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Transaction Advisory Services for the Centralized Effluent Treatment Plant (CETP) at Bangabandhu Sheikh Mujib Shilpa Nagar (BSMSN)

Business Case and Contract Structure

Revised Business Case Report

Submitted to:

Bangladesh Economic Zones Authority (BEZA)

Submitted by:
Association of Deloitte Touché Tohmatsu India LLP, India and BETS Consulting Services Ltd (BETS-Sub-Consultant), Bangladesh
(Association "Deloitte-BETS")

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List of Abbreviations

2030 WRG	2030 Water Resources Group
ACP	Anaerobic Contact Process
ACR	Anaerobic Contact Reactor
ARIPO	Acquisition/ Requisition of Immovable Property Ordinance
ASP	Activated Sludge Process
BDT	Bangladeshi Taka
BECA	Bangladesh Environment Conservation Act
BECR	Bangladesh Environment Conservation Rules
BEPZA	Bangladesh Export Processing Zones Authority
BEZA	Bangladesh Economic Zone Authority
BGMEA	Bangladesh Garment Manufacturers and Exporters Association
BNBC	Bangladesh National Building Code
BOD	Biochemical Oxygen Demand
BOT	Build Operate Transfer
BSCI	Business Social Compliance Initiative
BSMSN	Bangabandhu Sheikh Mujib Shilpa Nagar
CAPEX	Capital Expenditure
CCC	Clean Cloth Campaign
CDM	Clean Development Mechanism
CETP	Common Effluent Treatment Plant
COD	Commercial Operational Date/ Chemical Oxygen Demand
CPCB	Central Pollution Control Board, India
CSR	Corporate Social Responsibility
CWASA	Chattogram Water Supply & Sewerage Authority
DAF	Dissolved Air Floatation
DBFOT	Design Build Finance Operate Transfer
DBO	Design build operate
DO	Dissolved Oxygen
DOE	Department of Environment
DWASA	Dhaka Water Supply & Sewerage Authority
EC	Electro Conductivity
ECA	Environmental Conservation Act
ECA	Environmental Courts Act
ECC	Environmental Clearance Certificate
ECR	Environmental Conservation Rules

EHS	Environment Health and Safety
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EPC	Engineering, Procurement and Construction
EPR	Environmental Protection Rules
EPZ	Export Processing Zone
EQS	Environmental Quality Standards
ETAD	Ecological and Toxicological Association of Dyes
ETI	Ethical Trade Initiative
ETP	Effluent Treatment Plant
EZ	Economic Zone
FWF	Fairtrade, Fair Wear Foundation
FY	Fiscal Year
GDP	Gross domestic product
GIIP	Good International Industry Practice
GLSS	Gas-Liquid-Solid Separator
GOTS	Global Organic Textile Standard
GPP	Guidelines for People's Participation
GWI	Global Water Intel
HAM	Hybrid Annuity Model
IE	Independent Engineer
IEE	Initial Environmental Examination
IFC	International Finance Corporation
IRR	Internal Rate of Return
IWM	Institute of Water Modelling
KL	Kilolitre
kW	Kilowatt
kWH	Kilowatt Hour
MBBR	Moving Bed Bio Reactor
MBR	Membrane Bioreactor
MLD	Millions of Litres Per Day
MW	Megawatt
NEMAP	National Environment Management Action Plan
NGO	Non-Profit Organization
NOC	No Objection Certificate
NPC	Net Project Cost

NPV	Net Present Value
NWMP	National Water Management Plan
OEM	Original Equipment Manufacturer
OMT	Operation, Maintenance and Training
OPEX	Operational Expenditure
PAA	Property (Emergency) Acquisition Act
PPP	Public-private partnership
PSC	Public Sector Comparator
RO	Reverse Osmosis
RSL	Restricted Substance List
SA	Social Accountability
SBR	Sequencing Batch Reactor
SS	Suspended Solid
STP	Sewage Treatment Plant
SWTP	Surface Water Treatment Plant
TDS	Total Dissolved Solid
TOR	Terms of Reference
TSS	Total Suspended Solids
TTP	Tertiary Treated Plant
UASB	Up Flow Anaerobic Sludge Blanket
USD	United States Dollar
VAT	Value Added Tax
VFM	Value for Money
WACC	Weighted Average Cost of Capital
WRAP	Worldwide Responsible for Apparel Production
WTO	World Trade Organization
WWTP	Waste Water Treatment Plant

Executive Summary

The Bangladesh Economic Zones Authority (BEZA) is developing the Bangabandhu Sheikh Mujib Shilpa Nagar (BSMSN) Economic Zone to support the Government's initiative of promoting industrialization in the country. To mitigate the negative environmental impacts of such large-scale industrialization and ensure sustainable industrial growth, setting up of a Central Effluent Treatment Plant (CETP) is an integral part of the overall initiative. In this context, the association of "Deloitte Touché Tohmatsu India LLP with BETS" is assisting BEZA to come up with business case options for the design, finance, construction and operation-maintenance of a CETP in the Bangabandhu Sheikh Mujib Shilpa Nagar 2A Zone and subsequently support in the tendering and award of the project.

The study team has conducted literature survey, site visits, interacted with client and stakeholders to develop an understanding of the project. Various stakeholders across sectors including investors in BSMSN Economic Zone, Original Equipment Manufacturers (OEMs) and CETP developers, Client side stakeholders and end users of the treated water from the CETP have been consulted for the development of the Business Case options. The team has examined various CETP experiences in Bangladesh and similar industrial zones across the world. Subsequently the team has conducted a financial feasibility analysis for setting up the CETP project in BSMSN - 2A. The team has prepared alternative business cases and project structuring options for the proposed CETP project and examined the financial analysis of the various business cases.

The study team submitted a Draft Business Case report on 31st January 2019 and delivered a presentation on the report to BEZA on 13th February 2019. Based on the feedback received during the presentation, the study team submitted a Business Case Report on 26th February 2019. The study team further delivered a presentation to BEZA on 28th March 2019 and discussed the Business Case Report on 10th April 2019. Meanwhile, the study team addressed additional comments received from BEZA on 9th April 2019 and 14th May 2019 and submitted a Revised Business Case Report on 16th May 2019.

Thereafter, a market sounding workshop was held at BEZA on 30th June 2019. Based on the feedback received from the stakeholders in the consultation meeting, some key considerations were shared with BEZA on 9th July 2019. Subsequently, a meeting was held with BEZA officials on 8th August 2019 to discuss each of the key considerations. This modified Business Case Report is being submitted to the BEZA office after incorporating all the inputs received during the aforementioned meetings.

This report presents the broad project contours, project scoping, project structuring options, financial assessment and action points for BEZA.

Broad Project Contours

The study team has referred to the latest Master Plan and arrived at the effluent expected to be generated, based on an assessment of industry norms as well as interaction with the investors. To estimate the demand of effluent to be generated by the industries, two approaches were used – Bottom-up approach and Top-down approach.

Bottom-up approach: This approach comprises estimating effluent quantity of the industries based on the investment proposals submitted to BEZA. The total volume of effluent generation from 631.59 acres of processing land of BSMSN - 2A zone is estimated to be around 31 MLD[1] and the sewage is estimated to be around 0.93 MLD[1], thus taking the total effluent cum sewage generation to around 32 MLD. Similarly, the effluent volume projected from BSMSN - 2B is estimated at around 16 MLD[1].

Top-down approach: This approach comprises estimating effluent demand based on water demand calculated by Institute of Water Modelling (IWM). The demand calculated by this approach is in line with the demand calculated using Bottom-up approach.

To treat the effluent from BSMSN - 2A and BSMSN - 2B zones, a combined CETP of 48 MLD ultimate

[1] Subject to change based on finalization of plans by the tenant industries

capacity (32 MLD for BSMSN – 2A and 16 MLD for BSMSN – 2B) is required to be built.

To accommodate the different prevailing/proven effluent treatment technologies, about 18 acres of contiguous land has been earmarked by BEZA for development of the CETP. The influent norms at the inlet of the CETP have been considered to be set at BOD_5 – 600 mg/L, COD – 1260 mg/L and TDS – 2100 mg/L. The preliminary treatment of effluent will be under the scope of respective industries (upto the influent norms) to ensure successful CETP operations. In this regard, the industries will have to be mandated for pre-treatment of the effluent through individual ETP within their industry complex..

Project Components

The design philosophy of the project is envisaged as follows:

- *CETP*: CETP capacity will be enhanced in a modular stage wise manner. The electromechanical equipment will be installed/commissioned in stages over the years. However, the civil works will be constructed in a single stage for the ultimate capacity.
- *Effluent Network*: Effluent network will be constructed in a single stage. Effluent network operations will be carried out based on effluent load
- *Treated effluent/reuse network*: 70% of treated effluent can potentially be supplied for reuse. The Pumping station will be constructed in a single stage for full reuse capacity. Pump and rising main will however be installed in stages

The civil works for the ultimate capacity of the CETP is envisaged to be constructed in a single stage while the electromechanical equipment will be installed/commissioned in stages. It is envisaged that, in the year when the effluent load reaches 75% - 80% of the installed electromechanical capacity, the CETP Operator will augment the installed electromechanical capacity in the subsequent operating year. The initial electromechanical capacity of the CETP therefore is envisaged to be 16 MLD in the 3rd year of construction. It is envisaged to increase gradually to 48 MLD in the 9th year of construction when all the industries in BSMSN - 2A and BSMSN - 2B are expected to function at peak capacity utilization. The effluent network will be built to support a maximum effluent load of 48 MLD. However, the operational capacity of the network will increase depending on the increase in the effluent load over time. The reuse water pipeline will be constructed to support 17 MLD reuse water initially. Later on, depending on the demand for reuse water by the industries, the reuse water network may be augmented to 34 MLD in 9th year of construction.

Project Development Scope

The preliminary treatment of effluent will be under the scope of respective industries to ensure successful CETP operations. In this regard, the industries will have to be mandated for pre-treatment of the effluent through ETP.

The following two options emerge for the scope of the project for the CETP developer:

1) Option 1: CETP + Reuse Water Pipeline + Effluent Network
2) Option 2: CETP + Reuse Water Pipeline

The CETP + Reuse water pipeline will be under the scope of CETP developer. Integrating the effluent network with the CETP will have the advantage of single point responsibility, which BEZA will find easier to manage. However, there are alternative arguments for excluding the effluent network from the scope of the CETP developer which are discussed in the project structuring section.

Reuse of Treated Effluent

The study team has examined various water reuse options. BSRM Power and Steel and Mc Donald Steel have indicated an interest in consuming the reuse (treated) water from the CETP. BSRM Power and Steel and Mc Donald Steel can use about 18 MLD treated water from the CETP. The potential of treated water reuse may increase with other industries expressing their interest in using the treated water. While the study team also considered other reuse options, this option has been selected based on higher prima facie commitment of the users.

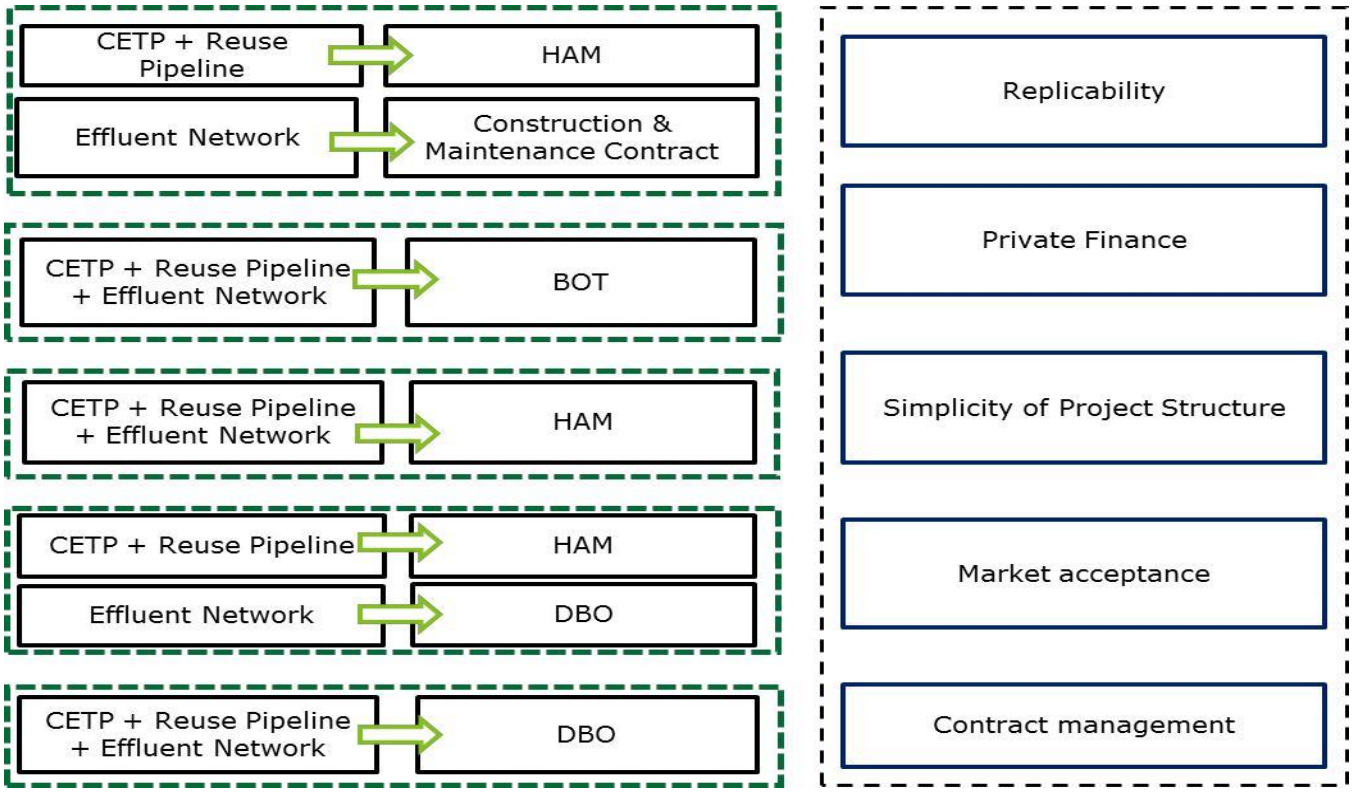
Project Structure

A Value for Money exercise has been carried out to evaluate an EPC option vis-à-vis a DBO (PPP) option for the above mentioned project scoping options to develop the 48 MLD CETP. The analysis shows that a *PPP option* provides more value to the Government.

Available PPP Options: Based on risk sharing arrangement between public and private parties and the components of the project, an assessment of various PPP options for engaging private sector was undertaken. The analysis brings out the following PPP options for consideration - Build Operate Transfer (BOT), Hybrid Annuity based PPP model (HAM)[2] and Design Build Operate (DBO).

Options for project structure:

Based on the considered PPP options, a total of five (5) project structuring options have been considered for detailed analysis - Build Operate Transfer (BOT), Hybrid Annuity based PPP model (HAM), Design Build Operate (DBO), a combination of HAM with a separate construction and maintenance contract and combination of HAM and DBO models. These options have been compared based on five parameters, namely private finance, simplicity of project structure, market acceptance, contract management and replicability. A comparison of these options is presented as follows:



Option 1: *Development of CETP + Reuse Water Pipeline on HAM basis and Effluent Network under a separate construction & maintenance contract:*

This option entails separating the development of CETP + Reuse Water Pipeline on HAM basis and the Effluent Network under a construction & maintenance contract. The project structure is relatively simple as there are two separate contracts and allows private finance of BDT 819 million (around 44% of the cost). Further, development of effluent network involves item-wise quantity estimation at bid stage. These estimates could later vary based on on-ground conditions. Hence, an item rate based Construction and Maintenance contract is preferred for development of the effluent network as a

[2] Availability based mechanism with upfront capital cost and support from Government (Refer Annexure 9 for further details)

means to address such quantity variation. Moreover, if development of effluent network is considered under the scope of BEZA, it will ease coordination while constructing and laying down infrastructure such as effluent network, water pipeline, gas pipeline, cables, roads, which can be planned properly.

As this project structure involves development of the project under separate contracts, there will be no single point responsibility. Further, a delay in execution of the construction & maintenance contract will cause an undue delay in commissioning of the CETP project, resulting in delayed capital recovery. This reduces the market acceptance of this option. However, this delay risk can be mitigated by ensuring that the effluent network is completed before scheduled construction end date of the CETP.

Option 2: *Development of CETP + Reuse Water Pipeline + Effluent Network on BOT basis*

This option considers the development of the CETP along with the reuse water pipeline and effluent network under the Build Operate and Transfer mode of PPP project structuring. This option ensures single point responsibility with maximum private finance of BDT 1850 million (100% of the project cost). The model has high replicability in other Economic Zones and smooth contract management.

However, the important risks in context of the CETP project are the **Finance risk** and **Demand risk**. Recent experiences have shown that private CETP developers are unwilling to take the finance risk completely. Further, unlike Dhaka CETP project, BSMSN is a greenfield project. Therefore, the demand for effluent treatment is unclear and demand for offtake of treated (reuse) water will also develop over a period. Thus, the demand risk may not be passed onto the CETP operator and the same was evident in the Investor meeting held on 18th December 2018. Thus, the CETP developers may hesitate to bid for the project if it is based on BOT mode.

Option 3: *Development of CETP + Reuse Water Pipeline + Effluent Network on HAM basis*

This option considers development of the CETP + Reuse Water Pipeline + Effluent Network by the CETP developer on a Hybrid Annuity based PPP model. This model ensures single point responsibility of the entire project and allows private financing of BDT 1110 million (60% of the project cost) which can help BEZA in using the leftover funds for other projects. This structure has potential for replicability. Single point responsibility of the entire project allows smoother contract management.

However, there are three issues with this model. Firstly, this model is relatively new for Bangladesh market. Secondly, since CETP developers are essentially technology firms focusing in the area of effluent treatment, most of them do not possess expertise in the business of laying effluent network and would end up subcontracting the job of laying effluent network which comprises 26% of the overall project cost. Lastly, traditionally development of effluent network is practiced on item-rate basis.

However, effluent network development in greenfield projects will have lesser technical complications as there is no interference from other existing infrastructures and thus can be undertaken under this option. Further, from the market sounding activity it emerged that the CETP developers are open to consideration of this option for the development of the project.

Option 4: *Development of CETP + Reuse Water Pipeline on HAM Basis and Effluent Network on DBO basis*

As explained above, development of effluent network involves item-wise quantity estimation at bid stage. However, these estimates could later vary based on on-ground conditions. Thus, a bidder faces quantity estimation challenge for the effluent network, under the previous model. Hence, an item rate based project structure is preferred for development of the effluent network as a means to address such quantity variation. Thus, it emerges that effluent network development on non-investment based model such as DBO is preferable. Further, the CETP with Reuse Water Pipeline does not have this issue and is therefore preferable on HAM basis because it will allow private finance of BDT 819 million (around 44% of the cost).

However, a mix of project structures (DBO and HAM) as one tender package would make the tender complex, make contract management difficult, have low replicability and may possibly lower bidder interest.

Option 5: *Development of CETP + Reuse Water Pipeline + Effluent Network on DBO basis*

This option considers development of the CETP + Reuse Water Pipeline + Effluent Network on a DBO based PPP model. This project structure is straightforward, has potential for replicability, is acceptable to the market players, involves easier contract management, and lastly, it ensures single point responsibility.

However, there is no scope for private finance and the entire cost needs to be borne by BEZA. Since mobilizing private finance is important from BEZA's standpoint, this option has less preference.

The table below represents a qualitative comparison of the project structuring options across the five parameters considered for the study of the options.

Table 1: Qualitative Comparison of the Project Structuring Options

Structuring Options	CETP + Reuse Pipeline on **HAM** and Effluent Network under separate **construction and maintenance contract**	All Components on **BOT**	All Components on **HAM**	CETP + Reuse Pipeline on **HAM** and Effluent Network on **DBO**	All Components on **DBO**
Private Finance	Private finance of BDT 819 million (44% of the cost)	Maximum private finance of BDT 1850 million (100% of project cost)	Private financing of BDT 1110 million (60% of project cost)	Private finance of BDT 819 million (around 44% of the cost)	No scope for private finance
Market Acceptance	Potential delay risk and Finance risk	Demand Risk and Finance Risk	CETP players are more comfortable with CETP on HAM vis-à-vis network	CETP players are more comfortable with CETP on HAM vis-à-vis network	Acceptable in the market
Simplicity of Project Structure	Simple due to separate contracts	Relatively more complex than DBO	Relatively more complex than DBO	Complex tender structure	Simple project structure
Contract Management	Difficult Contract management but easier coordination	Uniformity in contract structure facilitates better management	Uniformity in contract structure facilitates better management	Relatively difficult contract management	Uniformity in contract structure facilitates better management
Replicability	Multiple contracts but straightforward	Single contract	Single contract, but no prior precedence	Single but two stitched contracts	Straightforward contract

Low | Medium | High | Very High

CETP to be developed on HAM: In the meeting held with BEZA on 13th February 2019, the study team informed that unlike Dhaka CETP project, BSMSN Economic Zone is a greenfield project. Therefore, the demand for effluent treatment is unclear and demand for offtake of reuse (treated) water will also develop over a period. Therefore, the demand risk may not be passed onto the CETP developer and the same was evident in the investor meeting held on 18th December 2018. While recent experiences have shown private players have lesser interest to take finance risk, it was understood that mobilizing private finance is important from BEZA's standpoint. Thus the development of the CETP on HAM basis was concurred upon as it can mobilize private finance and also passes the above defined qualitative parameters.

Relative merits of development of Effluent Network as a part of an integrated project vis-a-vis a separate construction and maintenance contract: During the meeting dated 13th February 2019, certain pros of developing the effluent network under a separate construction and maintenance contract were discussed, as explained in Option 1 above. It had emerged that this option could be further looked into. Thereafter, as per the "BEZA Committee Report on Structuring Option on Business Case Report" (attached with BEZA letter dated 14th May 2019), the following was noted:

1) This option provides better contract management through single point responsibility and overcomes the interface risk (due to delays in construction schedule and operations) that may arise in case of Option

2) BEZA's preference for leveraging private finance is a key consideration for selection of a project structure. Including the effluent network under the scope of the CETP Developer as per Option 3 can mobilize BDT 1110 million (60% of the project cost) of private finance

Considering the relative importance of ease of contract management and availability of private finance for BEZA, Option 3 involving the development of effluent network as a part of an integrated project has emerged as the preferred option after discussions.

Market Sounding in support of Option 3: During the market sounding exercise carried out by the study team with various national and international CETP developers, it emerged that while HAM is relatively new in Bangladesh market, the CETP developers are open to consideration of HAM based PPP mode of project development.

Therefore, considering the above, Option 3: Development of CETP + Reuse Water Pipeline + Effluent Network on HAM basis emerged as the preferred project structuring option, wherein BDT 1110 million of the project cost (BDT 1850 million) is privately financed (assuming a scenario of 40% upfront construction support and 60% private financing)[3].

The project period is envisaged for 15 years wherein the private operator will undertake the construction of the project in the initial 2 years, and will operate and maintain the project for the remaining 13 years and meet the pre-defined key performance indicators (KPIs) during the entire project period. Lapse in meeting the KPIs will attract penalties which will be deducted from operator payments.

Assuming a scenario where 60% of the project cost is financed by the operator, the operator will be paid (i) 40% of capital cost during construction phase (upto a maximum of BDT 740 million), (ii) 60% of capital cost during Operation & Maintenance (O&M) phase with interest as capex annuity and (iii) annual O&M costs based on quantity and quality of effluent treated.

An escrow account mechanism will also be put in place to offer payment security to the concessionaire and comfort to project lenders. BEZA will ensure that the escrow account is funded with the minimum escrow balance of next two payment milestones at all times during the project period.

Tariff Structure:

It is envisaged that industries in Zone 2A and Zone 2B discharging effluent into the effluent network

[3] Please refer Chapter-8 where some recent development have been outlined and evaluation of various scenarios of lower and higher upfront construction support have been presented along with pros and cons.

will be charged based on the quantity and quality of effluent discharged by them. Higher quantity and higher effluent load will be charged higher following a "polluters pay principle". The study team has followed different approaches to estimate the tariff rates for the project across the five proposed options. The prevailing tariff rates charged at Dhaka EPZ and Chittagong EPZ have been taken as benchmark rates. Based on the feedback from the investors in BSMSN Economic Zone, it is observed that a tariff rate of BDT 30 per KL or less (80% of the tariff rate at Dhaka EPZ) is desirable for the treatment of effluent. Based on the feedback from the potential users of the treated water, it is observed that a tariff rate of BDT 26.40 per KL or less is desirable for reuse water supply.

The tariff rates across the five project structure options have been estimated such that there is 20% equity returns to the private operator/ developer and the net project lifecycle cash flows for BEZA is zero in NPV terms.

It is observed that there has to be a trade off between higher private (deferred) financing and higher tariff rates vs lower private (deferred) financing and lower tariff rates. The tariff rate in case of BOT model is the highest which makes the project relatively less attractive. The tariff is second highest when all project components are procured on HAM basis.

If BEZA would like to keep the tariff rate low and also make private finance available, then HAM for CETP + Reuse pipeline + Effluent Network emerges as the available option. This option allows private finance of around BDT 1110 million (assuming 60% of the project cost is financed by private operator). The average effluent treatment tariff rate for this option is around BDT 44/KL[1]. The tariffs are expected to be in the range of BDT 33/KL[1] to BDT 60/KL[1]. This is indicative and subjective to change based on the load factor of the effluent.

A decision on the tariff rate to be charged to the industries in BSMSN EZ may be taken by BEZA based on the selected project structure, acceptance in the market and confirmation of offtake of reuse water by consumer industries.

Action Points for BEZA

The following are the key action points needed from BEZA for development of the project.

1. BEZA will co-ordinate for internal approval for *Option 3: Development of CETP + Reuse Water Pipeline + Effluent Network on HAM basis* and provide such further direction to the study team.
2. *BEZA's role as reuse (treated) water supplier*:
   BEZA will coordinate internal approval for providing payment guarantee to the CETP developer for the amount of reuse (treated) water produced, provided characteristics of the reuse (treated) water measured at the consumer end of the reuse water pipeline meets prescribed standards.
   Further, BEZA will coordinate internal approval for signing agreements for offtake of reuse (treated) water between: i) BEZA and BSRM Power and Steel, (ii) BEZA and McDonald Steel.
3. To ensure successful CETP operations, BEZA will mandate the industries for pre-treatment of the effluent through ETP
4. BEZA will coordinate and ensure synchronization of water supply contract and storm water management contract with the contract for the development of the CETP.
5. Select key considerations regarding the project structure had emerged as a result of the feedback received from the market sounding workshop and subsequent discussions with BEZA officials and other stakeholders (*Annexure 17*). The study team seeks the consideration and approval of BEZA on the same.

1. Introduction

The Bangladesh Economic Zones Authority (BEZA) is developing the Bangabandhu Sheikh Mujib Shilpa Nagar (BSMSN) Economic Zone to further catalyze economic growth in the country. In order to make the project sustainable, treatment of effluent from the investor industries in the Economic Zone is important. It is in this regard that the Association of Deloitte Touché Tohmatsu India LLP and BETS Consulting Services Ltd have been appointed by BEZA to provide consulting services for assisting in financial structuring of a Central Effluent Treatment Plant (CETP) in the Economic Zone and assisting BEZA in administering the Bid Process for bringing a Private CETP operator on board.

This chapter provides a brief understanding of the economic scenario of Bangladesh, BEZA's plan to develop economic zones in the country, objectives of this project and the work methodology that has been adopted by the study team, as well as a list of stakeholders consulted for this project.

1.1. Background

Bangladesh has had a strong economic growth of around 6 percent over the past five years. This increased economic growth can be attributed to the booming domestic market. The per capita has also correspondingly increased from USD 820 to USD 3190 during the time period (1990 to 2013).[4]

Industrial sector growth rate is higher compared to other sectors in Bangladesh

Services sector is the largest contributor to the country's GDP with around 54 percent, followed by the industrial sector at 30 percent while the remaining 16 percent comes from the agricultural sector. Interestingly, the country has been industrializing rapidly over the recent years with a high growth rate of 10 percent while that of services and agricultural sector are growing at 6 percent and 3 percent respectively. The major reason for this growth can be attributed to the Government's initiatives to create an investment friendly environment linking the country with free market economy and liberalizing trade. In order to foster industrialization, one of the significant steps taken by the government is the creation of industrial parks and economic zones.

Figure 1: Economic Zones of Bangladesh

Source: BEZA

Promoting development of Industrial Parks

As developing and increasing access to infrastructure services in industrial areas is critical for sustaining industrialization in the country, the government has recognized the role of private sector in extending infrastructure services to meet uncovered demands.

As part of the government's initiatives for promoting industrialization, over 60 economic zones have been envisaged to be developed. The BSMSN Economic Zone, is one of the largest and first multi-sector economic zones of the country. It is identified in the Pre-Feasibility Report for the BSMSN Economic Zone that industrial operations of such scale may have severe negative environmental impact if adequate provisions are not taken. These impacts could include - loss of fertility of land, risk of degradation of aquatic life due to chemical pollution, contamination of surface and groundwater, and leaching.

[4] BEZA Brochure, 2015, pg. 10

Mitigating environmental impact on account of development of Industrial Parks

To mitigate these impacts and ensure sustainable industrial growth, safe treatment and disposal of industrial waste water through a centralized effluent treatment plant becomes critical. Accordingly, the pre-feasibility study of BSMSN 2 Economic Zone which included the location and process design of a CETP facility in the BSMSN 2 Economic Zone was conducted.

BEZA has appointed the Association of Deloitte Touché Tohmatsu India LLP, India and BETS Consulting Services Ltd (BETS-Sub-Consultant), Bangladesh (Association "Deloitte-BETS") as the transaction advisors, to support in preparation of business case options for the CETP project, design an appropriate contract structure, assist in preparation of bid documents, assist in managing the bid process and assist in signing of the contract agreement.

1.2. Objectives of the project

The project is envisaged to be carried out in two phases; the first phase focuses on the preparation of a sound Business Case to support the development of the CETP while the second phase focuses on the transaction advisory services for the CETP. The broad scope related to the business case phase is as follows:

- Exploration and market sensitization of CETP opportunities, options, and technologies
  - Identification, assessment and evaluation of CETP experiences in Bangladesh and similar industrial zones across the world
  - Assessment of regulatory requirements, gaps and key issues including recommendations to mitigate them
  - Feasibility study for the expansion of the scope of the project to include BSMSN 1 and BSMSN - 2B and also evaluate the options to include sewerage network, supply and distribution of water coming out of the CETP
  - Consider options for reuse of treated water from the CETP for other bulk customers, especially power plants
  - Exploration of various CETP procurement and structuring options between the CETP developer and BEZA
- Market sounding and capacity building activities

The broad scope related to the transaction advisory phase is as follows:

- Preparation of draft concession agreement based on the procurement option selected
- Preparation of tender/bid documents and assistance to BEZA during bid process management
  - Providing support to BEZA during bid evaluation process until financial closure in case of competitive tender
- Providing support in negotiation and signing of contract in case of negotiated procurement

1.3. Methodology adopted by the study team

The methodology adopted by the study team is in line with the objectives of the project. It involves preparation of the business case options for developing the CETP followed by contract documents preparation & support in signing.

Preparation of the business case

- Examining CETP experiences in Bangladesh and similar industrial zones across the world
- Examining existing practices - PPP guidelines, statutory guidance etc.
- Feasibility study for a PPP structure for CETP in BSMSN - 2A
- Preparation of alternative business cases and PPP structuring options for the proposed CETP project
- Initial market sounding amongst select prospective bidders
- Financial analysis of the project

Transaction advisory

During the transaction advisory phase, the study team will work on publishing the contract document for the development of the CETP along with other prerequisites required for successful execution of the project. A brief list of the methodology to be followed for the transaction advisory phase is provided below.

- Finalization of the contract structure through stakeholders consultation
- Identification of conditions precedent and preparation of contract documents for the selected project structure
- Market sounding and conducting of concessionaire outreach (already completed)
- Bid document publication and assistance in pre-bid meeting
- Evaluation of the bids and support in contract signing

1.4. Stakeholder Consultation

The study team consulted multiple key stakeholders across during the preparation of the business case. The following section provides a brief on the consultations held with stakeholders.

Consultation with Investors in BSMSN Economic Zone

The investors who have submitted their investment proposals for the BSMSN Economic Zone were consulted to understand their project implementation period, water requirements, effluent generation and treated water requirements for the successful development of the CETP. Survey questionnaires were prepared for the shortlisted investors in BSMSN Economic Zone, which were shared with them via e-mail and physical post sent by BEZA. The study team further met the investors and had multiple conversations to understand their CETP related requirements in details.

In this regard, a meeting with the investors was held under the Chairpersonship of Additional Secretary and Executive Member, Investment Promotion at BEZA on 18.12.2018 to reconfirm information provided by the investors in their respective investment proposals. The study team also interacted with authorities from Bangladesh Garment Manufacturers and Exporters Association (BGMEA) to collect information on the various industries that are going to set up industrial units in BSMSN - 2B Economic Zone.

Consultation with OEMs and CETP Developers

The study team interacted with multiple Original Equipment Manufacturers (OEMs) and CETP Developers to

a) understand their product offering to suit an economic zone featuring a variety of industry categories

b) understand if the CETP design offered is scalable and CETP module that can be added

c) understand the competing technologies available in the market along with their preliminary design and cost aspects.

d) understand their view regarding the scope of the CETP developer and project structure

Some of the key national and international CETP developers who were consulted include Flagship Ecosystems, Sigma Group, Chittagong Waste Treatment Plant Limited, FloWater, Degremont, Suez, Delcot Ltd., Acciona and the like. Details of the interaction with the developers is provided in *Annexure 13* and *Annexure 14*.

Client side Stakeholders

The key client side stakeholders consulted for the project include the following:.

- BEZA Team
- 2030 WRG group
- Bangladesh Export Processing Zones Authority (BEPZA)
- Institute of Water Modelling (IWM)

- Bangladesh Garment Manufacturers and Exporters Association (BGMEA)
- BSMSN Site Engineer

End Users for reuse of treated water

The development of the business case for the project involves assessment of feasibility of reuse of the treated water from the CETP. In this regard, the offtake of reuse water from CETP is required to be assessed.

The study team held discussions with potential investors in BSMSN regarding their willingness to reuse the treated water from the CETP in their proposed industries. It is a prevalent practice to reuse treated water in power plants and integrated steel cum power plants due to their sizeable water requirements. Such industries in the vicinity include BSRM Power and Steel Plant, McDonald Steel and RPCL Power Plant and therefore options for reuse treated water were discussed with them.

1.5. Report version and structure

The study team submitted a Draft Business Case report on 31st January 2019 and delivered a presentation on the report to BEZA on 13th February 2019. Based on the feedback received during the presentation, the study team submitted a Business Case Report on 26th February 2019. The study team further delivered a presentation to BEZA on 28th March 2019 and discussed the Business Case Report on 10th April 2019. Meanwhile, the study team addressed additional comments received from BEZA on 9th April 2019 and 14th May 2019 and submitted a Revised Business Case Report on 16th May 2019.

Thereafter, a market sounding workshop was held at BEZA on 30th June 2019. Based on the feedback received from the stakeholders in the consultation meeting, some key considerations were shared with BEZA on 9th July 2019. Subsequently, a meeting was held with BEZA officials on 8th August 2019 to discuss each of the key considerations. This modified Business Case Report is being submitted to the BEZA office on 30th October 2019 after incorporating all the inputs received during the aforementioned meetings.

This report focuses on identifying and evaluating the primary aspects pertaining to the development of the CETP that will help BEZA in making key decisions regarding the project.

Objective of this Report

- Estimate the quantity of effluent to be generated in BSMSN - 2A and BSMSN - 2B zones
- Determine the capacity of the CETP and the area requirement for the same
- Understand the necessity to increase the capacity of the CETP in phases
- Identify the options available for reuse of the treated water from the CETP and propose suitable reuse options
- Delineate the scope of the industries, CETP developer and BEZA for effective treatment of the effluent
- Present a financial analysis of the project and key implications
- Analysis of various project structuring options and proposing a suitable option for the project.

Chapters and annexures in the report

This report contains the chapters as presented in table below

Introduction	Chapter 1
Broad Project Contours	Chapter 2
Project Scoping	Chapter 3
Financial Assessment	Chapter 4
Project Structuring	Chapter 5
Conclusions and recommendations	Chapter 6
Value for Money Assessment	Annexure 1
Financials for the Project	Annexure 2
Environmental considerations	Annexure 3

National and International case studies	Annexure 4
Pollution load across industry	Annexure 5
Preliminary treatment by the industry	Annexure 6
Comments on allocation of land in the Economic Zone	Annexure 7
Basis of Project Structuring	Annexure 8
Overview of Hybrid Annuity Model (HAM)	Annexure 9
Technical aspects for designing the CETP	Annexure 10
Sample design of CETP and Effluent Network	Annexure 11
Questionnaires for the industries	Annexure 12
Minutes of the meetings	Annexure 13
Market Sounding	Annexure 14
Compliance with the Terms of Reference (ToR)	Annexure 15
Compliance with comments received from BEZA and 2030 WRG	Annexure 16
Select Key Considerations submitted to BEZA on 09.07.2019	Annexure 17

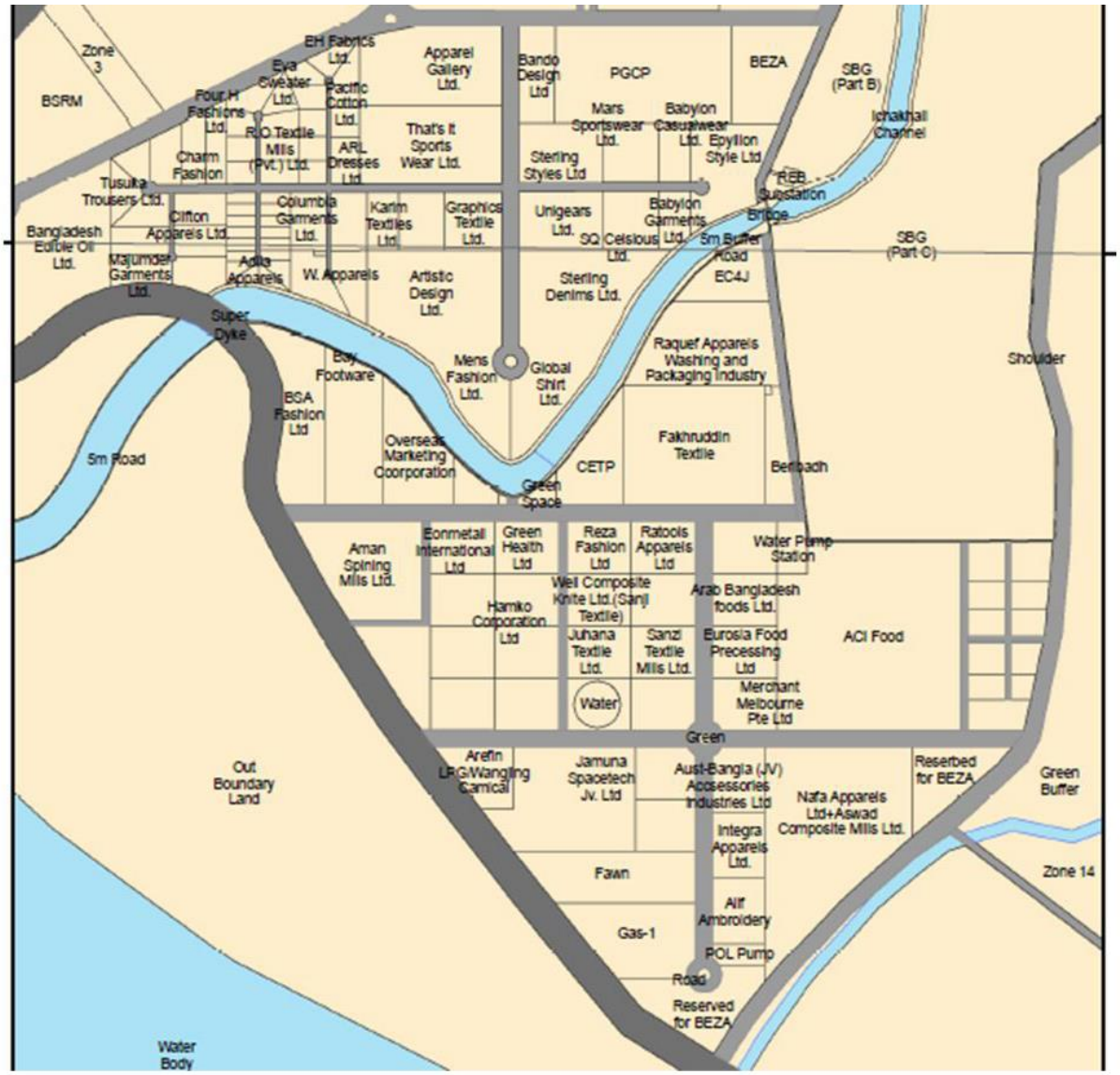
2. Broad Project Contours

This chapter presents the latest draft master plan of BSMSN - 2A and BSMSN - 2B zones. The study team has used the latest master plan to derive an industry wise area statement. Subsequently based on the area statement, the study team has estimated the volume of effluent to be generated from BSMSN - 2A and BSMSN - 2B zones. The thus generated estimated effluent volume has been taken into consideration to determine the capacity and area requirement for the CETP. Further, the study team has explored the potential for reuse of treated water from the CETP under various options. The study team has also presented the most preferred option for reuse of treated water.

2.1. Updated Draft Master Plan

The study team has reviewed the various revisions in the draft master plans developed for BSMSN - 2A dated 12th August 2018, 30th September 2018, 14th November 2018 and 18th December 2018 and incorporated the same in it's studies. This report is based on the latest master plan collected by the study team from BEZA dated 18th December, 2018.

Figure 2: Updated Draft Master Plan as on 18.12.18



2.1.1 Area and Land use plan emerging from the draft Master Plan for BSMSN - 2A & BSMSN - 2B

The land use plan as per the latest draft Master Plan is summarized in the table below.

Table 2: Area and Land use Plan for BSMSN - 2A and BSMSN - 2B

Zone	As per Draft Master Plan dated 18/12/18
	Areas of the Zones (in acre)
BSMSN - 2A	980
BSMSN - 2B	440
	No. of Plots
BSMSN - 2A	**34** (excluding BEZA plots)
BSMSN - 2B	67
	Land Use Plan for BSMSN - 2A
Commercial Area	9 acre
Processing Area	632 acre
Non Processing Area	340 acre
	Land Use Plan for BSMSN - 2B
Processing Area	415 acre
Non Processing Area	25 acre

The latest Master Plan was compared with the previous Master Plans published in earlier reports on the Economic Zone. It is observed that

The total area of BSMSN - 2A and BSMSN - 2B zones remained the same i.e. 980 acres and 440 acres respectively; however, the number of plots in BSMSN - 2A have reduced from 45 to 34 in the latest Master Plan, thus increasing the average size of the plots.

Further, the land allotted for development of the CETP as per the Terms of Reference (ToR) of the consultancy engagement was around 22 acres.

2.1.2 Other Information provided in the draft Master Plan

The latest Master Plan also provides information on

(i) the type of industries shortlisted for the Economic Zone

(ii) proposed allocation of land to the industries – location and area

2.2. Projected Effluent Quantity

Based on the above land use pattern and type of industries indicated in the latest Master Plan, the study team has projected the effluent generation from the industries in the BSMSN economic zone. The study team has undertaken two approaches to estimate the volume of effluent generated by the industries in the BSMSN zone.

Bottom-up Approach - Based on investment proposals submitted to BEZA, industrial norms and the emerging land use pattern, the team has estimated the volume of effluent generated by each of the industries that are proposed to be set up in the zone.

- Survey undertaken to refine effluent volume estimated under Bottom-Up Approach - The study team also conducted primary interactions with the proposed industries to be setup in the economic zone to understand their type of production, water utilization and resulting effluent volume. The team then incorporated the results of the survey to fine tune the effluent volume estimated as per Bottom-Up approach above.

Top-Down Approach – The team has studied a report on water demand in BSMSN economic

zone prepared by Institute of Water Modelling (IWM) to estimate the discharged effluent volume.

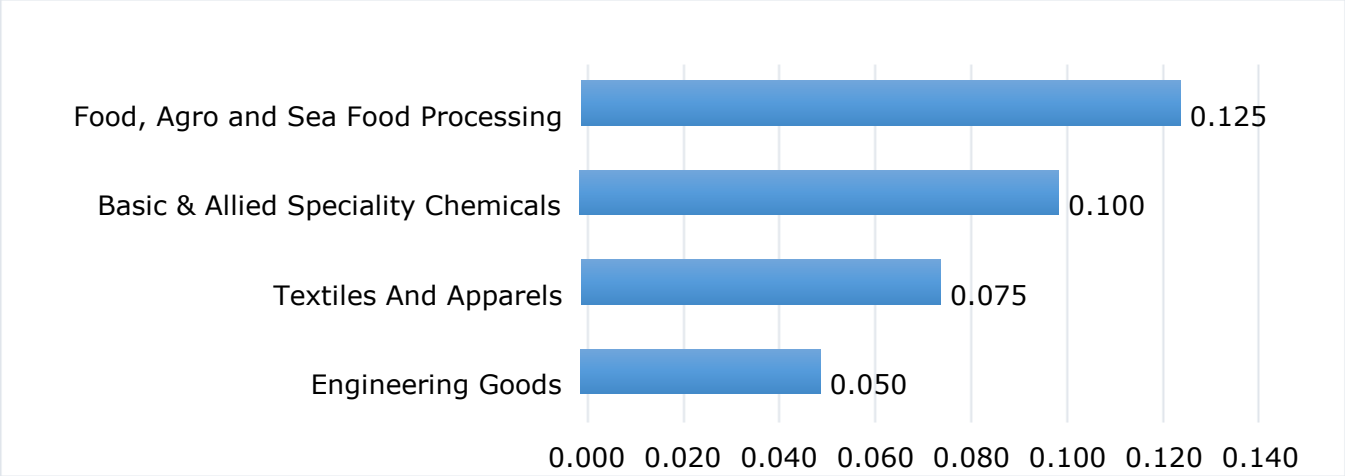
Bottom-up Approach – Estimation of volume of effluent and sewage generated by the industries based on water consumption norms

The study team has estimated the volume of effluent and sewage generated by the industries in BSMSN - 2A and BSMSN - 2B zones based on industrial water consumption norms. Further, the study team has conducted a survey of the potential industries to be setup in the economic zone to refine the effluent and sewage volume.

The proposed industries are broadly categorized into 4 broad industrial sectors and the volume of effluent generated by the industries was estimated accordingly.

The following figure shows the sector wise industrial water demand per acre based on the industrial norms. The proposed industries are grouped under these sectors to calculate their water demand and to subsequently estimate the volume of effluent generated by these industries.

Figure 3: Sector wise industrial water demand (in MLD per acre)

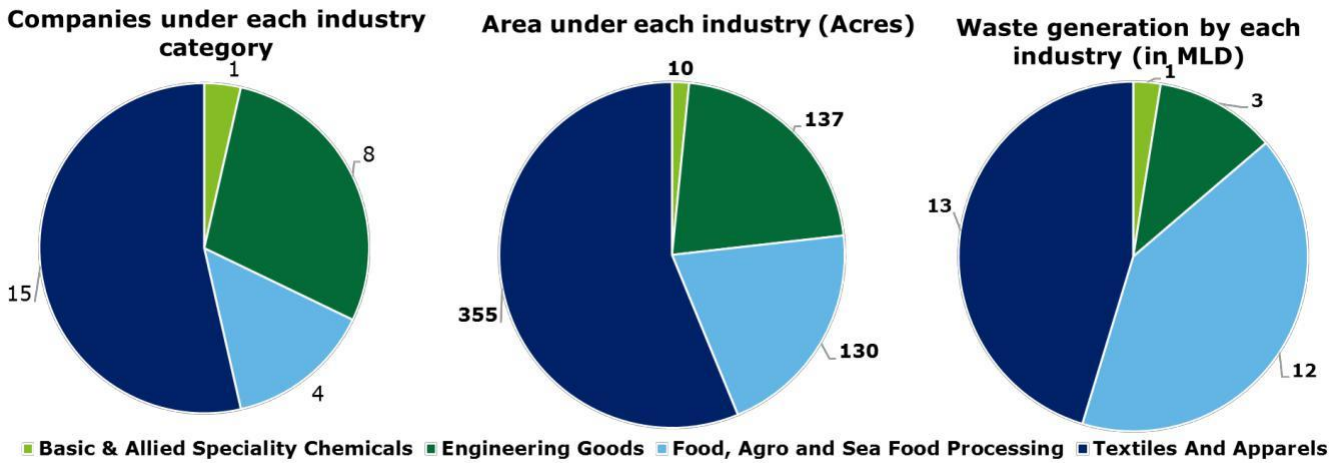


Estimation of volume of effluent and sewage generated by the industries to be set up in BSMSN - 2A

The sectoral breakdown of the industries proposed to be set up in BSMSN - 2A is given below. It is observed that majority of the industries belong to the textile and apparels sector followed by the food, agro and seafood processing sectors.

