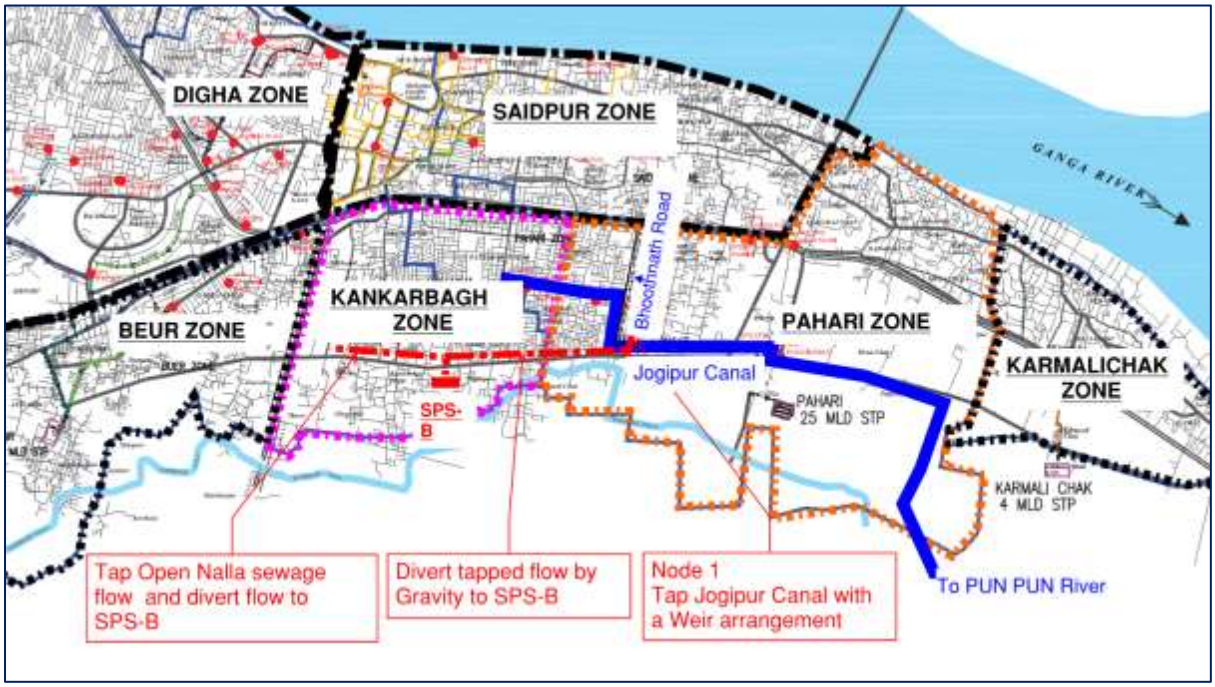
Flow Diversion Works for the Sewerage Zone of Kankarbagh

Following systems/ components shall be added for flow diversion works at Sewerage Zone Kankarbagh. The Flow Diversion Works construction shall be constructed by 21 months from the Effective Date.

1. A weir arrangement in the existing concrete channel from the existing Jogipur Drainage Pumping Station leading towards Pahari Pumping Stations, at the intersection of Bhoothnath Road with Patna-Bhagalpur National Highway.
2. Divert the flow from the concrete channel at a suitable location upstream of the weir, by way of laying a gravity trunk sewer of approximate diameter 1200mm of 1000 m long, along north of Patna-Bhagalpur National Highway, leading towards the new SPS-B planned for Kankarbagh Zone, with trenchless technology for the national highway crossing. Liaise appropriate authority to obtain the necessary permission, along with BUIDCO for laying and crossing of the national highway.
3. Collect wastewater north of Patna-Bhagalpur National Highway from west of Kankarbagh Zone, provide new culvert to cross the national highway for combined flow from Bhoothnath Road junction, convey the collected sewage to SPS-B.
4. The gravity system shall be designed for 25 MLD of average flow (with peak factor of 2.25). The Concessionaire shall confirm the actual flow by flow measurement before designing the system.
5. SPS-B and the associated rising main including all civil, mechanical and electrical and I&C works
6. The sewage pumping station shall be designed for the flows of 170 MLD peak flow for civil works and 109 MLD peak flow (peak factor of 2.25) for M&E works with rising main of 1000 mm diameter and length of 3.8 km.
7. It is expected that for SPS-B, the flow will gradually increase.

The figure below represents Flow Diversion Works for Kankarbagh.

Flow Diversion Works for Kankarbagh



Site Photos

I&D WORKS FOR DIGHA –

Mohamadpur / Mandiri Nalla

Rajapur Nalla

Kurjipul Nalla at River Ganga

I&D WORKS FOR KANKARBAGH –

Jogipur Canal (Seeing north – with Bhhothnath Road on East)

Tapping Point at Jogipur Canal (Looking toward East near Boothnath Road at National Highway NH98)

Open Ditch (on north along National HighwayNH98)

PROPOSED DIGHA STP – SITE

PROPOSED DIGHA STP SITE – LOOKING TOWARDS DIGHA BRIDGE

PROPOSED KANKARBAGH STP – SITE (ADJACENT TO EXISTING PAHARI STP)

(FISH POND – EXISTING PAHARI STP)

(AERATED LAGOON – EXISTING PAHARI STP)