86% (26 MLD) of the total effluent volume is estimated to be generated by food processing and textile industries. While the food processing industry has been allotted 20% of the land, it only contributes to 41% of the volume of effluent generated by the industries in BSMSN - 2A. This is due to the high level of water consumption by the industry. Textile industry, engineering goods industry and chemical industry have been allotted 56%, 22% and 2% of the land respectively. However, they contribute to 45%, 11% and 3% respectively to the volume of effluent estimated to be generated.

Figure 4: Industry Categorization in BSMSN - 2A



In order to fine tune the effluent volume as estimated above, a survey questionnaire was shared with the industries proposed to be setup in the economic zone. It is observed that certain industries like LPG bottling industries and textile industries (concerned with stitching only) expressed no water requirement and thus, no effluent will be generated by these industries. This resulted in a reduction in the estimated effluent volume generated for the zone. The table below presents the effluent volume generated by each of the proposed industry in BSMSN - 2A as estimated based on industrial norms and further fine tuned using information provided in the survey.

Table 3: Effluent and Sewage Generation in BSMSN - 2A

Name of the Organization	Type of Industry	Processing Area (acre)	Effluent Generation (in MLD)
Green Health Limited	Chemical	10.02	0.75
Arefin Enterprises	Engineering Goods	10.00	0.46
Gas 1 Ltd.		25.03	0.00
Jamuna Spacetech		26.41	0.00
Eon Steel		9.98	0.44
Hamko		9.99	0.44
Sanji Steel/ Jahangir		9.98	0.44
Empty Plot		20.00	0.84
Fawn International		25.14	1.12
Arab Bangladesh Foods Ltd.	Food Processing	9.99	0.93
Eurasia Food Processing		10.01	0.94
Merchant Food		10.00	0.94
ACI		99.90	9.31
Aust-Bangla (JV)	Textiles And Apparels	10.01	0.64
Integra Design Limited		10.01	0.64
Palmal Group		70.08	0.00
Overseas		24.14	0.00
Bay Leather		24.97	0.00
Ratool Apparels Ltd.		10.03	0.64
Reza Dress Ltd.		10.01	0.64
Alif Embroidery		10.02	0.64
Juhana Textile		10.00	0.64
Sanzi Textile		20.00	1.28
Well Composite		19.96	1.28
BSA		25.11	1.60
Raquef Apparels		30.01	1.91
Aman Spinning Mills Ltd.		30.17	1.92
Fakhruddin Textile Mills Ltd.		50.61	3.23
Subtotal 'A'		631.59	~31
Sewage			0.93
Subtotal 'B'			0.93
Total (A+B)			**~32**

Industries that have indicated no effluent generation in the survey questionnaire/ Investment proposal

Summarily, based on industrial water consumption norms and survey of the industries proposed to be setup in the economic zone, the total volume of effluent generated in the 631.59 acres of processing land of BSMSN - 2A zone has been estimated to be around 31 MLD. Further, the sewage from the Economic Zone is estimated to be around 0.93 MLD, thus taking the total volume of effluent cum sewage generated by the industries in BSMSN - 2A to around **32 MLD**[1].

Estimation of volume of effluent and sewage generated by the industries to be set up in BSMSN - 2B

The BSMSN - 2B economic zone has been allotted to various medium and small-scale textile industries under the Bangladesh Garment Manufacturers and Exporters Association (BGMEA). The study team has estimated the volume of effluent generated by the industries in this zone based on similar norms as before. The study team has assumed that the industries with allotted plot size of 10 acres or more shall involve dyeing and washing processes that are water intensive. On the other hand, industries with allotted plot size of less than 10 acres will be concerned only with stitching related activities and thus would not be generating as much effluent. Based on these assumptions, the team has estimated the volume of effluent generated by the industries in BSMSN - 2B zone to be **16 MLD[1].**

Table 4: Effluent and Sewage Generation in BSMSN - 2B

Industry	Type of Industry	Processing area (acre)	Effluent generation (MLD)
Total area of industries with area >=10 acres	Textiles (Dyeing)	260	16
Total area of industries with area <10	Textiles (Only Stitching)	155	0
Subtotal 'C'		**415**	**16**

Estimation of combined volume of effluent and sewage generated by the industries to be set up in BSMSN - 2A and BSMSN - **2B zones**

The total volume of effluent cum sewage generated by the industries in BSMSN - 2A and BSMSN - 2B zones combined stands at **48 MLD.** In order to treat the effluent from both the zones, it is proposed to build a **48 MLD CETP** in the BSMSN - 2A economic zone.

Table 5: Effluent and Sewage in BSMSN - 2A and 2B

Location	Effluent Generation (in MLD)
BSMSN - 2A	32
BSMSN - 2B	16
Total	**~48**

Top-Down Approach – Estimation of volume of effluent and sewage generated by the industries based on water demand assessed in the IWM Report

The Institute of Water Modelling (IWM) has undertaken water demand assessment for the BSMSN Economic Zone. The Interim report – II prepared by IWM was reviewed and was compared with the findings of the study team.

Overall Water Demand-Supply Scenario of BSMSN (Zone 2A, 2B, 3, 4, 5):
As per the IWM report, the priority zones of BSMSN Zone 2A, 2B, 3, 4 and 5 have a water requirement of around 106 MLD. Only 51 MLD of this water demand can be fulfilled by ground water. Hence, to overcome water deficit in the zones, the institute has recommended developing a 50 MLD capacity Surface Water Treatment Plant (SWTP) in Phase 1. This SWTP will draw water from upstream of Ichhakali canal where the water is not brackish.

Table 6: Water demand as per IWM Interim Report – 2

Parameters	**BSMSN** (overall)	**BSMSN** (Zone 2A, 2B, 3, 4, 5)
Area(in acres)	30000	2000
Water demand (in MLD)	1350	**106**
Ground water availability (in MLD)	148	**51**
Water deficit (in MLD)	-	55 MLD

Zone wise Water Demand-Supply Scenario of BSMSN (Zone 2A, 2B, 3, 4, 5):

IWM has provided the zone wise water demand for the priority zones in BSMSN Economic Zone. The water demand in BSMSN - 2A and BSMSN - 2B has been estimated to be 42 MLD and 20 MLD respectively. This is based on the assumption that around 110 m^3/day of water is required per hectare of Gross Industrial area.

As per industrial norms, it is assumed that around 80% of water demand will be generated as effluent. The effluent demand for **BSMSN - 2A** as per the IWM report therefore is estimated to be around **33.6 MLD** and for **BSMSN - 2B** will be around **16 MLD.**

Table 7: Water Demand in Priority Zones

Zone Id	Total Demand (in MLD)
2A	**42**
2B	**20**
3	12
4	11
5	21
Total	106

This effluent volume calculated by the study team by this approach is in line with the volume calculated under Bottom-Up Approach (mentioned earlier).

2.3. Land Requirement:

Different CETP technologies have different area requirements. To accommodate the different prevailing/proven effluent treatment technologies, about 18 acres of contiguous land has been earmarked by BEZA for development of the CETP. This will facilitate more technology providers to participate in the bid process and help in inviting more bids.

2.4. Envisaged capacity of the CETP

In this section, the study team has proposed a phased development of the CETP under two scenarios-the first scenario is considers CETP will treat the effluent from BSMSN - 2A zone only and the second scenario considers that the CETP will treat the effluent from both BSMSN - 2A and BSMSN - 2B zones.

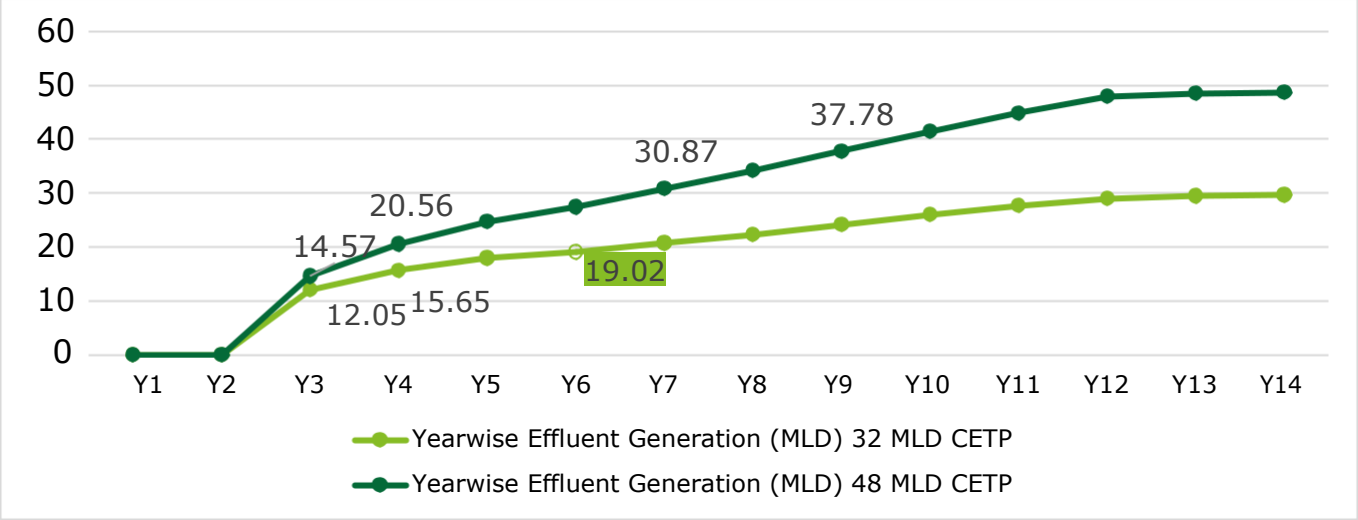
Studying year-wise effluent generation from the industries: The study team has reviewed the investment proposals submitted by industries to BEZA to understand year-wise effluent volumes:

In the investment proposals, the industries have indicated varied periods of construction and different commercial operational date (COD). This information indicates the year in which industries start generating effluent.

In the investment proposals, the industries have indicated gradual increase in their capacity utilization. With increase in capacity utilization, the volume of effluent from the industries will increase over the years. This information is used to estimate industry wise effluent volume over the operative years.

The following graph denotes the gradual increase in the volume of effluent generated by the industries in BSMSN - 2A (32 MLD CETP) and BSMSN - 2A and BSMSN - 2B combined (48 MLD CETP). The points highlighted in the graph denote the year in which the effluent volume reaches 75% - 80% of the installed capacity of the CETP, thus indicating installation of the next CETP module.

Figure 5: Yearwise Effluent Generation (MLD)



Phased development of the CETP: The study team has proposed a phased increase in the capacity of the CETP over the years to be able to treat the growing effluent volume from industries.

Defining the trigger year when capacity expansion occurs: The study team has assumed that in the year when the effluent volume reaches 75% - 80% of the installed capacity of the CETP, the CETP developer has to ensure an increase in the installed capacity of the CETP during the subsequent operating year. This allows increase in the capacity of the CETP prior to increase in effluent volume.

Scenario 1: Development of CETP for treating effluent from BSMSN - 2A only

The study team has estimated the effluent generation volume in BSMSN - 2A to grow over the years to **32 MLD**. Accordingly, there is a staggered increase in the CETP capacity over the operative years based on the estimated volume of effluent generated. The capacity shall be increased by installation of electromechanical modules of 8 MLD capacity. The following table indicates CETP capacity over the years

Table 8: Staggered increase in capacity of the 32 MLD CETP

Year of construction	CETP Installed Capacity (MLD)
3	**16**
4	**24**
6	**32**

Scenario 2: Development of CETP for treating effluent from BSMSN - 2A and BSMSN - 2B

The study team has estimated the effluent generation volume in BSMSN - 2A and BSMSN - 2B to grow over the years to **48 MLD**. Accordingly, there is a staggered increase in the CETP capacity over the operative years based on the estimated volume of effluent generated. The capacity shall be increased by installation of electromechanical modules of 8 MLD capacity. The following table indicates CETP capacity over the years.

Table 9: Staggered increase in capacity of the 48 MLD CETP

Year of construction	CETP Installed Capacity (MLD)
3	**16**
4	**32**
7	**40**
9	**48**

The initial capacity of the CETP is envisaged to be **16 MLD** with effluent volume growing over the years to reach the ultimate capacity of 48 MLD in the 9th year when all the industries in BSMSN - 2A and BSMSN - 2B shall be functioning at their maximum utilization capacity.

2.5. Key Takeaways

The key takeaways from this chapter are summarized below:

- Based on the latest Master Plan received from BEZA on 18th December, 2018, 12 acres of land has been allotted for the development of the CETP.
- To estimate the demand of effluent to be generated by the industries, two approaches were used – Bottom-up approach and Top-down approach.
  - *Bottom-up approach:* This approach comprises estimating effluent quantity of the industries based on the investment proposals submitted to BEZA. The total volume of effluent generation from 631.59 acres of processing land of BSMSN - 2A zone is estimated to be around 31 MLD and the sewage is estimated to be around 0.93 MLD, thus taking the total effluent cum sewage generation to around 32 MLD. Similarly, the effluent volume projected from BSMSN - 2B is estimated at around 16 MLD.
  - *Top-down approach:* This approach comprises estimating effluent demand based on water demand calculated by Institute of Water Modelling (IWM). The demand calculated by this approach is in line with the demand calculated using Bottom-up approach.
- Based on the gradual increase in effluent volume over the years, the CETP developer will expand the capacity of the CETP in phases. The installed capacity of the CETP increases from 16 MLD in year 3 of construction to 48 MLD in year 9 construction.
- To accommodate the different prevailing/proven effluent treatment technologies, about 18 acres of contiguous land has been earmarked by BEZA for development of the CETP.

3. Project Development Scope

In this chapter, the study team has presented various facilities forming part of a CETP infrastructure scheme. The team has described the design philosophy of the project to ensure best utilization of resources and to avoid creation of redundant capacity. The team has also described the scope of the CETP developer, infrastructure creation requirements for BEZA and facilities required to be setup by the industries.

3.1. Design philosophy of the project

Based on the increase in effluent volume generated by the industries in the zone over the years, the study team has envisaged a staggered capacity expansion of the CETP. This shall help in optimal utilization of the facilities and will ensure capital efficiency.
There are three major components involved in the development of the CETP infrastructure facilities- CETP, effluent conveyance network and treated effluent reuse pipeline. The design philosophy behind each of these component is mentioned below.

Central Effluent Treatment Plant

The civil works shall be constructed in a single stage for the ultimate capacity of the CETP. However, depending on the volume of effluent generated by the industries, the electro-mechanical works shall be commissioned in modules of eight MLD. This will ensure optimal utilization of the equipment and will prevent corrosion of the same. The operational cost of the CETP shall depend on the installed capacity of the CETP.

Effluent conveyance network

The effluent conveyance pipe will be laid for a pre-decided diameter corresponding to the ultimate effluent volume. Re-laying the pipe for a higher capacity in a subsequent year would involve discarding the earlier laid pipe. Since this is an avoidable expense, it would be prudent to lay the **effluent network for the ultimate effluent load in a single stage**. However, the operational expenses for the effluent network shall depend on actual effluent load.

Treated effluent reuse network

The civil structure of the pumping stations at the premises of the CETP and the reuse water pipeline from the CETP to BSRM and enroute industry shall be constructed in a single stage for full reuse capacity. The pumps and rising main shall be installed in stages depending on the demand for reuse water by the industries. However, the operational expenses for the reuse water network shall depend on actual reuse water load.

3.2. Envisaged phasing of the capacity expansion of the three project components

The phasing of the capacity expansion of the CETP has been considered for two

scenarios. Scenario 1: For a 32 MLD CETP treating the effluent from BSMSN - 2A only

Scenario 2: For a 48 MLD CETP treating the effluent from BSMSN - 2A and BSMSN - 2B

In this section, the study team has described the phasing of the three components involved in the development of the CETP.

Scenario 1: Phasing of the project components for a 32 MLD CETP for treating effluents from BSMSN - 2A only

In this scenario, the civil works for the 32 MLD CETP shall be completed in a single stage. The electromechanical capacity will be increased gradually from 16 MLD in year 1 to 32 MLD in year 4 of operation of the CETP. The effluent conveyance network shall be built for the envisaged capacity of

32 MLD. However, the operational capacity of the effluent network shall increase depending on the increase in the effluent load over time. The reuse water pipeline shall be constructed to supply 17 MLD of treated water initially. Later on, depending on the demand for reuse water by the industries, the network may be augmented to supply treated water of 20.75 MLD in 8th year of its operation.

Table 10: Phasing for 32 MLD CETP

Year of Operation	CETP		Effluent Network		Reuse water pipeline	
	Installed capacity (MLD)	Operating capacity (MLD)	Installed capacity (MLD)	Operating capacity (MLD)	Installed capacity (MLD)	Operating capacity (MLD)
Year 1	Civil –32 E&M -16	16	32	16	17	
Year 2	Civil –32 E&M -24	24		24		
Year 4	Civil –32 E&M -32	32		32		
Year 8					20.75	

Scenario 2: Phasing of the project components for a 48 MLD CETP for treating effluents from BSMSN - 2A and BSMSN - 2B

In this scenario, the civil works for the 48 MLD CETP shall be completed in a single stage. The electromechanical capacity of the CETP will be increased gradually from 16 MLD in year 1 to 48 MLD in year 7 of operation of the CETP. The effluent network shall be built for the envisaged capacity of 48 MLD. However, the operational capacity of the effluent network shall increase depending on the increase in the load over time. The reuse water pipeline shall be constructed to supply 17 MLD of treated water initially. Later on, depending on the demand for reuse water by the industries, the network may be augmented to supply 34 MLD of treated water in 7th year of its operation.

Table 11: Phasing for 48 MLD CETP

Year of Operation	CETP		Effluent Network		Reuse water pipeline	
	Installed capacity (MLD)	Operating capacity (MLD)	Installed capacity (MLD)	Operating capacity (MLD)	Installed capacity (MLD)	Operating capacity (MLD)
Year 1	Civil –48 E&M -16	16	48	16	17	
Year 2	Civil –48 E&M -32	32		32		
Year 4	Civil –48 E&M -40	40		40	27	
Year 7	Civil –48 E&M -48	48		48	34	

3.3. Components of project scope for the CETP developer and Industry

The study team has evaluated the scope of the CETP developer based on discussions with CETP developers and consideration of various aspects of the project. It is observed that while the scope of the developer should include development of the CETP and reuse water pipeline, the effluent network may or may not be included within the scope. Therefore, the following two project options may be considered for determining the scope of the CETP developer:

Option 1: Development of CETP + Reuse water pipeline with Effluent network
Option 2: Development of CETP + Reuse water pipeline without Effluent network

Key considerations for Option 1: CETP + Reuse water pipeline with Effluent network

The study team considered the following aspects for including the effluent network within the scope of the CETP developer:

Single point responsibility: Including the effluent network within the scope of the developer ensures single point responsibility and can be achieved through a single tender.
Mitigation of the risk arising due to delay in construction of the effluent network: A delay in execution of the construction & maintenance contract will cause an undue delay in commissioning of the CETP project. This reduces the market acceptance of this option. However, this delay risk can be mitigated by ensuring that the effluent network is completed before the scheduled construction end date of the CETP.

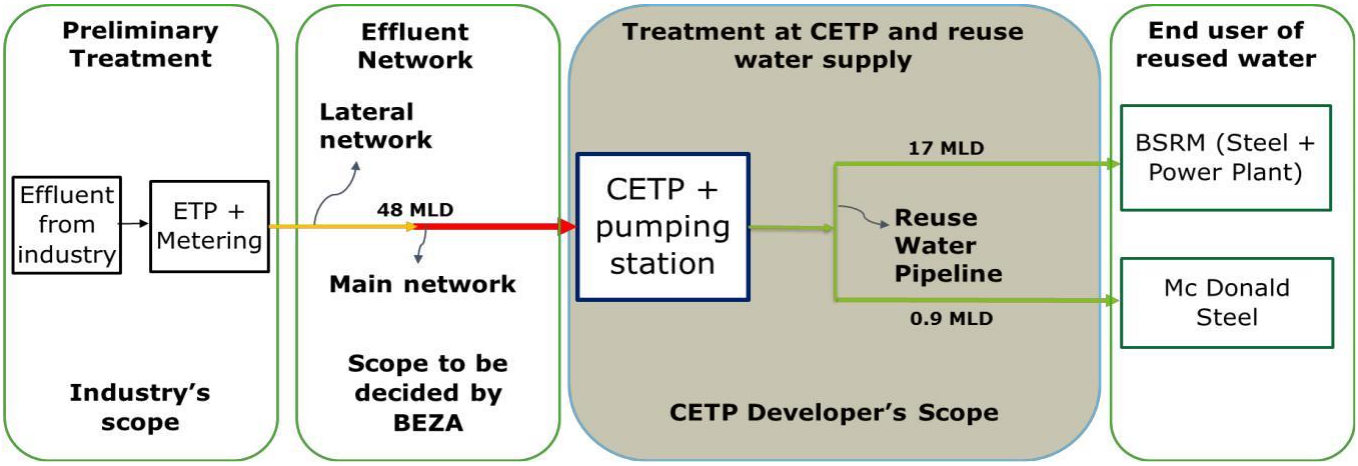
Key considerations for Option 2: CETP + Reuse water pipeline without Effluent network

The study team considered the following aspects for including the effluent network within the scope of the CETP developer:

Discussion with developers: Discussions with some CETP developers suggests that they are reluctant in effluent network being included in part of CETP developer's scope as they are focussed in the area of effluent treatment and not effluent conveyance. Further, laying effluent network will require obtaining permissions and coordination work which they are not keen to handle.
Financial analysis: It is observed that exclusion of Effluent Network from the developer's scope increase the percentage of capex recovery and improves the project returns.
Preferred project development structure for CETP + Reuse water pipeline is different from that of effluent network: Development of effluent network involves item-wise quantity estimation at bid stage. However, these estimates could later vary based on on-ground conditions. Hence, an item rate based Construction and Maintenance Contract/ DBO and is preferred for development of the effluent network as a means to address such quantity variation. Thus, it emerges that effluent network development on Construction and Maintenance Contract/ DBO basis is preferable.
Development of CETP + Reuse water pipeline is achievable on HAM based PPP mode which also brings in private finance for the project. Therefore, development of CETP + Reuse water pipeline on HAM basis is preferable.
This is further reviewed in Chapter 5 on Project Structuring.

Based on the above evaluation, the study team has summarized the scope of the CETP developer, BEZA and the industries in the figure below.

Figure 6: Components of project scoping



Creation of Project facilities by the Industries (with necessary orders from BEZA)

The study team has identified that preliminary treatment of the effluent before discharge into the effluent conveyance system is necessary to meet the inlet standards of the CETP. It is also required to avoid discharge of unwanted hazardous waste and chemicals that can damage the CETP and corrode the effluent conveyance pipeline. Before discharging the effluent to the CETP, it is suggested that the following project components are developed by the industries:

- Effluent Treatment Plant (ETP) at the industry premises to achieve industry specific pretreatment standards
- Meters to measure effluent flow and pre-defined effluent characteristics
- Pumps (if any) for pressured effluent supply from ETP to CETP

Creation of Project facilities by the CETP Developer

The CETP + Reuse water pipeline will be under the scope of CETP developer. Integrating the effluent network with the CETP will have the advantage of single point responsibility, which BEZA will find easier to manage. However, there are alternative arguments for excluding the effluent network from the scope of the CETP developer which are discussed in *Chapter 5: Project Structuring*.

3.4. Key Takeaways

- The effluent volume generated by the industries in BSMSN - 2A and BSMSN - 2B will increases over the years to 48 MLD. Accordingly, a staggered capacity expansion of the 48 MLD CETP over the operative years is envisaged.
- It is suggested that the effluent should undergo preliminary treatment by the industries at their premises and to be then discharged into the effluent conveyance system. Therefore, an ETP, pump, and meter at the industry premises is suggested.
- Based on analysis of the project scope by the study team, the following two options may be considered for determining the scope of the CETP developer:
  - Option 1: Development of CETP + Reuse water pipeline with Effluent network
  - Option 2: Development of CETP + Reuse water pipeline without Effluent network

As mentioned above, the CETP + Reuse water pipeline will be under the scope of CETP developer. Integrating the effluent network with the CETP will have the advantage of single point responsibility, which BEZA will find easier to manage. However, there are alternative arguments for excluding the effluent network from the scope of the CETP developer, which are discussed in *Chapter 5: Project Structuring*.

4. Reuse of Treated Effluent

Considering limited availability of water in the economic zone, a major objective of the project is to promote water reuse. In this section, the study team has analyzed various options for reuse of treated water from the CETP. The team has then proposed the most feasible reuse option.

BSRM Power and Steel plant is an industry proposed to be set up in the BSMSN economic zone. Through their response to the survey questionnaire, BSRM Power and Steel Plant expressed their interest in utilizing treated water from the CETP in its industrial premises. The company expressed a demand of 12 MLD treated water for its power plant and 5 MLD for its steel plant. Further, McDonald steel has expressed interest in utilizing about 1 MLD of treated water from the CETP.

The study team has thus evaluated three options for the reuse of treated water from the CETP. The team has primarily focused on providing treated water from the CETP to BSRM Power and Steel Plant. The subsequent section presents the analysis of different reuse options along with a suggestion on the most optimal option.

Option 1: Reuse water supply to BSRM Power and Steel Plant and to enroute industries (McDonald Steel)

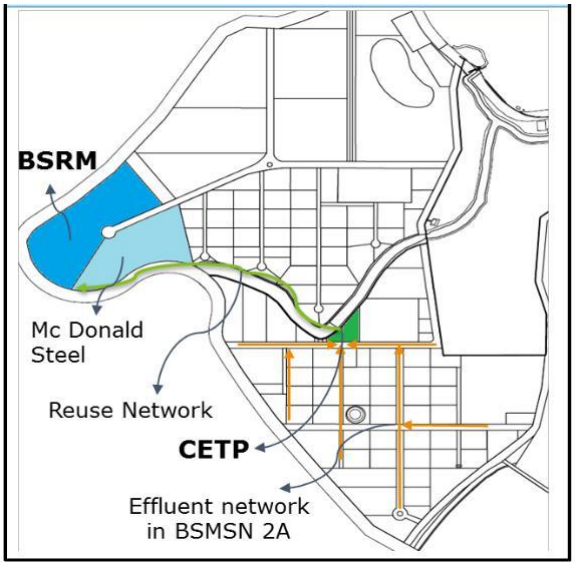
This option considers the reuse of treated water from the CETP by BSRM Power and Steel Plant and by industries in its close vicinity. McDonald Steel is proposed to be set up adjacent to BSRM Power and Steel Plant. The reuse water pipeline to BSRM can enroute supply water to McDonald Steel. Thus, the team has proposed to provide treated water from the CETP to BSRM and McDonald Steel for reuse purpose. Further, McDonald Steel has also expressed interest in using about 1 MLD of the treated water from the CETP.

Reuse Potential – 18 MLD

Capital Costs:
BSRM Power and Steel Plant – 18.09 BDT Crore Mc Donald – 2.71 BDT Crore
Total – 20.80 BDT Crore

Project Cost:
48 MLD CETP – **185.50 BDT Crore**

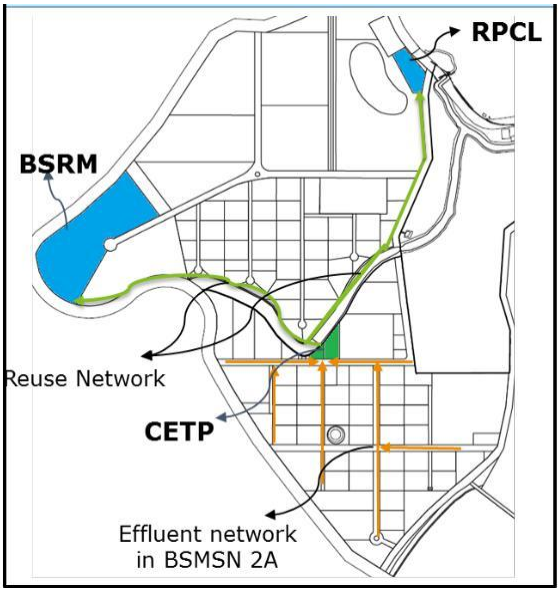
Figure 7: Reuse in BSRM and enroute industries (McDonald Steel)



Option 2: Reuse water supply to BSRM Power and Steel Plant and to RPCL Power Plant

This option considers reuse of treated water from the CETP by to BSRM Power and Steel Plant and to RPCL Power Plant. Compared to RPCL, BSRM is located closer to the CETP. Therefore, to save on pumping cost it makes sense to fulfill the water requirement of the closely located BSRM and the leftover reuse water be supplied to RPCL Power Plant. While doing so, it is observed that RPCL's water demand cannot be fully addressed with this reuse option. Further, the two power plants are distantly located, which is why this option requires construction of two separate pipelines to carry the reuse water from the CETP to the power plants. Clearly, the economies of scale due to a common pipeline in option 1 are not there in option 2 and hence it is more expensive. Hence, this option is not considered for reuse of treated water from the CETP.

Figure 8: Reuse in BSRM and RPCL



Reuse Potential – 17 - 18

MLD Capital Costs:

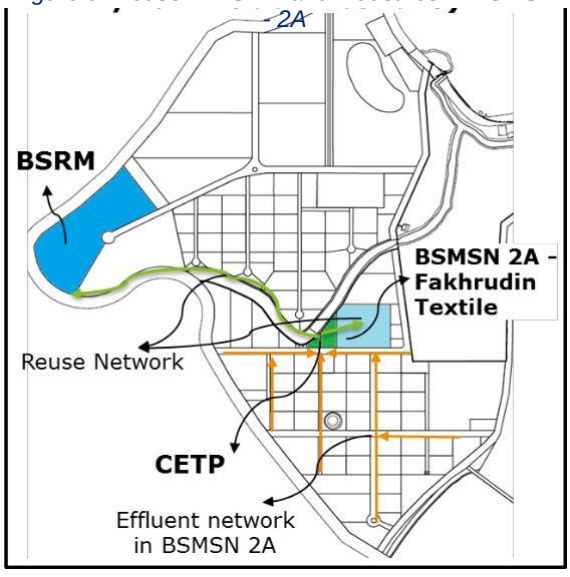
BSRM Power and Steel Plant – 18.09 BDT Crore
RPCL– 6.18 BDT Crore
Total –25.27 BDT Crore

Project Cost:
48 MLD CETP – **189.59 BDT Crore**

Option 3: Reuse water supply to BSRM Power and Steel Plant and to industries in BSMSN - 2A

This option considers the supply of 18 MLD treated water from the CETP to BSRM Power and Steel Plant and the rest of treated water to industries adjacent to the CETP. The industries proposed to be adjacent to the CETP have not yet shown interest in offtake of reuse water, thus it is premature to consider this option at this stage. Further, this option requires construction of two separate pipelines to carry the reuse water from the CETP to BSRM and to industries in BSMSN - 2A zone. . Laying of two separate pipelines therefore will increase the cost of the project. Hence, this option is not considered.

Figure 9: Reuse in BSRM and industries in BSMSN



Reuse Potential – 20.5

MLD Capital Costs:

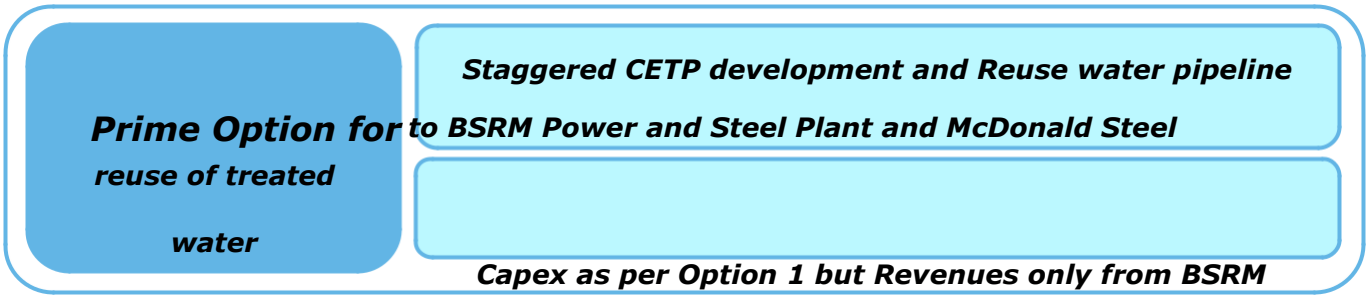
BSRM Power and Steel Plant – 18.09 BDT Crore Fakhruddin – 3.30 BDT Crore
Total – 21.39 BDT Crore

Project Cost:
48 MLD CETP – **185.71 BDT Crore**

Prime option for reuse of treated water

Based on the analysis of the three options for reuse of treated water from the CETP, it is observed that option 1 to supply treated water from the CETP to bulk consumer, BSRM Power and Steel and to enroute industry, McDonald Steel, is the most optimal option. This option has been selected based on higher prima facie commitment of the users. The potential of treated water reuse may increase with other industries expressing their interest in using the treated water.

Based on the envisaged capacity expansion of the CETP and reuse water option, the study team has presented the prime option for reuse of treated water.



Given the interest from BSRM Power and Steel and Mc Donald Steel, BEZA may coordinate internal approval for signing agreements for offtake of reuse (treated) water between: i) BEZA and BSRM Power and Steel, (ii) BEZA and McDonald Steel.

Additionally, BEZA may coordinate internal approval for providing payment guarantee to the CETP developer for the amount of reuse (treated) water produced, provided characteristics of the reuse (treated) water measured at the consumer end of the reuse water pipeline meets prescribed standards.

5. Project Structuring

This section presents the need for private sector engagement in the development of the project facilities. It provides an analysis of various structuring models available for the project. Based on the above assessment, the study team will suggest the most suitable models for the two project scoping options to develop the 48 MLD CETP.

5.1. Key considerations for project structuring

The key considerations involved in project structuring are as mentioned below.

- Assessment of relevant models for engaging private sectors
- Risk Assessment across project development structures and allocation of risk to suitable party
- Identification of the appropriate and preferred model for engaging private sector

5.2. Assessment of models for engaging private players

The study team has carried out a Value for Money exercise to evaluate an EPC option vis-à-vis a DBO (PPP) option for the two project scoping options to develop the 48 MLD CETP.

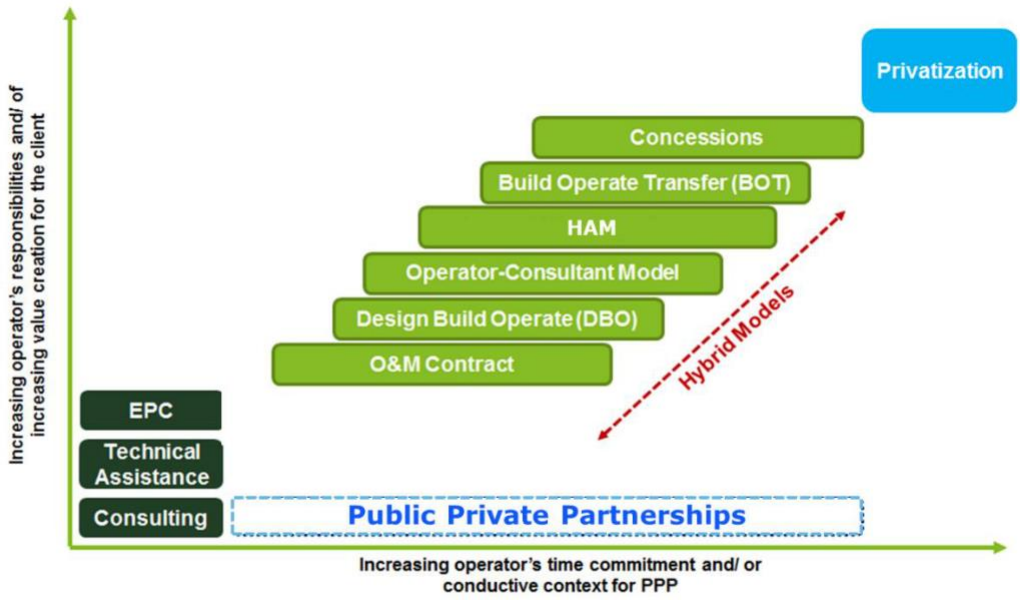
1) *Option 1: CETP + Reuse Water Pipeline + Effluent Network*
2) *Option 2: CETP + Reuse Water Pipelines*

The analysis shows that a PPP option provides more value to the Government. Please refer to Annexure 1 for a detailed Value for Money analysis. Hence, the study team has considered that project structuring is based on preferred risk sharing arrangement between public and private parties and components of the project. The exhibit below presents a continuum of project structures based on responsibilities that the private sector is willing to undertake. Please refer to Annexure 8 for a detailed description of the project structuring models.

(i) Minimal responsibility on the private sector - O&M contract

(ii)Maximum responsibility on the private sector – Concessions

Figure 10: Assessment of procurement models[5]



[5] Suez, 2014

The responsibility of private sector increases as we move from left to right on the graph above. In the O&M contract, the private player is not responsible for management decisions; however, the private player is responsible for entire operations and maintenance. In the operator consultant model, the private player is responsible for design of the project and supervision of construction. However, the private player is not responsible for construction but is responsible for operations and maintenance. In the Lease contract, the private player is responsible for design, construction and O&M, whereas the implementing authority does the financing of the project. In the BOT or other long-term concessions, the private player is responsible for financing the project.

5.3. Risk assessment across project structures

This section presents a basic risk assessment matrix to define the risk sharing arrangement between the private sector and the public sector. The assessment will assist BEZA in deciding the preferred risk sharing arrangement.

Preferred risk sharing arrangement by BEZA

BEZA has to decide on the preferred risk sharing arrangement keeping in mind what risks are acceptable to the private sector. The study team seeks validation on BEZA's preferred risk sharing arrangement in order to suggest a suitable project development structure.

Firstly, the risks associated with the project are mapped with the preferred PPP project structures. Risk allocation of the preferred project structures are then assessed to suggest the most appropriate model for development of the CETP. Further, the preferred models are shortlisted based on the general market perception about the project. The summary of risk assessment for various models is as follows:

Table 12: Risk Sharing Arrangement for various project-structuring options

Risk	BEZA's Preferred risk sharing arrangement	BOT	Hybrid Annuity (HAM) Financing Option	HAM + O&M	DBO Non-Financing Option
Commissioning risk	Private	Private	Private	Private	Private
Construction risk	Private	Private	Private	Private	Private
Design risk	Private	Private	Private	Public	Private
Commercial risk	Public	Private	Public	Public	Public
Financial risk	Public	Private	Public/Private	Public	Public
Performance risk	Private	Private	Private	Public/ Private	Private
Demand risk	Public	Private	Public	Public	Public
Enforcement risk	Public	Public	Public	Public	Public
Tariff risk	Public	Public	Public	Public	Public
Technology obsolescence risk	Private	Private	Private	Public	Private

Risk sharing mechanism that is in tandem with preferred/ optimal risk sharing arrangement is shaded in green. Risk sharing mechanism that is not in line with preferred/ optimal risk sharing arrangement is shaded in orange. Risk that may be shared by both parties is shaded in yellow. The analysis brings out the following PPP options for consideration **- Build Operate Transfer (BOT), Hybrid Annuity Model (HAM)[6] and Design Build Operate (DBO).**

6 Availability based mechanism with upfront capital cost and support from Government (Refer Annexure 9 for further details)

Key risks in the BEZA CETP project

The key risks in the context of the BEZA CETP project are classified under two categories i.e. Demand risk and Financial Risk

Demand Risk:

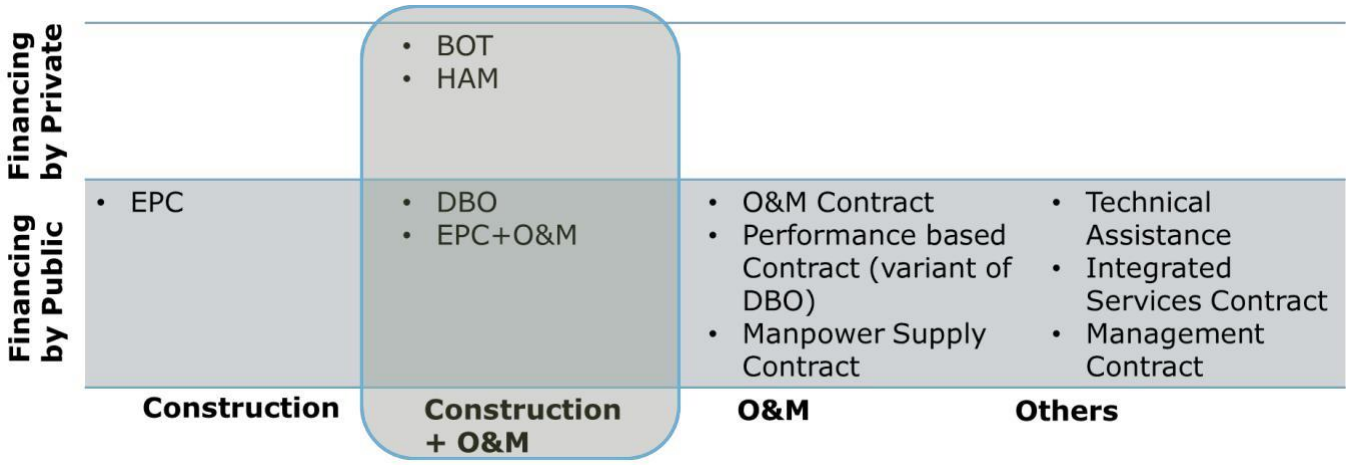
Unlike Dhaka CETP project, BSMSN is a greenfield project. Therefore, the demand for effluent treatment is unclear and demand for offtake of treated (reuse) water will also develop over a period. Therefore, the demand risk may not be passed onto the CETP operator and the same was evident in the Investor meeting held on 18th December 2018.

Financial Risk:

Recent experiences have shown private players have lesser interest to take finance risk. However, mobilizing private finance is important from BEZA's standpoint. Based on the market sounding conducted, some (five) players are open to Hybrid Annuity Mode.

The model for project structure needs to be shortlisted based on an assessment of Financing and Demand Risk. Based on the financing arrangement, the study team has classified different project structures in two categories and has presented below.

Figure 11: Project structure based on financial arrangement



Since, the private players are not willing to take demand risk; BOT is not a preferable mode of project structuring when compared to DBO and HAM. In addition, the private players have expressed reluctance to take complete financing risk. In the market sounding conducted, eight players indicated aversion for BOT.

5.4. Critical comparison of the project structures

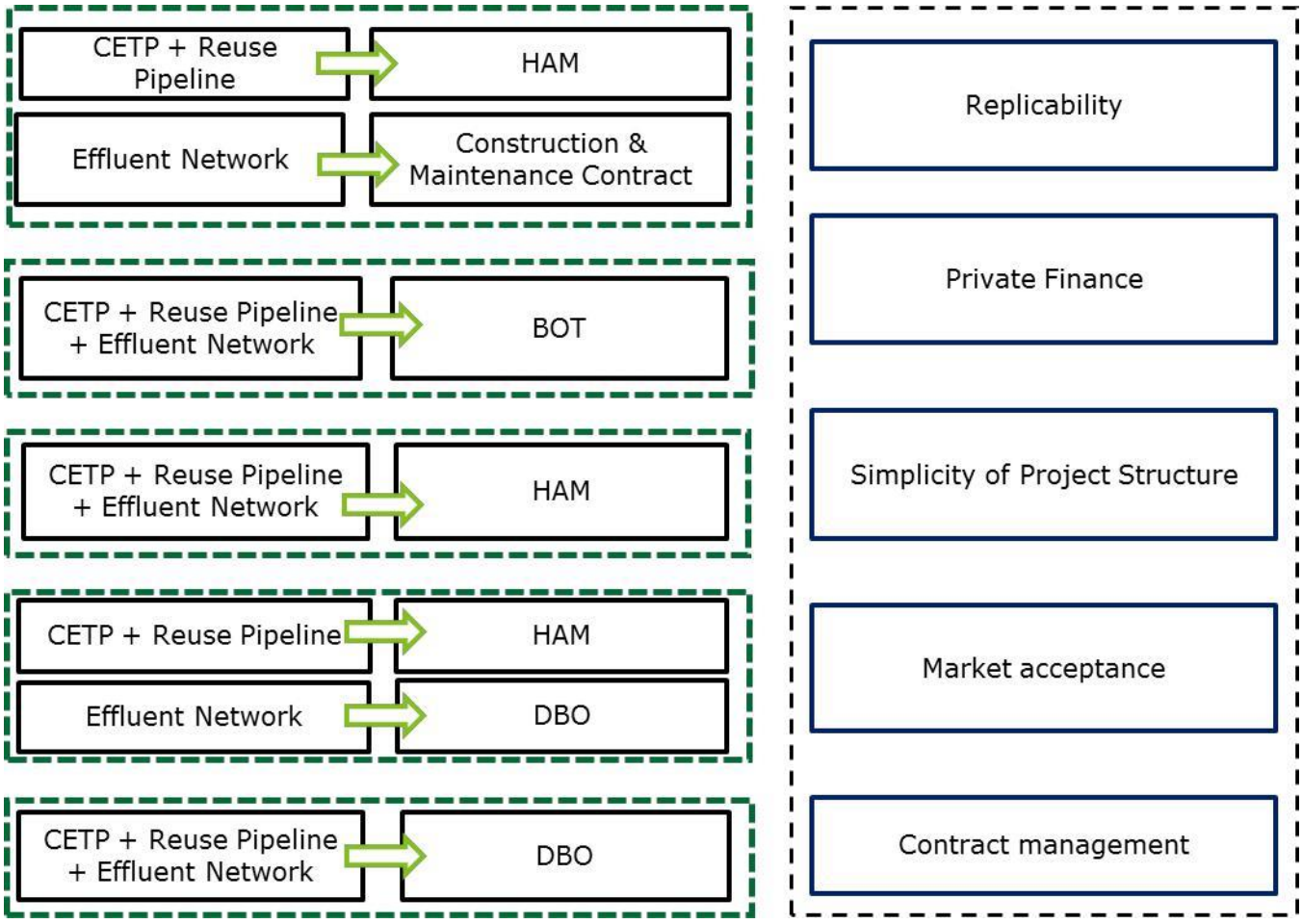
A Value for Money exercise has been carried out to evaluate an EPC option vis-à-vis a DBO (PPP) option for the above mentioned project scoping options to develop the 48 MLD CETP. The analysis shows that a PPP option provides more value to the Government.

Available PPP Options: Based on risk sharing arrangement between public and private parties and the components of the project, an assessment of various PPP options for engaging private sector was undertaken. The analysis brings out the following PPP options for consideration - Build Operate Transfer (BOT), Hybrid Annuity based PPP model (HAM) and Design Build Operate (DBO).

Options for project structure:

Based on the considered PPP options, a total of five (5) project structuring options have been considered for detailed analysis - Build Operate Transfer (BOT), Hybrid Annuity based PPP model (HAM), Design Build Operate (DBO), a combination of HAM with a separate construction and

maintenance contract and combination of HAM and DBO models. These options have been compared based on five parameters, namely replicability, private finance, simplicity of project structure, market acceptance and contract management. A comparison of these options is presented as follows:



Option 1: ***Development of CETP + Reuse Water Pipeline on HAM basis and Effluent Network under a separate construction & maintenance contract:***

This option entails separating the development of CETP + Reuse Water Pipeline on HAM basis and the Effluent Network under a construction & maintenance contract. The project structure is relatively simple as there are two separate contracts and allows private finance of BDT 819 million (around 44% of the cost). Further, development of effluent network involves item-wise quantity estimation at bid stage. These estimates could later vary based on on-ground conditions. Hence, an item rate based Construction and Maintenance contract is preferred for development of the effluent network as a means to address such quantity variation. Moreover, if development of effluent network is considered under the scope of BEZA, it will ease coordination while constructing and laying down infrastructure such as effluent network, water pipeline, gas pipeline, cables, roads, which can be planned properly.

As this project structure involves development of the project under separate contracts, there will be no single point responsibility. Further, a delay in execution of the construction & maintenance contract will cause an undue delay in commissioning of the CETP project, resulting in delayed capital recovery. This reduces the market acceptance of this option. However, this delay risk can be mitigated by ensuring that the effluent network is completed before the scheduled construction end date of the CETP.

Option 2: ***Development of CETP + Reuse Water Pipeline + Effluent Network on BOT basis***

This option considers the development of the CETP along with the reuse water pipeline and effluent network under the Build Operate and Transfer mode of PPP project structuring. This option ensures

single point responsibility with maximum private finance of BDT 1850 million (100% of the project cost). The model has high replicability in other Economic Zones and smooth contract management.

However, the important risks in context of the CETP project are the Demand risk and Financial risk. Recent experiences have shown that private CETP developers are unwilling to take the finance risk completely. Further, unlike Dhaka CETP project, BSMSN is a greenfield project. Therefore, the demand for effluent treatment is unclear and demand for offtake of treated (reuse) water will also develop over a period. Thus, the demand risk may not be passed onto the CETP operator and the same was evident in the Investor meeting held on 18th December 2018. Thus, the CETP developers may hesitate to bid for the project if it is based on BOT mode.

Option 3: *Development of CETP + Reuse Water Pipeline + Effluent Network on HAM basis*

This option considers development of the CETP + Reuse Water Pipeline + Effluent Network by the CETP developer on a Hybrid Annuity based PPP model. This model ensures single point responsibility of the entire project and allows private financing of BDT 1110 million (60% of the project cost) which can help BEZA in using the leftover funds for other projects. This structure has potential for replicability. Single point responsibility of the entire project allows smoother contract management.

However, there are three issues with this model. Firstly, this model is relatively new for Bangladesh market. Secondly, since CETP developers are essentially technology firms focusing in the area of effluent treatment, most of them do not possess expertise in the business of laying effluent network and would end up subcontracting the job of laying effluent network which comprises 26% of the overall project cost. Lastly, traditionally development of effluent network is practiced on item-rate basis.

However, effluent network development in greenfield projects will have lesser technical complication as there is no interference from other existing infrastructures and thus can be undertaken under this option. Further, from the market sounding activity it emerged that the CETP developers are open to consideration of this option for the development of the project.

Option 4: *Development of CETP + Reuse Water Pipeline on HAM Basis and Effluent Network on DBO basis*

As explained above, development of effluent network involves item-wise quantity estimation at bid stage. However, these estimates could later vary based on on-ground conditions. Thus, a bidder faces quantity estimation challenge for the effluent network, under the previous model. Hence, an item rate based project structure is preferred for development of the effluent network as a means to address such quantity variation. Thus, it emerges that effluent network development on non-investment based model such as DBO is preferable. Further, the CETP with Reuse Water Pipeline does not have this issue and is therefore preferable on HAM basis because it will allow private finance of BDT 819 million (around 44% of the cost).

However, a mix of project structures (DBO and HAM) as one tender package would make the tender complex, make contract management difficult, have low replicability and may possibly lower bidder interest.

Option 5: *Development of CETP + Reuse Water Pipeline + Effluent Network on DBO basis*

This option considers development of the CETP + Reuse Water Pipeline + Effluent Network on a DBO based PPP model. This project structure is straightforward, has potential for replicability, is acceptable to the market players, involves easier contract management, and lastly, it ensures single point responsibility.

However, there is no scope for private finance and the entire cost needs to be borne by BEZA. Since mobilizing private finance is important from BEZA's standpoint, this option has less preference.

The table below represents a qualitative comparison of the project structuring options across the five parameters considered for the study of the options.

Table 13: Qualitative Comparison of the Project Structuring Options

Structuring Options	CETP + Reuse Pipeline on **HAM** and Effluent Network under separate **construction and maintenance contract**	All Components on **BOT**	All Components on **HAM**	CETP + Reuse Pipeline on **HAM** and Effluent Network on **DBO**	All Components on **DBO**
Private Finance	Private finance of BDT 819 million (44% of the cost)	Maximum private finance of BDT 1850 million (100% of project cost)	Private financing of BDT 1110 million (60% of project cost)	Private finance of BDT 819 million (around 44% of the cost)	No scope for private finance
Market Acceptance	Potential delay risk and Finance risk	Demand Risk and Finance Risk	CETP players are more comfortable with CETP on HAM vis-à-vis network	CETP players are more comfortable with CETP on HAM vis-à-vis network	Acceptable in the market
Simplicity of Project Structure	Simple due to separate contracts	Relatively more complex than DBO	Relatively more complex than DBO	Complex tender structure	Simple project structure
Contract Management	Difficult Contract management but easier coordination	Uniformity in contract structure facilitates better management	Uniformity in contract structure facilitates better management	Relatively difficult contract management	Uniformity in contract structure facilitates better management
Replicability	Multiple contracts but straightforward	Single contract	Single contract, but no prior precedence	Single but two stitched contracts	Straightforward contract

Low	Medium	High	Very High

CETP to be developed on HAM: In the meeting held with the BEZA management on 13th February 2019, the study team informed that unlike Dhaka CETP project, BSMSN Economic Zone is a greenfield project. Therefore, the demand for effluent treatment is unclear and demand for offtake of reuse (treated) water will also develop over a period. Therefore, the demand risk may not be passed onto the CETP developer and the same was evident in the investor meeting held on 18th December 2018. While recent experiences have shown private players have lesser interest to take finance risk, it was understood that mobilizing private finance is important from BEZA's standpoint. Thus the development of the CETP on HAM basis was concurred upon as it can mobilize private finance and also passes the

above defined qualitative parameters.

Relative merits of development of Effluent Network as a part of an integrated project basis vis-a-vis a separate construction and maintenance contract: During the meeting dated 13th February 2019, certain pros of developing the effluent network under a separate construction and maintenance contract were discussed, as explained in Option 1 above. It had emerged that this option could be further looked into. Thereafter, as per the "BEZA Committee Report on Structuring Option on Business Case Report" (attached with BEZA letter dated 14th May 2019), the following was noted::

1) This option provides better contract management through single point responsibility and overcomes the interface risk (due to delays in construction schedule and operations) that may arise in case of Option

2) BEZA's preference for leveraging private finance is a key consideration for selection of a project structure. Including the effluent network under the scope of the CETP Developer as per Option 3 can mobilize BDT 963 million (60% of the project cost) of private finance

Considering the relative importance of ease of contract management and availability of private finance for BEZA, Option 3 involving the development of effluent network as a part of an integrated project has emerged as the preferred option after discussions.

Market Sounding in support of Option 3: During the market sounding exercise carried out by the study team with various national and international CETP developers, it emerged that while HAM is relatively new in Bangladesh market, the CETP developers are open to consideration of HAM based PPP mode of project development.

Therefore, considering the above, Option 3: Development of CETP + Reuse Water Pipeline + Effluent Network on HAM basis emerged as the preferred project structuring option, wherein BDT 1110 million of the project cost (BDT 1850 million) is privately financed.

The project period is envisaged for 15 years wherein the private operator will undertake the construction of the project in the initial 2 years, and will operate and maintain the project for the remaining 13 years and meet the pre-defined key performance indicators (KPIs) during the entire project period. Lapse in meeting the KPIs will attract penalties which will be deducted from operator payments.

The operator will be paid (i) 40% of capital cost during construction phase (upto a maximum of BDT 740 million), (ii) 60% of capital cost during Operation & Maintenance (O&M) phase with interest as capex annuity and (iii) annual O&M costs based on quantity and quality of effluent treated.

An escrow account mechanism will also be put in place to offer payment security to the concessionaire and comfort to project lenders. BEZA will ensure that the escrow account is funded with the minimum escrow balance of next two payment milestones at all times during the project period.

5.5. Market Sounding on Project Structuring

The study team carried out market sounding activities with various national and international CETP developers to understand their view on various aspects of the project. This section summarizes the perspective of the CETP developers regarding the project structuring options for the development of the CETP.

1. Preference of the CETP Developers for certain Project Structuring Options

The study team recorded the preference of the CETP developers for the available project structuring options. The developers indicated their most preferred project structuring option along with their openness for other options.

The table below provides the details of the most preferred option chosen by the respective developers.

Table 14: Preference of CETP Developers

Project Structuring Option	Prominent Respondents indicating the option as Most Preferred
EPC	Sigma Group, Degremont (Suez), Acciona, VA Tech Wabag, Jash Engineering, Akar Impex Pvt. Ltd., Punj Lloyd
DBO	Sigma Group, Degremont (Suez), Acciona, Jash Engineeering, Akar Impex Pvt. Ltd.
HAM	Delcot Ltd.
BOT	Chittagong Waste Treatment Plants Limited

The figures below provide details of the number of CETP developers who have indicated their preference for the available project structuring options. It is observed that while most of the developers have indicated EPC or DBO as their most preferred option, they are open to consideration of HAM mode of project development. Further, very few developers have indicated openness to BOT mode of project development.

Figure 13: No. of developers indicating the option as the Most Preferred Option

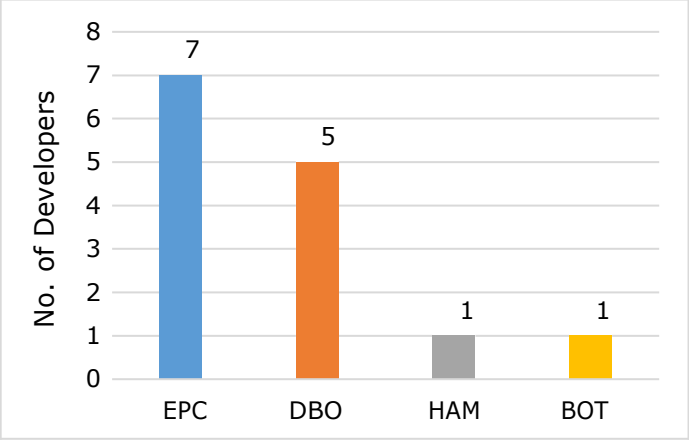
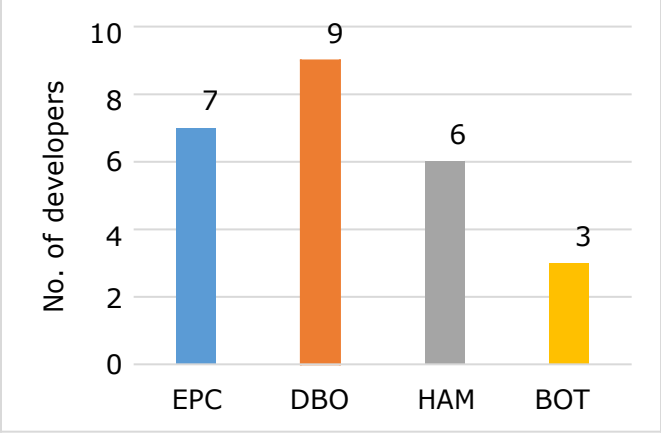


Figure 12: No. of developers indicating Openness to the option



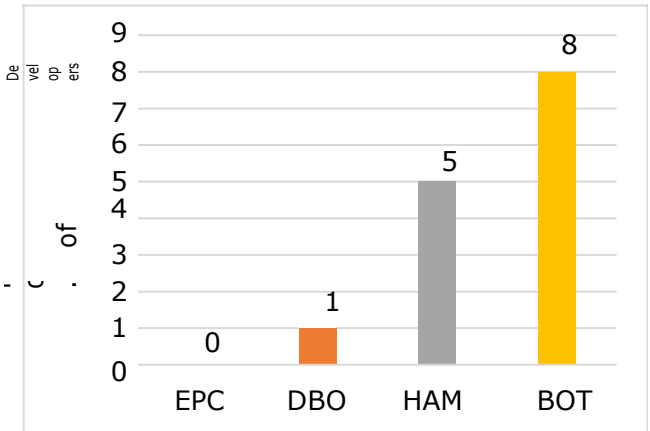
2. CETP Developers indicating aversion for certain Project Structuring Options

This section provides details of the aversion indicated by the CETP developers for certain project structuring options. It is observed that most of the CETP developers are unwilling to opt for BOT mode of project development as it has Finance risk and Demand risk.

Table 15: Aversion to the Option

Structuring Option	Prominent Respondents indicating aversion to adjacent Option
EPC	NA
DBO	Punj Lloyd
HAM	Chittagong Waste Treatment Plants Limited, Acciona, Degremont (Suez), VA Tech Wabag, Punj Lloyd
BOT	Sigma Group, Flagship Ecosystems, Acciona, Degremont (Suez), Jash Engineeering, Delcot Ltd., Akar Impex Pvt. Ltd., Punj Lloyd

Figure 14: No. of developers indicating aversion to the option



From the market sounding with the national and international CETP developers, it was understood that CETP developers are open to HAM mode of project structuring. Further details of the market sounding activity is provided in *Annexure 14: Market Sounding*.

5.6. Key Takeaways

Below is a summary of the key takeaways from the above analysis of project structuring options.

1) The Value for Money exercise to evaluate an EPC option vis-à-vis a DBO (PPP) option shows that a PPP option provides more value to the Government.
2) The risk assessment across project structures in section 5.3 above brings out the following models as the preferred ones for project-scoping options - Build Operate Transfer, Hybrid Annuity and Design Build Operate.
3) The study team has considered and compared the following options for the structuring of the project:
   Option 1: Development of CETP + Reuse Water Pipeline on HAM basis and Effluent Network under a separate construction & maintenance contract
   Option 2: Development of CETP + Reuse Water Pipeline + Effluent Network on BOT basis
   Option 3: Development of CETP + Reuse Water Pipeline + Effluent Network on HAM basis
   Option 4: Development of CETP + Reuse Water Pipeline on HAM Basis and Effluent Network on DBO basis
   Option 5: Development of CETP + Reuse Water Pipeline + Effluent Network on DBO basis
4) The study team compared the above project structuring options based on the following parameters: Replicability, Private Finance, Simplicity of Project Structure, Market acceptance and Contract management. Based on the pros and cons of the above options and preference for private finance indicated by BEZA, the following can be concluded:
   a. **Demand Risk:** Unlike Dhaka CETP project, BSMSN is a greenfield project. Therefore, the demand for effluent treatment is unclear and demand for offtake of treated (reuse) water will also develop over a period. Therefore, the demand risk may not be passed onto the CETP operator and the same was evident in the Investor meeting held on 18th December 2018.
   b. **Finance Risk:** Recent experiences have shown private players have lesser interest to take finance risk. However, mobilizing private finance is important from BEZA's standpoint. Thus, the development of the CETP + Effluent Network on HAM basis was concurred upon as it can mobilize BDT 1110 million of private finance and also passes the above defined qualitative parameters.
   c. **Scope of the CETP Developer:** Integrating the effluent network with the CETP will have the advantage of single point responsibility, which BEZA will find easier to manage. However, there are alternative arguments which are mentioned below:
      CETP developers generally lack expertise in laying effluent network. However market sounding activity indicated their openness for development of the effluent network within the scope of the project
      Traditionally development of effluent network is practiced on item-rate/BOQ basis because quantity estimation at bid stage is difficult
      Also, if development of effluent network is considered under the scope of BEZA, it will ease coordination while constructing and laying down infrastructure such as effluent network, water pipeline, gas pipeline, cables, roads, which can be planned properly
   d. **Market Sounding:** The study team carried out market sounding with various national and international CETP developers. It emerged that the CETP developers are open to consideration of HAM based PPP mode of project development. The views of the developers

is captured in *Table: Qualitative Comparison of the Project Structuring Options* and further details are provided in *Annexure 14: Market Sounding*.

Considering the above, Option 3: Development of CETP + Reuse Water Pipeline + Effluent Network on HAM basis emerged as the preferred project structuring option, wherein BDT 1110 million of the project cost (BDT 1850 million) is privately financed.

6. Financial Assessment

This section lists key assumptions for capital costs, operational costs, tariff, and revenue for carrying out the financial assessment of the project.

Both BSMSN - 2A and BSMSN - 2B require treatment of effluent. Therefore, it needs to be understood whether there should be a common CETP for both BSMSN - 2A and BSMSN - 2B or separate. Development of a centrally located CETP catering to effluent from BSMSN - 2A and BSMSN - 2B would bring in economies of scale, require lesser land, ensure better utilization of built assets and facilitate ease of supervision for BEZA. However, there is an additional cost of pumping effluent from BSMSN - 2B to BSMSN - 2A which would also impact the financial assessment.

Since development of a common CETP for both BSMSN - 2A and BSMSN - 2B is a more desirable option, the financial assessment for developing such a 48 MLD CETP has been carried out as under -

Additionally, the study team has also carried out similar financial assessment for developing a 32 MLD CETP to cater to the treatment of effluent from BSMSN - 2A only. (Please refer to Annexure 1B for the same).

6.1. Key Assumptions for financial analysis of the project

The study team has considered key assumptions relevant to the financial assessment of the project based on the rules and regulations followed in Bangladesh, common industry practices and interaction with stakeholders as mentioned below.

Project Details:

Table 16 Project Details

Particular	Input
Capacity of the CETP (ultimate capacity)	32 MLD (for BSMSN - 2A only) 48 MLD(for BSMSN - 2A and BSMSN - 2B)
Duration of the project (including construction period)	15 years
Construction period	2 years
CETP Inlet Standards	BOD_5 – 600 mg/L, COD – 1260 mg/L, TDS – 2100 mg/L
Level of treatment and treated water parameters	Tertiary with treated water parameters (BOD<10 mg/L, TSS<10 mg/L)
Reuse of treated water	Yes, to BSRM Power and Steel Plant and McDonald Steel

Capital Expenditure Assumptions:

The study team has assumed the below standard rates followed in Bangladesh for calculation of capital and operational costs.

Table 17 Capital Expenditure Assumptions

Particular	Input
Cost of power (per KWH)	9 BDT
Physical contingency	4%
Price contingency	4%
Weighted Average Cost of Capital (WACC)	12%
Monthly sludge haulage production for 24 MLD of effluent	89160 kg
Sludge haulage cost per kg of diluted sludge	1.25 BDT

Phasing of Capital Works

The investment proposals submitted by the industries to BEZA indicate their year wise capacity utilization. Based on the capacity utilization of the industries, the study team has undertaken assessment of the effluent volume generated by the industries in BSMSN - 2A and BSMSN - 2B. Based on the staggered growth of effluent demand the study team has proposed a staggered capacity expansion of CETP and of Reuse Water network for the prime option. The study team has assumed that in the year when the effluent load from the industries reach 80% of the installed CETP capacity, the developer will augment the installed CETP capacity to the next module in the subsequent financial year.

Table 18 Phasing of Capital Works

Year of Construction	CETP Installed Capacity (MLD)
3	**16**
4	**32**
7	**40**
9	**48**

Revenue Assumptions:

The study team has considered revenues from two sources

i. Treatment of effluent from the industries
ii. Supply of treated water to the industries.

The study team has assumed the tariff rates for effluent treatment and supply of reuse water as mentioned below.

Table 19 Revenue Assumptions

Particular	Input
Rate of increase in tariff every year	5%
Revenue collection (for effluent treatment) efficiency	75%
Increase in revenue collection (for effluent treatment) efficiency every year	2%
Arrears collection (for effluent treatment) efficiency	20%
Increase in arrears collection (for effluent treatment) efficiency every year	2%
Revenue collection (for supply of reuse water) efficiency	77%

Particular	Input
Increase in revenue collection (for supply of reuse water) efficiency every year	2%
Arrears collection (for supply of reuse water) efficiency	22%
Increase in arrears collection (for supply of reuse water) efficiency every year	2%
Minimum Alternate Tax	0.60% on gross receipts

Other Assumptions:

The study team has also considered the below incentives provided by BEZA to the Economic Zone developers in Bangladesh.

Table 20 Other Assumptions

Particular	Input
Tax Holiday	Income tax exemption on income derived from the business development of EZ in a block of 10 years in 15 years. After expiry of 10th year tax exemption will be 70% in 11th year and 30% in 12th year. But the tax exemption will not be applicable from 13th year
VAT on Electricity	Exemption of VAT on electricity or taxes on sale, of self-generated or purchased electric power for use of processing area of EZ (for 10 years)

6.2. Financial Impact on BEZA under preferred Project Structuring Option - HAM

This section provides the cash flows for developing a 48 MLD CETP under preferred option of HAM based project structuring.

Development of CETP + Reuse Water Pipeline + Effluent Network on HAM basis

The costs to be incurred by the private player for the development of the project under Hybrid Annuity based PPP model are mentioned below:

Bid Project Cost: Includes cost of construction of effluent network, CETP and its associated facilities and reuse water pipeline (including the interest during construction, taxes and all other pre-operative expenses).

O&M Charges: The amount required by the developer (including all Taxes) to operate and maintain the constructed facilities.

The cash outflow for BEZA will comprise repayment of this cost as annuity over a period of time and management cost for the project.

The cash inflows for BEZA include the revenue that will be generated from the treatment of effluent from the industries and the supply of reuse water to BSRM power and steel plant and Mc Donald steel.

The table below provides the cash flows for BEZA for 15 years when the project is executed under a HAM model.

Table 21: Cash flows for BEZA under HAM Model

Particular	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Year	30-Jun-21	30-Jun-22	30-Jun-23	30-Jun-24	30-Jun-25	30-Jun-26	30-Jun-27	30-Jun-28	30-Jun-29	30-Jun-30	30-Jun-31	30-Jun-32	30-Jun-33	30-Jun-34	30-Jun-35
Cash Outflow for BEZA															
Management cost	0.00	0.00	35.64	72.53	96.31	116.56	140.03	164.83	192.76	55.42	62.33	68.89	74.96	78.98	83.09
Power Charges	0.00	0.00	404.50	787.80	1001.74	1165.20	1382.99	1607.75	1866.39	2143.76	2429.25	2710.10	2954.29	3079.25	3205.48
Construction Payments	4061.71	3069.50	790.93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CAPEX Annuity	0.00	0.00	1104.45	2146.21	2040.57	1938.19	1835.82	1735.58	1631.06	1528.68	1426.30	1324.94	1221.54	1119.17	1016.79
OPEX Annuity	0.00	0.00	1803.71	3758.09	3900.16	4058.52	4223.31	4407.13	4573.74	4759.45	4952.70	5168.27	5363.65	5581.43	5808.06
Cash Inflow for BEZA															
Collections from Treatment of Effluents	0.00	0.00	1373.00	2802.74	3733.55	4571.91	5655.99	6801.86	8102.93	9446.81	10760.81	11988.36	13111.61	13821.05	14546.10
Collections from reuse water supply	0.00	0.00	408.86	823.84	1082.17	1255.91	1345.58	1439.81	1535.07	1636.25	1705.23	1790.52	1880.02	1974.03	2072.70
Net Cashflow	**-4061.71**	**-3069.50**	**-2357.38**	**-3138.05**	**-2223.06**	**-1450.64**	**-580.57**	**326.37**	**1374.06**	**2595.77**	**3595.46**	**4506.67**	**5377.20**	**5936.25**	**6505.39**
NPV of BEZA's net cashflow	**0**														

The study team has examined the financial viability of the project for developing a 48 MLD CETP using HAM project structuring option.

Based on the key assumptions detailed in section 6.1 above, the study team has assessed the costs required for the 48 MLD CETP project. Projected annual income statements, annual cash flows, Project & Equity IRR and NPV are some of the main financial parameters used for the assessment of the project.

A summary of the costs of the two project scoping options is provided in the following table.

Table 22: Summary of the financials for the two project scoping options

Project-scoping option	Terminal capacity (in MLD)	Construction Cost (in BDT crore)	Capex Phasing (in BDT crore)
CETP + Reuse Water pipeline+ Effluent Network	48	CETP: 115.70 Reuse Pipeline: 20.80 Effluent Network: 48.62 **185.13**	Year 1-Year 2: **185.13** Year 3: 8.13 Year 6: 1.97 Year 8: 11.48 **Total: 206.71**
CETP + Reuse Water pipeline		CETP: 115.70 Reuse Pipeline: 20.80 **136.50**	Year 1-Year 2: **136.50** Year 3: 8.13 Year 6: 1.97 Year 8: 11.48 **Total: 158.08**

The financial assessment for the same has been carried out as under –

(i) Assessment of the financials for developing a 48 MLD CETP
(ii) Detailed financial analysis of the 48 MLD CETP to study the financial feasibility and the associated financial results

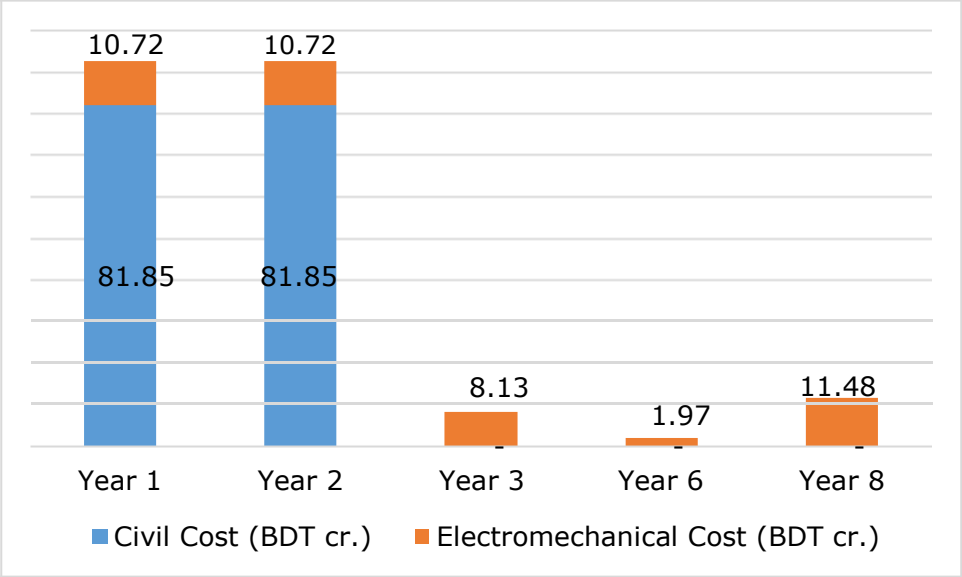
Capital Expenditure:

The study team has estimated a total capital expenditure outlay of ~206.71 BDT Crore on the project between Financial Year 2019-20 and Financial Year 2027-28. Capital expenditure works proposed under the project will include,

1) Common Effluent Treatment Plant (CETP): Construction of one (1) new CETP of 48 MLD capacity

2) Effluent Network: Construction of effluent network to carry the effluent from BSMSN 2A and BSMSN 2B zones to the CETP
3) Reuse Water Network: Construction of reuse water supply pipeline to supply treated effluent water to BSRM Power and Steel Plant and McDonald Steel

Figure 15: Capital Expenditure

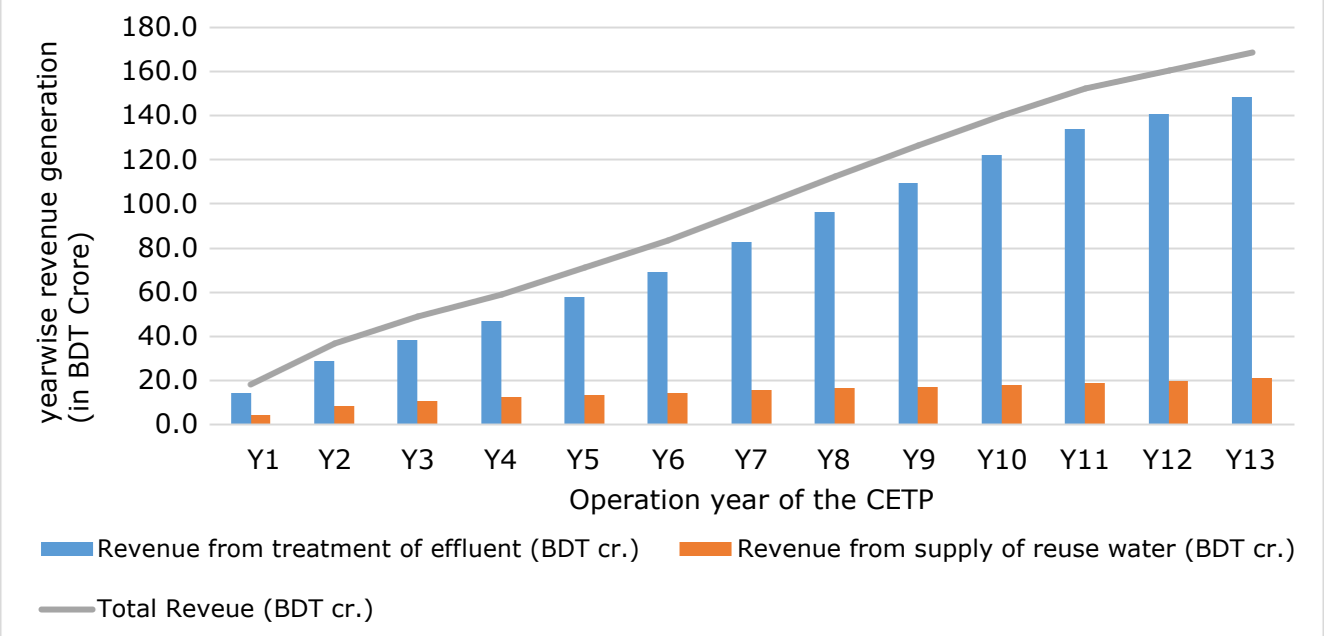


Revenue Generation:

The study team has considered two sources for generation of revenue:

1) Treatment of effluents generated by industries in BSMSN-2A and BSMSN-2B
2) Supply of treated effluent water to BSRM Power and Steel Plant and McDonald Steel

Figure 16: Revenue Generation



Firstly, Based on the year wise capacity utilization provided by the industries to BEZA, the study team has estimated the effluent volume generated by the industries in BSMSN-2A and BSMSN-2B. The study team has then worked out the revenues generated from treatment of the effluents at an assumed average tariff rate of 44 BDT/KL[1] of effluent treated. The tariffs are expected to be in the range of BDT 33/KL[1] to BDT 60/KL[1]. Similarly, the study team has worked out the revenue generated from the supply of reuse water to BSRM Power and Steel Plant and McDonald Steel (17MLD) at an assumed tariff rate of 20 BDT/KL of water supplied.

The study team has envisaged that major source of revenue for the project is from effluent treatment. The collection efficiency has been assumed to be only 75% and 77% of the revenues generated from effluent treatment and from supply of reuse water respectively. The study team has also assumed the collection efficiency to increase at a rate of 2% per year until it reaches 90% efficiency. The study team has also envisaged the project to be more viable with increase in collection efficiency of the developer.

Income Statement:

Below is the income statement for a concession period of 15 years for the 48 MLD CETP project for the private developer. All figures are in BDT lakhs unless specified.

Timeline	30-Jun-21	30-Jun-22	30-Jun-23	30-Jun-24	30-Jun-25	30-Jun-26	30-Jun-27	30-Jun-28	30-Jun-29	30-Jun-30	30-Jun-31	30-Jun-32	30-Jun-33	30-Jun-34	30-Jun-35
FY No	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Revenue															
Annuity	-	-	-	457.05	914.09	914.09	914.09	914.09	914.09	914.09	914.09	914.09	914.09	914.09	914.09
Interest	-	-	-	647.40	1,232.12	1,126.48	1,024.10	921.72	821.48	716.97	614.59	512.21	410.85	307.45	205.07
O&M Revenue	-	-	-	1,803.71	3,758.09	3,900.16	4,058.52	4,223.31	4,407.13	4,573.74	4,759.45	4,952.70	5,168.27	5,363.65	5,581.43
Total Net Revenue	-	-	-	2,908.16	5,904.30	5,940.73	5,996.71	6,059.13	6,142.71	6,204.79	6,288.13	6,379.00	6,493.21	6,585.19	6,700.60
Expenses															
Operating Expenses	-	-	-	511	1,454	1,842	2,140	2,536	2,946	3,417	3,923	4,445	4,959	5,408	5,640
Major Maintenance provisions	-	-	-	1,022.05	424.59	319.97	246.13	246.13	-	-	-	-	-	-	-
Total Expenses	-	-	-	1,532.67	1,878.26	2,161.81	2,385.66	2,781.93	2,945.56	3,417.09	3,923.18	4,444.78	4,959.13	5,407.64	5,640.29
EBITDA	-	-	-	1,375.50	4,026.04	3,778.92	3,611.05	3,277.19	3,197.15	2,787.70	2,364.95	1,934.22	1,534.08	1,177.55	1,060.31
Depreciation	-	-	-	706.50	1,068.51	1,065.59	1,065.59	1,065.59	1,068.51	1,065.59	1,065.59	1,065.59	1,068.51	1,065.59	1,065.59
PBIT	-	-	-	669.00	2,957.53	2,713.32	2,545.46	2,211.60	2,128.63	1,722.11	1,299.36	868.63	465.57	111.95	(5.29)
Interest on Debt	-	-	601.52	536.14	457.68	379.22	300.76	222.30	143.84	65.38	13.08	-	-	-	-
PBT	-	-	(601.52)	132.86	2,499.85	2,334.11	2,244.70	1,989.30	1,984.79	1,656.73	1,286.28	868.63	465.57	111.95	(5.29)
Tax	-	-	-	17.45	35.43	35.64	35.98	36.35	36.86	37.23	37.73	38.27	38.96	39.51	40.20
PAT	**-**	**-**	**(601.52)**	**115.41**	**2,464.43**	**2,298.46**	**2,208.72**	**1,952.95**	**1,947.94**	**1,619.50**	**1,248.55**	**830.36**	**426.61**	**72.44**	**(45.49)**

Cash flow Statement:

Below is the cash flow statement for a concession period of 15 years for the 48 MLD CETP project for the private developer. All figures are in BDT lakhs unless specified.

Timeline	30-Jun-21	30-Jun-22	30-Jun-23	30-Jun-24	30-Jun-25	30-Jun-26	30-Jun-27	30-Jun-28	30-Jun-29	30-Jun-30	30-Jun-31	30-Jun-32	30-Jun-33	30-Jun-34	30-Jun-35
FY No	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	30-Jun-21	30-Jun-22	30-Jun-23	30-Jun-24	30-Jun-25	30-Jun-26	30-Jun-27	30-Jun-28	30-Jun-29	30-Jun-30	30-Jun-31	30-Jun-32	30-Jun-33	30-Jun-34	30-Jun-35
Cash Flow to Project															
PBDIT	-	-	1,375.50	4,026.04	3,778.92	3,611.05	3,277.19	3,197.15	2,787.70	2,364.95	1,934.22	1,534.08	1,177.55	1,060.31	949.21
Tax	-	-	17.45	35.43	35.64	35.98	36.35	36.86	37.23	37.73	38.27	38.96	39.51	40.20	40.95
Add: Major maintenance	-	-	1,022.05	(183.69)	319.97	47.68	246.13	-	-	-	-	-	-	-	-
Capex funded by Concessionaire (Including ID	4478.97	8115.29	908.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
IDC	38.70	393.29	209.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cash Flow to Project (PBDIT-Tax - Capex +	-4440.27	-7721.99	1681.37	3806.92	4063.24	3622.75	3486.97	3160.29	2750.47	2327.22	1895.95	1495.13	1138.03	1020.10	908.26
Cash Flow to Equity															
Particulars															
PAT	-	(601.52)	115.41	2,464.43	2,298.46	2,208.72	1,952.95	1,947.94	1,619.50	1,248.55	830.36	426.61	72.44	(45.49)	(157.33)
Add: Depreciation	-	-	706.50	1,068.51	1,065.59	1,065.59	1,065.59	1,068.51	1,065.59	1,065.59	1,065.59	1,068.51	1,065.59	1,065.59	1,065.59
Add: Provision for major maintenance	-	-	1,022.05	424.59	319.97	246.13	246.13	-	-	-	-	-	-	-	-
Less: major maintenance expense in cash	-	-	-	608.29	-	198.45	-	-	-	-	-	-	-	-	-
Equity Investment	2743.89	4971.56	556.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Equity Withdrawn															
Repayment of Loan	-	435.88	653.82	653.82	653.82	653.82	653.82	653.82	653.82	217.94	-	-	-	-	-
Cash flow to Equity(PAT + Depreciation + Provisions-expense on provision- Equity Investment + Equity Withdrawn (if any)- Repayment of Loan)	(2,743.89)	(6,008.96)	633.81	2,695.42	3,030.20	2,668.17	2,610.84	2,362.62	2,031.27	2,096.20	1,895.95	1,495.13	1,138.03	1,020.10	908.26

6.3. Determination of Tariff Rate under preferred Project Structuring Option - HAM

It is envisaged that industries in Zone 2A and Zone 2B discharging effluent into the effluent network will be charged based on the quantity and quality of effluent discharged by them. Higher quantity and higher effluent load will be charged higher following a "polluters pay principle".

The study team has followed different approaches to estimate the tariff rates for the project across the five proposed options. The prevailing tariff rates charged at Dhaka EPZ and Chittagong EPZ have been taken as benchmark rates. Based on the feedback from the investors in BSMSN Economic Zone, it is observed that a tariff rate of BDT 30 per KL or less (80% of the tariff rate at Dhaka EPZ) is desirable for the treatment of effluent. Based on the feedback from the potential users of the treated water, it is observed that a tariff rate of BDT 26.40 per KL or less is desirable for reuse water supply.

The tariff rates across the project structure options have been estimated such that there is 20% equity returns to the private operator/ developer and the net project lifecycle cash flows for BEZA is zero in NPV terms.

It is observed that there has to be a trade off between higher private (deferred) financing and higher tariff rates vs lower private (deferred) financing and lower tariff rates. The tariff rate in case of BOT model is the highest which makes the project relatively less attractive. The tariff is second highest when all project components are procured on HAM basis.

If BEZA would like to keep the tariff rate low and also make private finance available, then HAM for CETP + Reuse pipeline + Effluent Network emerges as the available option. This option allows private finance of around BDT 1110 million (around 60% of the project cost). The average effluent treatment tariff rate for this option is around BDT 44/KL[1]. The tariffs are expected to be in the range of BDT 33/KL[1] to BDT 60/KL[1]. This is indicative and subjective to change based on the load factor of the effluent.

A decision on the tariff rate to be charged to the industries in BSMSN EZ may be taken by BEZA based on the selected project structure, acceptance in the market and confirmation of offtake of reuse water by consumer industries.

6.4. Mechanism for Estimation of Tariff Rate

The effluent released by the industries in the Economic Zone is toxic to the environment. It is necessary to treat the effluent at a CETP before discharging it to the environment. This chapter explains the basis on which the tariff rate for effluent treatment at the CETP should be fixed in the Economic Zone.

Principles for Tariff Rate Estimation:

The principle for tariff rate estimation for treatment of effluent from the industries may be divided into three categories:

I. Relating to Pollution Load of the Effluent
II. Relating to Financial Viability of Effluent Treatment

I. Pollution Load of the Effluent:

The tariff rate charged to the industry should be based both the quality and quantity of effluent released by an industry. Industries releasing higher quantity of effluent and/or higher pollution load in the effluent should be charged more as compared to industries releasing lower quantity of effluent and/or having lower pollution load in the effluent.

1. Quantity of effluent generated: The tariff collected from an industry shall be directly proportional to the quantity of effluent generated by the industry. This quantity may be monitored through installation of flow meters at the outlet of the ETPs of the industries.

2. Quality of effluent generated: The pollution load (BOD, COD, TSS etc.) in the effluent released by an industry plays an important role in estimating the tariff rate to be charged from the industry. The quality of the effluent released from the industries may be monitored by either of the following ways:
    - Random sampling and laboratory testing of the effluent
    - Installation of aggressive effluent quality monitoring meters for measuring pollution load parameters like BOD, COD, TSS, TDS, pH etc. (as explained in *"Annexure 6: Preliminary Treatment by the Industry"* of the Business Case Report)
3. It is consistent with industry practices

II. Financial Viability of Effluent Treatment:

As explained in the previous section, the treatment of effluent at the CETP should be financially viable. The approach adopted by the study team for estimation of the tariff rates after ensuring financial viability:

1. It is ensured that the equity returns to the private operator/ developer of the CETP should be around 20%, and
2. the net project lifecycle cash flows for BEZA is zero in NPV term
3. The tariff rate generates sufficient revenue to support the continued provision of high quality service

Formula for Estimation of Tariff Rate:

The formula adopted for calculation of the tariff rate is as follows:

Tariff rate (in BDT/KL) = (

where,

NPV(Cost of Effluent Treatment) – The NPV of the cost incurred by BEZA over a period of 20 years, to be paid to the Concessionaire for the treatment of the effluent released by the industries. This cost will be dependent on the quality and quantity of treated at the CETP
NPV(Revenue from Reuse Water Supply) – The NPV of revenue received by BEZA over a period of 20 years for the supply of treated water to the industries
Total(Effluent Volume Generated) – The total volume of effluent generated by the industry over a period of 20 years

Based on the formula stated above, the preliminary tariff rates for Option 3 (all components on HAM), calculated for different levels of pollution load (BOD) at the inlet of the CETP is presented in the table below:

Table 23:Tariff Rate Based on Pollution Load

Level of BOD at Inlet of CETP (in mg/L)	Preliminary Tariff Rate (in BDT/KL)
750-1000	50.34
500-750	45.76
250-500	41.60
<250	33.60

The tariff rate presented in the table above will be updated during the course of the project after the finalization of plans by the tenant industries .

Penalty for Non-Compliance with CETP Inlet Standards:

Preliminary treatment by the industries before the discharge of the effluent into the effluent conveyance system plays a vital role in the successful operation of the CETP. The penalties to be sought based on the degree of non-compliance with the CETP inlet standards are:

1. **Monetary penalty** – The non-compliant industry may be charged a penalty of around 20%-50% above the maximum tariff rate for effluent treatment. This amount shall depend on the cost incurred for treatment of the non-compliant effluent at the CETP. The penalty shall be imposed over the period of non-compliance
2. **Legal penalty** – In case of continuous long-term non-compliance with the CETP inlet standards, a show cause notice may be served to the industry which may lead to the closure of the industry, if required.

6.5. Key Takeaways

1) This chapter provided the key assumptions undertaken by the study team for the financial assessment of the project.
2) The study team has analysed the cash flows for BEZA under the preferred project structuring option of HAM in section 6.2
3) If BEZA would like to keep the tariff rate low and also make private finance available, then HAM for CETP + Reuse pipeline + Effluent Network emerges as the available option. This option allows private finance of around BDT 1110 million (around 60% of the project cost).
4) The tariff rate to be charged to the industries in BSMSN EZ may be decided by BEZA based on the selected project structure, market acceptance and the expected returns from the project.

7. Remarks and Action Points

This section provides a conclusion to the findings in the report and establishes the key decision making points for BEZA. It also identifies the key parameters that need further evaluation for successful implementation of the project.

7.1. Remarks

The study team has reviewed prior studies for BSMSN Economic Zone, held consultations with multiple stakeholders, reviewed the latest Master Plan while preparing the business case for the project. . The following are the key observations:

- The effluent volume projected from BSMSN - 2A is 32 MLD while that from BSMSN - 2B is 16 MLD. To treat the effluent from BSMSN - 2A and BSMSN - 2B zones, developing a combined CETP of 48 MLD ultimate capacity is required. Based on the increase in volume of effluent generated by the industries, the capacity of the CETP is envisaged to increase gradually over the years. The year when effluent volume reaches 75% - 80% of the installed capacity of the CETP, the CETP Operator will augment the installed capacity in the subsequent operating year.
- To accommodate the different prevailing/proven effluent treatment technologies, about 18 acres of contiguous land has been earmarked by BEZA for development of the CETP.
- Design philosophy of the three project components will be as follows:
    - *CETP*: CETP capacity will be developed in modules in stages. The electromechanical equipment will be installed/commissioned in stages. However, the civil works will be constructed in a single stage
    - *Effluent Network*: Effluent network will be constructed in a single stage. Based on the effluent volume, the effluent network operations will be carried out
    - *Treated effluent/reuse network*: 70% of treated effluent can potentially be supplied for reuse. Pumping station will be constructed in a single stage for full reuse capacity. However, pump and rising main will be installed in stages
- Preliminary treatment of the effluent and measurement of the effluent characteristics before being discharged into the effluent conveyance system should be under the scope of individual industries.
    - The industries need to be mandated for pre-treatment of the effluent through ETP. The industries also need to submit effluent characteristics report measured by installing metering devices at their premises in regular intervals.
    - The guidelines for effluent treatment plants currently available in Bangladesh are exclusively for textile industries and are for final disposal of the treated effluent into the environment only. It is suggested that BEZA mandates pretreatment standards by the industries to meet the inlet norms of the CETP for all categories of industries
    - The cost of metering devices may be built into the licensing and clearance certificate of the industries
    - Industry may be asked to submit (bank) guarantee as an undertaking for setting up responsible ETP operations.
- **Scope of CETP Developer:** The CETP + Reuse water pipeline will be under the scope of CETP developer. Integrating the effluent network with the CETP will have the advantage of single point responsibility, which BEZA will find easier to manage. However, there are alternative arguments for excluding the effluent network from the scope of the CETP developer which are

discussed in the project structuring section.

- **Reuse of Treated Effluent:** Various water reuse options have been examined. Investors like BSRM Power and Steel Plant and Mc Donald Steel have indicated interest in consuming the reuse (treated) water from the CETP. About 18 MLD of treated water from the CETP can be used by BSRM Power and Steel Plant and by Mc Donald Steel. The potential of treated water reuse may increase with other industries expressing their interest in using the treated water. While the study team also considered other reuse options, this option has been selected based on higher prima facie commitment of the users. An Offtake Agreement with BSRM Power and Steel Plant and McDonald Steel may be signed to ensure the offtake of reusable water. It may be noted that there is a prevalent practice in India to supply reuse (treated) water to closely situated power plants and oil refineries to complement their water requirement.
- **Project Structuring:** The study team has considered and compared the following options for the structuring of the project:
  - Option 1: Development of CETP + Reuse Water Pipeline on HAM basis and Effluent Network under a separate construction & maintenance contract
  - Option 2: Development of CETP + Reuse Water Pipeline + Effluent Network on BOT basis
  - Option 3: Development of CETP + Reuse Water Pipeline + Effluent Network on HAM basis
  - Option 4: Development of CETP + Reuse Water Pipeline on HAM Basis and Effluent Network on DBO basis
  - Option 5: Development of CETP + Reuse Water Pipeline + Effluent Network on DBO basis
- The study team compared the above project structuring options based on the following parameters: Replicability, Private Finance, Simplicity of Project Structure, Market acceptance and Contract management. Based on the pros and cons of the above options and preference for private finance indicated by BEZA, the following can be concluded:
  a. **Demand Risk:** Unlike Dhaka CETP project, BSMSN is a greenfield project. Therefore, the demand for effluent treatment is unclear and demand for offtake of treated (reuse) water will also develop over a period. Therefore, the demand risk may not be passed onto the CETP operator and the same was evident in the Investor meeting held on 18th December 2018.
  b. **Finance Risk:** Recent experiences have shown private players have lesser interest to take finance risk. However, mobilizing private finance is important from BEZA's standpoint. Thus, the development of the CETP on HAM basis was concurred upon as it can mobilize BDT 1110 million of private finance and also passes the above defined qualitative parameters.
  e. **Scope of the CETP Developer:** Integrating the effluent network with the CETP will have the advantage of single point responsibility, which BEZA will find easier to manage.
- **Market Sounding:** The study team carried out market sounding with various national and international CETP developers. It emerged that the CETP developers are open to consideration of HAM based PPP mode of project development. The views of the developers has been captured in *Table: Qualitative Comparison of the Project Structuring Options* and further details are provided in *Annexure 14: Market Sounding*.

Considering the above, Option 3: Development of CETP + Reuse Water Pipeline + Effluent Network on HAM basis emerged as the preferred project structuring option, wherein BDT 1110 million of the project cost (BDT 1850 million) is privately financed.

7.2. Action points for BEZA

The following are the key action points needed from BEZA for development of the project.

1. BEZA will co-ordinate for internal approval for *Option 3: Development of CETP + Reuse Water Pipeline + Effluent Network on HAM basis* and provide such further direction to the study team.
2. *BEZA's role as reuse (treated) water supplier*:
   BEZA will coordinate internal approval for providing payment guarantee to the CETP developer for the amount of reuse (treated) water produced, provided characteristics of the reuse (treated) water measured at the consumer end of the reuse water pipeline meets prescribed standards.
   Further, BEZA will coordinate internal approval for signing agreements for offtake of reuse (treated) water between: i) BEZA and BSRM Power and Steel, (ii) BEZA and McDonald Steel
3. To ensure successful CETP operations, BEZA will mandate the industries for pre-treatment of the effluent through ETP
4. BEZA will coordinate and ensure synchronization of water supply contract and storm water management contract with the contract for the development of the CETP.
5. Select key considerations regarding the project structure had emerged as a result of the feedback received from the market sounding workshop and subsequent discussions with BEZA officials and other stakeholders (*Annexure 17*). The study team seeks the consideration and approval of BEZA on the same.

8. Recommendations

The recommendations provided in this chapter are based on developments further to the Revised Business Case Report submitted on 30th October 2019. Based on detailed discussions with the BEZA project team and other stakeholders after February, July and August 2020, it was deliberated and agreed that two important developments have taken place which need to be considered

The ongoing Covid-19 pandemic has put an economic and financial stress on a lot of business including private firms involved in construction and operations of infrastructure projects including projects in wastewater sector situation. This impacts the risk perception of the private operators in the market

BEZA has signed a 5-year loan (externally aided funding from a multilateral funding agency), financing of which is available for the project. This loan expires in June 2025. The cost of funds for BEZA for this project is around 2-3%.

In the context of the above two developments, multiple discussions were held between the BEZA team and other stakeholders, to deliberate the implications of the above on the choices available to BEZA. This chapter presents various scenarios which have emerged in the above context.

8.1. Financial Feasibility of the Project

A detailed financial feasibility of the project has been undertaken. The project feasibility has been assessed based on the revenues that accrue to the project from user charges from industrial users, cost of operations and the capital cost, irrespective of funding source and the mode of partnership between the private operator and BEZA (the contracting authority). More specifically, the revenue, capital costs and O&M costs for the project include the following:

Revenues: The revenues for the project are due to accrue from 2 sources – (i) Collection and treatment of industrial effluent generated in BSMSN Zone 2A and Zone 2B and (ii) Sale of treated wastewater (for reuse)

Capital costs: Capital costs includes 3 components (i) Effluent network in Zone 2A and 2B and associated pumping stations (ii) CETP (iii) Reuse pipeline and associated pumping stations **O&M costs:** O&M costs for the project include (i) Power charges (ii) Cost of chemical and consumables (iii) Manpower and establishment charges (iii) Minor repairs and maintenance (v) Cost of independent engineer, project and contract management

Based on the above 3 parameters, key project financial indicators were evaluated i.e. internal rate of return (IRR) for the project, benefit cost ratio (BCR) and NPV for the project to evaluate the financial viability of the project. The financial parameters of Internal Rate of Return (IRR), Benefit Cost Ratio (BCR) and NPV have been calculated to evaluate the financial viability of the project. A summary of the financial indicators is presented in the table below:

Financial indicators for the Project	NPV	IRR	BCR
Indicators for the project	BDT 73.82 crs	11.43%	1.35

It is observed that the project is feasible and does not require any viability gap funding (VGF) from the government. The detailed cash flows for the project is presented in the table below.

Financial Indicators for the Project											all figures in lakhs					
Year		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Timeline		30-Jun-21	30-Jun-22	30-Jun-23	30-Jun-24	30-Jun-25	30-Jun-26	30-Jun-27	30-Jun-28	30-Jun-29	30-Jun-30	30-Jun-31	30-Jun-32	30-Jun-33	30-Jun-34	30-Jun-35
Capital Expediture																
Capex (incl. IDC)		8,541	11,185	1,699	-	-	-	-	-	-	-	-	-	-	-	-
Total Capex		**8,541**	**11,185**	**1,699**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Revenue																
Collections from Treatment of Effluents		-	-	1,402	2,862	3,813	4,669	5,776	6,946	8,275	9,647	10,989	12,243	13,390	14,114	14,855
Collections from reuse water supply		-	-	409	824	1,082	1,256	1,346	1,440	1,535	1,636	1,705	1,791	1,880	1,974	2,073
Total Net Revenue		**-**	**-**	**1,811**	**3,686**	**4,895**	**5,925**	**7,122**	**8,386**	**9,810**	**11,283**	**12,694**	**14,033**	**15,270**	**16,088**	**16,927**
Expenses																
Operating Expense (excluding power)		-	-	511	1,454	1,842	2,140	2,536	2,946	3,417	3,923	4,445	4,959	5,408	5,640	5,876
Power expense		-	-	405	788	1,002	1,165	1,383	1,608	1,866	2,144	2,429	2,710	2,954	3,079	3,205
Major Maintenance		-	-	1,022	425	320	246	246	-	-	-	-	-	-	-	-
Management Costs		-	-	36	74	98	118	142	168	196	56	63	70	76	80	85
Total Expenses		**-**	**-**	**1,973**	**2,740**	**3,261**	**3,669**	**4,307**	**4,721**	**5,480**	**6,123**	**6,938**	**7,739**	**8,438**	**8,800**	**9,166**
EBITDA		**0**	**0**	**-162**	**946**	**1,633**	**2,255**	**2,814**	**3,665**	**4,330**	**5,160**	**5,757**	**6,294**	**6,831**	**7,288**	**7,762**
Tax		-	-	17	35	36	36	36	37	37	38	38	39	40	40	41
EBITDA after tax		**0**	**0**	**-180**	**911**	**1,598**	**2,219**	**2,778**	**3,628**	**4,293**	**5,122**	**5,718**	**6,255**	**6,792**	**7,248**	**7,721**
Add: Provision for major maintenance		-	-	1,022	425	320	246	246	-	-	-	-	-	-	-	-
Less: major maintenance expense in cash		-	-	-	608	-	198	-	-	-	-	-	-	-	-	-
Cash flow to Project		**-8,541**	**-11,185**	**-857**	**727**	**1,918**	**2,267**	**3,024**	**3,628**	**4,293**	**5,122**	**5,718**	**6,255**	**6,792**	**7,248**	**7,721**
DSCR		**-**	**-**	**1.1**	**3.6**	**3.6**	**3.7**	**3.7**	**4.0**	**3.8**	**10.1**	**-**	**-**	**-**	**-**	**-**
BCR		**-**	**-**	**0.5**	**1.3**	**1.5**	**1.6**	**1.7**	**1.8**	**1.8**	**1.8**	**1.8**	**1.8**	**1.8**	**1.8**	**1.8**
IRR	**11.43%**															
NPV (7.2% disc rate)	**7382**															
BCR	**1.35**															

8.2. No requirement of Viability Gap Funding (VGF)

There is no requirement of VGF for this CETP project because of two important reasons:

Project has positive IRR and NPV: The project has an IRR of 11.43% , an NPV of BDT 73.82 cr. (with discount rate at 7.20%[7]) and BCR of 1.35 – considered viable in an infrastructure project. Thus, the project is bankable and is suitable for attracting private sector participation. **Hence, there is no requirement of VGF to make the project viable** as presented in the earlier section.

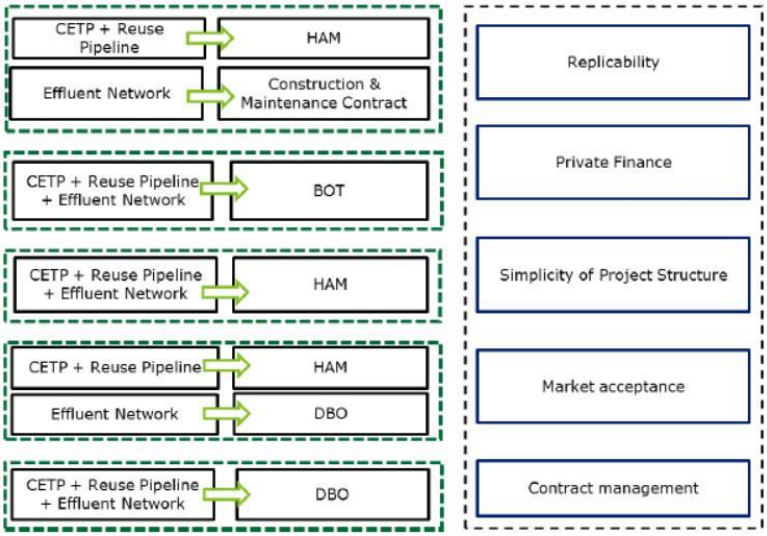
User charges not collected by the operator: Usually insufficiency of user charges results in private operator seeking support of viability gap funding. However, the private operator's revenues are not dependent on user charges as the private operator is expected to get Availability Based Payments (detailed later in this chapter). Hence, there is no requirement of VGF support.

8.3. Hybrid Annuity Model (HAM) as the preferred Project Structuring Option for the Project

A comprehensive risk assessment was undertaken to present the key risks associated with the project, their description, and its consequence. After multiple discussions with potential bidders and other stakeholders, parties best suited to handle the risk were identified and appropriate mitigation mechanisms have been considered. Based on this assessment various PPP options for engaging private operator for this project were analysed.

Five (5) PPP options were considered - Build Operate Transfer (BOT), Hybrid Annuity Model (HAM), Design Build Operate (DBO), a combination of HAM with a separate construction and maintenance contract and combination of HAM and DBO models.

The pros and cons of these 5 PPP options were evaluated in detail across five (5) parameters, namely replicability, private finance, simplicity of project structure, market acceptance and contract management.



Based on the assessment, Hybrid Annuity Model (HAM) was agreed as most suitable for development of the CETP project because of following reasons:

Demand risk cannot be passed on to the operator: BSMSN Economic Zone is a greenfield project and the mobilisation of industries especially given the current pandemic situation is uncertain. Hence, the potential of effluent generation is also uncertain in short to medium term

[7] For calculation of NPV, a discount rate of 7.20% has been considered assuming 5-year yield for bonds issued by Government of Bangladesh.

scenario. Therefore, the demand for effluent treatment is unclear and demand for offtake of reuse (treated) water is expected to stabilise over a longer term. Therefore, it is only appropriate that the demand risk is retained by the Concessioning Authority, BEZA, and is not passed on to the private operator.

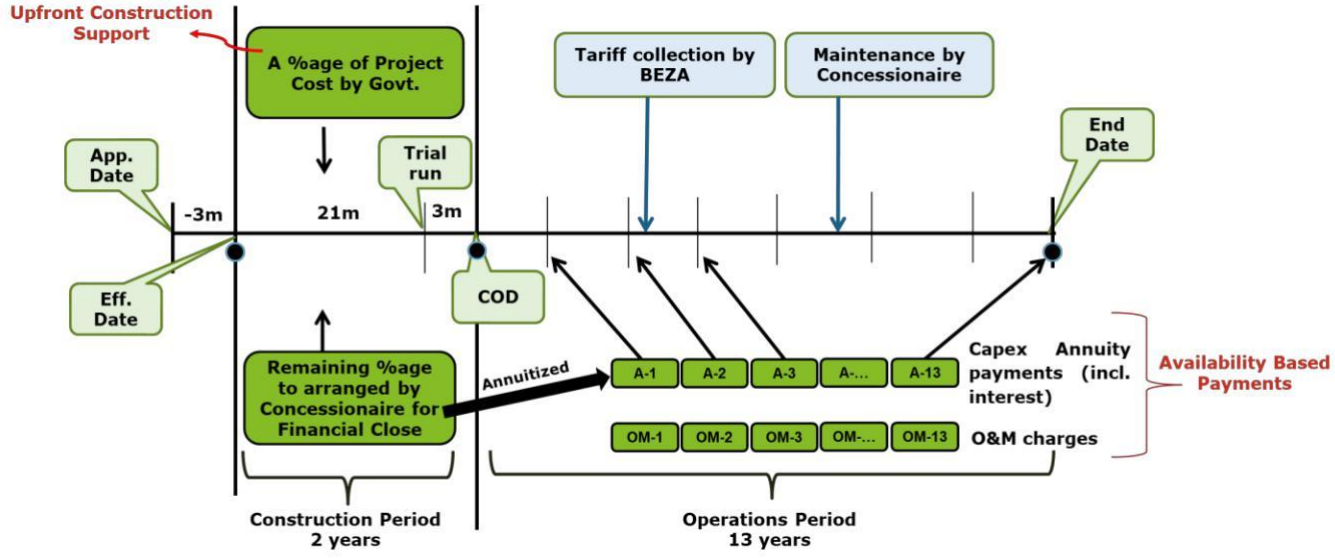
Sensitive issue of tariff setting: The tariff setting for treatment of industrial effluent and reuse of treated water for industries is not only a highly sensitive issue, but also impacts the industrial development objective of this economic zone, and therefore is better dealt with directly by the government authority. Any CETP operator would be very sceptical of assuming the tariff risk which directly effects its revenue.

Financing risk due to liquidity issues: Leveraging private finance is one of the objectives from BEZA's standpoint. However, based on our consultations with potential bidders, it has been understood that they would not like to take on financing risk, especially on a long term financial exposure on a project. Hence hybrid annuity structure offers a middle ground, wherein there is a part financing from both BEZA and the private sector.

Hence, under HAM, while the authority assumes all regulatory risks, compensation risks and commercial risks of the project, the operator assumes the design, construction and operations risk.

8.4. Overview of the Hybrid Annuity Model (HAM)

Hybrid Annuity Model (HAM) is an annuity variant of Design, Build, Finance, Operate and Transfer (DBFOT) wherein the payment to the private operator is made through an **Availability Based Payment Mechanism** during the O&M period and **Upfront Construction Support** during the construction period. The figure below presents an illustration of both these mechanism.



Details on why both availability based mechanisms and upfront construction support is important in the context of this project is detailed in the sections below.

Upfront Construction Support

During the market sounding workshop, the potential bidders had raised concerns around both, their preference for not taking long term financial investment exposure, as well as regarding the lack of

availability of long term loans in Bangladesh for financing the project. Upfront construction support reduces the financial exposure of the operator, as the authority finances a certain percentage of the capital cost of the project. The balance is to be financed by the operator through debt and/or equity.

The provision of upfront construction support improves the market acceptance many fold and it also increases the bankability of the project. The upfront construction support is paid by the authority in milestones based on physical progress of the project assets.

Definition of Upfront Construction Support is as follows: *"Upfront Construction Support" means the Bid Project Cost which refers to the capital cost quoted by the Preferred Bidder in its Financial Proposal, which shall be paid to the Preferred Bidder in instalments during the Construction Period, upon satisfactory completion of milestones of Project, in accordance with the terms of this Agreement.*

Availability Based Payment Mechanism

As per the market sounding exercise conducted, the bidders have preferred to distance themselves from the demand risk which is dependent on establishment of industrial units at Zones 2A and 2B of BSMSN and is not directly under their control. Moreover, there also exists the collection risk wherein some potential local bidders have cited the example of Comilla CETP where the private operator is unable to collect the required revenue for sustenance of the project.

It is proposed that the private operator be paid availability based payments during the O&M period and not user charges which is inherently linked to both demand risk and tariff risk. The Concessioning authority, BEZA, would be responsible for revenue collection.

The availability based payments are made provided the project meets the requisite key performance indicators (KPIs). One of the KPIs include "availability of project assets" which states that the CETP must be operational and available throughout the O&M period and that it will operate as per the specifications agreed on. More specifically, the Availability Based Payments will cover the

Capex Annuity Payments: Capex annuity is paid to the operator for the balance portion of capital cost which was initially financed by the operator. Either, it could be divided equally throughout the O&M period or could be paid within 3-5 years of O&M period. An evaluation of both these options are presented later in the chapter. The capex annuity is paid along with applicable interest on reducing balance.

Fixed O&M charges: Fixed O&M charges are paid to the operator irrespective of utilization of the asset. Fixed O&M charges is particularly important because, as explained earlier, as demand risk is not assumed by the operator, the operator is paid at least a fixed sum periodically to cover its fixed O&M costs irrespective of effluent generated and treated, provided the CETP meets the requisite KPIs.

Variable O&M charges: Variable O&M charges are paid to the operator based on actual quantity of effluent treated by the CETP. This is expected to cover additional O&M expenses on account of additional costs incurred due to increased operations costs incurred to treat the effluent.

Further, liquidated damages on account of energy efficiencies, availability, discharge quality are adjusted from availability based payments. Costs incurred for power are paid based on actual consumption to the Private Operator, limited to the quoted Guaranteed Energy Consumption rate, thereby preventing risk of non-judicious use of electricity for operations.

Availability Based Payments is as follows: *"Availability Based Payments" means the payments to the Operator during the O&M Period which are the agreed upon payments made from the Contracting Authority to the Operator for operating and maintaining the Project Facilities. It comprises the Principal Annuity, Interest on Reducing Principal, Fixed O&M Charges and Variable O&M Charges, during the O&M Period in accordance with this Agreement.*

Previous experience in Bangladesh

Also in the past, the project for development of Water Distribution and Supply Facilities in Purbanchal New Town, Dhaka has been developed on a similar Hybrid Annuity model (DBFOT). It had two key components – (i) **Fixed Upfront Construction Support** and (ii) **Fixed Availability Based Payments** to be made to the private operator on a quarterly basis during the O&M period. Both were clearly defined in the bidding documents. **Also, there was no requirement for VGF since the project was bankable and received good participation from many international bidders.**

8.5. Scenarios with respect to Upfront Construction Support

Based on discussions and as suggested by BEZA, three scenarios with respect to upfront construction support of 40%, 60% and 80% is presented in this section. For BEZA, the sources of income and expenditure are as follows:

Income: Income from 2 sources – (i) treatment of industrial effluent (ii) sale of treated effluent to BSRM and Mcdonald Steel (18 MLD)
Expenditure: Apart from upfront construction support, availability based payments, and the energy costs of CETP will be borne by BEZA. Secondly, management costs including cost of independent engineer and governance/ monitoring costs are also considered as expenditure.

The table below summarizes financial indicators for BEZA for different levels of upfront construction support, assuming constant operator returns.

Financial indicators for BEZA	NPV (in BDT cr.)	IRR	BCR
40% upfront construction support	0 crs	7.2%	1.24
60% upfront construction support	22.41 crs	8.8%	1.32
80% upfront construction support	43.65 crs	9.9%	1.40

The tables below presents detailed cash flows for BEZA for all the 3 scenarios.

Scenario 1: Construction Support provided by the Government is 40%

Financial Indicators for BEZA when Construction Support provided by the government is	40%									all figures in lakhs					
Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Timeline	30-Jun-21	30-Jun-22	30-Jun-23	30-Jun-24	30-Jun-25	30-Jun-26	30-Jun-27	30-Jun-28	30-Jun-29	30-Jun-30	30-Jun-31	30-Jun-32	30-Jun-33	30-Jun-34	30-Jun-35
Cash Outflow for BEZA															
Management cost	-	-	36	74	98	118	142	168	196	56	63	70	76	80	85
Power Charges	-	-	405	788	1,002	1,165	1,383	1,608	1,866	2,144	2,429	2,710	2,954	3,079	3,205
Construction Payments	4,062	3,070	791	-	-	-	-	-	-	-	-	-	-	-	-
CAPEX Annuity	-	-	457	914	914	914	914	914	914	914	914	914	914	914	914
Interest on CAPEX Annuity	-	-	647	1,232	1,126	1,024	922	821	717	615	512	411	307	205	103
OPEX Payment	-	-	1,804	3,758	3,900	4,059	4,223	4,407	4,574	4,759	4,953	5,168	5,364	5,581	5,808
Total Cash Outflow	**4,062**	**3,070**	**4,140**	**6,766**	**7,040**	**7,280**	**7,585**	**7,918**	**8,267**	**8,488**	**8,872**	**9,273**	**9,616**	**9,860**	**10,115**
Cash Inflow for BEZA															
Collections from Treatment of Effluents	-	-	1,402	2,862	3,813	4,669	5,776	6,946	8,275	9,647	10,989	12,243	13,390	14,114	14,855
Collections from reuse water supply	-	-	409	824	1,082	1,256	1,346	1,440	1,535	1,636	1,705	1,791	1,880	1,974	2,073
Total Cash Inflow	**-**	**-**	**1,811**	**3,686**	**4,895**	**5,925**	**7,122**	**8,386**	**9,810**	**11,283**	**12,694**	**14,033**	**15,270**	**16,088**	**16,927**
Net Cashflow	**(4,062)**	**(3,070)**	**(2,329)**	**(3,080)**	**(2,145)**	**(1,356)**	**(463)**	**468**	**1,542**	**2,795**	**3,822**	**4,760**	**5,654**	**6,228**	**6,812**
BCR (for BEZA)	**-**	**-**	**0.4**	**0.5**	**0.7**	**0.8**	**0.9**	**1.1**	**1.2**	**1.3**	**1.4**	**1.5**	**1.6**	**1.6**	**1.7**
BCR (Overall) for BEZA	**1.24**														
IRR for BEZA	**7.2%**														
NPV of BEZA's net cashflow	**0**														

Scenario 2: Construction Support provided by the Government is 60%

Financial Indicators for BEZA when Construction Support provided by the government is	60%									all figures in lakhs					
Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Timeline	30-Jun-21	30-Jun-22	30-Jun-23	30-Jun-24	30-Jun-25	30-Jun-26	30-Jun-27	30-Jun-28	30-Jun-29	30-Jun-30	30-Jun-31	30-Jun-32	30-Jun-33	30-Jun-34	30-Jun-35
Cash Outflow for BEZA															
Management cost	-	-	36	74	98	118	142	168	196	56	63	70	76	80	85
Power Charges	-	-	405	788	1,002	1,165	1,383	1,608	1,866	2,144	2,429	2,710	2,954	3,079	3,205
Construction Payments	5,514	5,067	1,302	-	-	-	-	-	-	-	-	-	-	-	-
CAPEX Annuity	-	-	305	609	609	609	609	609	609	609	609	609	609	609	609
Interest on CAPEX Annuity	-	-	432	821	751	683	614	548	478	410	341	274	205	137	68
OPEX Payment	-	-	1,691	3,524	3,657	3,806	3,960	4,133	4,289	4,463	4,644	4,847	5,030	5,234	5,447
Total Cash Outflow	**5,514**	**5,067**	**4,171**	**5,817**	**6,117**	**6,382**	**6,710**	**7,065**	**7,439**	**7,683**	**8,088**	**8,510**	**8,875**	**9,140**	**9,415**
Cash Inflow for BEZA															
Collections from Treatment of Effluents	-	-	1,402	2,862	3,813	4,669	5,776	6,946	8,275	9,647	10,989	12,243	13,390	14,114	14,855
Collections from reuse water supply	-	-	409	824	1,082	1,256	1,346	1,440	1,535	1,636	1,705	1,791	1,880	1,974	2,073
Total Cash Inflow	**-**	**-**	**1,811**	**3,686**	**4,895**	**5,925**	**7,122**	**8,386**	**9,810**	**11,283**	**12,694**	**14,033**	**15,270**	**16,088**	**16,927**
Net Cashflow	**(5,514)**	**(5,067)**	**(2,360)**	**(2,131)**	**(1,223)**	**(457)**	**412**	**1,321**	**2,371**	**3,601**	**4,606**	**5,523**	**6,395**	**6,948**	**7,513**
BCR (for BEZA)	**-**	**-**	**0.4**	**0.6**	**0.8**	**0.9**	**1.1**	**1.2**	**1.3**	**1.5**	**1.6**	**1.6**	**1.7**	**1.8**	**1.8**
BCR (Overall) for BEZA	**1.32**														
IRR for BEZA	**8.8%**														
NPV of BEZA's net cashflow	**2241**														

Scenario 3: Construction Support provided by the Government is 80%

Financial Indicators for BEZA when Construction Support provided by the government is						80%					all figures in lakhs					
Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Timeline	30-Jun-21	30-Jun-22	30-Jun-23	30-Jun-24	30-Jun-25	30-Jun-26	30-Jun-27	30-Jun-28	30-Jun-29	30-Jun-30	30-Jun-31	30-Jun-32	30-Jun-33	30-Jun-34	30-Jun-35	
Cash Outflow for BEZA																
Management cost	-	-	36	74	98	118	142	168	196	56	63	70	76	80	85	
Power Charges	-	-	405	788	1,002	1,165	1,383	1,608	1,866	2,144	2,429	2,710	2,954	3,079	3,205	
Construction Payments	6,966	7,065	1,813	-	-	-	-	-	-	-	-	-	-	-	-	
CAPEX Annuity	-	-	152	305	305	305	305	305	305	305	305	305	305	305	305	
Interest on CAPEX Annuity	-	-	216	411	375	341	307	274	239	205	171	137	102	68	34	
OPEX Payment	-	-	1,586	3,304	3,429	3,568	3,713	3,874	4,021	4,184	4,354	4,543	4,715	4,907	5,106	
Total Cash Outflow	**6,966**	**7,065**	**4,208**	**4,881**	**5,209**	**5,498**	**5,850**	**6,228**	**6,627**	**6,894**	**7,322**	**7,765**	**8,153**	**8,439**	**8,735**	
Cash Inflow for BEZA																
Collections from Treatment of Effluents	-	-	1,402	2,862	3,813	4,669	5,776	6,946	8,275	9,647	10,989	12,243	13,390	14,114	14,855	
Collections from reuse water supply	-	-	409	824	1,082	1,256	1,346	1,440	1,535	1,636	1,705	1,791	1,880	1,974	2,073	
Total Cash Inflow	**-**	**-**	**1,811**	**3,686**	**4,895**	**5,925**	**7,122**	**8,386**	**9,810**	**11,283**	**12,694**	**14,033**	**15,270**	**16,088**	**16,927**	
Net Cashflow	**(6,966)**	**(7,065)**	**(2,397)**	**(1,195)**	**(314)**	**427**	**1,271**	**2,158**	**3,183**	**4,390**	**5,372**	**6,268**	**7,117**	**7,649**	**8,192**	
BCR (for BEZA)	**-**	**-**	**0.4**	**0.8**	**0.9**	**1.1**	**1.2**	**1.3**	**1.5**	**1.6**	**1.7**	**1.8**	**1.9**	**1.9**	**1.9**	
BCR (Overall) for BEZA	**1.40**															
IRR for BEZA	**9.9%**															
NPV of BEZA's net cashflow	**4365**															

As mentioned earlier, over the past few months due to certain developments, additional points have been discussed with BEZA:

Covid-19: Global Covid-19 situation has increased overall uncertainty in the economy, and has also affected most of the potential private operators who were envisaged to bid for the project. Due to stalled / slow movement in existing projects, many private operators are facing cash constraints. Hence, financing a large portion of private finance or equity may be perceived as a high risk given the current situation. As the upfront support increases, it is envisaged that it would enable sector participation

Access to external funding: BEZA has access to the externally aided funding from a multilateral funding agency which has a window of five years (till June 2025) which can be leveraged for the project. The cost of this loan is in the range of 2-3% which is envisaged to be significantly lower than the rate of loans at which private operator would end up borrowing

Liquidity issues post 2025: A detailed look at cash flows across the 3 scenario presented above reveals that cash flows for BEZA is negative till year 7 in case BEZA provides 40% upfront construction support. But, in case of 80% upfront support, the cash flows turn positive by year 6 (June 2025). In this context, as external aided funds are available till June 2025, BEZA may not face liquidity issues in order to pay the annuities and other O&M payments to the operator in case of 80% upfront construction support. BEZA is expected to pay about 1.53% per annum as annuity (approx. BDT 3 crores), which is in the manageable range given the user charges from industries and from resale of treated effluent will cover it. However, in case of 40%, the liquidity with BEZA may become an issue post June 2025, as the operator payments and other costs would exceed the revenues BEZA is envisaged to earn from the project for initial years. In this case, BEZA is expected to pay about 4.53% per annum as annuity (more than BDT 9 crores), which may put a stress on BEZA cash flows throughout the O&M period.

It may be noted that while higher upfront construction support offers more "Value for Money" for the government, the "skin in the game" or continued commitment for the private operator reduces to a certain extent due to lack of private investment in the project. Both these parameters are important, as one increases the market acceptance while the other ensures that the private operator stays "invested in the project" from a long-term sustainability of operations. As both of them are very important for the success of the project, it is important to strike a good balance between the two **– therefore BEZA has to consider the trade-off between the two.** Another consideration is that needs to be kept in perspective, is the uncertainty and the risk perception that may emerge if there is no sovereign guarantee provided.

If the prime consideration of BEZA is the project related payouts and absence of subsequent funding source post the IDA project, BEZA may consider upfront construction support at higher percentage. However, if BEZA is looking at multiple projects and looking this as a replicable model then BEZA may consider upfront construction support at lower percentage. The other aspects is related to a bid parameter, that is. whether to keep the upfront construction support fixed or market determined, which is best determined at the time of RFP based on the market scenario and discussions with stakeholders at that time. In case of market determined, an appropriate percentage may be quoted by each individual operator depending on their own risk perception.

8.6. Scenarios with respect to Capex Annuity Payments

Upfront construction support is provided during the construction period and thereafter BEZA would be paying annuity payments that would include annuity payment towards the balance capex contribution by the Operator. There are two ways of paying the capex annuity:

Divided equally throughout the O&M period: Capex annuity is equally divided over the O&M period (i.e. if x% is paid as upfront construction support, the remaining (100-x%) may be paid equally every year for the O&M period

Paid within 2 years of start of O&M period: The entire capex annuity is paid within the first 2 years of the O&M period. As discussed earlier, to reduce the financial burden on BEZA, the remaining (100-x%) may be paid as annuity during the first 2 years of the O&M period.

While the second option reduces the financial stress for BEZA, this also reduces the operator's "skin in the game" within 2 years of O&M. This is not preferable as the private operator will not be any more invested in the project after the first 2 years. **Hence, we recommend that the remaining 20% may be paid equally over the entire 13 years of O&M period.**

8.7. Foreign Currency Payments

During the market sounding workshop, international bidders requested that bidders be allowed to bid and receive payments from BEZA in foreign currency. This becomes particularly relevant due to lack of long term financing from local financial institutions. It is necessary to fix minimum percentage of payment in foreign currency at various stages (construction and operations phase) to the operator.

During construction activities, operator may consider purchasing equipment / machinery from the international markets thereby exposing him to the currency risk fluctuations. Hence, a cap on foreign currency payment upto 40% of the envisaged capital works may be considered.

For operations and maintenance works, since most of the cost of operations pertain to energy and manpower, bidders are not exposed to foreign currency risk during the O&M period. Hence, a cap of 20% on foreign currency payment may be considered for availability based payments. Hence, upto

40% of upfront construction support payments can be made in foreign currency, and upto 20% of Availability Based Payments can be made in foreign currency (upto 2 foreign currencies).

8.8. Sovereign Guarantee

During market sounding exercise undertaken for this project, especially potential international bidders have indicated a strong preference for a sovereign guarantee. They have cited examples of power sector PPP projects being implemented under the Bangladesh Power Development Board (BPDB) for provisioning of sovereign guarantee through Implementation Agreements in Bangladesh. Thus, the following options may be considered regarding sovereign guarantee:

MIGA Guarantee: MIGA Guarantee may be chosen for providing a guarantee to the bidders. In this case, a preliminary form has to be filled up on which MIGA will provide a cost quote (approx. 1% of insured amount per year) - the cost of which has to be borne by BEZA. Thereafter, if that cost is acceptable to BEZA then the guarantee will be processed by MIGA.
Sovereign Guarantee: In case provision of MIGA Guarantee is not opted as the preferred option, potential bidders may be provided comfort through sovereign guarantee. In this situation, the Ministry of Finance may be approached for such assurances.
No Guarantee: Not providing any guarantee (MIGA Guarantee or sovereign guarantee) to potential bidders may discourage participation from the market (particularly international bidders) due to two reasons. Firstly, the project structure requires potential bidders to invest certain %age of capital costs and a guarantee would help secure periodic operator payments. Secondly, being a greenfield project the user charges would depend on the quantum of wastewater flows which is dependent on utilization of land allotted to industries.

8.9. Summary of Recommendation

1. **No VGF is required:** Expected user charges from industries and from sale of treated effluent, is ensuring that the project is financially viable project with positive NPV. Also, since the operator revenues are not dependent on user charges, there is no requirement to give VGF.
2. **Preference for Hybrid Annuity Model:** Hybrid Annuity Model emerged as the most favourable model based on detailed market consultations with prospective bidders and discussion with other stakeholders due to better replicability, potential to leverage private finance, and market acceptance.
3. **Payments to the Operator:** During the construction period, operator will be paid upfront construction payment, and during O&M period, operator will be paid availability based payments provided the projects meets the key performance indicators.
4. **Provision of Upfront Construction Support:** Scenario analysis for 40%, 60% and 80% is presented earlier (section 8.5) and evaluation of the same has been elaborated.
5. **Annuity Payments to be paid equally throughout the O&M period:** The amount which is initially financed by private operator is to be annuitized and paid equally over the remaining 13 years of O&M period – which would be expected to be paid by BEZA.
6. **Foreign Currency Payments:** To encourage international participation, upto 40% of upfront construction support and upto 20% of availability based payments can be considered to be paid in upto 2 foreign currencies.
7. **Sovereign Guarantee:** To encourage international participation payment, either sovereign guarantee or MIGA guarantee should be considered to provide necessary payment security to the potential bidders.

Annexure 1: Value for Money Assessment

The study team has discussed the four key elements (base Public Sector Comparator (PSC) costs, competitive neutrality, retained risk and transferable risks) of evaluating PSC and value for money in the following section. The study team has followed the below approach while preparing the PSC model and VfM Framework for two project scoping options.

1) *Option 1: CETP + Reuse Water Pipeline + Effluent Network*
2) *Option 2: CETP + Reuse Water Pipelines*

At first, the study team has identified the costs required for the preparation of PSC and VfM Framework. The study team then compared and analyzed the costs of two procurement models as mentioned below.

1. Procurement done on EPC basis followed by O&M
2. Procurement done on Design Build Operate (DBO) basis (PPP)

Subsequently, cash flows and risks associated with each model have been valued and compared on a common platform to get a holistic picture.

Identification of cost of both the models to the government

The study team has estimated the cost of four key elements for both the models from government's point of view.

Estimation of Key Elements	EPC Basis	DBO (PPP) Basis
Base PSC Costs	Base PSC costs consist of three parts – total project costs, operational and maintenance costs and revenues. Total project costs is sum of base EPC cost of the project and various preliminary expenses like DPR preparation costs, preoperative expenses, pre-bid advisory, independent engineer costs (during construction) etc. Cost of land has been excluded from computations in all cases Operating and maintenance costs consists of periodic maintenance, major maintenance, power, chemical, manpower, independent engineer costs (during operation), running cost etc. Revenues from the project are based on the assumed tariff rates for treatment of industrial effluent and supply of treated water.	The capital cost of DBO is slightly more than that of EPC. The operating and maintenance cost is relatively higher due to better skillset and levels of operation. Revenues generated from effluent treatment and reuse water supply in DBO is based on the same tariff rates as that of EPC.
Competitive Neutrality	Exclusive benefits enjoyed by the government in an EPC project have been identified and added back to the PSC model. Taxation benefits available to the EPC project have been added to the PSC model.	Taxation benefits available in DBO project have been added to the model.
Retained Risk	Value of risk retained by the government in EPC contract is added to the PSC model. Value of various risks such as loss in revenue due	In DBO model, it is assumed there is no delay risk due to a more reliable developer.

Estimation of Key Elements	EPC Basis	DBO (PPP) Basis
	tocollectioninefficiency,arrearsand construction delay, economic costs due to delays in construction and non-quantifiable risk (on estimated basis) are added to the PSC model.	However, other revenue relatedrisksandnon-quantifiable risks are borne by the government. Value of these risks have been estimated and added to the cost of DBO model.
Transferable Risk	Typically, in an EPC project, O&M component is transferred later to the private party (through an OMT contract). Cost of procurement of OMT operator can be valued as the premium demanded by the private party to assume the responsibility for O&M of the CETP facilities. These costs have been added to the PSC model.	No transferable risks have been considered for the government in DBO contract.

Preparation of both models

After identifying various components under these four elements, the study team has calculated the NPV of costs under these four elements for both the models. Thereafter, the study team has compared the results in the Value for Money Framework to understand benefits to the government.

Assumptions used in the model

There are certain assumptions that are different for EPC and DBO model that relates to competitive neutrality, valuation of retained risk and transferable risks – for example, delays in construction, cost of O&M procurement, loss in revenue due to inefficiency, cost of non-quantifiable risks etc.

The key assumption for EPC and DBO are given in the table below.

Table 24: Key Assumptions for the VFM Model

Assumptions for the government	Value
Delay in construction period in EPC	12 months
Economic cost of delay	0.3% of project cost per month
Operational expense of DBO over EPC	15%
Discount rate	7.2%
Additional cost of procurement in EPC for OMT contract	5% of OPEX
Revenue collection efficiency in EPC	3% less than DBO
Arrear collection efficiency in EPC	2% less than DBO
Preliminary Costs	
DPR Design (one time of EPC cost)	0.1%
Preoperative expenses of EPC (DPR & Supervision Engineer cost on EPC)	1.5%
Pre-Bid Advisory	50 BDT lakh – EPC 300 BDT Lakh - DBO
Independent Engineers (IE) Charge of EPC during construction	2% of cost – EPC 1% of cost - DBO

Assumptions for calculation of Conditional Probability

The study team has identified certain non-quantifiable risk parameters that can affect the capital cost,

operational cost and revenue generation. The conditional probability of the parameters is given in the table below:

Table 25: Risk Assessment Assumption

Risk Assessment Assumption	Remarks	Impact	Probability	Total Probability	Financial Impact
Cost overrun					
Cost escalation					
Best Case	Cost overrun by 0%	0%	25%	100%	13.00%
Average	Cost overrun by 10%	10%	40%		
Average	Cost overrun by 20%	20%	20%		
Average	Cost overrun by 30%	30%	10%		
Worst Case	Cost overrun by 40%	40%	5%		
Unsuitable technology					
Best Case	Cost overrun by 0%	0%	50%	100%	9.00%
Average	Cost overrun by 10%	10%	25%		
Average	Cost overrun by 20%	20%	15%		
Average	Cost overrun by 30%	30%	5%		
Worst Case	Cost overrun by 40%	40%	5%		
Force majeure					
Best Case	Cost overrun by 0%	0%	70%	100%	4.70%
Average	Cost overrun by 10%	10%	20%		
Average	Cost overrun by 20%	20%	5%		
Average	Cost overrun by 30%	30%	3%		
Worst Case	Cost overrun by 40%	40%	2%		
Delays Land Acquisition					
Best Case	Cost overrun by 0%	0%	70%	100%	4.70%
Average	Cost overrun by 10%	10%	20%		
Average	Cost overrun by 20%	20%	5%		
Average	Cost overrun by 30%	30%	3%		
Worst Case	Cost overrun by 40%	40%	2%		
Unsuitable weather					
Best Case	Cost overrun by 0%	0%	35%	100%	6.00%
Average	Cost overrun by 5%	5%	30%		
Average	Cost overrun by 10%	10%	20%		
Average	Cost overrun by 15%	15%	10%		
Worst Case	Cost overrun by 20%	20%	5%		
Delay in shifting utilities					
Best Case	Cost overrun by 0%	0%	20%	100%	6.75%
Average	Cost overrun by 5%	5%	45%		
Average	Cost overrun by 10%	10%	20%		
Average	Cost overrun by 15%	15%	10%		
Worst Case	Cost overrun by 20%	20%	5%		
Operating Cost					
Poor construction quality					

Risk Assessment Assumption	Remarks	Impact	Probability	Total Probability	Financial Impact
Best Case	Opex increase by 0%	0%	5%		
Average	Opex increase by 10%	10%	20%		
Average	Opex increase by 20%	20%	45%	100%	20.50%
Average	Opex increase by 30%	30%	25%		
Worst Case	Opex increase by 40%	40%	5%		
Unsuitable weather					
Best Case	Opex increase by 0%	0%	50%		
Average	Opex increase by 5%	5%	20%		
Average	Opex increase by 10%	10%	15%	100%	5.00%
Average	Opex increase by 15%	15%	10%		
Worst Case	Opex increase by 20%	20%	5%		
Revenue					
Decrease in effluent volume					
Best Case	Revenue decrease by 0%	0%	15%		
Average	Revenue decrease by 5%	5%	25%		
Average	Revenue decrease by 10%	10%	30%	100%	9.25%
Average	Revenue decrease by 15%	15%	20%		
Worst Case	Revenue decrease by 20%	20%	10%		
Decrease in reuse water volume					
Best Case	Revenue decrease by 0%	0%	70%		
Average	Revenue decrease by 5%	5%	15%		
Average	Revenue decrease by 10%	10%	7%	100%	2.80%
Average	Revenue decrease by 15%	15%	5%		
Worst Case	Revenue decrease by 20%	20%	3%		
Decrease in tariff rate					
Best Case	Revenue decrease by 0%	0%	50%		
Average	Revenue decrease by 5%	5%	20%		
Average	Revenue decrease by 10%	10%	20%	100%	4.75%
Average	Revenue decrease by 15%	15%	5%		
Worst Case	Revenue decrease by 20%	20%	5%		

Annexure 1A: Value for Money Assessment for Scoping Option 1

In this section, the study team has carried out the Value for Money analysis for project scoping option 1 consisting of development of CETP, Reuse water pipeline and Effluent Network.

Value for Money

This analysis quantifies Value for Money for procuring a project on DBO basis instead of EPC basis. Net Project Costs (NPC) has been calculated under various heads – Base PSC Costs (includes revenues, capital expenditure, operational expenditure), Competitive Neutrality, Retained Risks and Transferable Risks. Subsequently, the study team has calculated NPV of each category in order to assess the difference of both DBO and EPC models across these categories.

Risk faced by the project are of two types: quantifiable and non-quantifiable risks.

> Quantifiable risks include risk of increase in capital expenditure due to delays, risk of loss of revenues due to delays and inefficient collection.
>
> Non quantifiable risks include risk of cost overrun due to force majeure, land acquisition problems, unsuitable technologies, risk of operation cost overruns due to poor construction quality, risk of revenue shortfall due to decrease in effluent volume, reuse water volume, tariff rate etc.

The escalation of costs due to non-quantifiable risk is illustrated in the table below. The non-quantifiable risks are considered as the risks to be retained by the Government.

Table 26: Retained risk - Non quantifiable risk

RISK ALLOCATION	FINANCIAL IMPACT	RISK PROBABILITY		VALUE AT RISK			NPV OF RETAINED RISK FOR BEZA	
		EPC	DBO	Value at Risk	EPC MODEL	DBO MODEL	EPC MODEL	DBO MODEL
Capital costs overrun								
Capital Cost overrun due to increase in input costs	**13.00%**	100%	100%	NPV of EPC Cost	19654.49	18092.65	2555.08	2352.04
Capital Cost overrun due to use of unsuitable technology	**9.00%**	100%	20%	NPV of EPC Cost	19654.49	18092.65	1768.90	325.67
Capital Cost overrun due to force majeure	**4.70%**	100%	100%	NPV of EPC Cost	19654.49	18092.65	923.76	850.35
Capital Cost overrun due to delays in land acquistion	**4.70%**	100%	100%	NPV of EPC Cost	19654.49	18092.65	923.76	850.35
Capital Cost overrun due to adverse weather conditions	**6.00%**	100%	100%	NPV of EPC Cost	19654.49	18092.65	1179.27	1085.56
Capital Cost overrun due to delay in shifting utilities	**6.75%**	100%	100%	NPV of EPC Cost	19654.49	18092.65	1326.68	1221.25
Operational costs overrun								
Opex Cost overrun due to poor construction quality	**20.50%**	100%	60%	NPV of Opex Cost	34662.73	37963.95	7105.86	4669.57
Opex Cost overrun due to adverse weather conditions	**5.00%**	100%	100%	NPV of Opex Cost	34662.73	37963.95	1733.14	1898.20
Revenue shortfall								
Revenue shortfall due to decrease in effluent load	**9.25%**	100%	100%	NPV of Revenues	46440.94	51938.60	4295.79	4804.32
Revenue shortfall due to decrease in reuse water demand	**2.80%**	100%	100%	NPV of Revenues	46440.94	51938.60	1300.35	1454.28
Revenue shortfall due to tariff reduction	**4.75%**	100%	100%	NPV of Revenues	46440.94	51938.60	2205.94	2467.08
TOTAL VALUE AT RISK							**25318.53**	**21978.68**

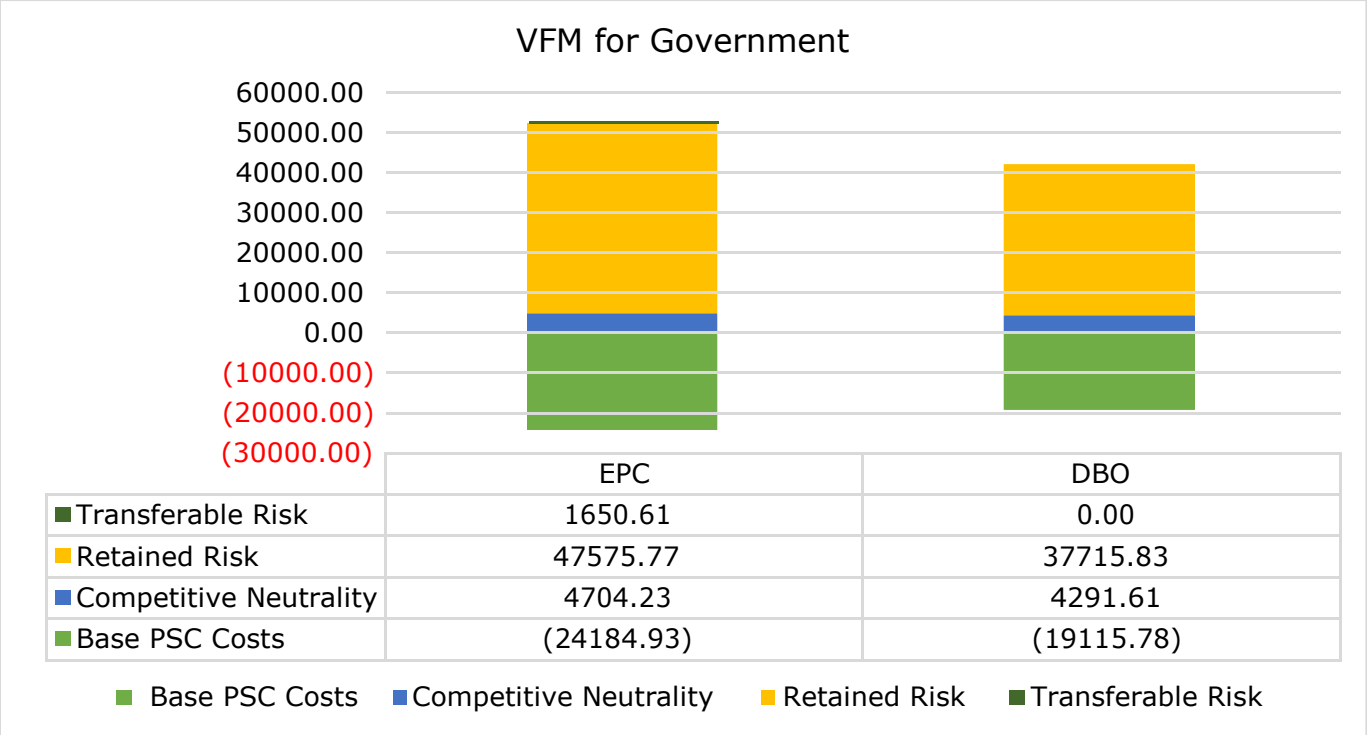
The risk adjusted project costs and risk adjusted project returns discounted at 7.2% has been calculated for both DBO and EPC models. Outcome of the Value for Money analysis is given in the table below.

Table 27: Value for Money Analysis

VALUE FOR MONEY for government	EPC with O&M	DBO
Base PSC Costs		
Revenue from Effluent Treatment	50634.03	50634.03
Revenue from Reuse water supply	19096.01	19096.01
Capital Cost	18092.68	18150.92
Operational cost	33012.13	37963.95
Total Base PSC Costs (A)	**(18625.23)**	**(13615.18)**
Competitive Neutrality		
Taxation	4659.44	4246.82
Total Cost of Competitive Neutrality (B)	**4659.44**	**4246.82**
Retained Risk		
Loss in revenue due to collection inefficiency	12502.22	10410.32
Loss in revenue due to arrears	9108.88	7381.12
Loss in revenue due to delay in construction activities	1678.01	0.00
Rise in capex due to delay in construction	1561.84	0.00
Non Quantifiable risk	25318.53	21978.68
Economic cost-delay in construction	800.84	0.00
Total Costs of Retained Risk (C)	**50970.32**	**39770.12**
Transferable Risk		
Additional procurement cost to BEZA in EPC	1650.61	0.00
Total Costs of Transferable Risk (D)	**1650.61**	0.00
NPV of Net Project Costs (A + B + C + D)	**38655.13**	**30,401.76**
Value for Money		**8253.37**

It is observed that the project cash flows for government is higher if project were to be procured through DBO mode. **The project gives Value for Money of more than BDT 82.53 crores if the project were to be developed on DBO model**. Thus, DBO (PPP) mode is more preferable as compared to EPC mode of project delivery.

Figure 17: VFM for Government



	EPC	DBO
Transferable Risk	1650.61	0.00
Retained Risk	47575.77	37715.83
Competitive Neutrality	4704.23	4291.61
Base PSC Costs	(24184.93)	(19115.78)

The figure above gives a graphical representation of the value for money to the Government when it pursues DBO over EPC. In EPC, the study team has considered risk of escalation of project costs and risk of loss of revenues due to delays in construction which is not there in case of DBO due to probability of better skillset. Non-quantifiable risk has been valued separately in greater detail as mentioned above. Economic costs of delays in construction have been accounted for as well. In EPC, additional cost of O&M procurement has been considered.

Annexure 1B: Value for Money Assessment for Scoping Option 2

In this section, the study team has carried out the Value for Money analysis for project scoping option 2 consisting of development of CETP and Reuse water pipeline.

Value for Money

This analysis quantifies Value for Money for procuring a project on DBO basis instead of EPC basis. Net Project Costs (NPC) has been calculated under various heads – Base PSC Costs (includes revenues, capital expenditure, operational expenditure), Competitive Neutrality, Retained Risks and Transferable Risks. Thereafter the study team has calculated NPV of each category in order to assess the difference of both DBO and EPC models across these categories.

Risk faced by the project are of two types: quantifiable and non-quantifiable risks.

> Quantifiable risks include risk of increase in capital expenditure due to delays, risk of loss of revenues due to delays and inefficient collection.
>
> Non quantifiable risks include risk of cost overrun due to force majeure, land acquisition problems, unsuitable technologies, risk of operation cost overruns due to poor construction quality, risk of revenue shortfall due to decrease in effluent volume, reuse water volume, tariff rate etc.

The escalation of costs due to non-quantifiable risk is illustrated in the table below. The non-quantifiable risks are considered as the risks to be retained by the Government.

Table 28: Retained risk - Non quantifiable risk

RETAINED RISK - NON QUANTIFIABLE RISK								
RISK ALLOCATION	**FINANCIAL IMPACT**	**RISK PROBABILITY**		**VALUE AT RISK (in BDT Lacs)**			**NPV OF RETAINED RISK FOR BEZA (in BDT lacs)**	
		EPC	**DBO**	**Value at Risk**	**EPC MODEL**	**DBO MODEL**	**NPV of Retained Risk added to EPC MODEL**	**NPV of Retained Risk added to DBO MODEL**
Capital costs overrun								
Capital Cost overrun due to increase in input costs	**13.00%**	100%	100%	NPV of EPC Cost	13613.56	12532.99	1769.76	1629.29
Capital Cost overrun due to use of unsuitable technology	**9.00%**	100%	20%	NPV of EPC Cost	13613.56	12532.99	1225.22	225.59
Capital Cost overrun due to force majeure	**4.70%**	100%	100%	NPV of EPC Cost	13613.56	12532.99	639.84	589.05
Capital Cost overrun due to delays in land acquistion	**4.70%**	100%	100%	NPV of EPC Cost	13613.56	12532.99	639.84	589.05
Capital Cost overrun due to adverse weather conditions	**6.00%**	100%	100%	NPV of EPC Cost	13613.56	12532.99	816.81	751.98
Capital Cost overrun due to delay in shifting utilities	**6.75%**	100%	100%	NPV of EPC Cost	13613.56	12532.99	918.92	845.98
Operational costs overrun								
Opex Cost overrun due to poor construction quality	**20.50%**	100%	60%	NPV of Opex Cost	34662.73	37963.95	7105.86	4669.57
Opex Cost overrun due to adverse weather conditions	**5.00%**	100%	100%	NPV of Opex Cost	34662.73	37963.95	1733.14	1898.20
Revenue shortfall								
Revenue shortfall due to decrease in effluent load	**9.25%**	100%	100%	NPV of Revenues	46440.94	51938.60	4295.79	4804.32
Revenue shortfall due to decrease in reuse water demand	**2.80%**	100%	100%	NPV of Revenues	46440.94	51938.60	1300.35	1454.28
Revenue shortfall due to tariff reduction	**4.75%**	100%	100%	NPV of Revenues	46440.94	51938.60	2205.94	2467.08
TOTAL VALUE AT RISK							**22651.46**	**19924.39**

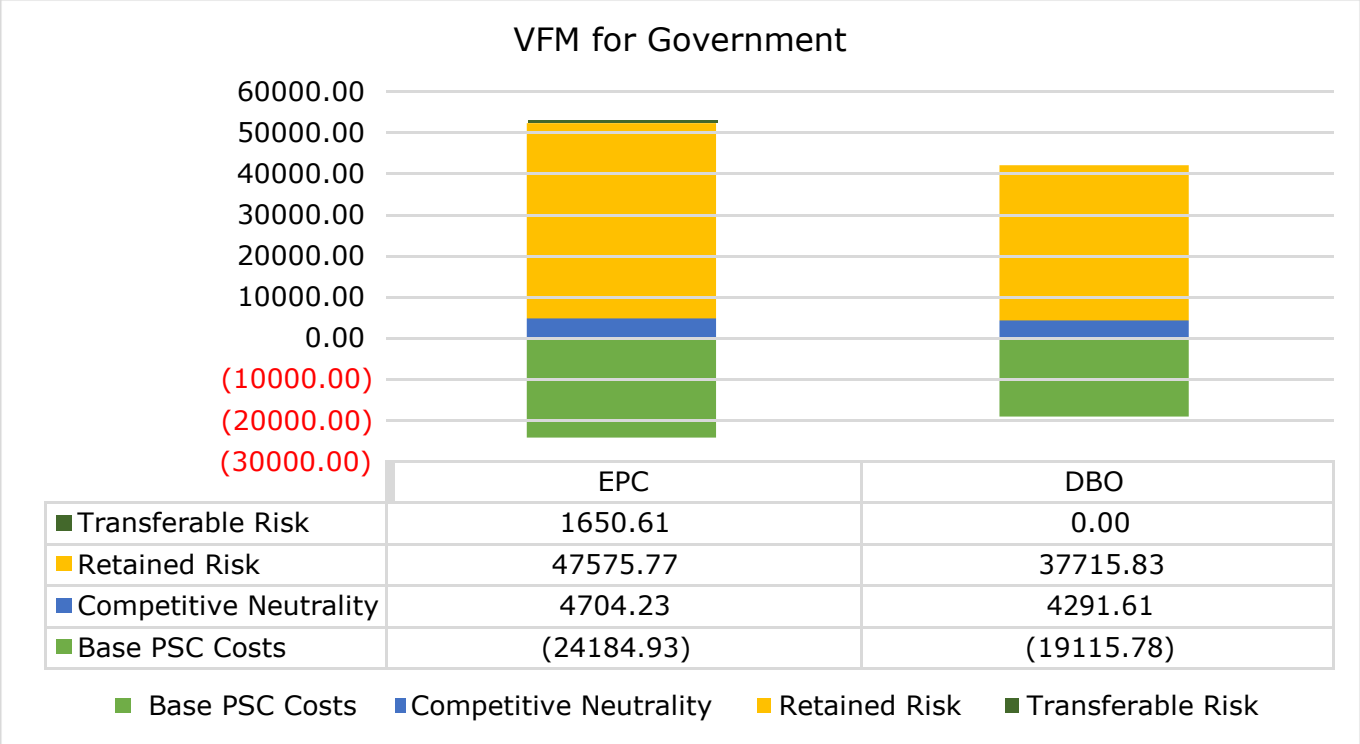
The risk adjusted project costs and risk adjusted project returns discounted at 7.2% has been calculated for both DBO and EPC models. Outcome of the Value for Money analysis is given in the table below.

Table 29: VFM Analysis

VALUE FOR MONEY for government	EPC with O&M	DBO
Base PSC Costs		
Revenue from Effluent Treatment	50634.03	50634.03
Revenue from Reuse water supply	19096.01	19096.01
Capital Cost	12532.99	12650.32
Operational cost	33012.13	37963.95
Total Base PSC Costs (A)	**(24184.93)**	**(19115.78)**
Competitive Neutrality		
Taxation	4704.23	4291.61
Total Cost of Competitive Neutrality (B)	**4704.23**	**4291.61**
Retained Risk		
Loss in revenue due to collection inefficiency	12502.22	10410.32
Loss in revenue due to arrears	9108.88	7381.12
Loss in revenue due to delay in construction activities	1678.01	0.00
Rise in capex due to delay in construction	1080.57	0.00
Non Quantifiable risk	22651.46	19924.39
Economic cost-delay in construction	554.63	0.00
Total Costs of Retained Risk (C)	**47575.77**	**37715.83**
Transferable Risk		
Additional procurement cost to BEZA in EPC	1650.61	0.00
Total Costs of Transferable Risk (D)	**1650.61**	0.00
NPV of Net Project Costs (A + B + C + D)	**29745.67**	**22,891.66**
Value for Money		**6854.02**

It is observed that the project cash flows for government is higher if project were to be procured through DBO mode. **The project gives Value for Money of more than BDT 68.54 crores if the project were to be developed on DBO model**. Thus, DBO (PPP) mode is more preferable as compared to EPC mode of project delivery.

Table 30: VFM for Government



	EPC	DBO
Transferable Risk	1650.61	0.00
Retained Risk	47575.77	37715.83
Competitive Neutrality	4704.23	4291.61
Base PSC Costs	(24184.93)	(19115.78)

The figure above gives a graphical representation of the value for money to the Government when it pursues DBO over EPC. In EPC, the study team has considered risk of escalation of project costs and risk of loss of revenues due to delays in construction which is not there in case of DBO due to probability of better skillset. Non-quantifiable risk has been valued separately in greater detail as mentioned above. Economic costs of delays in construction have been accounted for as well. In EPC, additional cost of O&M procurement has been considered.

Annexure 2: Financial analysis and Tariff Estimation as indicated in report dated 16th May 2019

Financial analysis

This section provides the cash flows of the remaining four project options for developing a 48 MLD CETP. As these options have not been preferred, the cashflows for these options reflect our previous assumptions presented in the earlier version of the Revised Business Case Report submitted on 16th May 2019.
For the preferred option (Option 3), we have presented the updated financial analysis based on the latest developments. This includes inputs received from the market sounding workshop held on 30th June, 2019 and the developments thereafter.

1. Option 1: *Development of CETP + Reuse Water Pipeline on HAM basis and Effluent Network under a Separate Construction and Maintenance Contract*

In this option, the cost of CETP and Reuse Water Pipeline will be borne by the CETP developer under the HAM mode while the effluent network will be built under a separate Construction and Maintenance contract. The cash outflows for BEZA include the annuity payments to the CETP developer and the cost of construction of the effluent network. The cash inflows for BEZA comprise the revenues generated from treatment of effluent and supply of reuse water from the CETP. The table below provides the cash flows for BEZA for 20 years when the project is executed under this mode.

Table 31: Cash flows for BEZA under HAM + Separate Construction and Maintenance Mode

Particular	1	2	3	4	5	6	7	8	9	10
Year	30-Jun-20	30-Jun-21	30-Jun-22	30-Jun-23	30-Jun-24	30-Jun-25	30-Jun-26	30-Jun-27	30-Jun-28	30-Jun-29
Cash Outflow for BEZA										
CETP + Reuse pipeline on HAM										
Management Cost	0.00	0.00	26.71	55.57	73.68	87.23	102.89	119.03	136.36	38.46
Power Charges	0.00	0.00	276.83	523.91	655.42	756.43	884.92	1018.55	1171.30	1335.97
Construction Payment	2008.70	1847.05	960.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CAPEX Annuity	0.00	0.00	601.23	1170.52	1126.89	1079.35	1033.77	988.19	944.07	897.03
OPEX Annuity	0.00	0.00	1438.22	2987.56	3117.74	3235.67	3367.19	3504.07	3656.83	3795.22
Total for CETP + Reuse Pipeline	2008.70	1847.05	3303.03	4737.56	4973.73	5158.68	5388.78	5629.85	5908.55	6066.68
Effluent Network on Separate Construction and Maintenance Contract										
Effluent Network Construction cost	2401.91	2401.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Effluent Network O&M Cost	0.00	0.00	15.09	15.63	16.16	16.70	17.24	17.78	18.32	18.86
Total for Effluent Network	2401.91	2401.91	15.09	15.63	16.16	16.70	17.24	17.78	18.32	18.86
Cash Inflow for BEZA										
Collections from Treatment of Effluents	0.00	0.00	929.29	1867.59	2490.70	3037.60	3697.74	4390.54	5163.80	5948.21
Collections from reuse water supply	0.00	0.00	444.49	892.28	1167.16	1290.74	1405.74	1511.38	1594.86	1676.02
Net Cashflow	**-4410.61**	**-4248.96**	**-1944.34**	**-1993.31**	**-1332.03**	**-847.05**	**-302.54**	**254.29**	**831.79**	**1538.69**

Particular	11	12	13	14	15	16	17	18	19	20
Year	30-Jun-30	30-Jun-31	30-Jun-32	30-Jun-33	30-Jun-34	30-Jun-35	30-Jun-36	30-Jun-37	30-Jun-38	30-Jun-39
Cash Outflow for BEZA										
CETP + Reuse pipeline on HAM										
Management Cost	42.40	46.17	48.43	50.45	52.51	54.62	56.81	59.09	61.45	63.91
Power Charges	1504.44	1672.24	1759.68	1833.96	1909.19	1985.55	2064.98	2147.58	2233.48	2322.82
Construction Payment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CAPEX Annuity	851.45	805.87	761.24	714.71	669.13	623.55	578.42	532.39	486.81	441.23
OPEX Annuity	3949.55	4110.16	4289.39	4451.78	4632.85	4821.30	5031.57	5222.10	5434.54	5655.63
Total for CETP + Reuse Pipeline	6347.84	6634.44	6858.74	7050.90	7263.68	7485.03	7731.79	7961.15	8216.28	8483.59
Effluent Network on Separate Construction and Maintenance Contract										
Effluent Network Construction cost	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Effluent Network O&M Cost	19.40	19.94	20.47	21.01	21.55	22.09	22.63	23.17	23.71	24.25
Total for Effluent Network	19.40	19.94	20.47	21.01	21.55	22.09	22.63	23.17	23.71	24.25
Cash Inflow for BEZA										
Collections from Treatment of Effluents	6696.11	7383.29	7765.96	8098.17	8434.25	8775.07	9128.47	9495.27	9876.34	10272.20
Collections from reuse water supply	1705.60	1764.58	1828.71	1897.32	1970.05	2046.65	2126.96	2210.93	2298.61	2390.00
Net Cashflow	**2034.47**	**2493.49**	**2715.45**	**2923.57**	**3119.07**	**3314.60**	**3501.02**	**3721.88**	**3934.97**	**4154.37**
NPV of BEZA's net cashflow	**0**									

2. Option 2: *Development of CETP + Reuse Water Pipeline + Effluent Network on BOT basis*

In this case, the cost for the project development is borne by the CETP Developer. The revenue is collected by the CETP developer and ~2% of the revenue may be shared with BEZA. The cost to BEZA includes the contract management cost only. The table below provides the cash flows for BEZA for 20 years when the project is executed under a BOT model.

Table 32: Cash flows for BEZA under BOT Model

Particular	1	2	3	4	5	6	7	8	9	10
Year	30-Jun-20	30-Jun-21	30-Jun-22	30-Jun-23	30-Jun-24	30-Jun-25	30-Jun-26	30-Jun-27	30-Jun-28	30-Jun-29
Cash Outflow for BEZA (in BDT lakhs)										
Contract management	0.00	0.00	33.34	69.35	92.07	109.65	130.20	151.46	174.50	197.47
Cash Inflow for BEZA (in BDT lakhs										
2% Share of revenue collected from sources	0.00	0.00	33.34	69.35	92.07	109.65	130.20	151.46	174.50	197.47
Net Cashflow	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Particular	11	12	13	14	15	16	17	18	19	20
Year	30-Jun-30	30-Jun-31	30-Jun-32	30-Jun-33	30-Jun-34	30-Jun-35	30-Jun-36	30-Jun-37	30-Jun-38	30-Jun-39
Cash Outflow for BEZA (in BDT lakhs)										
Contract management	219.14	239.28	251.11	261.65	272.38	283.32	294.69	306.50	318.77	331.54
Cash Inflow for BEZA (in BDT lakhs										
2% Share of revenue collected from sources	219.14	239.28	251.11	261.65	272.38	283.32	294.69	306.50	318.77	331.54
Net Cashflow	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
NPV of BEZA's net cashflow	**0**									

3. Option 3: Development of CETP + Reuse Water Pipeline + Effluent Network on HAM basis

As this is the preferred option, the cash flows presented in this option have been updated based on the market sounding workshop held on 30th June, 2019 and the latest developments thereafter. Detailed financial assessment for this option is presented in "Chapter 6: Financial Assessment."

The table below provides the cash flows for BEZA for 15 years when the project is executed under a HAM model.

Table 33: Cash flows for BEZA under HAM Model

Particular	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Year	30-Jun-21	30-Jun-22	30-Jun-23	30-Jun-24	30-Jun-25	30-Jun-26	30-Jun-27	30-Jun-28	30-Jun-29	30-Jun-30	30-Jun-31	30-Jun-32	30-Jun-33	30-Jun-34	30-Jun-35
Cash Outflow for BEZA															
Management cost	0.00	0.00	35.64	72.53	96.31	116.56	140.03	164.83	192.76	55.42	62.33	68.89	74.96	78.98	83.09
Power Charges	0.00	0.00	404.50	787.80	1001.74	1165.20	1382.99	1607.75	1866.39	2143.76	2429.25	2710.10	2954.29	3079.25	3205.48
Construction Payments	4061.71	3069.50	790.93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CAPEX Annuity	0.00	0.00	1104.45	2146.21	2040.57	1938.19	1835.82	1735.58	1631.06	1528.68	1426.30	1324.94	1221.54	1119.17	1016.79
OPEX Annuity	0.00	0.00	1803.71	3758.09	3900.16	4058.52	4223.31	4407.13	4573.74	4759.45	4952.70	5168.27	5363.65	5581.43	5808.06
Cash Inflow for BEZA															
Collections from Treatment of Effluents	0.00	0.00	1373.00	2802.74	3733.55	4571.91	5655.99	6801.86	8102.93	9446.81	10760.81	11988.36	13111.61	13821.05	14546.10
Collections from reuse water supply	0.00	0.00	408.86	823.84	1082.17	1255.91	1345.58	1439.81	1535.07	1636.25	1705.23	1790.52	1880.02	1974.03	2072.70
Net Cashflow	**-4061.71**	**-3069.50**	**-2357.38**	**-3138.05**	**-2223.06**	**-1450.64**	**-580.57**	**326.37**	**1374.06**	**2595.77**	**3595.46**	**4506.67**	**5377.20**	**5936.25**	**6505.39**
NPV of BEZA's net cashflow	**0**														

4. Option 4: Development of CETP + Reuse Water Pipeline on HAM Basis and Effluent Network on DBO basis

The source of revenue for BEZA in this option is from collection of tariff for treatment of effluent and supply of treated water for reuse. In this case, the cost of the development of the CETP and reuse water pipeline will be based on the HAM mode while the cost to be incurred for the development of the effluent network will be based on DBO mode. The table below provides the cash flows for BEZA for 20 years for this option.

Table 34: Cash flows for BEZA under HAM + DBO Mode

Particular	1	2	3	4	5	6	7	8	9	10
Year	30-Jun-20	30-Jun-21	30-Jun-22	30-Jun-23	30-Jun-24	30-Jun-25	30-Jun-26	30-Jun-27	30-Jun-28	30-Jun-29
Cash Outflow for BEZA										
CETP + Reuse pipeline on HAM										
Management cost	0.00	0.00	27.82	55.88	74.07	87.68	103.42	119.65	137.07	38.67
Power Charges	0.00	0.00	276.83	523.91	655.42	756.43	884.92	1018.55	1171.30	1335.97
Construction Payment	2008.70	1847.05	960.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CAPEX Annuity	0.00	0.00	601.23	1170.52	1126.89	1079.35	1033.77	988.19	944.07	897.03
OPEX Annuity	0.00	0.00	1438.22	2987.56	3117.74	3235.67	3367.19	3504.07	3656.83	3795.22
Total for HAM	2008.70	1847.05	3304.13	4737.87	4974.11	5159.13	5389.31	5630.46	5909.26	6066.89
Effluent Network on DBO										
Effluent Network payment	2528.33	2528.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Effluent Network O&M Cost	0.00	0.00	16.60	17.19	17.78	18.37	18.97	19.56	20.15	20.74
Total for DBO	2528.33	2528.33	16.60	17.19	17.78	18.37	18.97	19.56	20.15	20.74
Cash Inflow for BEZA										
Collections from Treatment of Effluents	0.00	0.00	946.30	1901.76	2536.29	3093.22	3765.47	4470.99	5258.45	6057.26
Collections from reuse water supply	0.00	0.00	444.49	892.28	1167.16	1290.74	1405.74	1511.38	1594.86	1676.02
Net Cashflow	**-4537.02**	**-4375.37**	**-1929.94**	**-1961.01**	**-1288.44**	**-793.55**	**-237.06**	**332.35**	**923.90**	**1645.65**

Particular	11	12	13	14	15	16	17	18	19	20
Year	30-Jun-30	30-Jun-31	30-Jun-32	30-Jun-33	30-Jun-34	30-Jun-35	30-Jun-36	30-Jun-37	30-Jun-38	30-Jun-39
Cash Outflow for BEZA										
CETP + Reuse pipeline on HAM										
Management cost	42.62	46.42	48.68	50.72	52.79	54.91	57.11	59.40	61.78	64.25
Power Charges	1504.44	1672.24	1759.68	1833.96	1909.19	1985.55	2064.98	2147.58	2233.48	2322.82
Construction Payment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CAPEX Annuity	851.45	805.87	761.24	714.71	669.13	623.55	578.42	532.39	486.81	441.23
OPEX Annuity	3949.55	4110.16	4289.39	4451.78	4632.85	4821.30	5031.57	5222.10	5434.54	5655.63
Total for HAM	6348.07	6634.69	6859.00	7051.17	7263.96	7485.32	7732.09	7961.47	8216.61	8483.93
Effluent Network on DBO										
Effluent Network payment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Effluent Network O&M Cost	21.34	21.93	22.52	23.11	23.71	24.30	24.89	25.49	26.08	26.67
Total for DBO	21.34	21.93	22.52	23.11	23.71	24.30	24.89	25.49	26.08	26.67
Cash Inflow for BEZA										
Collections from Treatment of Effluents	6818.87	7518.63	7908.25	8246.61	8588.86	8936.05	9295.99	9669.66	10057.61	10460.85
Collections from reuse water supply	1705.60	1764.58	1828.71	1897.32	1970.05	2046.65	2126.96	2210.93	2298.61	2390.00
Net Cashflow	**2155.07**	**2626.59**	**2855.44**	**3069.65**	**3271.24**	**3473.08**	**3665.97**	**3893.63**	**4113.54**	**4340.25**
NPV of BEZA's net cashflow	**0**									

5. Option 5: Development of CETP + Reuse Water Pipeline + Effluent Network on DBO basis

The revenue for BEZA in this option remains the same as that of the previous option. The entire project cost in this case shall be based on DBO mode of project structuring. The table below provides the cash flows for BEZA for 20 years for this option.

Table 35: Cash flows for BEZA under DBO Model

Particular	1	2	3	4	5	6	7	8	9	10
Year	30-Jun-20	30-Jun-21	30-Jun-22	30-Jun-23	30-Jun-24	30-Jun-25	30-Jun-26	30-Jun-27	30-Jun-28	30-Jun-29
Cash Outflow for BEZA (in BDT lakhs)										
Construction payment	8025.18	8025.18	813.25	0.00	0.00	196.83	0.00	1148.38	0.00	0.00
O&M payment	-	-	1,076	2,228	2,637	2,951	3,347	3,803	4,274	4,802
Contract management	0.00	0.00	25.36	52.75	69.93	82.71	97.46	112.64	128.91	36.26
Cash Inflow for BEZA (in BDT lakhs										
Collections from Treatment of Effluents	0.00	0.00	841.72	1751.52	2336.82	2850.64	3470.81	4121.59	4847.92	5584.67
Collections from reuse water supply	0.00	0.00	428.78	891.25	1166.27	1290.01	1405.16	1510.94	1594.55	1659.47
Net Cashflow	**-8025.18**	**-8025.18**	**-643.91**	**361.65**	**795.91**	**909.83**	**1431.67**	**568.63**	**2039.91**	**2406.10**

Particular	11	12	13	14	15	16	17	18	19	20
Year	30-Jun-30	30-Jun-31	30-Jun-32	30-Jun-33	30-Jun-34	30-Jun-35	30-Jun-36	30-Jun-37	30-Jun-38	30-Jun-39
Cash Outflow for BEZA (in BDT lakhs)										
Construction payment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
O&M payment	5,562	6,109	6,410	6,672	6,939	7,212	7,496	7,792	8,101	8,423
Contract management	40.04	43.58	45.69	47.60	49.54	51.53	53.59	55.74	57.97	60.29
Cash Inflow for BEZA (in BDT lakhs										
Collections from Treatment of Effluents	6287.02	6932.44	7291.82	7603.85	7919.47	8239.58	8571.47	8915.86	9273.70	9645.48
Collections from reuse water supply	1710.34	1767.90	1831.03	1898.94	1971.20	2047.45	2127.51	2211.32	2298.89	2390.20
Net Cashflow	**2395.46**	**2547.32**	**2666.80**	**2782.81**	**2901.84**	**3023.75**	**3149.54**	**3279.31**	**3413.47**	**3551.91**
NPV of BEZA's net cashflow	**0**									

The cash flows represented above for the different options of project structuring have been calculated after ensuring that the net project lifecycle cash flows for BEZA is zero in NPV terms. This was achieved by setting the tariff rate to different levels under the different modes. A detailed analysis of the tariff rates set for each option is presented in the next section.

Principle for determination of tariff rate based on assumptions indicated in report dated 16th May 2019

This section provides the tariff rate estimates of the project options for developing a 48 MLD CETP. While the tariff rate estimates for the preferred option (all components under HAM) has been updated in Chapter 6.3. Determination of Tariff Rates, this section presents the tariff rates estimates based on our previous assumptions presented in the earlier version of the Revised Business Case Report submitted on 16th May 2019. The objective of this section is to understand the methodology adopted by the study team to determine the tariff rates.

In this section, the study team has described certain approaches for setting the tariff rate for effluent treatment and for reuse water supply in order to ensure financial viability of the project. The study team has followed the below mentioned approaches for determining the tariff rate:

1) Prevailing tariff rates at Dhaka EPZ and Chittagong EPZ
2) Indicative feedback from prospective investors in the BSMSN Economic Zone
3) Estimating tariff based on cash flows to BEZA for:
    a) Option 1: Development of CETP + Reuse Water Pipeline on HAM Basis and Effluent Network under a Separate Construction and Maintenance Contract basis
    b) Option 2: Development of CETP + Reuse Water + Effluent Network on BOT basis
    c) Option 3: Development of CETP + Reuse Water + Effluent Network on HAM basis
    d) Option 4: Development of CETP + Reuse Water Pipeline on HAM Basis and Effluent Network on DBO basis
    e) Option 5: Development of CETP + Reuse Water Pipeline + Effluent Network on DBO basis

1) Prevailing tariff rates at Dhaka EPZ and Chittagong EPZ

The Dhaka and Chittagong Tariff rates are as follows:

(i) Dhaka Tariff rates:

a) Effluent Treatment (BEPZA) – BDT 36.95 per KL of effluent,

b) Water Supply (DWASA) – BDT 33 per KL of treated surface water from WTP

(ii) Chittagong Tariff rates:

a) Effluent Treatment (BEPZA) – BDT 45 per KL of effluent,

b) Water Supply (CWASA) – BDT 26.25 per KL of treated surface water from WTP

The study team has considered the above rates as benchmark for determining tariff at CETP at BSMSN - 2A.

2) Feedback from the prospective investors in the BSMSN Economic Zone

A meeting was organized between the study team, BEZA officials, other government officials and prospective investors in BSMSN EZ on the 18th of December, 2018 to receive feedback from the investors on the tariff rate for the effluent treatment and reuse water supply.

In the meeting, it was communicated that the industries have to bear the cost of setting up of ETP at their premises for pre-treatment of the effluent before discharging it into the CETP. Hence, the investors conveyed that the tariff rates charged by BEPZA in the Dhaka EPZ and Chittagong EPZ are high and BEZA may consider lowering the tariff rate to about BDT 30 per KL of effluent treatment.

Regarding the tariff rate for reuse water supply, the study team informed that at 80% of the DWASA water supply rate, capex is recoverable. There were, however, no comments made on the proposed reuse water rate of BDT 26.40 per KL of reuse water supply.

3) Estimating tariff rate based cash flows to BEZA based on

a. Option 1: *Development of CETP + Reuse Water Pipeline on HAM Basis and Effluent Network under a Separate Construction and Maintenance Contract basis*

The study team has undertaken a financial assessment of the project based on HAM mode of project structuring for CETP and Reuse Pipeline and a separate Construction and Maintenance contract for the development of the effluent network. To get viable returns from the project after ensuring the net project lifecycle cash flows for BEZA is zero in NPV terms, the following tariff rates may be considered:

For effluent treatment - BDT 30.05 per KL[8]

For reuse water supply - BDT 20 per KL

b. Option 2: *Development of CETP + Reuse Water + Effluent Network on BOT basis*

Financial assessment of the project based on BOT mode of project structuring suggest that to get viable returns (same as previous option) from the project, the following tariff rates may be considered:

For effluent treatment - BDT 41.50 per KL[8]

For reuse water supply - BDT 20 per KL

c. Option 3: *Development of CETP + Reuse Water + Effluent Network on HAM basis*

The study team has undertaken a financial assessment of the project based on HAM mode of project structuring. To get viable returns from the project (same as previous option), BEZA needs to make certain payments to the operator. BEZA also earns fee for effluent treatment and reuse water from consumers. The following tariff rates may be considered:

For effluent treatment - BDT 33.60 per KL[8]

For reuse water supply - BDT 20 per KL

d. Option 4: *Development of CETP + Reuse Water Pipeline on HAM Basis and Effluent Network on DBO basis*

When the CETP + Reuse Pipeline is developed under HAM mode and Effluent Network is developed under DBO mode, the following tariff rates may be considered to get viable returns (same as previous

[8] Based on assumptions indicated in the earlier version of the Revised Business Case Report dated 16th May 2019 **90** |

option) from the project:

For effluent treatment - BDT 30.60 per KL[8]

For reuse water supply - BDT 20 per KL

e. Option 5: *Development of CETP + Reuse Water Pipeline + Effluent Network on DBO basis*

A financial assessment of the entire project based on DBO mode of project structuring suggest that to get viable returns (same as previous option) from the project, the following tariff rates may be considered:

For effluent treatment - BDT 28.22 per KL[8]

For reuse water supply - BDT 20 per KL

Summary of Tariff Structure:

The study team has followed different approaches to estimate the tariff rates for the project across the five project structuring options. The prevailing tariff rates charged at Dhaka EPZ and Chittagong EPZ have been taken as benchmark rates (Dhaka EPZ – BDT 36.95/KL for effluent treatment, Dhaka EPZ – 33/KL for reuse water supply). However, based on the feedback from the investors in BSMSN Economic Zone, it was noted that a tariff rate of BDT 30/KL or less (80% of Dhaka EPZ rate) is desirable for the treatment of effluent. Further, based on the feedback from the potential users of the treated water, it was concluded that a tariff rate of BDT 26.40/KL or less is desirable for reuse water supply.

Based on cash flows to BEZA, the estimated tariff rate ranges from BDT 41.50/KL to BDT 28.22/KL for effluent treatment while the tariff rate for reuse water supply has been fixed at BDT 20/KL as described in the table below.

Table 36: Tariff rates estimated as per different approaches

Sl. No.	Approach	Tariff rate (in BDT/KL)	
		Effluent Treatment	Reuse Water Supply
1	Benchmark Rates used for comparison: Prevailing tariff rates at Dhaka EPZ and Chittagong EPZ	Dhaka EPZ – 36.95 Chittagong EPZ - 45	Dhaka EPZ - 33 Chittagong EPZ – 26.25
2	Feedback from the prospective investors in the BSMSN Economic Zone	30 (80% of Dhaka EPZ)	26.4 (80% of Dhaka EPZ)
3	Estimating tariff rate based on cash flows to BEZA (ensuring 20% equity returns to the private operator/ developer and ensuring that the net project lifecycle cash flows for BEZA is zero in NPV term)		
a.	Option 1 (HAM + Separate Construction and Maintenance)	30.05[8]	20
b.	Option 2 (BOT)	41.50[8]	20
c.	Option 3 (HAM)	33.60[8]	20
d.	Option 4 (DBO+HAM)	30.60[8]	20
e.	Option 5 (DBO)	28.22[8]	20

It is observed that there has to be a trade off between higher private (deferred) financing and higher tariff rates vs lower private (deferred) financing and lower tariff rates. The tariff rate in case of BOT model is the highest which makes the project relatively less attractive. The tariff is second highest when all project components are procured on HAM basis.

A decision on the tariff rate to be charged to the industries in BSMSN EZ may be taken by BEZA based on the selected project structure and the market acceptance.

Annexure 3: Environmental Considerations

This section covers key regulations related to Environment, Water Resources, Industry and Construction that need to be considered during the development and operation & maintenance of the CETP. Further, it consists of a comparison of local and international laws and minutes of the meeting with Department of Environment (DoE), Bangladesh

- ***Environment***
  - Environment Policy, 1992 and Environment Action Plan, 1992
  - National Environment Management Plan, 1995
  - Environmental Conservation Act (ECA), 1995
  - Environmental Conservation Rules (ECR), 1997
  - Environmental Courts Act, 2000
- ***Water Resources***
  - National Water Policy, 2000
  - National Water Management Plan, 2001
- ***Industry, Occupational Health & Safety and Construction***
  - Industrial Policy, 2005
  - The Bangladesh Labor Act, 2006
  - Bangladesh National Building Code (1993, 2006)
  - BEZA Building Code (March 2017)
  - BEZA Building Code (March 2017)
- ***Land Acquisition/Requisition***
  - Acquisition/ Requisition of Immovable Property Ordinance (ARIPO, 1982) (amended in September 21, 2017)
  - Property (Emergency) Acquisition Act, 1989
- ***Others***
  - International Buyers Rules and Regulations
  - IFC/ World Bank Group Environmental Health and Safety Guidelines
  - Comparison and analysis of Wastewater Rules and Regulations of Bangladesh and Other countries
  - Potential Environmental Issues and Mitigation Measures regarding the development of the CETP
  - Minutes of the Meeting with Department of Environment (DoE)

Environmental Policy, 1992 and Environmental Action Plan, 1992

The concept of environmental protection through national efforts was first recognized and declared with the adoption of the Environment Policy, 1992 and the Environment Action Plan, 1992. The importance of policies in beefing up the environmental regime is recognized in a number of international instruments including the World Conservation Strategy in 1980 and the Brundtland Commission Report, 1987. Paragraph 14 of Chapter 8 of Agenda 21 underscored the necessity of formulation of national policies as well as laws for environmental protection and sustainable development. The major objectives of Environmental policy are to

i) maintain ecological balance and overall development through protection and improvement of the environment;

ii) protect the country against natural disaster;

iii) identify and regulate activities, which pollute and degrade the environment;

iv) ensure environmentally sound development in all sectors;

v) ensure a sustainable, long term and environmentally sound base of natural resources; and

vi) actively remain associate with all international environmental initiatives to the maximum possible extent.

National Environment Management Plan, 1995

The National Environment Management Action Plan (NEMAP, 1995), based on a nationwide consultation program identified the main national environmental issues, including those related to the water sector which EA practitioners should note. The main related national concerns included flood damage, riverbank erosion, environmental degradation of water bodies, increased water pollution, shortage of irrigation water and drainage congestion; various specific regional concerns were also identified.

Bangladesh Environment Conservation Act (BECA) 1995

The Bangladesh Environment Conservation Act (BECA), 1995 is an Act to provide for:

1) Conservation of the environment
2) Improvement of environmental standards
3) Control and Mitigation of environmental pollution

In order to amend the sections of the Act to address economic growth patterns, the Bangladesh Environment Conservation (Amendment) Act, 2010 was enacted to provide amendment to The Bangladeshi Environment Conservation Act (BECA), 1995.

Some of the key features of The Bangladesh Environment Conservation Act (BECA), 1995 and The Bangladesh Environment Conservation (Amendment) Act, 2010 are as follows:

Table 37: Comparison of the Bangladesh Environment Conservation Act 1995 and 2010[9]

Section No.	Particulars	The Bangladesh Environment Conservation Act, 1995	The Bangladesh Environment Conservation (Amendment) Act, 2010
3	Department of Environment	1) The Government shall, for carrying out the purposes of this Act, establish a Department to be called the Department of Environment and headed by a Director General. 2) The Director General shall be appointed by the Government and the terms and conditions of his service shall also be determined by the Government.	No change
4A	Assistance from law enforcing agencies and other authorities	The Director General or a person authorized by him may, for the purpose of exercising any power or performing any function under this Act, request any law enforcing agency, or any other Government or statutory authority to render necessary assistance, and upon such request that agency or authority shall render the assistance.	No change

[9] Bangladesh Environment Protection Act, 1995

Section No.	Particulars	The Bangladesh Environment Conservation Act, 1995	The Bangladesh Environment Conservation (Amendment) Act, 2010
5	Declaration of ecologically critical area	If the Government is satisfied that an area is in an environmentally critical situation or is threatened to be in such situation, the Government may, by notification in the official Gazette, declare such area as an ecologically critical area and specify the activities or processes that cannot be initiated or continued in an ecologically critical area	Replaced with: If the Government is satisfied that an area is in an environmentally critical situation or is threatened to be in such situation, the Government may, by notification in the official Gazette, declare such area as an ecologically critical area, take necessary steps for improvement of critical situation immediately and specify the activities or processes that cannot be initiated or continued in an ecologically critical area. Demarcation of particular area and legal description with map and, all maps and legal description will be shown in certain area and these will be considered as legal description of that area. After declaration of any area as ecologically critical area, the Government will take management plan for this area.

Section No.	Particulars	The Bangladesh Environment Conservation Act, 1995	The Bangladesh Environment Conservation (Amendment) Act, 2010
6	Restrictions regarding vehicles emitting smoke injurious to environment	A vehicle emitting smoke or gas injurious to health or environment shall not be operated nor shall such vehicles be switched on except for the purpose of test-operation for stopping the emission of such smoke or gas. 6A: Restrictions on manufacture, sale etc. of articles injurious to environment If, on the advice of the Director General or otherwise, the Government is satisfied that all kinds or any kind of polythene shopping bag, or any other article made of polyethylene or polypropylene, or any other article is injurious to the environment, the Government may, by notification in the official Gazette, issue a 4direction imposing absolute ban on the manufacture, import, marketing, sale, demonstration for sale, stock, distribution, commercial carriage or commercial use, or allow the operation or management of such activities under conditions specified in the notification, and every person shall be bound to comply with such direction	Section 6B, 6C, 6D and 6E were added: 6B. Restriction on cutting hill- It is prohibited to cutting and/ or razing of hill and tilla by person or institution of government or semi-government or personal or autonomous organization or occupied or personal acquisition. 6C.Restriction on production, import, storage, loading, transportation etc of hazardous waste- To protect the environmental damage, govt with respect to provision of other law can control by means of provision production, processing, contain, storage, loading, supply, transportation, import, export, disposal, dumping etc of hazardous 6D. Restriction on pollution due to ship breaking-It will not create any environmental pollution and health hazardous by producing hazardous waste from any ship cutting or breaking which have to ensure by every ship owner, importer and user of yard in ship cutting or breaking activities. 6E. Restriction on water reservoir – Notwithstanding anything contained in any other law for the time being in force, it is prohibited to filling land or changing the class by other means which is already specified as water reservoir.

Section No.	Particulars	The Bangladesh Environment Conservation Act, 1995	The Bangladesh Environment Conservation (Amendment) Act, 2010
7	Remedial measures for injury to ecosystem	If it appears to the Director General that any act or omission of a person is causing or has caused, directly or indirectly, injury to the ecosystem or to a person or group of persons, the Director General may determine the compensation and direct the firstly mentioned person to pay it and in an appropriate case also direct him to take corrective measures, or may direct the person to take both the measures; and that person shall be bound to comply with the direction, otherwise the the Director General may file a suit for compensation in the competent court or file a criminal case for failure to comply with the direction or file both kinds of cases.	No change
8	Information to the Director General regarding environmental degradation or pollution	Any person affected or likely to be affected as a result of pollution or degradation of the environment may, in the manner prescribed by rules, apply to the Director General for remedy of the damage or apprehended damage. The Director General may hold a public hearing and take other measures for disposing of an application made under this section.	No change

Section No.	Particulars	The Bangladesh Environment Conservation Act, 1995	The Bangladesh Environment Conservation (Amendment) Act, 2010
9	Discharge of excessive environmental pollutant	Where, due to an accident or other unforeseen incident, the discharge of any environmental pollutant occurs or is likely to occur in excess of the limit prescribed by the rules, the person responsible and the person in charge of the place of occurrence shall take measures to control or mitigate the environmental pollution. The persons referred above shall inform the Director General of the occurrence or the likelihood of such occurrence and on receipt of information with respect to the accident or other incident, the Director General shall take necessary remedial measures to control or mitigate the environmental pollution, and the said person shall be bound to render assistance and co-operation as required by the Director General. The expenses incurred with respect to remedial measures to control and mitigate the environmental pollution under this section shall be payable to the Director General and may be realized from the persons responsible as public demand.	Replaced with: Where, due to incident, the discharge of any environmental pollutant occurs or activities or an accident is likely to occur in excess of the limit prescribed by the rules, the person responsible and the person of occupied of the place of occurrence or related organization shall take measures to control or mitigate the environmental pollution. The persons referred above shall inform the Director General of the occurrence or the likelihood of such occurrence and On receipt of information with respect to the accident or other incident, the Director General or a person authorized by his orders the responsible person or organization specified under subsection (1) of section 9 or any other person or organization to take necessary remedial measures to control or mitigate the environmental pollution, and the said person or persons or organization shall be bound to comply as required by the Director General. The expenses incurred with respect to remedial measures to control and mitigate the environmental pollution under this section shall be payable to the Director General and may be realized from the persons responsible as public demand. Due to the activities of under subsection (1) emi ed waste or pollutant excessed the prescribed limit is proved by the Director General or a person authorized by him in immediate test, then that test report shall be accepted as evidence in court.

Section No.	Particulars	The Bangladesh Environment Conservation Act, 1995	The Bangladesh Environment Conservation (Amendment) Act, 2010
10	Power of entry	Subject to the provisions of this section, any person generally or specially authorized in this behalf by the Director General shall have the right to enter any building or other place at all reasonable times for discharging his duties under this Act. The person operating any industry, activity or process or the person handling any hazardous substance shall be bound to render all assistance to the said authorized person in discharging his duties under this Act.	No change
11	Power to collect samples	A person authorised on this behalf by the Director General may, in the manner prescribed by rules, collect from any factory, premises or other place any sample of air, water, soil or other substance for analysis. The person collecting the sample shall serve, in the manner prescribed by rules, a notice to the occupier of the place or his agent specifying his intention to collect any sample, collect samples in presence of that occupier or his agent, place the sample in a container and seal the container after recording signatures of himself and of the occupier or his agent on the container and prepare a report on the collection of the sample and record signatures of himself and of the occupier or his agent	No change

Section No.	Particulars	The Bangladesh Environment Conservation Act, 1995	The Bangladesh Environment Conservation (Amendment) Act, 2010
12	Environmental Clearance Certificate	No industrial unit or project shall be established or undertaken without obtaining, in the manner prescribed by rules, an Environmental Clearance Certificate from the Director General.	Replaced with: No industrial unit or project shall be established or undertaken without obtaining, in the manner prescribed by rules, an Environmental Clearance Certificate from the Director General. On the regard to environmental clearance certificate in written provision of act with other subject environmental impact assessment report, compilation of environmental management plan, surveying public opinion, getting information from public about all these matter, making committee and activities of supplying clearance certificate, minimum required conditions for clearance certificate, appeal etc. shall be noted in detailed. Department shall renew the list of previous years enlisted industry or project for giving environmental clearance certificate and define the minimum quality or responsibility of related person or organization with compilation of environmental impact assessment report or environmental management plan of different industry or project and prepare such list, approve and renew.
13	Formulation of environmental guidelines	The Government may, by notification in the official Gazette from time to time, formulate and publish environmental guidelines relating to the control and mitigation of environmental pollution, conservation and improvement of the environment.	No change

Section No.	Particulars	The Bangladesh Environment Conservation Act, 1995	The Bangladesh Environment Conservation (Amendment) Act, 2010
14	Appeal	Any person aggrieved by a notice, order or direction issued under this Act or rules may, within 30 days from the date of issuance of the notice, order or direction, appeal to the 3Appellate Authority constituted by the Government and the decision of such Authority on the appeal shall be final and shall not be called in question in any court.	No change
15	Penalties	For violation of a provision or for non-compliance of a direction, or for the activities specified in the sub-sections of the Act (please refer to the Act), the penalty may be imposed. Certain offences and penalties for such offences may be specified in the rules, but the penalty so specified shall not exceed imprisonment for 2 (two) years or a fine of Tk. 10 (ten) thousand or both.	Replaced with: For violation of a provision or for non-compliance of a direction, or for the activities specified in the sub-sections of the Act (please refer to the Act), the penalty may be imposed. Subject to the other provisions of this section, certain offences and penalties for such offences may be specified in the rules, but the penalty so specified shall not exceed imprisonment for 2 (two) years or a fine of Tk. 2 (two) lakh or both.
15A	Confiscation of materials and equipments involved in offence	Where a person is found guilty and sentenced under section 15, all equipments or part thereof, transport, substance or any other thing used in the commission of the offence may be confiscated under order of the court.	Replaced with: Where a person is found guilty and sentenced under section 15, all equipments or parts thereof, transport, substance or any other thing used in the commission of the offence may be confiscated or demolished under order of the court.
15B	Claim for compensation	Where a person or a group of persons or the public suffers loss due to violation of a provision of this Act or the rules made thereunder or a direction issued under section7, the Director General may file a suit for compensation on behalf of that person, group or the public.	Replaced with: Where a person or a group of persons or the public suffers loss due to violation of a provision of this Act or the rules made thereunder or a direction issued under section7, the person, group, public or on behalf of them the Director General may file a suit for compensation.

Section No.	Particulars	The Bangladesh Environment Conservation Act, 1995	The Bangladesh Environment Conservation (Amendment) Act, 2010
16	Offences committed by companies	Where a company violates any provision of this Act or fails to perform its duties in accordance with a notice issued under this Act or the rules or fails to comply with an order or direction, then the owner, director, manager, secretary or any other officer or agent of the company, shall be deemed to have violated such provision or have failed to perform the duties in accordance with the notice or failed to comply with the order or direction, unless he proves that the violation or failure was beyond his knowledge or that he exercised due diligence to prevent such violation or failure.	Replaced with: Where a company or multipurpose society or union violates any provision of this Act or fails to perform its duties in accordance with a notice issued under this Act or the rules or fails to comply with an order or direction, then the owner, partner, proprietor, chairman, managing director, director, general manager, manager, secretary or any other officer or agent of the company, shall be deemed to have violated such provision or have failed to perform the duties in accordance with the notice or failed to comply with the order or direction, unless he proves that the violation or failure was beyond his knowledge or that he exercised due diligence to prevent such violation or failure. Addition of: Where a department of government or government's organization or institution or local government organization or autonomous organization violates any provision of this Act or fails to perform its duties in accordance with a notice issued under this Act or the rules or fails to comply with an order or direction, then the chairman, managing director, director, general manager, manager, secretary or any other officer or agent or which name are they known of department, government's organization or institution or local government organization or autonomous organization shall be deemed to have violated such provision or have failed to perform the duties in accordance with the notice or failed to comply with the order or direction, unless he proves that the violation or failure was beyond his knowledge or that he exercised due diligence to prevent such violation or failure.

Section No.	Particulars	The Bangladesh Environment Conservation Act, 1995	The Bangladesh Environment Conservation (Amendment) Act, 2010
17	Cognizance of offence and claim for compensation	No court shall take cognizance of an offence or receive any suit for compensation under this Act except on the written report of an Inspector of the Department or any other person authorized by the Director General.	Replaced with: **File case for compensation** - Where a person or a group of persons or the public suffers loss due to violation of a provision of this Act or the rules made thereunder, the person, group, public or on behalf of them the Director General may file a case in environmental court for compensation.
18	Action taken in good faith	No civil or criminal case or other legal proceeding may be instituted against the Government, Director General, or any other person of the Department for any action which caused or is likely to cause injury to any person, if such action is taken in good faith under this Act or rules.	No change
21	Repeal and saving	The Environment Pollution Control Ordinance, 1977 (Act XIII of 1977) is hereby repealed. Notwithstanding such repeal, anything done or any action taken under the repealed Ordinance shall be deemed to have been done under the provisions of this Act.	No change

The Bangladesh Environment Conservation Rules (BECR), 1997

Moreover, to supplement and fulfill the objectives of the Bangladesh Environment Conservation Act 1995, the Bangladesh Environment Conservation Rules (BECR), 1997 was adopted in accordance with section 20 of The Bangladesh Environment Conservation Act (BECA), 1995. The Rules have broadly defined guidelines for disposal of waste from different categories of industries and standards of air, water, sound, soil and other components of the environment.

Under these Rules, the following aspects, among others, are covered:

(i) Declaration of ecologically critical areas

(ii) Classification of industries and projects into 4 categories

(iii) Procedures for issuing the Environmental Clearance Certificate

(iv) Determination of environmental standards

These Rules were amended three times (17 February 2002, 26 August 2002 and 01 April 2003) to specify different sections like inclusion of Certificate of Fitness, Pollution Under Control Certificate, Fees for Environmental Clearance Certificate and other services etc.

Classification of industries and projects into 4 categories

ECR'97 (Rule 7) classifies industrial units and projects into four categories depending on environmental impact and location for the purpose of issuance of ECC. These categories are:

- Green
- Orange A
- Orange B, and
- Red

All existing industrial units and projects and proposed industrial units and projects, that are considered to be low polluting are categorized under "Green" and shall be granted Environmental Clearance. For proposed industrial units and projects falling in the Orange- A, Orange- B and Red Categories, firstly a site clearance certificate and thereafter an environmental clearance certificate will be issued. A detailed description of those four categories of industries has been given in Schedule-1 of ECR'97. Apart from the general requirements, for every Orange-B and Red category proposed industrial unit or project, the application must be accompanied with feasibility report on Initial Environmental Examination (IEE), (EIA) based on approved TOR by DOE, Environmental Management Plan (EMP) etc.

Implications of Policies and Environmental Clearance Procedure

The ECR'97 also contains the procedures for obtaining Environmental Clearance Certificates (ECC) from the Department of Environment for different types of proposed units or projects. Any person or organization wishing to establish an industrial unit or project must obtain ECC from the Director General. The application for such certificate must be in the prescribed form together with the prescribed fees laid down in Schedule 13 of ECR'97, through the deposit of a Treasury Chalan (Pay Order) in favor of the Director General. Rule 8 prescribes the duration of validity of such certificate (3 years for green category and 1 year for other categories) and compulsory requirement renewal of certificate at least 30 days before expiry of its validity.

According to the ECR'97, construction/reconstruction/expansion of CETPs is classified as a "Red" category project. Please note that works such as laying of a network of pipes etc. that transport the effluents to the CETP will fall under CETP project and will also be Red Category. All major structures will require environmental impact assessments and DOE clearance.

It is the responsibility of the proponent to conduct an EIA of the development proposal. The responsibility to review EIAs for the purpose of issuing Environmental Clearance Certificate (ECC)

rests on DOE. The procedures for "Red" Category include submission of:

An Initial Environmental Examination (IEE)

An Environmental Impact Assessment (EIA)

An Environmental Management Plan (EMP)

Environment clearance has to be obtained by the respective implementing agency or project proponent (private sector) from Department of Environment (DOE). The environmental clearance procedure for Red Category projects can be summarized as follows:

Step-1: Application to DOE

Step-2: Obtaining Site Clearance

Step-3: Applying for Environmental Clearance

Step-4: Obtaining Environmental Clearance

Step-5: Clearance Subject to annual renewal

Detailed steps for getting an Environmental Clearance Certificate:

The following are the steps need to be followed in getting an environmental clearance certificate from the Department of Environment (DOE).

(a) Feasibility Study Report of the Project (applicable only for proposed industries or projects);

(b) Initial Environmental Examination (IEE) Report together with the terms of reference of the Environmental Impact Assessment (EIA) and the process-flow diagram of the project, or, the Environmental Impact Assessment (EIA) Report prepared on the basis of terms of reference approved earlier by the Department of Environment, layout plan (indicating the site for the effluent treatment plant), design and time-schedule to construct the effluent treatment plant and the process-flow diagram;

(c) Environment Management Plan (EMP) together with process-flow diagram, layout plan (indicating location of effluent treatment plant), design and efficiency of the effluent treatment plant;

(d) No-objection-certificate (NOC) from the local authority;

(e) Contingency plan with respect of adverse environmental impacts together with a plan to reduce pollution load;

(f) Outlines of relocation, rehabilitation plan (where applicable); and

(g) Other relevant information.

Determination of Environmental Standards

The ECR'97 also establishes the National Environmental Quality (EQS) for ambient air, various water sources/ bodies, industrial effluents, etc. Table 2.3-1 shows the Industrial Project Effluent standard for Bangladesh.

Table 38: Standards for Waste from Industrial Units or Projects Waste[10]

Sl. No.	Parameters	Unit	Places for Determination of Standards i.e. Discharge To		
			Inland Surface Water	Public Sewer from Secondary Treatment Plant	Irrigable Land
1	Ammonical nitrogen	mg/l	50	75	75
2	Ammonia (as free ammonia)	mg/l	5	5	15
3	Arsenic (as As)	mg/l	0.2	0.05	0.2
4	BOD_5 at 20^oC	mg/l	50	250	100
5	Boron	mg/l	2	2	2
6	Cadmium (as Cd)	mg/l	0.05	0.5	0.5
7	Chloride	mg/l	600	600	600
8	Chromium (as total Cr)	mg/l	0.5	1	1
9	COD	mg/l	200	400	400
10	Chromium (as hexavalent Cr)	mg/l	0.5	1	1
11	Copper (as Cu)	mg/l	0.5	3	3
12	Dissolved oxygen (DO)	mg/l	4.5-8	4.5-8	4.5-8
13	Electro-conductivity (EC)	µmhoms/cm	1200	1200	1200
14	Total dissolved solids	mg/l	2100	2100	2100
15	Flouride (as F)	mg/l	2	15	10
16	Sulfide (as S)	mg/l	1	2	2
17	Iron (as Fe)	mg/l	2	2	2
18	Total kjeldahl nitrogen (as N)	mg/l	100	100	100
19	Lead (as Pb)	mg/l	0.1	1	0.1

[10] The Environment Conservation Rules, 1997, pg. 34-35

Sl. No.	***Parameters***	***Unit***	***Places for Determination of Standards i.e. Discharge To***		
			Inland Surface Water	***Public Sewer from Secondary Treatment Plant***	***Irrigable Land***
20	Manganese (as Mn)	mg/l	5	5	5
21	Mercury (as Hg)	mg/l	0.01	0.01	0.01
22	Nickel (as Ni)	mg/l	1	2	1
23	Nitrate (as elementary N)	mg/l	10	Not yet set	10
24	Oil and grease	mg/l	10	20	10
25	Phenolic compounds (as C6H5OH)	mg/l	1	5	1
26	Dissolved phosphorus (as P)	mg/l	8	8	15
27	Radioactive substance	(to be specified by Bangladesh Atomic Energy Commission)			
28	pH		6-9	6-9	6-9
29	Selenium (as Se)	mg/l	0.05	0.05	0.05
30	Zinc (as Zn)	mg/l	5	10	10
31	Total dissolved solids	mg/l	2100	2100	2100
32	Temperature	^{o}C (summer)	40	40	40
		^{o}C (winter)	45	45	45
33	Suspended solids	mg/l	150	500	200
34	Cyanide (As Cn)	mg/l	0.1	2	0.2

Notes:

1) These standards shall be applicable to all industries or projects other than those specified under the heading "Standards for sector wise industrial effluent or emission."
2) Compliance with these standards shall be ensured from the moment an industrial unit starts trial production, and in other cases, from the moment a project starts operation.
3) These standards shall be inviolable even in case of any sample collected instantly at any point of time. These standards may be enforced in a more stringent manner if considered necessary in view of the environmental conditions of a particular situation.

4) Inland Surface Water means drains/ponds/tanks/water bodies/ ditches, canals, rivers, springs and estuaries.

5) Public sewerage system means treatment facilities of the first and second stage and also the combined and complete treatment facilities.

6) Irrigable land means such land area which is sufficiently irrigated by waste water taking into consideration the quantity and quality of such water for cultivation of selected crops on that land.

7) Inland Surface Water Standards shall apply to any discharge to a public sewerage system or to land if the discharge does not meet the requirements of the definitions in notes 5 and 6 above.

Environmental Courts Act, 2000

The Environment Court Act, 2000 has been enacted in order to establish environmental courts in each administrative division of Bangladesh. Under this Act, the court has concurrent jurisdiction i.e. to try both civil and criminal cases. The basis for instituting a case is a violation of the "environmental law", meaning the Bangladesh Environment Conservation Act, 1995 (ECA) and Rules made thereunder. In particular, the environment court is empowered to:

i) Impose penalties for violating court orders;

ii) Confiscate any article, equipment and transport used for the commission of the offence;

iii) Pass any order or decree for compensation;

iv) Issue directions to the offender or any person (a) not to repeat or continue the offence; (b) to take preventive or remedial measures with relation to any injury, specifying the time limit and reporting to the DOE regarding the implementation of the directions.

Under this Act the Director General of the DOE has the power to impose heavy penalties to industrial polluters who are dumping untreated wastewater into the environment or not operating their legally mandated ETPs.

National Water Policy, 1999

The National Water Policy was promulgated in 1999 with the intention of guiding both future public and private actions to ensure the optimal development and management of water that benefits both individuals and the society at large. The policy aims to ensure progress towards fulfilling the national goals of economic development, poverty alleviation, food security, public health and safety, decent standard of living for the people and protection of natural environment. According to the policy, *all agencies and departments entrusted with water resource management responsibilities (regulation, planning, construction, operation, and maintenance) will have to enhance environmental amenities and ensure that environmental resources are protected and restored in executing their tasks. Environmental needs and objectives will be treated equally with the resources management needs.*

The policy has several clauses related to the protection of the natural environment. Some of the relevant clauses are:

Clause 4.5b: Planning and feasibility studies of all projects will follow the Guidelines for Project Assessment, the Guidelines for People's Participation (GPP), the Guidelines for Environmental Impact Assessment, and all other instructions that may be issued from time to time by the Government.

Clause 4.9b: Measures will be taken to minimize disruption to the natural aquatic environment in streams and water channels.

Clause 4.12a: Give full consideration to environmental protection, restoration and

enhancement measures consistent with National Environmental Management Action Plan (NEMAP) and the National Water Management Plan (NWMP).

Clause 4.12b: Adhere to a formal environmental impact assessment (EIA) process, as set out in EIA guidelines and manuals for water sector projects, in each water resources development project or rehabilitation program of size and scope specified by the Government from time to time.

Industrial Policy, 2005

Several sections of the policy highlight the importance of environmental issues in industrial development.

***Section 2.11*:** Provide all necessary assistance for producing environment-friendly product with the objective for creating a pollution-free environment in the industrial sector.

Section 3.24: Arrange for incentives to be given for research and development, acceptance and transfer of environmentally friendly appropriate technology. At the same time, develop market-oriented institutional structure in overall technological development.

Section 17.1: One of the foremost objectives of the Industrial Policy 2005 is to help attain competitive efficiency by developing technology, reducing consumers" costs by using cost-effective technology, and assisting in the development of an environmentally friendly industrial production system.

Section 18.6: Environmental pollution control: The Environmental Protection Act 1995 and other relevant legislations are gradually implemented to control environmental pollution. Those industries that pollute the environment and endanger public health must ensure safety measures in respect of environmental pollution control. Industrial enterprises will be encouraged to obtain ISO-14000 certificates.

National Industrial Policy-2016

Chapter 14 of the national industrial policy, 2016 describes about the environment friendly industrial management. The clauses are as below:

i. Decision will be made for allocation of soil and water resources to industrial project after EIA.
ii. Awareness will be created to establish ETP, CETP in order to control pollution by industries.
iii. The industries which take measures against adverse impact of climate change will be brought under Clean Development Mechanism (CDM) and government will cooperate in this issue.
iv. Industrial establishment will be given priority based on disaster risk reduction and surrounding environment.
v. National and international investors' will be given incentives for the waste management industry establishment.
vi. Business organizations, NGOs, and other social organizations will be encouraged to participate actively in industrial waste management and environmental conservation activities.
vii. It will be encouraged to establish green industry and industry capable of climate change mitigation.
viii. It will be discouraged to establish industry in intensive cultivable and more fertile land.
ix. Investment in environment friendly big project through public private partnership will be encouraged.

Industrial entrepreneurs will be encouraged to follow 3R (Reduce, Reuse, and Recycle) strategy in case of industrial establishment and management.

Bangladesh Economic Zones (Construction of Building) Rules 2017

In exercise of the powers conferred under section 38 of the Bangladesh Economic Zones Act, 2010 (Act No. 42 of 2010), the Government is pleased to make the Bangladesh Economic Zones (Construction of Building) Rules based on S.R.O No. 46-Law/2017. This rule was gazette on 2nd March

2017. Rule 8 of the BEZ (Construction of Building) Rules 2017 has specified the CETP planning under the **Drainage, waste management, etc.** The following provisions shall be followed in drainage, waste management and other systems of the economic zones:

(a) preparing a master plan of the drainage and sanitary system for the total economic zone showing slopes, retention areas and ultimate discharge point;
(b) preparing a master plan of the waste management having CETP with metering system so that individual may be charged as per their effluent discharge;
(c) heterogeneous effluents shall be pre-treated before discharging to CETP as per requirement of CETP;
(d) economic zone shall have STP for individual plot;
(e) economic zones having more than 80 acre in size shall have central power, water supply system with metering system so that individual may be charged as per their use.

The developer or any person working under the Economic Zone shall be responsible for carrying out the work in conformity with the provisions of the Bangladesh Economic Zones (Construction of Building) Rules.

Bangladesh National Building Code, 2006

Part-7, Chapter -1 of the Bangladesh National Building Code (BNBC) clearly sets out the constructional responsibilities according to which the relevant authority of a particular construction site shall adopt some precautionary measures to ensure the safety of the workmen.

According to section 1.2.1 of chapter 1 of part 7, "In a construction or demolition work, the terms of contract between the owner and the contractor and between a consultant and the owner shall be clearly defined and put in writing. These however will not absolve the owner from any of his responsibilities under the various provisions of this Code and other applicable regulations and bye-laws. The terms of contract between the owner and the contractor will determine the responsibilities and liabilities of either party in the concerned matters, within the provisions of the relevant Acts and Codes (e.g.) the Employers' Liability Act, 1938, the Factories Act 1965, the Fatal Accident Act, 1955 and Workmen's Compensation Act 1923". (After the introduction of the Bangladesh Labor Act, 2006, these Acts have been repealed).

Section 1.4.1 of chapter-1, part-7 of the BNBC, states the general duties of the employer to the public as well as workers. According to this section, "All equipment and safeguards required for the construction work such as temporary stair, ladder, ramp, scaffold, hoist, run way, barricade, chute, lift etc. shall be substantially constructed and erected so as not to create any unsafe situation for the workmen using them or the workmen and general public passing under, on or near them".

Part-7, Chapter-3 of the Code has clarified the issue of safety of workmen during construction and with relation to this, set out the details about the different safety tools of specified standard. In relation with the health hazards of the workers during construction, this chapter describes the nature of the different health hazards that normally occur in the site during construction and at the same time specifies the specific measures to be taken to prevent such health hazards. According to this chapter, exhaust ventilation, use of protective devices, medical checkups etc. are the measures to be taken by the particular employer to ensure a healthy workplace for the workers.

To prevent workers falling from heights, the Code in section 3.7.1 to 3.7.6 of chapter 3 of part 7 sets out the detailed requirements on the formation and use of scaffolding. According to section 3.9.2 of the same chapter, "every temporary floor opening shall either have railing of at least 900 mm height or shall be constantly attended. Every floor hole shall be guarded by either a railing with toe board or a hinged cover. Alternatively, the hole may be constantly attended or protected by a removable railing. Every stairway floor opening shall be guarded by railing at least 900 mm high on the exposed sides except at entrance to stairway. Every ladder way floor opening or platform shall be guarded by a guard railing with toe board except at entrance to opening. Every open sided floor or platform 1.2 meters or more above adjacent ground level shall be guarded by a railing on all open sides except where there is entrance to ramp, stairway or fixed ladder the above precautions shall also be taken

near the open edges of floors and roofs".

The major challenge is the proper implementation of the Code as section 2.1 of chapter 2 of part 1 duly states that, "The Government shall establish a new or designate an existing agency responsible for the enforcement of this Code with a given area of jurisdiction. For the purpose of administering and enforcing the provisions of the Code, the enforcing agency shall have the authority of the Government and shall herein be referred to as the Authority."

Part 9, 1.2.1 states that if the land is changed and the occupants of the area are against the change, no change in use of an existing building will be allowed.

Section 1.2.3 of Part-9 also states that in case of partial changing of a building, fire resistance should be ensured and all provisions with greater public safety should be applied to the entire building structure.

Section 1.2.4 of Part 9 clearly states "Additions to existing building shall comply with all of the requirements of the BNBC for new constructions. The combined height and area of the existing building and the new addition shall not exceed the height and open space requirements for new building specified in Part 3 of the Code. Where a fire wall that complies with Table 3.3.1 of Part 3 is provided between the addition and the existing building, the addition shall be considered as a separate building."

Acquisition and Requisition of Immovable Property Ordinance, 1982 (amended in September 21, 2017)

Currently the only legal framework that governs land acquisition in Bangladesh is the **Acquisition and Requisition of Immovable Property Ordinance, 1982.** The Acquisition of Immovable Property Rules, 1982 (No. S. R. O. 172-U82) are made for the exercise of the powers conferred upon by Section 46 of the Acquisition and Requisition of Immovable Property Ordinance, 1982 (Ordinance. No. II of 1982). The rules spell out the procedural details required for the acquisition of immovable properties in the following sub-heads:

a) Proceedings for acquisition

b) Notices under sections 3, 6, and 7

c) Declaration of acquisition and possession

d) Declaration of abatement and revocation of proceedings Transfer of acquired land

f) Assessment of compensation, and

g) Unutilized acquired property

In other words, when the pre-requisites are fulfilled, the step-wise activity of land acquisition process that has to be followed is given below:

- Submission of land acquisition proposal by the requiring body to the Deputy Commissioner.
- Holding District Land Acquisition meeting and providing land allocation.
- Serving Notice under Section 3 to the affected persons.
- Joint verification of the acquired property
- Final approval of land to be acquired by the Deputy Commissioner (for area of land 50 big has or less) or the Land Ministry (for area of land over 50 big has) on the basis of land area requirement.
- Serving notice under Section 6 to settle any dispute
- Estimation of jointly verified property for cost compensation and informing requiring body.
- Acceptance of estimate of cost compensation and placement of fund to the Deputy Commissioner by the requiring body.
- Serving Notice under Section 7 by the Deputy Commissioner to the affected land owners for disbursement of compensation.
- Disbursement of compensation as per estimate to the affected persons.

- Giving possession of land to the requiring body.
- CCL payment by the Deputy Commissioner.

(1) The ARIPO has again been amended in 2017 with a provision of 100% premium instead of 50% premium (amendment 1994) on average transacted deeds in a particular Mouza/vicinity of the proposed site. The amendment has a provision to acquire community property (places of worship, graveyard and cremation grounds) for development purposes in consultation with the community people.

(2) In case of acquisition of land for any government requirement, a person belonging to the interest shall be paid an additional percentage of 200 (two hundred) compensation on the market price as mentioned in clause (a) of sub-section (1):

Provided that in case of acquisition of land for a private company, the amount of compensation will be 300 percent on the market price.

(3) In case of damage mentioned in clause (b), (c), (d) and (e) of sub-section (1), an additional 100% compensation will be provided on the market value.

(4) In addition to the compensation mentioned in this section, due to the acquisition, necessary action may be taken to rehabilitate the displaced family.

Property (Emergency) Acquisition Act, 1989

The Property (Emergency) Acquisition Act (PAA) of 1989 was formulated to expedite the emergency acquisition of land to enable the government 'to control inundation, flood and upsurge caused by natural calamity and to prevent river erosion." The PAA was not meant to replace the 1982 ordinance, but to complement it for special circumstances. Normally, acquisition of land for development purposes would not come under the 1989 act. Use of PAA to acquire land for development would require extremely compelling reasons.

The above acts, policies and rules will be taken into consideration while developing the CETP to ensure environmental protection, optimal development and management of water, development of an environmentally friendly industrial production system and sustainable development in Mirsarai Economic Zone.

International Buyers Rules and Regulations:

As a developing country, Bangladesh is under close scrutiny of international investors, buyers, NGOs and corporate social responsibility (CSR) stakeholders regarding compliance in the industrial sectors especially the textile sector. The guidelines exist for the environmental management in the textile sector of Bangladesh and new guidelines are added along with the correction of existing ones every year. This will ensure best management practices in this sector in the coming years. But the important thing here to be noted is the adoption and exercising practically. Awareness regarding the execution of the management practices is a must for the betterment of the scenarios. Textile industry has been making crucial contribution to rebuilding the country and its economy. This sector accounts for 81% of total export earnings of the country. The main consumers of the textile products of Bangladesh are the European and North American countries. With the increasing demand, the buyers of that countries have set up some legal instruments considering the sustainability issues of environment. Again there are some national legal instruments which must be followed in the industrial set up for maintaining better environmental management.

International buyers has two types of compliance requirements for the industries of Bangladesh. The compliances are mainly on:

- **Social Compliance Standards:** Social Accountability (SA) 800, Social Responsibility, Business Social Compliance Initiative (BSCI), WRAP (Worldwide Responsible for Apparel Production),

Clean Cloth Campaign (CCC), Ethical Trade Initiative (ETI), Fairtrade, Fair Wear Foundation (FWF) are some examples of social compliance standards.

- **Environmental Compliance Standards:** ISO 14001, Oeko Tex Standard 1000 are examples of environmental standards. Some standards are formulated for T&C industries to ensure sustainability, like GOTS (Global Organic Textile Standard), Bluesign, EU Flower etc.

The textile and garment industry is boosting its greener credentials through industry and supplier driven certifications and it ensures the safety of their supply chain. These certifications include Oeko Tex, Bluesign, EU Flower, and EcoLabel. Beside this, textile manufacturers are moving ahead with environmental initiatives targeted at energy efficiency, renewable energy use, waste recycling, sustainable resource use & efficiency and other greener technologies adoption.

Oeko Tex Certification Body (USA) lists substances typically found in restricted substance lists (RSLs), as well as skin- sensitizing substances and has issued 73,000 certifications to manufacturers in more than 80 countries since its introduction in 1992.

The **Bluesign standard** controls more than 6000 restricted or banned substances. The input stream management needs the advance testing of all components and processes engaged in the manufacturing of the product instead of only examining the manufacturers' final product.

The **Ecological and Toxicological Association of Dyes** and Organic Pigments Manufacturers (ETAD) member companies coordinate their efforts to minimize negative impacts of organic colorants on health and the environment. Member companies must abide by the ETAD Code of Ethics, based on the principles of responsible care, and they must also comply with all national and international chemical regulations.

Worldwide Responsible Accredited Production (WRAP) certifies complaint manufacturing and service facilities to a 12-point labor and environmental code. The program looks as RSLs as part of its certifications, especially as part of the new WRAPe program which evaluates chemical use, restricted chemicals, and REACH Compliance. Besides, Textile manufacturers also proactively look at their own facilities and production processes to minimize their environmental impact in party by tougher regulations.

The European EcoLabel is a voluntary scheme designed to encourage business to market products and services that are friendly to the environment. The 'flower' label is awarded only to those products with the least environmental impact in a product range, based on researches analyzing the impact of the product on the environment throughout its life-cycle, starting from raw material extraction in the pre-production stage, through production, distribution, and disposal.

Environmental problems associated with the textile processing are well known. Due to increasing global awareness regarding the issues of environmental pollution, improved environmental performances has become a major factor in the dynamics of the global market, and successful business around the world are striving to achieve the goals of responsible environmental behavior.

Enhancing sustainability in textile exports is essential to address the associated environmental problems on urgent basis. The new regime of international trade under World Trade Organization (WTO) requires that the production of textile products should comply local environmental standards. If these standards are not considered precisely, the textile products would not be accepted in the international markets.

IFC / World Bank Group Environmental Health and Safety Guidelines

IFC has a specific EHS guidelines for the Wastewater and Ambient water quality**.** In this guideline IFC has prescribed the overall EHS management system to:

- Understand the quality, quantity, frequency and sources of liquid effluents in its installations. This includes knowledge about the locations, routes and integrity of internal drainage systems and discharge points;
- Plan and implement the segregation of liquid effluents principally along industrial, utility, sanitary, and storm water categories, in order to limit the volume of water requiring specialized treatment. Characteristics of individual streams may also be used for source segregation;
- Identify opportunities to prevent or reduce wastewater pollution through such measures as recycle/reuse within their facility, input substitution, or process modification (e.g. change of technology or operating conditions/modes);
- Assess compliance of their wastewater discharges with the applicable:
  - discharge standard (if the wastewater is discharged to a surface water or sewer), and
  - water quality standard for a specific reuse (e.g. if the wastewater is reused for irrigation).

Additionally, the generation and discharge of wastewater of any type should be managed through a combination of:

- Water use efficiency to reduce the amount of wastewater generation
- Process modification, including waste minimization, and reducing the use of hazardous materials to reduce the load of pollutants requiring treatment
- If needed, application of wastewater treatment techniques to further reduce the load of contaminants prior to discharge, taking into consideration potential impacts of cross-media transfer of contaminants during treatment (e.g., from water to air or land)

When wastewater treatment is required prior to discharge, the level of treatment should be based on:

- Whether wastewater is being discharged to a sanitary sewer system, or to surface waters
- National and local standards as reflected in permit requirements and sewer system capacity to convey and treat wastewater if discharge is to sanitary sewer
- Assimilative capacity of the receiving water for the load of contaminant being discharged wastewater if discharge is to surface water
- Intended use of the receiving water body (e.g. as a source of drinking water, recreation, irrigation, navigation, or other)
- Presence of sensitive receptors (e.g., endangered species) or habitats
- Good International Industry Practice (GIIP) for the relevant industry sector

Draft Environmental Rules (2017) to be considered in the course of the project designing

The Draft ECR'2017 have categorized the CETP based on its capacity. A CETP having capacity of less than or equal 1000m3/day is categorized as orange, whereas more than 1000m3/day capacity CETP will fall under the Red Category project. As per this guideline, this project will fall under the red category. In the old ECR'97 this categorization was not clearly defined.

In the Draft ECR'2017 it has clearly stipulated that the industrial liquid waste analysis shall be made following the prescribed methods of **"Standard Methods for the Examination of Water and Wastewater"** which was jointly published by American Public Health Association, American Water Works Association and Water Environment Federation. The old ECR had no guideline of the methodology of the industrial liquid waste analysis.

The Draft Environmental Conservation Rules 2017 has added a new Parameter in Schedule-8 (ECR'97 it is scheduled as Schedule-10). The parameter is listed below:

Sl. No.	Parameters	Unit	Standard		
			Inland Surface Water	Public Sewer from Secondary Treatment Plant	Marine/ Coastal Area
33	Bio assay Test (Only applicable for pesticide & Pharmaceutical Industry)	-	90% survival of fish after 96 hours in 100% effluent	90% survival of fish after 96 hours in 100% effluent	90% survival of fish after 96 hours in 100% effluent

In addition to the Bio assay test adoption in the Draft ECR2017, standards of eight (8) parameters have been revised. Comparison of standards of ECR'97 & Draft ECR 2017 parameters Schedule-8 (ECR'97 it is scheduled as Schedule-10) are listed in the table below:

Table 39: Parameters revised in Draft ECR 2017

Sl. No.	Parameters	Unit	Inland Surface Water	
			ECR'97	Draft ECR2017
1.	Ammonical nitrogen	mg/l	50	40
2.	BOD_5 at 20^oC	mg/l	50	30
3.	Cadmium (as Cd)	mg/l	0.05	2
4.	Copper (as Cu)	mg/l	0.5	1
5.	Iron (as Fe)	mg/l	2	3
6.	Manganese (as Mn)	mg/l	5	2
7.	Dissolved phosphorus (as P)	mg/l	8	4
8.	Suspended solids	mg/l	150	100

The draft ECR-2017 is almost at the final stage for the gazette, so the CETP of this project need to be designed based on the draft ECR 2017 standards.

Comparison and analysis of Wastewater Rules and Regulations of Bangladesh and other countries

India has The Environmental Protection Rules 1986 (EPR'86) where the general standards for discharge of environmental pollutants are schedules. This schedule is known as Schedule–VI which was prescribed in rule-3A of EPR'86 of India. This schedule can be comparable with the ECR'97 Schedule -10. Table-1 shows the comparison of ECR'97 & EPR'86. In the EPR the discharge to the Marine/Coastal Area has been defined whereas in ECR'97 does not address the Marine/ Coastal Area.

Table 40: Comparison of Wastewater standards of ECR'97 & EPR'86

Sl. No.	Item	ECR'97	EPR'86
1.	Consideration of discharge to the Marine/Coastal Area	Not considered	Considered
2.	Color & Odor	Not considered	Considered
3.	EC	considered	Not Considered
4.	DO level	Considered	Not Considered
5.	Temperature	Fixed based on Season	Fixed based on Receiving water temperature
6.	COD	Considered for Public Sewer from Secondary Treatment Plant & Irrigable land	Not considered
7.	Bio assay Test	Not Considered	Considered
8.	Manganese	Much Higher compare to EPR (5mg/l)	EPR standard is 2mg/l
9.	Ammonia (as free ammonia)	Considered for Public Sewer from Secondary Treatment Plant & Irrigable land	Not considered
10	Dissolved phosphorus (as P)	Considered for Public Sewer from Secondary Treatment Plant & Irrigable land.	Not considered
11	Radioactive substance	To be specified by Bangladesh Atomic Energy Commission	Defined

Review of Existing ESIA Report & Risks, Impact and Mitigation Measures Associated with the Construction and Operation of the CETP for the BSMSN

The existing ESIA report was prepared based on the baseline scenario of the year 2016. More than two years have passed after the last study of the ESIA of the project. However, the study team has reviewed the existing ESIA report as well as understands the present baseline scenario of the project. It has understood in consultation with DOE that individual ESIA need to be studied for individual industry of the BSMSN Economic Zone.

Different environmental issues can arise at different stages of the project. These issues need to be mitigated to ensure successful implementation of the project. The issues along with the probable mitigation measures are provided in the table below. All the issues should be considered and adequate mitigation measures should be taken by the CETP developer for successful development of the CETP.

Table 41: Potential Environmental Issues and Mitigation Measures

Sl. No.	Environmental Component	Sources of Impacts	Potential Impacts	Mitigation Measures
A. Preconstruction Phase				
1.	Resettlement and Land	No Land Acquisition is Required for the CETP	Not Applicable	Not Applicable (N/A)

Sl. No.	Environmental Component	Sources of Impacts	Potential Impacts	Mitigation Measures
	Acquisition	Area.	(N/A)	
B. Construction Phase				
2.	Air Quality	Production of dust from land preparation and other construction work, but the impact will be temporary.	Dust emission Stacking of construction material may block roads	Water spraying on haul roads in project site Regular maintenance of vehicles The construction activity will be completed in shortest possible period
3.	Noise	The effects of noise and vibration are assumed due to the operation of heavy earth moving machineries, heavy machinery and trucks, the influence range is limited to the vicinity of the construction site.	Workers exposed to increased noise near machineries	Construction work during day time only Ear plugs to workers Regular maintenance of machineries and trucks
4.	Water Quality	Wastewater produced from labor colony and Excavated material	Public health concern due to wastewater Storm water with sediments from excavated material	Modular Septic tank for wastewater treatment Secured storage and reuse of excavated material in construction and land filling Embankment towards river side
5.	Soil Quality	There is a possibility of soil contamination due to leakage of fuel oil and lubricant from construction vehicles and construction machinery.	Change in land use pattern, Overburden & construction waste may pollute soil	Project site is open land allotted for CETP so no change in land use pattern, Reuse of spent lubricant & construction waste in construction and for land fill during landscaping
6.	Waste	General waste and hazardous waste may generate from the construction work. Sewage and garbage from workers	Public health concern; Pollution of environment due to inappropriate waste disposal	Waste management Waste management program consisting of reduction, reuse, and recycling of materials

Sl. No.	Environmental Component	Sources of Impacts	Potential Impacts	Mitigation Measures
				Systematic collection and protected storage Waste disposal at appropriate location Hazardous waste shall be treated under the related regulations Prohibition of dumping any contaminating materials
7.	Ecology (terrestrial and aquatic)	Land preparation for the construction of CETP	Production of noise	Construction work during day time lonely and vehicles will be maintained in good condition
8.	Protected Area	Project Area is out of the Reserved forest/Hilly/Ecologically Critical Area	Not Applicable	Not Applicable
9.	Socio-Economic	Improvement of the socioeconomic status of local people	No adverse impact	Direct and indirect Employment opportunities
10.	Infrastructure & Services	Commercial and economic development	Development of industries in the area	Commercial and economic development
11.	Environmental Hazards	No environmental hazard is expecting from the construction of the project.	Not Applicable	Not Applicable
12.	Public Health	Labour colony	Insanitary conditions & public health problems	Low cost sanitation and safe water will be provided First aid and medical help will be provided Personal protective equipment's will be provided
13.	Transportation and Communication	Construction of CETP	Project site is well connected with highways, internal	Not Applicable

Sl. No.	Environmental Component	Sources of Impacts	Potential Impacts	Mitigation Measures
			roads and communication means, so no impact on these aspects is expected.	
14.	Infectious Disease (HIV/AIDS)	A temporary influx of migrant labor during the construction period may increase the risk of infectious diseases.	Sanitation for local residents	Implementation of periodic medical check-ups by temporary medical team Education and training on health care of workers
C. Operation Phase				
15.	Air quality	Vehicular Movement, Diesel Generator (DG) Operation CETP operation may emit air pollutant	Small amount of dust emission due to vehicular movement Negligible emission of air pollutants due to DG sets Traces of odor may be produced	Vehicular movement is reduced due to pipeline conveyance of the effluent Good housekeeping will be maintained Vehicles will be maintained in good conditions Roads will be maintained in good condition; Generators with proper height of stack as per guidelines and will be used during emergency only Equalization tanks with air sparging system to reduce odor Aerobic sludge after decanter will be disposed off through tankers immediately If bio sludge is mixed with primary sludge, its alkalinity and aerobic nature will reduce smell to a great extent Peripheral green belt will minimize odor further

Sl. No.	Environmental Component	Sources of Impacts	Potential Impacts	Mitigation Measures
16.	Noise	Waste treatment pumps, fans, generator and vehicles will generate noise	Some amount of increase in noise levels	Noise from generator sets will be within stipulated standards due to acoustic enclosures Machineries within acoustic enclosures / rooms Earmuffs to workers Roads will be maintained in good condition to reduce noise due to traffic
17.	Water Quality	Disposal of excess amount of treated effluent, complying to the strict norms aimed at and with that of DOE, in surface water bodies like river	No impact like eutrophication will be there in the River Overall quality of River will be improved due to controlled single point discharge of treated effluent complying to the stringent norms aimed at.	Stoppage of discharge of partially treated/untreated effluent in the nearby river Recycle and reuse of treated effluent to maximum extent Domestic sewage from CETP facility and from industrial areas will be treated in the same facility Treatment of five streams of effluent as per their compatibility to reduce TDS, colour, BOD & COD CETP will be constructed with strong foundation and water proof RCC work to avoid any seepage Rainwater harvesting will be done for groundwater recharge
18.	Soil Quality	Production of hazardous chemical sludge may contaminate the soil quality	No impact due to proper management	Chemical sludge after reduction in quantity by segregation from biosludge and by decantation will be sent to authorized

Sl. No.	Environmental Component	Sources of Impacts	Potential Impacts	Mitigation Measures
				Solid Waste Management Facility Only biosludge will be used as manure after chemical testing to improve the soil quality, otherwise it will be disposed off to SWMF
19.	Ecology (terrestrial and aquatic)	Operation of CETP may be impacted the air quality, noise level, water quality which are to be properly checked with EMP execution in field.	No impact due to insignificant emission through air	CETP will have beneficial effect on the environment and will reduce the environmental pollution index gradually Immediate effect will be reduction in the discharge of pollution load to the River Installation of CETP will reduce the eutrophication of River boosting up aquatic life and DO content and necessary nutrients The discharge of excess treated effluent remaining after recycle and reuse will not only meet the discharge standards and it will not be harmful to the river ecology Green belt/ plantation will be developed around the CETP
20.	Socio-Economic	Improvement of the socioeconomic status of local people	Negligible influx of outside people as workers Beneficial impacts with respect to employment and other	Local people will be given preference in employment or contract jobs Generation of primary & secondary employment to local people

Sl. No.	Environmental Component	Sources of Impacts	Potential Impacts	Mitigation Measures
			socioeconomic aspects	
21.	Infrastructure & Services	Operation of CETP	Infrastructural and industrial development will take place	Commercial and economic development will be possible
22.	Transportation and Communication	No impact on transportation & communication is expected as all the facilities are already well developed in the area	Not Applicable	Not Applicable
23.	Cultural Heritage	No historical, archeological and architectural sites are present in the study Area	Not Applicable	Not Applicable
24.	Local Conflicts of Interest	Conflict between local residents and workers	Change in Local Customs	BEZA will be sincere in building good relation with the Locals so that no conflict of interest are aroused in the locality. Employ local residents as much as possible Promote communication between workers and local people (e.g., join in local events).

Identification of public consultation requirements for Environmental Assessment

A. Introduction

Public Participation in a project is a process, through which stakeholder's influence and share control over development initiatives, decisions and resources, which affects them. Participation of stakeholders in the projects is also a primary requirement in developing an appropriate management plan that addresses project's requirement and suited to the needs of the stakeholders. Stakeholder's involvement is also vastly increases the probability of successful implementation of management plan. In order to make consultation and disclosure process effective and successful, comprehensive planning is required to assure that local government, NGOs, host population and project staff interacts regularly and tenaciously, throughout all stages of the project and contribute toward a common goal.

For this project, the public consultation approach would be in the following key processes.

Mapping and Identification of key stakeholders such as primary (direct project influence) and secondary (indirect project influence) stakeholders;
Undertaking interviews and focus group discussions (FGD) with the respective stakeholders;
Assessing the influence and impact of the project on these stakeholder groups; and Summarizing of key findings and observations from the consultations.

B. Stakeholder Assessment

A stakeholder would be "a person, group, or organization that has direct or indirect stake in a project/organization because it can affect or be affected by the Project or its Proponent's actions, objectives, and policies". Stakeholders may vary in terms of degree of interest, influence and control they have over the Project or the proponent. In the present study, all the stakeholders have been primarily categorized into two categories that have been identified as:

Primary Stakeholders: include people, groups, institutions that either have a direct influence on the project or are directly impacted (positively or adversely) by the project and its activities; and

Secondary stakeholders: are those that have a bearing on the project and its activities by the virtue of their being closely linked or associated with the primary stakeholders and due to the influence they have on the primary stakeholder groups.

Apart from categorization, the stakeholders have also been classified in accordance with the level of influence they have over the project as well as their priority to the project proponent in terms of importance.

The influence and priority have both been primarily rates as:

- ✓ High Influence/Priority: This implies a high degree of influence of the stakeholder on the project in terms of participation and decision-making or high priority for project proponent to engage that stakeholder.
- ✓ Medium Influence/Priority: This implies a moderate level of influence and participation of the stakeholder in the project as well as a priority level for project proponent to engage the stakeholder who are neither highly critical nor are insignificant in terms of influence.
- ✓ Low Influence/Priority: This implies a low degree of influence of the stakeholder on the project in terms of participation and decision-making or low priority for project proponent to engage that stakeholder.

Based on the above attributes, the following table delineates the stakeholders identified for the project and their analysis.

Table 42: Stakeholder Mapping for the Project

Stakeholders	Category of stakeholder	Brief profile	Overall influence on the project	Basis of Influence Rating
Project Management				
BEZA	Primary	BEZA is the primary project proponent own a controlling full stake of the project	Highest	Are the primary project proponents

Stakeholders	Category of stakeholder	Brief profile	Overall influence on the project	Basis of Influence Rating
				Responsible for operation of this project Primary financial beneficiaries Responsible for all the project related risks and impact liabilities
Community				
Local Community	Primary	Primarily includes adjacent community to the project area especially Nayapara & Charsharad Villages Ward.6 of Char Sarat Village	Medium	No major restrictions around the project site especially with respect to grazing land Project bring development to the area Increase in employment opportunities and preference in job Minimize impact
Regulatory/Administrative Authorities & Agencies				
Dept. of Environment, Bangladesh	Primary	The Department of Environment is the primary government regulatory authority for Environmental protection in Bangladesh.	High	Responsible for monitoring project's Environmental compliance throughout the project lifecycle

Stakeholders	Category of stakeholder	Brief profile	Overall influence on the project	Basis of Influence Rating
Other Regulatory & Permitting Authorities	Primary	- **Department of Fisheries**: Necessary permission would need for road construction of crossing water bodies. - **Local Government, Rural Development and Cooperatives**: Management and Control of water supply and sanitation in urban areas. - Ministry of Water Resources and FCD: Development of embankment & sluice gate on Isakhali channel and embankment all along the proposed EZ boundary.	High	Agencies required for obtaining permits and licenses for operation of the project Primary involvement during operation phases
Political Administration				
Upazilla (sub District Level) Political Administration	Secondary	Elected representative of people at sub-district level for a fixed tenure of Mirsharai Upazila	Medium	Key linkage between the community and the project proponent
Union leaders & local representatives	Secondary	Elected representative at union level i.e. village level for a fixed tenure of Ward no.6 & 10 of Ichhakali Union	Medium	Plays important role in providing public opinion and sentiment on the project

Stakeholders	Category of stakeholder	Brief profile	Overall influence on the project	Basis of Influence Rating
				Empowered to provide consent and authorization for establishment of project on behalf of the community

Cost Identification for Ensuring Compliance with Environmental Laws

Considering the large volume of data required to be collated, compiled, processed and interpreted a software system will be developed in future in the DOE for continuous monitoring of the environmental parameters of the industries from the headquarter. In this connection, DOE has advised BEZA for establishing a continuous monitoring system within this project area to comply the upcoming DOE requirements.

It has understood that all the parameters need not to be monitored continuously at the CETP for this project. The parameter i.e. Flow, pH, TSS, COD, BOD, and Ammonia would be good enough to monitor by installing Real Time Monitoring Systems. Other parameters specified in the consent to operate/Environmental Clearance will be monitored on quarterly basis using the established laboratory methods.

Details of parameters and feasible technologies required to be installed for real time continuous effluent monitoring systems for the said parameters are listed below:

Table 43: Cost identification for ensuring Environmental Compliance

Sl. No.	Parameters	Available Technologies	Approximate Cost (Lakhs) BDT	Approximate Cost (USD)[11]
1.	pH	Electrode Method	1.00	1185.00
2.	BOD	1.UV-Vis Spectrophotometry (Entire spectrum scanning)	20.00 (BOD+COD+TSS) +Controller & DAS & Data Transmission	23700.00
		2. Combined Combustion Catalytic Oxidation at 680°C and NDIR Method (TOC)	34.00 (BOD+COD) +Controller & DAS & Data Transmission	40290.00
3.	COD	1. UV-Vis Spectrophotometry (Entire spectrum scanning)	Combined with BOD	Combined with BOD

[11] *1 USD = 83.33 BDT*

Sl. No.	Parameters	Available Technologies	Approximate Cost (Lakhs) BDT	Approximate Cost (USD)[11]
		2. Combined Combustion Catalytic Oxidation at 680°C and NDIR Method (TOC)	Combined with BOD	Combined with BOD
4.	TSS	Scattered light IR Method	4.00	4740.00
		UV-Vis Spectrophotometry (Single wavelength)	4.00	4740.00
5.	Ammonical Nitrogen	Ion Selective Electrode method With temp correction	4.00	4740.00
		UV Vis Spectrophotometers (Entire spectrum scanning)	4.00	4740.00
6.	Flow	Magnetic /Ultrasonic	1.00	1185.00

Minutes of the Meeting with Department of Environment (DoE), Bangladesh on 07.02.2019

Draft Minutes of the Meeting held with Department of Environment (DoE), Bangladesh at 12:35 PM on 07.03.2019			
Attendees			
DoE	Mr. Syed Nazmul Ahsan, Director (ECC)		
Deloitte - BETS	Engr. Mohammad Nurul Alam Siddique, BETS Engr. Sumaiya Binte Fazlulla, BETS		
Venue	Department of Environment (DOE)	**Date**	7th March, 2019, 12:35 PM

Suggestions of Mr. Nazmul:

Individual EIA study shall be conducted for all individual industries of the Bangabandhu Sheikh Mujib Shilpa Nagar (BSMSN);
Provisional capacity/adjustable scenario should be there for the construction of CETP, keeping in mind the future installation & expansion of the industries of the project area;
As an information, he opined that Bangladesh Economic Zones (Construction of Building) Rules 2017 does not mention anything of the instruction for the building height. For any industrial building construction, there should have specified vertical expansion instruction;
According to the Revised ECR-2017 the standard and guidelines shall be sets as well as design of CETP should be made for keeping full treatment of the wastewater before disposing off to the environment;
Continuous Remote Environmental Monitoring Systems should be in the Economic Zone Area for compliance of the future vision of the Department of Environment's (DOE's) regulatory system.

Annexure 4: National and International Case Studies

A brief description of the case studies is presented in the table below:

Table 44: National and International Case Studies

Name of Case Study	Location	Capacity	Industries Served	Project Cost (in BDT cr)	Technology	Implementation mode (service model)
Baddi CETP	Himachal Pradesh, India	Present - 25 MLD Future - 40 MLD	Textile, Dying and Spinning, Pulp and Paper, Pharmaceutical, Soap and detergents, Food and Beverages, Miscellaneous	-	MBBR	EPC
WWTP at MM2100 Industrial Park	Indonesia	45 MLD	Food processing and bottling, Chemical and plastic, Engineering goods, Miscellaneous	94	Organica FCR	EPC
TTP at Bamroli	Surat, India	40 MLD	Textile and Apparels, Chemical Industries, Miscellaneous	102	UF, RO	Design, Build, Finance, Operate and Transfer (DBFOT)
Roha CETP	Himachal Pradesh, India	Civil - 22.5 MLD EM – 16 MLD	Roha Industrial park	-	ASP	Design, Build and Operate
Panki TTP	Uttar Pradesh, India	40 MLD	Reuse water supply to Power Plant	-	UF, RO	Turnkey with 15 years O&M
Dhaka CETP	Dhaka EPZ, Bangladesh	35 MLD	Textile, plastic, leather, chemical	70	ECR	EPC
Chittagong CETP	Chittagong EPZ, Bangladesh	15 MLD	Garments & Accessories, Footwear, Metal Products, Ropes and Textile	50	Bio-physical and chemical	EPC
Comilla CETP	Comilla, Bangladesh	15 MLD	50 local and foreign industries	40	-	EPC

Detailed Case Studies:

1. Baddi CETP, Himachal Pradesh, India:

Scope – Construction of CETP, effluent conveyance system and operation and maintenance **Mode of development** – EPC based with formation of SPV named 'Baddi Infrastructure' **Technology** – MBBR and treatment of effluent in separate streams depending on effluent characteristics

A Modular CETP: The capacity of the CETP developed for the current scenario is 25 MLD, while the capacity envisaged in the future is 40 MLD that shall be achieved through further investment

Multi-industry CETP - Industries Served:

- Textile, Dying and Spinning
- Pulp and Paper
- Pharmaceutical
- Soap and detergents
- Food and Beverages
- Miscellaneous

The project was financed through a combination of sources as mentioned below:

Source of Finance for 25 MLD CETP	
Source of finance	Amount (in BDT cr.)
Central government	70
State government	8.5
Pollution control board	3.5
Industry contribution	12
Financial institution	If required
Total	**94**

The CETP provides reusable water:
Industries utilizing reusable water:

- Textile and dying industry
- Paper and pulp industry

Tariff Calculation:
Formula adopted for determining tariff rate for treatment of the effluent:

Treatment Charges (in Rs /KL) =
[0.02*So+0.03*(C-2.5*So) + 0.005*Css+0.01*(C1- 2100)] x 1.10*[1 + R/100] y

Where,

- So = BOD of sample, mgs/L
- C = COD of sample, mgs/L
- Css = Suspended solids of sample, mgs/L
- C1 = TDS of sample, mgs/L
- R = Appreciation in each year.
- y = no. of years from base year 2011

Key Learnings:

- An agreement was signed between the CETP developer and the industries in the zone to fund the development of the CETP based on the investment and the effluent quantity and quality of the industry
- The tariff rate is set by a formula that is based on the quality of effluent from each industry. Thus each industry will have a different tariff rate
- The effluent is treated through different streams by zoning the industries based on their quality of effluent

2. Waste Water Treatment at MM2100 Industrial Park, Indonesia:

The MM2100 Industrial Park is the largest Industrial Park of Indonesia. The water treatment project for the industrial park was shortlisted for GWI Awards 2017 in the Industrial Water Project of the Year category. Latest technology was used for 67% higher capacity in 30% lower footprint than existing conventional technology. The treatment plant has a capacity of 45 MLD to serve 300+ industries which are spread over 1350 hectares. The land requirement for the plant stands at 4 acres.

Scope – Establishment of a 45 MLD treatment plant
Mode of development – EPC
Multi-Industry CETP: Industries Served:

- Food processing and bottling
- Chemical and plastic
- Engineering goods
- Miscellaneous

The following table provides the effluent characteristics at the inlet and outlet of the plant.

Effluent characteristics at treatment plant		
Parameter	Inlet (mg/L)	Outlet (mg/L)
BOD	500	25
COD	1000	50
TSS	220	50
TKN	47	-
Temperature	Min. 23°C	Max. 31°C

Key Learnings:

- The technology adopted reduced the area requirement drastically
- Odorless treatment plant reduced the buffer area and improved the aesthetics
- The industries are big and have their own ETPs to treat their effluent before discharging it to the WWTP or water body. Thus developed countries do not have CETPs
- As the industries in BSMSN EZ are small scale, complete treatment of the effluent is not possible at their premises and the effluent needs to be treated at the CETP to attain ZLD and reuse the treated water. Howsoever, preliminary treatment needs to be done at the industry to comply with the CETP inlet norms

3. Tertiary treatment plant for supply of Industrial Grade water to Pandesara Industrial Estate:

Mode of development – Design, Build, Finance, Operate and Transfer (DBFOT) **Scope –**

- ✓ Construction, Operation and Maintenance of a 40 MLD capacity Tertiary Treatment plant to produce Industrial Grade Water with provision to progressively scale up capacity in a modular fashion to 80 MLD.
- ✓ Construction, Operation and Maintenance of new Transmission pipelines - a) between the STP and Tertiary Treatment Plant (~ 0.5 km) to convey secondary treated water to TT Plant and b) from the TT Plant to Storage sumps at Pandesara (5 km) to convey bulk Tertiary Treated water Technology – Ultra filtration, reverse osmosis and activated carbon filter Capacity of the TTP – 40MLD

Cost of the project – 102.12 crore BDT
Tariff Rate:

- Rate of fresh water supply to industries – **Rs. 23/KL**
- Rate of recycled water to industries – **Rs. 19.84/KL**

Multi-Industry and Modular TTP: Modular expansion from 40 MLD to 80 MLD in future to provide treated water to 119 industries

- Industries Served:
  - ✓ Textile and Apparels
  - ✓ Chemical Industries
  - ✓ Miscellaneous

The following table provides the effluent characteristics at the inlet and outlet of the plant.

Effluent characteristics at TTP		
Parameter	Inlet (mg/L)	Outlet (mg/L)
BOD	20	<5
COD	100	<50
TDS	2100	<500
pH	6.5-7.5	6-7.5
Suspended solids	30	<2

Key Learnings:

- The tariff rate of recycled water is lesser than that of fresh water making it more viable for industrial utilization

- Agreement by the industries to purchase the treated water of committed quantity for well defined duration
- Reduction of pressure on ground water resources and other conventional sources

4. Roha CETP, Himachal Pradesh, India:

Scope:

- Civil and Piping rehabilitation and upgrade for average flow of 22500 m3/d;
- Mechanical and electrical rehabilitation and upgrade for average flow of 16000 m3/d

Mode of development: Design, supply, installation, construction, testing, commissioning, performance guarantee test, operation and maintenance of the CETP

A Modular CETP

- Actual Design Capacity - 22.5 MLD, but in actual, the effluent flow is only 16 MLD
- Hence, Civil and Piping Rehabilitation and Upgrade shall be executed for 22.5 MLD and Mechanical, Electrical, Instrumentation Control & Automation (MEICA) Rehabilitation and Upgrade shall be executed for 16 MLD

The following table provides the effluent characteristics at the inlet and outlet of the plant.

Parameters	Units	Inlet Characteristics		Outlet Characteristics
		High COD WW Stream	Low COD WW Stream	
pH		6.0-9.0	6.0-9.0	6.0-9.0
BOD	mg/l	1000	100	<=30
COD	mg/l	3000	300	<=250
TSS	mg/l	800	75	<=100

Key Learnings:

- The cost of civil works is for 22.5 MLD CETP while that of electromechanical work is for 16 MLD CETP since the current demand is of 16 MLD
- The electromechanical work of 6.5 MLD can be done in the future based on the demand

5. Tertiary Treatment Plant at Panki, Kanpur, India

Scope: Design, Construction, Supply, Installation, Testing & Commissioning and Trial run of Tertiary Treatment Plant, laying of Pipe Line & other allied works for Treated Waste Water Reuse at 1X660 MW Panki Thermal Power Station Extension, Panki, Kanpur

Mode of Development: Turn-key basis, followed by 15 years of Operation & Maintenance including 2 year of Defects liability period

Capacity: 40 MLD

Technology: RO and UF based

The following table provides the effluent characteristics at the inlet and outlet of the plant.

Sl.No.	Parameter	Unit	Inlet to TTP	Design Tertiary Treated Effluent parameters
1.	PH	-	7.0-8.0	6.5-8.0
2.	Temperature	Deg.C	25-30	-
3.	TSS	Mg/l	50-100	<5
4.	Turbidity	Mg/l	-	<1
5.	BOD	Mg/l	50-70	<5
6.	COD	Mg/l	150-200	<30
7.	Total Dissolved solids	Mg/l	1000-1100	<241

Key Learnings:

- 40 MLD tertiary treated water (RO treated) is supplied to a power plant at a distance of 16 kms through a 700 mm diameter PCCP pipe
- There is a mandate in India for power plants to use treated water from nearby STPs and CETPs

6. Common Effluent Treatment Plant in Vishakhapatnam, Andhra Pradesh, India

Mode of development – Design, Supply, Construct, Erect, Test, Commission, Operate and Maintain **Scope** – Civil and electromechanical works for a 1.5 MLD CETP

Modular CETP: Total size – 4.5 MLD which shall be constructed in 3 modules of 1.5 MLD each
Multi-industry CETP: Industries Served:

- Pharmaceuticals
- Pesticides
- Organic Chemicals
- Synthetic Rubber
- Agrochemical Intermediates

Key learnings:

- The effluent from the industries shall be collected through tankers and conveyance system shall be built only after saturation of the industrial park as the economics of scale can support the collection of effluent through tankers
- However, the quantity of effluent to be generated in the BSMSN Economic Zone cannot be supported through tankers and need effluent network to be setup

7. CETP in Dhaka EPZ:

The design capacity of the CETP is 43 MLD and is constructed on 4.10 acres (16600 m^2) of land. A Singapore-Bangladeshi joint venture company has established the CETP in Dhaka EPZ. The company invested USD $4.793 million, with the aim of treating 15,000-43,000 cubic meters of liquid effluent per day in the Dhaka EPZ. 35 Bangladeshi and 7 foreign nationals got Employment opportunities in this plant.

Industries connected to CETP

Table below shows the total 105 number of industries as per the categories. There are 15 different types of industries and 66 industries are connected to CETP.

Table 41: List of total Industries in Dhaka EPZ (including unconnected to CETP) [12]

Sl.no	Name of Industries	Nr.	Sl.no	Name of industries	Nr.
1	Knitting and other Textile products	**5**	9	Garment Accessories	**27**
2	Caps	**2**	10	Textiles	**16**
3	Paper products	**1**	11	Chemical and Fertilizers	**1**
4	Garments	**28**	12	Sewing Threads	**1**
5	Footwear & leather goods	**5**	13	Metal products	**2**
6	Miscelleneous	**9**	14	Electronic and electronic goods	**1**
7	Plastic goods	**4**	15	Power industry	**1**
8	Service Oriented industries	**2**			
	Sub-total	**56**			**49**
	TOTAL of 16 Types, Nos	**105**			

Treatment Technology adopted: This system applies the highest treatment levels to get desired results by introducing **ECR**, especially, for the mixed industrial pollution loads of Dhaka EPZ by directly receiving the sewage from all industries. An overall decision has been taken to control high industrial pollution load that shall be pre-treated before entering the ETP.

Raw and Treated Wastewater Quality: The online display shows the parameters as mentioned above that includes both raw and treated wastewater quality except for the major two parameters- BOD inlet and COD Inlet. As per CETP operators and Chemist and MD, BOD ranges from 250-300 mg/l and for COD ranges from 800-950 mg/l. A total of eight parameters are shown, namely DO_Outlet,(7.77 mg/l) COD _outlet(135 mg/l), BOD Outlet(30 mg/l), Flow Inlet(1088 m^3/hr), Flow outlet(1004 m^3/hr), pH inlet(10.64), pH outlet(8.62), TDS _outlet(2514 mg/l).

[12] Data Collected during the visit of CETP site of DEPZ in Dhaka (on August 30, 2018)

Sludge Management and Treated Effluent discharge: The sludge produced in sedimentation tanks/Clarifiers are collected in a tank before dewatering. Treated wastewater effluent is discharged by gravity to the nearby (1.5 km away from CETP) river Bangshi.

Investment, Operation and Maintenance

I. **Investment cost:** As stated earlier, A Singapore based Company constructed the ETP. They started construction in September 2009 and ended in February 2012. All electro-mechanical equipment are brought from Singapore. The total cost was 70 crores, i.e. 8.97 million USD.

II. **O & M Costs:** There are 42 persons to operate and maintain the CETP. The entire Operation and maintenance costs are given below:

a. **Electricity Costs**- for power using for screening(1x1.5 KW), Air Blower(2x30 Kw), Flash Mixer(3x1 kw),Effluent pump (1x 40 KW0, ECR(70 KW), Scrapper(1x3 Kw), Screw press & feed pump(1x2.2 Kw), Poly dosing and others (2x 2 KW) and Floating Aerators (6x30 KW)= 367 KW x24x30x Tk8.97(per KWH) = approx. 2400000/-b. **Manpower Cost** : 42 persons (35 Bangladeshi and 7 Foreigners)LS = 2500000/-

c. **Other Costs:**

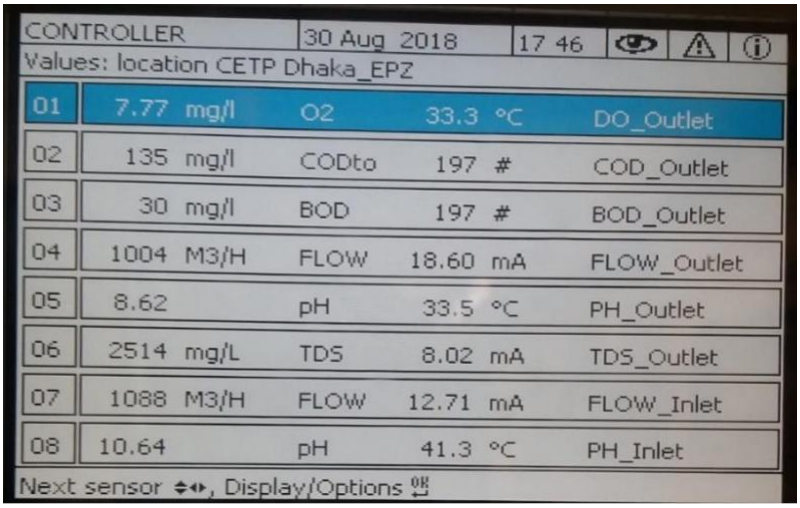
i.	bHCL(22% strength) , 15 ton per month x Tk.4.5/kg	= 67500/-
ii.	Poly-electrolyte 530 Kgs	= 200000/-
iii.	ECR Steel(Ferrous Plate) 30,000kg/month x Tk.78/kg	= 2340000/-
iv.	Other Recurrent maintenance, per month	= 150000/-
v.	Periodic Maintenance per year 200000/- and per month	= 17000/-
TOTAL COST		**= 7,67,45,000/- ($92,500)**

The cost per m^3 of sewage Treatment= 7674500/26000/30= **Tk. 9.84**

Tariff per m^3 of sewage treatment is realized to be **Tk.36.95.**

This cost does not include the cost involved for equipment purchase for going out of order or major repair etc. For instance, nearly one year ago. The company purchased and installed one on-line Flow meter (Sensor Detection –LCD) at a cost of around Tk. 60 Lacs.

Figure 18: On line Flow Meter Reading for Waste Water Parameters



Issues arising during the course of the project:
Certain Issues arose during the course of the project that affected the performance of the Dhaka CETP and also increased the cost of treatment[13]. These issues are described below:

The land allocated to develop the CETP was a swamp which was used as a dumping ground for unabated wastewater and sludge for over 15 years. It took 6 months to drain the site and clear the mock due to poor operating conditions and seasonal monsoon.

According to the officials of the CETP developer, the initial treatment cost envisaged for the CETP development was based on ASP technology but it had to be abandoned due to lack of space and

13 http://flagshipdhaka.com/about/pdf/profile.pdf

poor contaminant removal performance. Further, the use of ASP technology wouldn't have allowed for increasing the treatment capacity of the CETP with increase in the effluent volumes. The CETP collects effluents from the Old and New zones in the Dhaka EPZ through underground gravity piping system. But due to issues with the pipes, the pipeline connecting the old zone is not functioning efficiently resulting in establishment of small pumps to collect the effluent from the industries. This led to increase in the O&M cost of the CETP.

However, the CETP is performing satisfactorily as indicated during discussions with the CETP operators

Key learnings:

- The aforementioned issues need to be addressed while proposing the development of a CETP at BSMSN EZ.
- BEPZA collects the user charges from the individual industrial units, retains 10% of the collected user charges and pays the rest to the CETP operator. Earlier BEPZA was retaining up to 30% of the collected user charges.
- The infrastructure (civil construction) component of the CETP will need to be built for the total capacity together. The technology component of the CETP can be installed in a phase wise manner based on the demand built up.
- The infrastructure cost (effluent network) and the connection costs to the CETP should be borne by the EPZ Authority.

8. CETP in Chittagong EPZ:

Chittagong Export Processing Zone which is 3.10 kms from the Chittagong Seat Port had 502 industrial plots upto June 2011. The industries operating in the Chittagong EPZ belong to the key sectors - Garments, Garment Accessories, Footwear, Terry Towel, Metal Products, Ropes, Knitting and Textile. Most of the factories in the EPZ do not have own Effluent Treatment Plants, hence, affecting the health and wellbeing of thousands of people in the communities nearby. So, the Chittagong Waste Treatment Plants Ltd. Company invested US$6.01 million to build the CETP at Chittagong EPZ using Bio-physical and chemical technology equipment. The Tariff collected from the users depends on the functioning of the companies. The effluent treatment charge is Tk.44.79/m3 of effluent for the companies dying and washing textiles (full charge). The companies conducting only washing need to pay 50% of the full charge i.e. Tk.22.4/m3 of effluent. And, the companies neither dying nor washing textiles need to pay 15% of the full charge i.e. Tk.6.72/m3 of effluent. Capacity of the CETP is 15000 m^3/day.

Key learnings:

- In addition to the 10% of collected user charges that is retained by BEPZA as service charge, the CETP operator has to pay water charges, electricity charges and land rent to BEPZA.
- The tax benefits (including export benefits) that are applicable to industrial units should also be made applicable to the CETP. The CETP should be treated as an industrial unit for the purpose of tax incentives that provided to units in the economic zone.
- BEZA must ensure mandatory use of the effluent treatment service by 100% of industrial units in the economic zone.

9. CETP in Comilla EPZ:

Comilla CETP is owned by a local firm in Bangladesh. The company invested USD 4.87 million, with the aim of treating 15 thousand cubic meters of liquid effluent per day in the Comilla EPZ. Employment opportunities for 33 Bangladeshi and 7 foreign nationals has been created. Asper the CETP operator, the tariff approved by BEPZA for the Comilla EPZ CETP is inadequate for capital expenditure recovery and even O&M cost recovery. The revenue requirement to ensure capital and O&M cost recovery and a reasonable return on investment would be Taka 52/ Cu. m. However, the average tariff recovery by the operator in CEPZ is around Taka 23-28/ Cu. m.

Key learnings:

The average tariff to be collected from the industrial units was supposed to be Taka 48/ Cu. m with 40% of the recovery retained by BEPZA and 60% paid tothe operator. Subsequently, BEPZA exempted a section of industrial units from paying the tariff- around 30% of the total recovery, apparently for already having individual ETPs.

10. CETP in Savar Leather Park:

The Savar leather park was envisaged to transfer the highly toxic tanneries from Hazaribagh to a safer place with better infrastructure, thus saving the nearby Buriganga river in the process. A joint venture between "Jiangsu Lingzhi Environmental Protection Co Ltd & Development Constructions Ltd" was selected for the development of a CETP to treat the effluent of the leather industries in the area. However due to multiple reasons, the Savar leather park has in turn resulted in hazardously polluting the adjacent Dhaleswari river.

Even after a decade of commissioning, the CETP has recently started operating partially with all the hazardous pollutants being released at the outlet of the CETP. According to a study the BOD and COD levels have been found to be 224 mg/L and 595 mg/L respectively, which is significantly higher than the permitted environmental standards. The following are the major reasons for the failure:

- The Government has already changed the CETP development deadline 8 times yet the work is not completed. This is because there is no heavy penalty structure for non-compliance with deadlines.
- The salt removal unit has not been installed in the CETP and hence huge amount of salt is released into the water.
- The company has been running the CETP on trial run with frequent breaks due to power cuts. Further, it is alleged that the company shuts it down to save costs.
- The industries ministry forced the tanners to relocate from Hazaribagh to Savar before the CETP could be built completely, resulting in great levels of pollution in the river
- According to the CETP developer, The CETP has 2 separate channels: one for general waste and another for chromium-mixed water. But a huge quantity of chromium-mixed water is entering the general tank killing the bacteria used to decompose tannery waste resulting in improper treatment of the effluent and poor performance of the CETP.
- Since the CETP is not fully functional, tannery owners are not able to comply with the environmental standards and are not able to get compliance certificate which has resulted in reduction in foreign investment and decline in the economy.

Thus, it can be seen that lack of a proper regulation structure and lack of a penalty framework on the CETP developer are resulting in environmental hazards at Savar. Adequate provisions need to be built in to ensure that the CETP development at BSMSN - 2A does not face such issues.

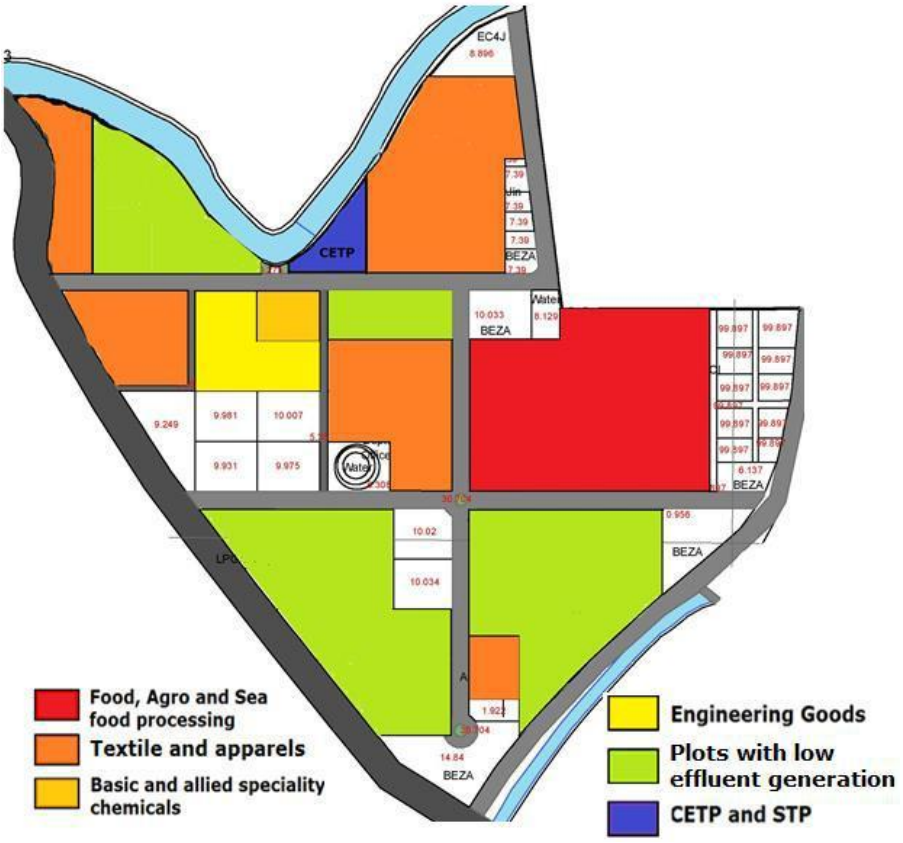
Annexure 5: Pollution load across industry

Industry categorization based on pollution load

Different industries produce different quantities of effluent along with varying quality of the effluent. The adjacent figure categorizes the industries that have been allotted plots in the BSMSN - 2A Economic Zone based on the quality of effluent generated by them. The plots have been colored based on a scale where red denotes the most polluting industries while green denotes less polluting industries. The figure helps in grouping the industries based on their effluent quality and compares their distance from the CETP.

The water intensive food processing industries are the most polluting followed by textile and chemical industries. The engineering goods industries and textile industries concerned with stitching related activities only are the least polluting.

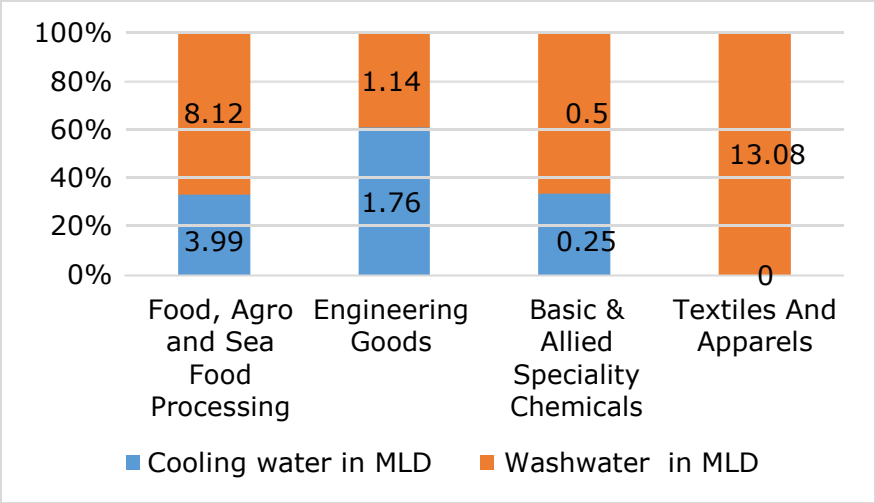
Figure 19: Industry categorization based on effluent load



Composition of effluent released by the industries

- The graph shows the amount of water that is converted into effluent in each industry category. Cooling water and washwater are released as effluent by the industries. Washwater has greater concentration of pollutants as compared to cooling water
- Textile industry has high effluent load with washwater contributing to 100% of the effluent load
- Engineering goods have low effluent load since 60% of the effluent is from cooling purposes

Figure 20: Composition of effluent from the industry



Setting Tariff based on Pollution Load of the Industry:

This section describes the basis of setting the tariff in Dhaka EPZ which is based on categorization of the industries based on their pollution load. The following table describes the tariff payment mechanism adopted.

Tariff payment in Dhaka EPZ

Industry Category	Effluent Volume Calculation	Types of industries
Red	**90%** of the water volume is considered as effluent volume	Highly polluting industries - tannery and chemical
Wash	**75%** of the water volume is considered as effluent volume	Medium polluting industries - Textile
Dry	**50%** of the water volume is considered as effluent volume	Less polluting industries - Garment stitching, lpg bottling

The industries have been categorized into three categories depending on their type of production and the quality of the effluents discharged by them. Then the water demand of the industries is taken into account to calculate the amount of water which is converted into effluent. A tariff rate of **36.95 Tk/m^3** has been fixed for the effluent treatment at the Dhaka EPZ.

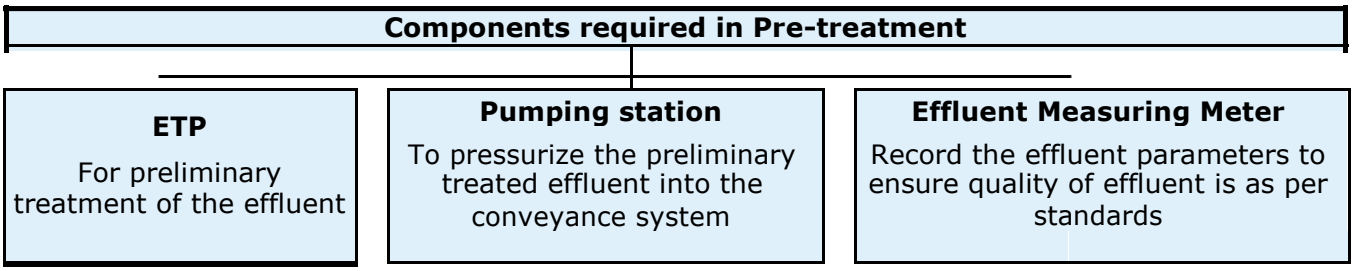
Prevailing issues with the above mechanism includes surplus effluent volumes (possibly generated due to individual borewells within the industries) and variation in quality of effluent discharge committed by the industry. Thus, it is suggested that a better mechanism to calculate the effluent generation from the industries may be adopted. This includes installation of an online effluent metering device at the industry premise which would accurately measure both the quality and quantity of effluent discharged by the industry. The tariff may be charged based on the values provided by the meter.

Annexure 6: Preliminary treatment by the industry

Preliminary treatment by the industries before the discharge of the effluent into the effluent conveyance system plays a vital role in the successful operation of the CETP. The following are the key factors that demand the need for the preliminary treatment:

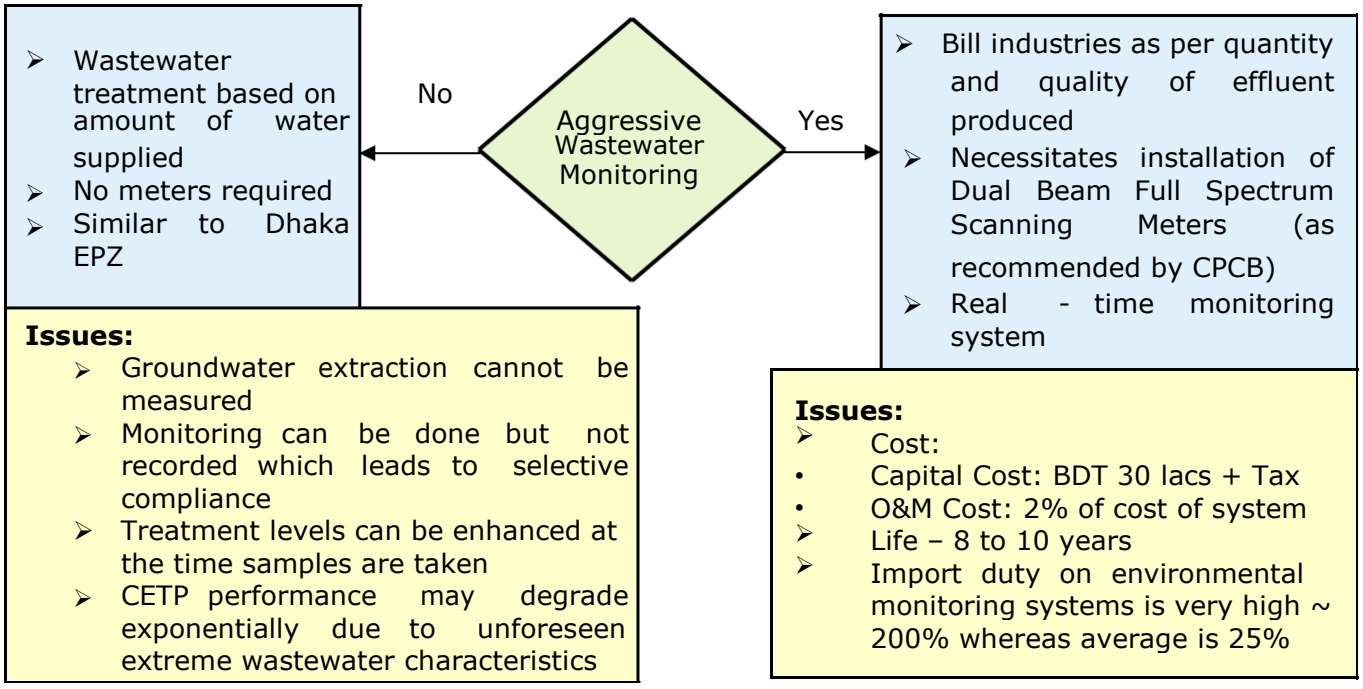
- To meet the inlet standards prescribed for the CETP
- To avoid discharge of unwanted hazardous waste and chemicals to the CETP that can damage the CETP
- To avoid corrosion of the effluent conveyance pipeline due to presence of highly toxic unexpected chemicals from the industries

Key components required for preliminary treatment:



Aggressive Wastewater Monitoring

A comparison of no effluent quality monitoring vs aggressive wastewater monitoring is illustrated below which indicates the importance of installation of effluent measuring meters in the industry premises.



Funding ETP and associated infrastructure

- Multinational buyers sourcing goods from producers have mandates not only buy products but also to develop the infrastructure of the producer

- Eg. H&M provides funds to its supplier Maxcom to treat their effluent and monitors the performance of the plant through online meters
- Guidelines provided by Sweden Water Initiative to fund infrastructure of producers for environmental compliance

Penalties for failure in pre-treatment:

Preliminary treatment by the industries before the discharge of the effluent into the effluent conveyance system plays a vital role in the successful operation of the CETP. The penalties to be sought based on the degree of non-compliance with the CETP inlet standards are:

1. **Monetary penalty** – The non-compliant industry may be charged a penalty of around 20%-50% above the maximum tariff rate for effluent treatment. This amount shall depend on the cost incurred for treatment of the non-compliant effluent at the CETP. The penalty shall be imposed over the period of non-compliance
2. **Legal penalty** – In case of continuous long-term non-compliance with the CETP inlet standards, a show cause notice may be served to the industry which may lead to the closure of the industry, if required.

Suggestions

- The guidelines for effluent treatment plants currently available in Bangladesh are exclusively for textile industries and are for final disposal of the treated effluent into the environment only. It is suggested that BEZA mandates pretreatment standards by the industries to meet the inlet norms of the CETP for all categories of industries
- The cost of metering devices may be built into the licensing and clearance certificate of the industries
- Industry may be asked to submit (bank) guarantee as an undertaking for setting up ETP

Annexure 7: Comments on allocation of land in the Economic Zone

Relocation of the CETP:

An option for relocation of the CETP from its prescribed location is described in this section. As the river is flowing westwards, lower contour levels are towards the west. Thus the option of shifting the CETP westwards for better flow of the effluent via gravity was considered.

Issues:

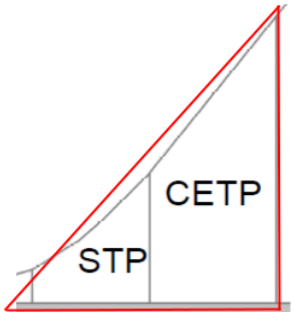
The following issues were identified in the shifting of the CETP from its prescribed location:

- Increase in length of the pipeline of the effluent conveyance system which will lead to increase in the cost of the project
- The pipeline will be more prone to corrosion due to flow of the effluent in the pipeline over a greater distance

Suggestion: Thus, it is suggested that the CETP may not be relocated.

Shape of the land for the CETP:

The land allotted for the development of the CETP is triangular in shape.



Observations:

The following are the observations on the shape of the land:

- The shape may lead to unused stretches of land
- The design of the CETP needs to ensure optimal utilization of the available land

Rearrangement of plots allocated to the industries in BSMSN - 2A:

Various options for the rearrangement of the plots allocated to the industries were evaluated to arrive at the best arrangement possible. The following are the observations:

- Water intensive food processing industries are located away from the CETP increasing length of pipeline carrying aggressive pollutants
- Textile industries are spread across BSMSN - 2A, thus ruling out zone-wise effluent treatment
- Most of the less polluting industries are located far away from the CETP which is desirable from cost perspective

Considerations:

The following considerations were taken into account while evaluating the rearrangement options:

- Food processing industry cannot be near the CETP
- CETP cannot be fragmented
- LPG bottling plants have to be at the south west corner facing the sea for direct berthing of import vessels
- Reallocation is premature as the effluent generation of the industries is yet to be known accurately
- Investors might change their product portfolio or surrender plots

Suggestion: Reallocation of plots is not necessary under the present circumstances.

Annexure 8: Basis of Project Structuring

A comprehensive risk assessment was undertaken to present the key risk associated with the project, their description, consequence and mitigation measure. Before allocation of the risks between the parties, it is critical to clearly identify the risks inherent in the project and the consequences of the risk. The following table lists the risks in the project.

Risks in Project Structuring

Risk Category	Description of the Risk	Direct Consequences	Preferred Mitigation measure	Party best suited to take the risk
Commissioning risk	Commissioning of the project might be delayed due to delay in getting the required permits and approvals.	In case of delay, the performance targets for the utility might not be achieved in the target time frame.	Permissions and approval as part of conditions precedent period.	Authority would provide requisite permissions and private player is responsible for seeking approvals.
Construction risk	In case of time over run, the construction cost is expected to escalate. Changes in the design/ layout during project preparation and construction phase affects the project execution timelines. The operator will need to plan construction schedule after accounting for monsoon otherwise construction can get delayed leading to increase in costs.	In case of increase in the cost, the contractor might experience financial distress.	The contract would have provision of liquidated damages and penalties for delay in construction	Private
Commercial risk	Efficiency of billing and collection mechanisms will directly impact revenues from user charges. Private sector efficiencies and innovative techniques to bill and collect user charges	Poor billing and collection efficiency means reduction in collection of user charges	The operator would be paid only for volume of water billed and collected. Hence operator will be incentivised to bill and collect	Private

	efficiently may be utilised.		efficiently.	
Design risk	Proper designing of the CETP based on the volume of effluent generation and area provided for the plant is critical	In case of improper design, the achievement of project targets will get delayed.	Design and construction is responsibility of the same private player to ensure that the contractor does not challenge the design.	Private
Financial risk	It is observed that the private players are not willing to take the financial risks. It is more preferable if it is borne by BEZA	The delays in fulfilment of targets may affect the disbursement of funds to the project.	Private sector is not expected to finance the project.	Public
Performance risk	The project has certain specified targets. There is a risk of the targets not being achieved by the operator. There is also a risk of the cost of achievement of the targets being higher than expected.	Project objectives will not be met. The revenues will not improve. The project might experience financial distress.	The contract would have provision for performance security. Further, the O&M payment to the operator would be linked to achievement of performance	Private
Demand risk	There is a risk that the effluent treatment demand and reuse water demand does not increase as per the expectations.	This lower demand would impact the revenues.	The revenue to the private are not contingent on demand.	May be shared.
Tariff risk	There is a risk that either the effluent treatment tariff and reuse water tariff and the expected growth in the tariffs is not commensurate to the expectations. The changes in tariffs would impact the	Changes in tariff would impact the revenue for the project. It will have an impact on the subsidy, the utility would require from BEZA.	The tariff risk would lie with the authority. The tariff would not have any impact on performance of private	Public

	consecutive revenues Further, there is a risk that the increase in tariff may not be acceptable to the certain consumers.			
Technology obsolescence risk	There is a risk that the technology used in the project might be obsolete by the time the project is implemented, because of regulatory changes.	This might lead to an increase in overall project costs.	The private sector shall be expected to meet performance parameter, with or without use of technology.	Private

Table 45: Evaluation of Project Structures

	BOT/ DBFOT	Hybrid Annuity/ Full Annuity	Lease/ Affermage	EPC + O&M	Operator Consultant	DBO model
Examples	TTP to treat secondary treated water from Bamroli STP to supply industrial grade water to Pandesara Industrial Estate & Surat Municipal Corporation (DBFOT) Developing additional Water Resources by installing STP of 2.0 MLD capacity at Maloya-1 (Rehabilitation Colony) Chandigarh (BOT)	STP Projects in Varanasi, Haridwar developed by National Mission for Clean Ganga, India	CETP at Dhaka EPZ	EPCM for MM2100 Industrial Park Waste Water Treatment Plant Kanpur CETP APIIC CETP	Hubli-Dharwad, Kalaburgi water supply	WB funded sewerage projects -Karmalichak S. network Design, Build, Rehabilitation, Commissioning & upgrade of 22.5 MLD CETP on DB basis with O&M at Roha Industrial Area
Role of private player	Design, build, finance, operate and transfer. Financing includes government grant (capital grant/annuities /per unit output subsidy) and revenue collection from user charges The operator would be responsible for fulfilment of performance	Design, build, finance, operate and transfer. Financing occurs via 40% as capital grant and 60% as annual grant during O&M period. Operator responsible for fulfilment of performance parameters including design, construction,	Primarily a land lease agreement with added features for development of effluent treatment facilities as per prevailing laws	The contractor builds the facility as per design specifications provided by the Authority and thereafter is responsible for fulfilment of operational parameters	Private player is responsible for preparing design, PMC during construction & full day to day operations Billing & collection	The operator would be responsible for fulfilment of performance parameters including design, construction & operational efficiencies Billing & collection may or may not be part of scope

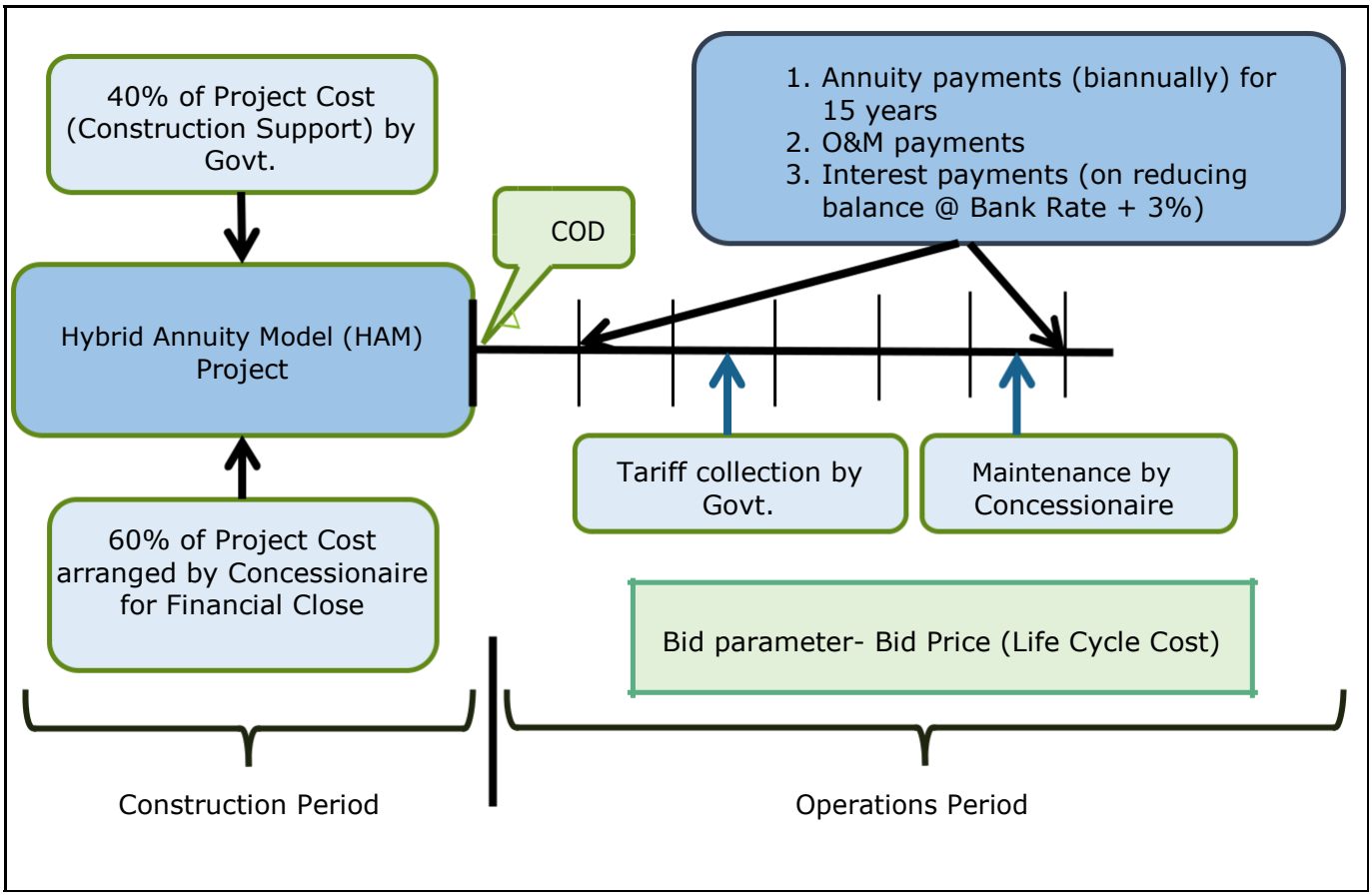
	BOT/ DBFOT	Hybrid Annuity/ Full Annuity	Lease/ Affermage	EPC + O&M	Operator Consultant	DBO model
	parameters including design, construction, operational efficiencies, billing & collection and transfer of assets at the end of concession	operational efficiencies, billing & collection & transfer of assets at the end of concession				
Role of utility	Responsible for contract management Review of concessionaire's deliverables Determine the tariff to be levied Monitoring construction & fulfilment of performance parameters	Responsible for contract management Review of concessionaire's deliverables Determine the tariff to be levied Monitoring construction & fulfilment of performance parameters Making timely payment to private	Determine the tariff to be levied Monitor compliance with prevailing environmental regulations Billing & Collection	Responsible for contract management Review of concessionaire's deliverables Determine the tariff to be levied Monitoring construction & fulfilment of performance parameters Making timely payment to private Billing & Collection	Responsible for contract management Review of concessionaire's deliverables Determine the tariff to be levied Setting performance parameters for private player Monitoring of construction and timely payment to private Billing & Collection	Responsible for contract management Review of concessionaire's deliverables Determine the tariff to be levied Monitoring construction & fulfilment of performance parameters Making timely payment to private
Context of application	Creation of infrastructure, operations & management as a single point service provider whose motive is to generate RoI despite demand risk	Creation of infrastructure, operations & management as a single point service provider whose motive is to generate RoI (without demand risk)	Authority's goal is regulatory compliance Limited participation of Authority in development / operations of treatment facilities	Creation of infrastructure, operations & management as a single point service provider but, with lower 'skin in the game' of the private player during	Highly relevant when a lot of project preparation work is required to be conducted over a period of time O&M is major part of work as against	Creation of infrastructure forms large part of scope, authority does not have capacity to operate and manage the system, public utility want to

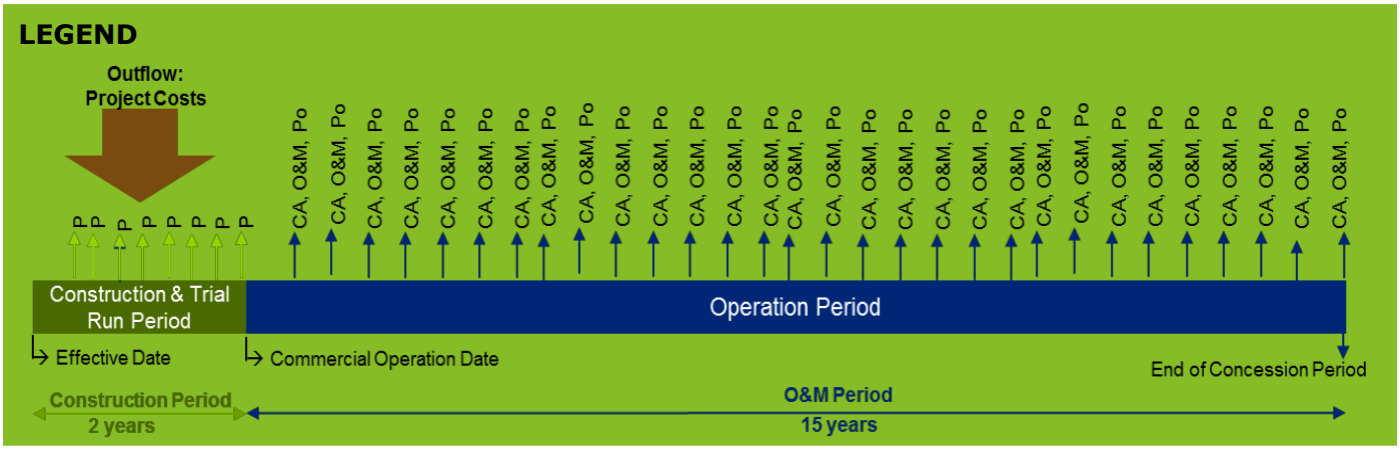
	BOT/ DBFOT	Hybrid Annuity/ Full Annuity	Lease/ Affermage	EPC + O&M	Operator Consultant	DBO model
			Unlike concessions, this mode of implementation attracts stamp duty which will have to be borne by the project	operations period, since capex is already paid off	infrastructure creation. This model has emerged because an operator need not have construction /development skillset.	leverage private sector efficiencies in service delivery
Management responsibility	Utility's management responsibility is with public, private player responsible for overall service delivery and high accountability	Utility's management responsibility is with public, private player responsible for overall service delivery and high accountability	Utility's management responsibility is with public, private player responsible for regulatory compliance	Utility's management responsibility is with public, private player responsible for service delivery	Utility's management responsibility is with public, private player responsible for service delivery	Utility's management responsibility is with public, private player responsible for overall service delivery
Duration of the contract	10 – 15 years	15 years	More than 15 years	5-10 years	10 – 15 years	More than 10 years
Revenue for the private player	User Fee	Deferred capex payments and performance linked O&M Fee by the Authority	User Fee	Capex cost and performance linked O&M Fee by the Authority	O&M fees	Construction and O&M cost
Payments by the public utility	Construction Phase: Grant Operations Phase: Operating Fee paid by Authority or Revenue sharing if project is highly profitable	Construction Phase: 40% of the construction cost Operations Phase: (i) Balance construction cost adjusted for interest and inflation paid over	(i)Treatment Cost on volumetric basis	Construction Phase: Construction Cost Operations Phase: Operating fee with penalties for non performance	Preparatory Phase: Fee for various deliverables such as Systematic Improvement Plan (SIP). Survey Fee etc Construction	Construction Phase: Disbursement based on physical progress of work Operations Phase: Combination of fixed fees and performance

	BOT/ DBFOT	Hybrid Annuity/ Full Annuity	Lease/ Affermage	EPC + O&M	Operator Consultant	DBO model
		15 years (ii) Operating fee with penalties for non performance			Phase: Project Management Fee Operations Phase: Combination of fixed fees and performance linked fees	linked fees
Bidding parameter		Arithmetic sum of Project (Capital) Cost, O&M fee, Power Charges, Land Cost.	Land Lease or Treatment cost or sum of the above	NPV of capital and O&M cost	NPV of fee during Preparatory Phase, Construction Phase, Operations Phase	NPV of capital and O&M cost

Annexure 9: Overview of Hybrid Annuity Model (HAM)

In this model, 40% of the project cost is provided by the Government in the construction period while 60% of the project cost is arranged by the concessionaire for the financial closure. However, it is paid back to the private sector in the form of annuity payments (biannually) over a 15-year period. The tariff is collected by the Government.





P	8 quarterly payment of 5% each of Project Cost during construction period (Capex Annuity)
CA	60% of Project Cost/ 60- 1% of Projects Costs on a quarterly basis (Capex Annuity)
O&M	Quarterly O&M charges (adjusted for inflation) for 15 years

Annexure 10: Basis for Designing the CETP

The Bangladesh Environmental Conservation Rules, 1997 has classified the industries into four categories, namely, Red, Orange A, Orange B and Green. The effluent from these industries must meet the Bangladesh effluent discharge quality standards, including the "Quality Standards for Classified Industries", before being discharged to the environment. In order to meet these standards, the effluent from the industries need to be treated in an effluent treatment plant, designed to meet the specific requirements of the industries and the environment. This section describes Stages of CETP Design, Basis of the Design, Treatment Standards, Treatment Processes and Treatment Levels.

Stages of CETP Design:

There are broadly two stages of designing of the CETP:

The first stage of Planning and designing of CETP involves gathering information on proposed institutional, environmental and infrastructural issues in the particular geographic area. The study also aims at identifying and establishing various parameters that ultimately influence the design of the plant.

While determining whether a CETP is feasible for a group of industries, it is important to recognize that certain characteristics of industries, certain regional and regulatory considerations favor the establishment of CETPs. Preliminary investigation of the following factors is essential during the feasibility assessment –

- **Number of industries** - This is a very important factor as this decides the unit cost of treatment. The more the industries participate, the lower would be the unit cost of treatment for each industry.
- **Location of industries** - This factor has a major impact on the transportation costs which strongly influences the feasibility and cost-effectiveness of a CETP.
- **Presence of sewer system** - This also has a positive effect on the feasibility of CETP. Proper laid out sewer lines aid in conveyance of effluents from the individual factories to the centralized facility. If no sewer line is present then good roads are essential for truck access.
- **Volume and strength of waste**- industries that produce waste of small volume of concentrated waste are more likely to benefit from CETP while firms that produce large quantities of waste are more likely to find that installing their own waste treatment system is more economical. In some cases a firm can reduce its waste flow using recovery, recycling and waste reduction practices and then join a CETP.
- **Industries size**- It is also an important factor that affects the applicability of CETP. Small industries often lack the ability to raise the capital needed to install pollution control equipment. Using CETP, small firms need to implement less costly waste reduction techniques and install small storage facility.
- **Existence and enforcement of waste water regulations**- Existence and enforcement of regulations is the key, otherwise if such regulations are absent, firms will not take initiatives for installing onsite pollution control equipment or utilizing a CETP.

The second stage of planning and designing involves assessing a potential waste flow from the specific proposed industries for which the CETP is being proposed. It involves the following steps-

- **Identifying industries in the geographic area**- Identification of the industries that are the potential users of the CETP, which includes determining the number and type of industries, sources such as industrial associations, trade organizations and local governmental organizations can be consulted.
- **Identifying types and volumes of wastes generated** - Collecting data on the types and volumes of wastes is a complex and difficult one. Data to be collected on this aspect should

reveal enough information that can distinguish among types of wastes such as organic and inorganic and should reveal the volume of diluted and concentrated wastes and the amount of total waste to be received at the CETP. Depending on the waste stream to be treated, it is determined whether a centralized facility to treat hazardous and/or non-hazardous waste is needed and will affect how a CETP is designed and managed.

- **Identifying treatment options**- Once the types and volumes of wastes generated by the proposed industries are identified, the next step is to examine their compatibility and to identify potential treatment options.

- **Evaluating cleaner technologies**- This is the last but the most important step in the feasibility assessment and the possibility of any changes in the raw material, manufacturing processes or finished products to reduce waste generation. For some industries adoption of cleaner technologies should be considered along with or in lieu of development of the CETP itself.

Basis of the Design

The impact of the plausible pollution prevention measures including waste segregation measures have to be assessed based on which characteristics of the combined waste water will have to be evaluated. Site characteristics and wastewater characteristics form an integral part of design basis. Pre-treatment standards for waters entering the collection system serving the CETP and treatment standards for effluents discharged from CETP also are significant design considerations.

- **Site characteristics**- Characteristics such as topography, soils, geology, hydrology, climate and land use are to be considered while designing a sewer network and a CETP. Topography and depth to bedrock effect the cost of sewer installation, for example elevation distributions that allow gravity flow and adequate depth for burial of pipe are most desirable. Soil thickness and soil characteristics like clay content, sand content, permeability etc. play a major role while deciding on certain treatment options such as land and lagoon treatment or granular media filtration etc. Climatic factors such as precipitation is important when inflow is a problem with sewers and evaporation is important when treatment processes being considered rely on evaporation of treated waste water.

- **Wastewater characteristics**- Key characteristics that must be considered in designing CETP are flow rate, physical and chemical characteristics of the wastewater.

- **Flow (m^3/day or MLD)-** It is important in determining the size of CETP. Minimum and maximum flows should be computed as they decide the hydraulic computations and the size of distribution pipes. Anticipated future increase should also be incorporated. Temporal flow variations require use of equalization tanks to allow a constant flow rate through downstream processes. Mixing of waste water with lower concentration such as addition of sewage helps in reducing toxic shock on treatment processes.

- **Physical characteristics-**

  - **Solids-** Solids in the form of floating debris, grease and oil slicks indicate a highly polluted stream and suspended solids contribute to turbidity and silt load and require sedimentation or filtration for removal.
  - **Temperature** - It is an important criterion as it affects chemical and biological reactions and solubility of gases such as oxygen. For example high temperatures increase reaction rates and solubility to a certain extent.
  - **Colour and odour**-These serve as indicators of the degree of pollution of a waste stream and their presence in waste water indicate inadequate pre-treatment prior to discharge.

Chemical characteristics- Significant chemical characteristics include organics,

inorganics in solution and gases. These are indicated by-

- **BOD (mg/l)-** Biological oxygen demand provides an indicator of the amount of organic substances of biological origin such as proteins, carbohydrates, fats and oils and biodegradable synthetic organic chemicals in water.
- **COD (mg/l)-** Chemical oxygen demand measures non-biodegradable as well as biodegradable organics. The ratio between BOD and COD provides an indicator of the ease of biological treatment.

Treatment Standards:

In order to ensure efficient functionality of the CETP and avoid issues related to corrosion of the CETP components, there are certain inlet standards set for the effluent that enters the CETP. The following table provides the effluent standards for the inlet of the CETP.

Table 46: Inlet Parameters of the CETP [15]

Parameter	Unit	Concentration
pH	[-]	5.5 -9.0
Temperature	°C	45
Oil & Grease	mg/l	20
Phenolic compounds	mg/l	5.0
Ammonical Nitrogen (as N)	mg/l	50
Cyanide (as CN)	mg/l	2.0
Hexavalent Chromium	mg/l	2.0
Total Chromium	mg/l	2.0
Copper	mg/l	3.0
Lead	mg/l	1.0
Nickel	mg/l	3.0
Zinc	mg/l	15.0
Arsenic	mg/l	0.2
Mercury	mg/l	0.01
Cadmium	mg/l	0.05
Selenium	mg/l	0.05
Fluoride	mg/l	15.0
Boron	mg/l	2.0
BOD	mg/l	600[14]
COD	mg/l	1290

1. Pre-treatment standards- Wastewater from industrial processes requires some form of pre-treatment prior to discharge to CETP. This is mainly required 1) when waste water is carried through sewer lines to minimise corrosion and clogging of sewer lines and 2) to prevent reductions in biological treatment process efficiency by toxic effects from toxic concentration of organic and inorganic substances. Pre-treatment standards for sulphides, sulphates and pH are concerned with preventing corrosion of concrete parts in sewers and limits to discharge of oil, grease, grit and heavy sediments prevent clogging of sewers. Limits to heavy metals and toxic organics ensure proper performance of biological treatment and minimise accumulation of contaminants in residual sludge.

2. Treated effluents discharge standards- Waste water treatment processes differ in reducing the concentration of parameters of concern such as BOD or Suspended solids etc. and the standards of discharge determine whether a given combination of treatment processes provide an acceptable level of treatment. Thus before designing a CETP effluent discharge standards should be identified. Standards may vary depending on the point of discharge of

[14] Indicative BOD and COD values based on analysis of industries to be set up in the BSMSN Zone 2A and Zone 2B

[15] Guidelines for management, operation and maintenance of common effluent treatment plants, CPCB publications, Chap. 3, pg. 8

treated wastewater. For example sewer standards, irrigation standards, drinking water standards are different.

Levels and Process involved in the treatment:

The various levels of effluent treatment are preliminary, primary, secondary and tertiary. Based on the level of treatment required, the effluents can be treated in different ways. The three broad treatment mechanisms are physical, chemical and biological treatment. The table below illustrates the same.

Table 47: Steps of Effluent Treatment[16]

Steps of Treatment	Treatment Level	Description	Process
Step 1	Pre-treatment	Removal of large solids such as rags, sticks, grit and grease that may damage equipment or result in operational problems	Physical
Step 2	Primary	Removal of floating and settleable materials such as suspended solids and organic matter	Physical and chemical
Step 3	Secondary	Removal of biodegradable organic and suspended solids	Biological and chemical
Step 4	Tertiary	Removal of residual suspended solids/ dissolved solids	Physical, chemical and biological

Processes of Treatment

There are broadly three types of treatment Process:

Biological Treatment

Biological treatment plants require the presence of microorganisms adapted to degrade the components of the effluent to be treated. It was stated by CETP operators in some textile factories that a properly designed biological CETP can efficiently satisfy BOD, pH, TSS, oil and grease requirement. In some cases the wastewater compounds of textile industries may be toxic to the microorganisms so pretreatment may be necessary. Similarly, most dyes are complex chemicals are difficult for microbes to degrade so there is usually very little colour removal through biological CETP treatments. The basic units needed for biological treatment are: screening; an equalization unit; a pH control unit; an aeration unit; and a settling unit. A sludge dewatering unit may also be included.

Physio-chemical Treatment

The physio-chemical treatments generally used in Bangladesh (coagulation and flocculation) are capable of removing much, possibly all, of the colour, depending on the process used. It is however difficult to reduce BOD and COD to the value needed to meet the national effluent discharge standard, and impossible to remove TDS. Removal rate is dependent on the influent wastewater quality. The removal efficiency of this type of treatment has been found to be 50 % and 70 % for BOD and COD respectively. The basic units needed for a stand-alone physio-chemical treatment plant are screening, an equalization unit, a pH control unit, chemical storage tanks, a mixing unit, a flocculation unit, a settling unit and a sludge dewatering unit.

Physio-chemical and Biological Treatment

The three treatment mechanisms (physical, chemical and biological) are often combined in a CETP. The basic units needed for a physio-chemical and biological treatment plant are screening,

[16] Technical EIA Guidance Manual for Common Effluent Treatment Plant, Prepared for Ministry of Environment and Forests, Govt. of India, Chap. 3, pg. 17 - 19

an equalization unit, a pH control unit, chemical storage tanks, mixing units, flocculation units, a primary settling unit, an aeration unit, and a secondary settling unit. The physio-chemical unit always comes before the biological unit.

The Levels of Treatment

The following table gives a brief description of the levels of effluent treatment and the various processes and technologies involved in them.

Table 48: Technology options for the levels of treatment[17]

Step 1	Step 2	Step 3	Step 4
Pre-treatment	**Primary**	**Secondary**	**Tertiary**
Screening	Primary Sedimentation	Stabilization ponds/lagoons	Sand filtration
Grit Removal	Oil and grease removal - Dissolved air flotation	Activated sludge process (ASP)	Activated carbon filtration
Flow equalization/ flow segregation	Chemical/ electrochemical coagulation and flocculation	Sequencing batch reactor (SBR)	Reverse Osmosis
Pre-aeration or pre-chlorination	Emulsion breaking	Moving bed bio reactor (MBBR)	Ultra Filtration
	Clarification	Membrane bioreactor (MBR)	Nano Filtration
	Granular Media Filtration	Up Flow Anaerobic Sludge Blanket (UASB) reactor	Ion exchange
		Anaerobic Contact Reactor (ACR)	Colour removal - Electrochemical oxidation/ Fenton's reaction

➢ Preliminary Treatment:

This level mainly includes physical processes and some chemical processes:

- **Screening** - It is adopted to remove floating matter and is provided at the intake point
- **Grit chambers -** use gravity to remove grit and dirt which mainly consists of mineral particles and coarse screens strain out large solids and when organic material enters as large particles comminutors can be used to reduce particle size to enhance treatment in later stages .
- **Equalization** - Equalization is a process to equalize wastes by holding waste streams in a tank for a certain period of time prior to treatment in order to obtain a stable waste stream that is easier to treat. Equalization helps in mixing smaller volumes of concentrated wastes with larger volumes at lower concentrations. It also controls the pH to prevent fluctuations that could upset the efficiency of treatment system, by mixing acid and alkaline wastes. Equalization tanks are equipped with agitators that helps not only in proper mixing of waste water but also prevents suspended solids from settling to the bottom of the unit.
- **Pre-aeration or pre-chlorination**- This process helps in controlling odours if wastewater becomes oxygen deficient while travelling through the sewer collection system. It also helps in grease removal during primary clarification

[17] Report on Wastewater Treatment Technologies published by ZDHC (2018), pg. 24

- **Primary Treatment:**

This level also includes mainly physical processes:

Sedimentation- Removal of readily settleable inert and organic solids is accomplished in sedimentation. Fine screens may also be used in the treatment process. Sedimentation chambers may also include baffles and oil skimmers to remove grease and floatable solids and may include mechanical scrapers for removal of sludge at the bottom of the chamber.

Dissolved air floatation- It is the process of using fine bubbles to induce suspended particles to rise to the surface tank where they can be collected and removed. Gas bubbles are introduced into the wastewater and attach themselves to the particles, thus reducing their specific gravity and causing them to float. Bubbles may be generated by

- dispersing air mechanically
- by drawing them from water using vacuum or
- by forcing air into solution under elevated pressure followed by pressure release.

This is called dissolved air floatation. It is used to remove suspended solids and dispersed oil and grease from oily wastewater. It reduces the sedimentation times of suspended solids that have a specific gravity slightly greater than 1.0. Wastewater is pressurized and contacted with air in a retention tank. The pressurized water that is nearly saturated with air is passed through a pressure reducing valve and introduced into at the bottom of floatation tank. As soon as pressure is released the supersaturated air begins to come out of solution in the form of fine bubbles. The bubbles get attached to suspended particles and become enmeshed in sludge flocs, floating them to surface. Float is continuously swept from the surface and sludge may be collected from the bottom. Addition of certain coagulants increases the oil removal efficiency of DAF units.

Flocculation- It is physical- chemical process that encourages the aggregation of coagulated colloidal and finely divided suspended matter by physical mixing or chemical coagulant aids. Flocculation process consists of a rapid mix tank and a flocculation tank. The waste stream is initially mixed with a coagulant in the rapid mix tank and after mixing the coagulated waste water flows to the flocculation basin where slow mixing of waste occurs which allows the particles to agglomerate into heavier more settleable solids. Either mechanical paddles or diffused air provide mixing. Three different types of chemicals used in coagulation are inorganic electrolytes, natural organic polymers and synthetic poly electrolytes. The selection of a specific chemical depends on the characteristics and chemical properties of the contaminants.

- **Emulsion breaking-** It involves addition of chemicals and/or heat to cause dispersed oil droplets to coalesce and separate from the wastewater. This process mainly used for pre - treatment of oily wastewater. Commonly used method is acid cracking where sulphuric or hydrochloric acid is added to the oil water mixture until pH reaches 1 or 2. Another alternative to this is where emulsion breaking chemicals such as surfactants and coagulants are added to the mixture and the content are mixed. After the emulsion bond is broken, oil residue is allowed to float to the top of the tank. Heat may be applied to speed the separation process. The oil is then skimmed by mechanical means or the water is decanted from the bottom of the tank.

- **Clarification**- Clarification system utilize gravity to provide continuous, low cost separation and removal of particulate, flocculated impurities and precipitates from water and generally follow the processes which generate suspended solids such as biological treatment . In a clarifier wastewater is allowed to flow slowly and uniformly, permitting the solids more dense than water to settle down. The clarified water flows from the top of the clarifier over the weir. Solids get collected at the bottom and sludge must be periodically removed, dewatered and disposed.

- **Granular media filtration-** Many processes fall under this category and the common element being the use of mineral particles as the filtration medium. It removes suspended solids by physical filtration, physical chemical sorption and biological decomposition.

  1) Sand filters are the most common type which consists of either a fixed or moving bed of media that traps and removes suspended solids from water passing through media.
  2) Dual or multimedia filtration consists of two or more media and it operates with the finer, denser media at the top and coarser, less dense media at the top. Common arrangement being garnet at the bottom, sand in the middle and anthracite coal at the top. Flow pattern of multimedia filters is usually from top to bottom with gravity flow. These filters require periodic back washing to maintain their efficiency.

  Granular media filters can separate particle size (generally less than 2 mm) smaller than biological filters which increase their efficiency over other treatment process. These processes are most commonly used for tertiary treatment in municipal wastewater treatment plants and for supplemental removal of residual suspended solids from the effluents of chemical treatment processes.

➢ Secondary Treatment:

Biological treatment processes are used primarily for secondary treatment and use microbial action to decompose suspended and dissolved organic wastewater. Biological treatment can be either aerobic where microbes require oxygen to grow or anaerobic where microbes will grow only in absence of oxygen or facultative where microbes can grow with or without oxygen. There are many methods available for treatment of the effluent at this stage. A brief description of the various technological options available for secondary treatment is presented below:

- **Stabilization ponds/lagoons**- Also called oxidation ponds, treats waste water by the interaction of sunlight, wind and algae with or without assistance of mechanical aeration equipment. Lagoons are smaller than ponds and have a second pond to remove suspended solids. Lagoons are simple in design and require low operation and maintenance costs and the control of discharge may eliminate the need for additional treatment. Disadvantages include large area requirements and bad odours.
- **Activated Sludge Process (ASP)** - is a suspended growth aerobic process. It is provided with primary clarifier to reduce the organic load in biological reactor (aeration basin). About 40% of organic load is intercepted in primary clarifier in the form of sludge, decreasing the loading in the aeration tank. Detention period in aeration tank is maintained between 4-6 h. After aeration tank, the mixed liquor is sent to secondary clarification where sludge and liquid are separated. A major portion of the sludge is recirculated and excess sludge is sent to a digester.
- **Moving Bed Biofilm Reactor (MBBR) -** Moving Bed Biofilm Reactor is an aerobic attached biological growth process. It does not require primary clarifier and sludge recirculation. Raw sewage, after screening and de-gritting, is fed to the biological reactor. In the reactor, floating plastic media is provided which remains in suspension. Biological mass is generated on the surface of the media. Attached biological mass consumes organic matter for their metabolism. Excess biological mass leaves the surface of media and it is settled in clarifier. Usually a detention time of 5 to 12 h is provided in the reactors
- **Sequencing Batch Reactor (SBR)** - It is a fill-and-draw batch aerobic suspended growth (Activated Sludge) process incorporating all the features of extended aeration plant. After screening and de-gritting, sewage is fed to the batch reactor. Reactor operation takes place in certain sequence in cyclic order and in each cycle, following operations are involved
  - Anoxic Filling tank
  - Aeration
  - Sedimentation/clarification
  - Decantation
  - Sludge withdrawal
- **Membrane Bioreactor (MBR)** - It is a biological reactor with a suspended biomass. A microfiltration membrane achieves the solid-liquid separation in membrane bioreactor with pore sizes ranging from 0.1 to 0.4 µm. No secondary clarifier is used and has the ability to operate at high MLSS concentrations. Membranes are patented and not available in the open

market, leading to single supplier conditions which limit or deny price competition.

- **Up Flow Anaerobic Sludge Blanket (UASB)** - It is an anaerobic process in which influent wastewater is distributed at the bottom of the UASB reactor and travels in an up-flow mode through the sludge blanket. Critical components of UASB design are the influent distribution system, the gas-liquid-solid separator (GLSS) and effluent withdrawal design. Compared to other anaerobic processes, UASB allows the use of high hydraulic loading.

- **Anaerobic Contact Reactor (ACR)** - Anaerobic contact process (ACP) waste water is mixed with recycled sludge and digested in a sealed reactor, the waste water /sludge mixture externally separated (sedimentation, or vacuum fine screening flotation) and the supernatant discharged for further downstream treatment.

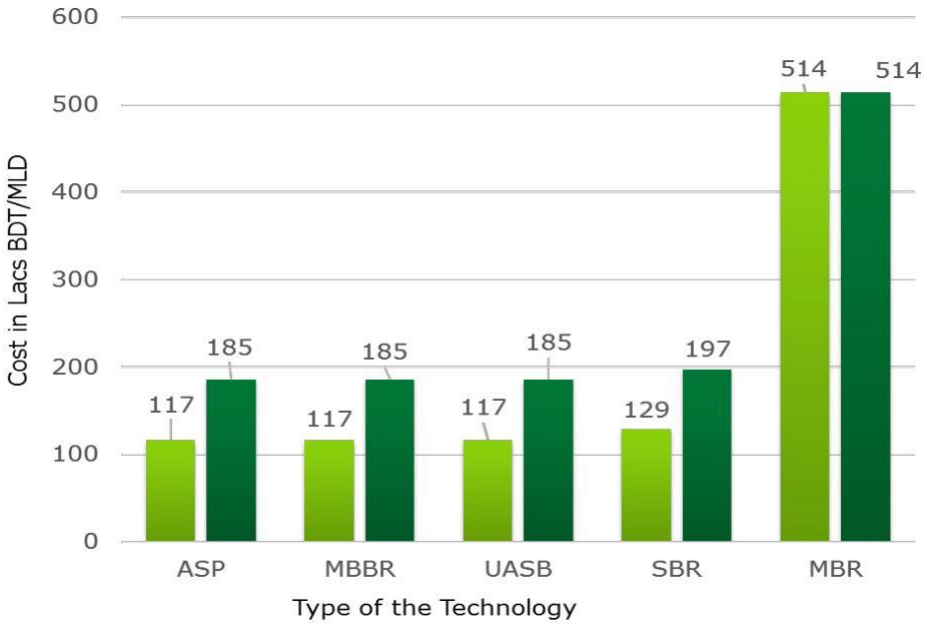
The selection of a technology is based on the quality and type of effluents that is generated from the industries and the standards that needs to be reached after treatment. The following table provides a comparative analysis of the various technological options available for the secondary treatment:

Table 49: Comparative analysis of technology options for secondary treatment[18]

Name of Technology	ASP	SBR	MBR	MBBR	UASB
Performance in terms of Quality of treated effluent (TSS, BOD and COD	High	Very High	Very High	Very High	High
Capital Cost (lacs BDT/MLD)	78	87	78	348	78
Operational Cost (Lacs BDT per annum per MLD)	41	34	-	44	34
Area Requirement (m^2 per MLD)	900	450	450	450	1000

Further a comparison of the cost for the secondary treatment by the various technology options is mentioned below to give an understanding of the technology that may be preferred for the CETP establishment.

Figure 21: Estimated per MLD CAPEX Cost for CETP technologies[19]

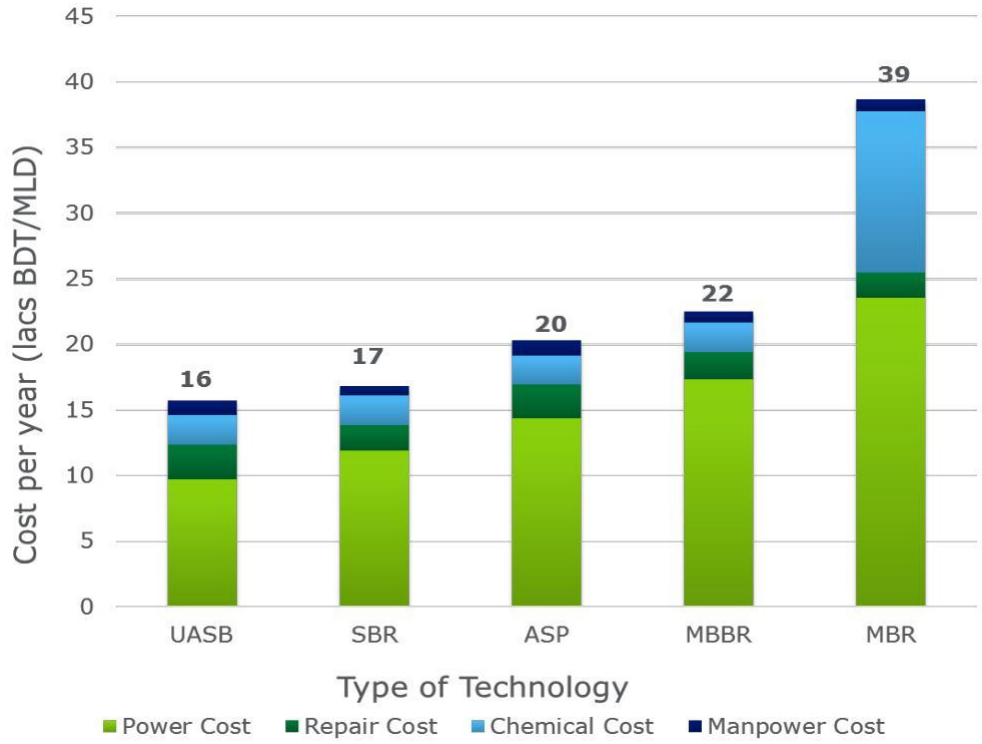


The capital cost of the MBR technology is observed to be the highest while that of the other technologies are similar.

[18] Sewage Treatment in Class I Towns: Recommendations and Guidelines, 2010, pg. 12

[19] Sewage Treatment in Class I Towns: Recommendations and Guidelines, 2010, pg. 9

Figure 22: Estimated per MLD OPEX Cost for CETP technologies[20]



In case of MBR, while the repair and maintenance cost is low but due to high power and chemical cost, the operational cost of MBR is the highest. But it can be seen that although MBR technology is cost intensive, it requires the least amount of land. Technologies like ASP and UASB are land intensive but the capital cost is the lowest and operational cost is also not high. Thus, with the overall lifecycle cost not being high, ASP & UASB are among the economically viable technologies.
In case of SBR, both the Capital cost and Operational Cost are quite close to the bottom of the range and hence SBR offers an overall competitive (low) lifecycle cost. Further, in the case of SBR, the land requirement is among the lowest.

➢ Tertiary Treatment:

Conventional secondary treatment frequently is not sufficient to meet the required effluent quality standards to discharge water to surface water bodies. Certain effluents may require tertiary processes so as to complete solids and organic matter removal, for color reduction or recalcitrant compounds degradation, nutrient (ammonia and phosphorous more common in domestic sewage) reduction and disinfection. The different methods of tertiary treatment are:

- **Sand Filters and Activated Carbon Filtration** – Sand filters remove undissolved pollutants such as suspended solids, undissolved phosphate and attached organics. Activated carbon absorbs organics. They are flexible for modifications in basic design structure to accommodate site specific criteria.
- **Reverse Osmosis (RO) -** Separates water and dissolved constituents down to ionic species. It is applied when a high purity of water is required. The segregated water phase is recycled and reused such as desalination, final removal of degradable components if biological treatment is not available, heavy metals, toxic components and segregation of pollutants with the aim of concentrating or further processing. It is often used in combination with post treatment techniques for the permeate.
- **Ultra Filtration -** Removes pollutants such as proteins and other macromolecular compounds

[20] Sewage Treatment in Class I Towns: Recommendations and Guidelines, 2010, pg. 10

and toxic non-degradable components. Separates heavy metals after complexation or precipitation and components that are not readily degradable. It is a pre-treatment step prior to reverse osmosis or ion exchange. Removes SS along with attached COD as a polishing step and avoiding secondary clarification.

- **Nano Filtration -** Applied to remove larger organic molecules and multivalent ions in order to recycle and reuse the waste water or reduce its volume.

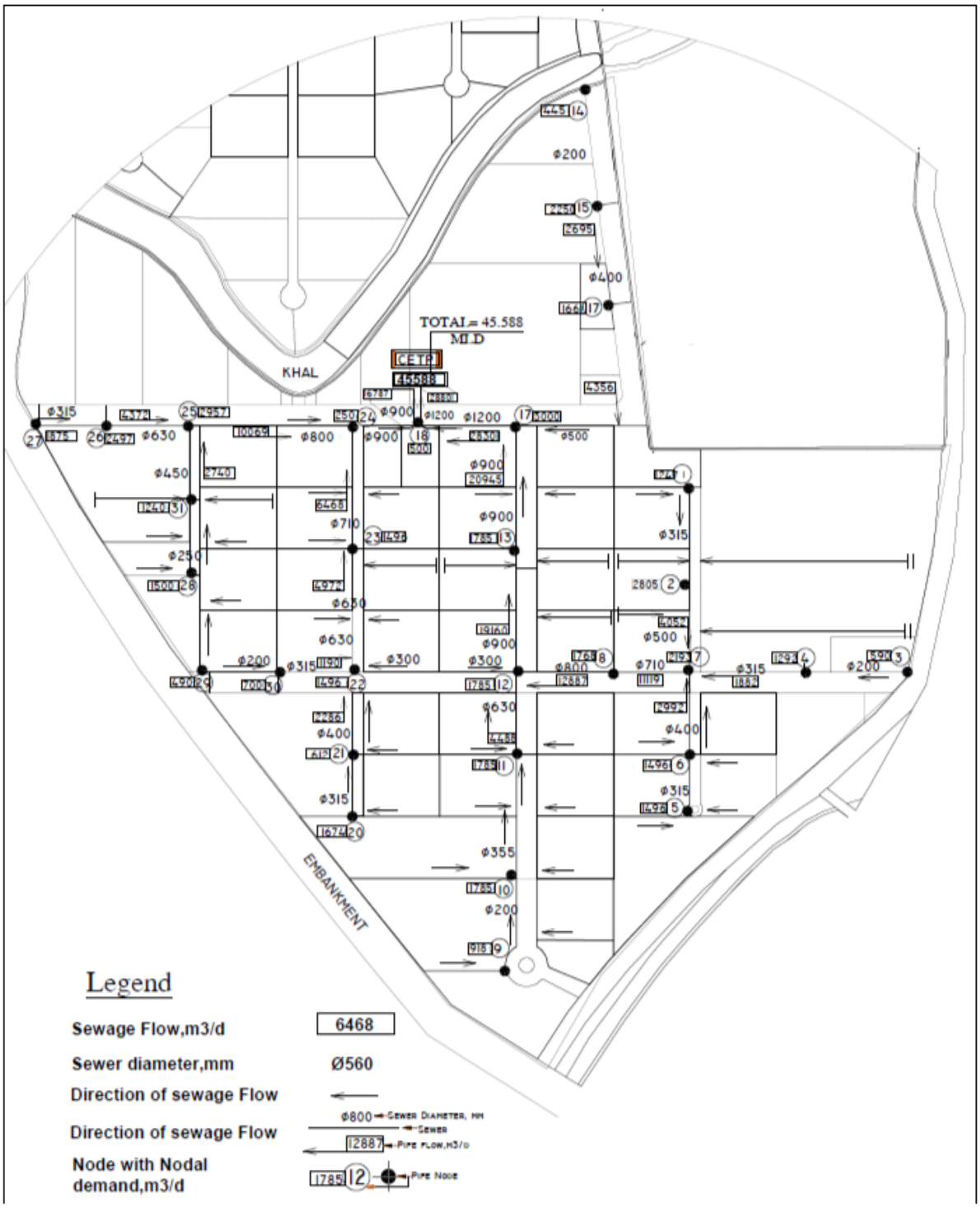
Ion Exchange - Applied to remove unwanted ionic and ionisable species from wastewater. Its greatest value lies in recovery potential as it recovers rinse water and process chemicals. Soluble, ionic or ionisable organic compounds, *e.g*. carboxylic acids, sulphonic acids, some phenols, amines as acid salt, quaternary amines, alkyl sulphates and organic mercury can be removed.

Annexure 11: Sample Design of CETP and Effluent Network

A. Layout Design of the Effluent Network in the BSMSN – 2A Economic Zone

A sample layout of the proposed effluent network in BSMSN - 2A is provided in the figure below. The layout will be further updated during the preparation of the tender documents.

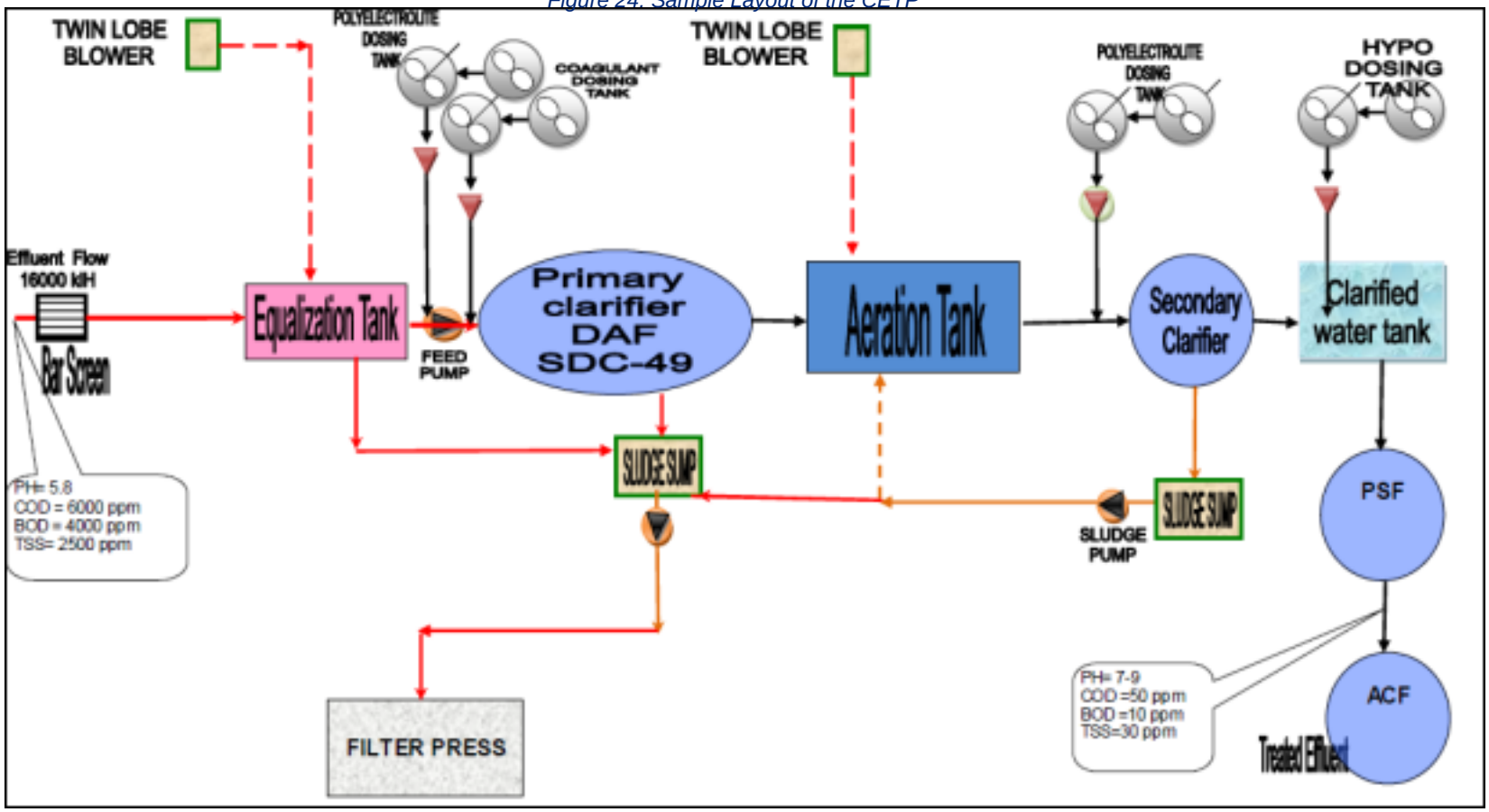
Figure 23: Sample Layout Design of Effluent Network in BSMSN - 2A



2. Sample Layout of the CETP

A sample layout of the proposed CETP in BSMSN - 2A is provided in the figure below. The layout will be further updated during the preparation of the tender documents.

Figure 24: Sample Layout of the CETP[21]



[21] The Layout was presented by Krofta Engineering Limited to the Study Team during the stakeholder consultation activity carried out with CETP Developers

Annexure 12: Questionnaire

1. Questionnaire for Industries

This is with regards to your proposal submitted to BEZA for setting up an industrial unit in BSMSN Economic Zone. To arrive at the actual effluent demand and characteristics, etc. for setting up the proposed common effluent treatment plant for the BSMSN Economic Zone - 2A, it was directed by BEZA to contact the organizations who have submitted the proposals. Kindly provide the following details as well as share additional information, if any.

Name of the Organization:	Main Products envisaged to be produced in BSMSN SEZ:

Proposed Industry type:

☐ Textile and Apparels
☐ Basic & Allied Speciality Chemicals
☐ Engineering Goods
☐ Non Metallic Mineral Products
☐ Food, Agro and Sea Food Processing
☐ Plastic & Plastic Products
☐ Others (Please specify) _____

Contact Name of the interviewee/concerned officer:	
Address of the Organization:	
Phone No.:	Fax No.:
Email Address:	

Implementation Period

Q1. Please fill the below Implementation schedule for setting up your industry in BSMSN Economic Zone.

Start Date:	End Date:	Commercial Operation Date:

Water Requirement

Q2 a) Quantity of water consumed **(m^3/day)** *(assuming 100% capacity utilization of your factory)*	
Q2 b) Percentage of quantity of fresh water that converts into effluent for discharge into the conveyance system **(%)**	

Q2 c) Please provide below details of your company's existing factory, if any.

Existing Factory	Products & their Capacity	Water Requirement per month	WaterCostper month

(Please attach a separate sheet if required)

Pollution Load/Effluent Discharged into Effluent Conveyance System

Q3. What is the projected volume of effluents planned to be discharged (in m^3/day) from your industry?

Year	**Volume Discharged (m^3/day)**
Year 1 of operations	
Year 5 of operations	
Year 10 of operations	

Q4 a) Will you be providing in-house pre-treatment facilities before the discharge of effluent into Effluent Conveyance System? YES / NO

Q4 b) If yes, please provide details of the Effluent Treatment Plant (ETP) planned to be setup at your industrial premises?

Q4 c) Please provide all chemical and physical characteristics (Range: maximum level and minimum level) of effluent to be discharged after treatment into the conveyance system. *(Chemical and physical characteristics include parameter such as pH, BOD, COD, TSS (Total Suspended Solids), TDS (Total Dissolved Solids), Temperature (^oC), Other Pollutants - Ammonical Nitrogen, Ammonia, Arsenic, Boron, Cadmium, Chloride, Chromium, Chromium, Copper, Dissolved Oxygen, Electro-conductivity, Flouride, Sulfide, Iron, Total Kjeldahl Nitrogen, Lead, Manganese, Mercury, Nickel, Nitrate, Oil and grease, Phenolic compounds, Dissolved Phosphorus, Radioactive substance, Selenium, Zinc, Cyanide)*

Parameters	**Unit**	**Minimum Level**	**Maximum Level**

(Please attach a separate sheet if required)

Q4 d) Please provide the density of the effluents discharged into the conveyance system in mg/L at 20°C. *(Required for designing of conveyance system as well as CETP)*

Q4 e) Will the discharge of effluent into the conveyance system be continuous or in batches per 24 hours a day?

☐ Continues

☐ Batch wise: Batch duration _____; Number of batches per day _____

Q4 f) Have you set up an Effluent Treatment Plant (ETP) for your present factories elsewhere? If yes, please provide details of the ETP.

Size of ETP (m^3/day)	Year of Establishment	Effluent Characteristics			
		Parameter	Unit	Inlet Level	Outlet Level

(Please attach a separate sheet if required)

Treated Effluent / Water Demand

Q5 a) Would your industry need/accept treated effluent / water after treatment from CETP to complement your water demand? Yes / No

Q5 b). If yes, what is the quantity you will accept / need? _____ **m^3 / day**

Q5 c). If yes, what is the minimum acceptable quality of treated effluent? Please indicate range of the physical characteristics of the treated effluent.

Parameters	Unit	Minimum	Maximum

(Please attach a separate sheet if required)

Willingness to Pay

Q6. The tariff rate charged by BEPZA Common Effluent Treatment Plant (CETP) to treat effluents is 36.95 Taka per m^3 of treated effluent. To achieve cost recovery and ensure reliable effluent treatment operations, tariffs may be higher. How much additional tariff are you willing to pay?

☐ 10% more than the base rate ☐ 30% more than the base rate

☐ 20% more than the base rate ☐ No Change

(*The rates are indicative and subject to applicable tariff policy)*

Q7. The tariff rate for fresh water supply charged by BEPZA to industries is 25.98 Taka per m^3 of fresh water supplied. To achieve cost recovery and ensure reliable water supply operations, tariffs may be higher. How much additional tariff above this reference rate are you willing to pay?

☐ 10% more than the base rate ☐ 30% more than the base rate

☐ 20% more than the base rate ☐ No Change

(*The rates are indicative and subject to applicable tariff policy)*

Requirement of Manpower

Q8. What is the manpower (skilled and unskilled) requirement for your industry to be set up in BSMSN Economic Zone?

Other concerns

Q9. Do you have any concerns regarding the discharge of effluents to the CETP? If yes, then please elaborate.

2. Questionnaire for CETP Developers

Brief: A CETP is envisaged to be developed in Bangabandhu Sheikh Mujib Shilpa Nagar (BSMSN) – 2A Economic Zone in Bangladesh for treating the effluent from an industrial zone comprising a mix of industries such as textile, pharma, food processing and engineering goods. The CETP will be developed in stages to achieve an ultimate capacity of 48 MLD. Illustratively, the civil works will be built for entire 48 MLD capacity and the electromechanical equipment will be installed/commissioned over time. Further, the treated water from the CETP will be reused in power cum steel plants.

The **Project** comprises 3 components, namely:

Effluent Network | CETP | Reuse Water Pipeline

In this regard, a consultation with CETP Developers is being carried out to invite suggestions on development of the CETP – specifically, to understand the project scope of the CETP developer, project mode of implementation, inlet effluent standards and tariff rate for effluent treatment.

Name of your Organization:	Date:
Address:	
Name of the interviewee:	
Phone No.:	Fax No.:
Email Address:	
Project Scope	
Q1. Are you willing to have all the three Project components within your scope? If no, kindly elaborate.	

Q2. What are some of the most important ETP/ CETP projects that your firm has developed?

Sl. No.	Project Name and location	Project Components and Capacities (in MLD/metres)	Year of built/ commissioning	Cost (CAPEX & OPEX)	Remarks
		ETP/ CETP - _____ MLD Network - _____ m Pumping Station: ____ MLD Reuse Water: ____ MLD			
		CETP - _____ MLD Network - _____ m			

		Pumping Station: ____ MLD Reuse Water: ____ MLD			
		STP - _____ MLD Network - _____ m Pumping Station: ____ MLD Reuse Water: ____ MLD			
		STP - _____ MLD Network - _____ m Pumping Station: ____ MLD Reuse Water: ____ MLD			
		STP - _____ MLD Network - _____ m Pumping Station: ____ MLD Reuse Water: ____ MLD			

(Please attach a separate sheet if required)

Project Structure

Q3. What PPP models do you think are best suited for the Project? Kindly elaborate.

Q4. Are you willing to take the demand risk (i.e. the revenues will be based on the demand of effluent treatment in the Economic Zone) for the Project?

Q5. Are you willing to take the finance risk (i.e. return of your investments in the Project over the concession period) for the Project?

Q6. What are your expectations from the project? Returns (Equity IRR) (in %) - Payback period - Breakeven -
Project Contours
Q6. What should be the inlet effluent standards (pH/BOD/COD/TSS/TDS/chemicals etc.) for the CETP? *(Please attach a separate sheet if required)*
Q7. What should be the likely tariff rate for a metric ton of the effluent treated?
Other concerns
Q8. Have you faced any performance challenges with your existing CETPs?
Q9. Would you like to suggest any important DOs & DON'Ts for the CETP project?

3. Questionnaire for BEPZA Officials

Name of the Authority: Bangladesh Export Processing Zones Authority	
Project Name and Location: Construction of CETPs in EPZs	
Contact Name of the interviewee: Md. Jillur Rahman (General Manager – Maintenance)	
Address of the interviewee: BEPZA Complex, House # 19/D, Road #6, Dhanmondi, Dhaka-1205, Bangladesh	
Phone No.: +88-02-9614970 (Office), Fax No.: +88-02-9673020 +88-01-71123039 (Mobile)	
Email Address: jillur89@yahoo.com	
Q1. Of all the Export Processing Zones in Bangladesh, how many of them already have CETPs, capacities, date of completion? Q2. What are some of the most important CETP projects undertaken in the EPZs? Q3. Are any of the aforementioned CETP development projects based on a PPP model? Q4. If yes, what PPP model do you think is best suited for a CETP transaction? Q5. When it comes to PPP projects, who do you think are some of the major players in this sector? Q6. What is the risk appetite of the players in this sector? Q7. What are the key expectations of players in this sector in terms of risk/reward sharing? Q8. What are your thoughts about participation in the PPP projects in the current economic environment?	

Q9. Coming back to CETP development, what are the major industrial sectors that are discharging effluents in the treatment plant in the EPZs?

Q10. Is there any allowable pollution level (pH/COD/BOD/TDS/TSS) in terms of Pre-treatment of the discharged effluents by individual industries?

Q11. . If yes, can you please elaborate on the allowable levels of the effluent discharged by the individual industries?

Q12. If no, then are the users charged based on the pollution level of the effluents? Please elaborate.

Q13. What is the tariff rate for a metric ton of the effluent treated?

Q14. What is the current capacity of the CETP? Has there been any upgradation in the capacity of the CETP? If yes, please state the reason for the upgradation.

Q15. What is the current level of plant utilization and current average flow of effluents per day from the user industries?

Q16. What is the desired Equity IRR and Project IRR for a CETP project of such capacity?

Q17. What is the status of development of CETPs in other EPZs?

Q18. What are the applications of the treated wastewater?

Q19. Did you face any performance challenges with the operation and maintenance of the CETP?

Q20. Any important DOs & DON'Ts for common effluent treatment plants.

Q21. Please fill the below table with the required information.

CETP	Incoming BOD, COD	Outgoing BOD, COD	Technology	Industry Mix	Year of Establishment	Year of Upgradation	Project Cost	Capacity Utilization (%)	Operating Cost
Comilla CETP									
Dhaka CETP									
Chittagong CETP									

CETP	Players who has bid for	Problems/Issues
Comilla CETP		
Dhaka CETP		
Chittagong CETP		

Annexure 13: Minutes of the meetings

Annexure 13A: Meetings with Client Side Stakeholders

Meetings with the client side stakeholders were held to discuss the findings of the study team over the course of the project and receive feedback from the client on the way forward.

1) Meeting with BEZA on 28th March, 2019

Draft Minutes of the Meeting held under the Chairmanship of Mr. Mohammed Shoheler Rahman Chowdhury, General Manager (P&M) on 28.03.2019 to discuss structuring options of project, "Transaction Advisory for Services for the Centralized Effluent Treatment Plant (CETP) at Mirsarai EZ – Contract Package No. BEZA S-123"			
Attendees			
BEZA	Mr. Mohammed Shoheler Rahman Chowdhury, General Manager (P&M)- Chairperson for the meeting Dr. Malay Choudhury, Joint Secretary, Project Director (Additional Charge) Mr. Doyananda Debnath, Manager, (MIS and Research), BEZA Mr. Md. Hamidul Islam, DPD, Senior Assistant Secretary, STCB Mr. AKM Mahbubur Rahman, Zone Development Consultant Mr. Shakil Ahmed, Environment Specialist Mr. Nasir Uddin Chowdhury, Infrastructure Specialist Mr. Md. Nazrul Islam, Project Management and Monitoring Specialist and other officials from BEZA		
Deloitte & BETS	Mr. Sudeep Sinha, Deloitte Mr. Shubham Tiwari, Deloitte (on skype) Mr. Verinder Singh Thind, Deloitte (on skype) Mr. Ajayesh Mohanty, Deloitte (on skype) Mr. Sharif Islam, Deloitte Mr. Md. Dalim Hossen, Deloitte Ms. Zareen Tasnim, Deloitte Mr. Md. Mizanur Rehman, Deputy Team Leader, BETS Ms. Sumaiya Binte Fazlullah, BETS		
Others	Mr. Javed Bin Karim, Senior Advisor, 2030 WRG		
Venue	Conference Room of BEZA, Dhaka	**Date**	28th March, 2019

The meeting started with a round of introduction of all attendees. The following was discussed during the meeting:

1. ***Project structuring options*** The discussion started with the project structure options for the CETP, along with the reuse water pipeline and effluent network. In this regard, the study team has carried out Value for Money and Public Sector Comparator exercise to evaluate the project scoping options. The analysis shows that a PPP option provides more value to the Government.

   Based on the risk sharing arrangement between public and private parties and the components of the project, various models for engaging private sector have been outlined in the business case report.

2. ***Scope of the CETP developer*** The pros and cons of integrating the effluent network with the CETP were discussed. Including the effluent network in the CETP operator's scope will have the advantage of single point responsibility, which BEZA will find easier to manage.

However, there were alternative arguments, which were discussed.

Since it is a greenfield project, if development of effluent network is considered under the scope of BEZA, it will ease coordination while constructing and laying down infrastructure such as effluent network, water pipeline, gas pipeline, cables, roads, which can be planned properly

CETP developers generally lack expertise in laying effluent network.

Traditionally development of effluent network is practised on item-rate/BOQ basis because quantity estimation at bid stage is more difficult.

3. ***Bidding process options*** The question was raised whether the tender process should be a one-stage or two-stage process. While both these methods might be considered, the consultants mentioned that recent precedence has been towards single stage bidding process. Pros and cons of both these options would be considered in subsequent discussions in Phase 2 of the study.

4. **Action Point for BEZA**:
   BEZA would get back to the consultants with the approval of the preferred project structure, along with decisions on the action points outlined in the business case report and the meeting dated 13th February, 2019.

The meeting ended with a vote of thanks to the chairperson.

2) Meeting with BEZA on 13th February, 2019

Draft Minutes of the Meeting held under the Chairpersonship of Mr. Md. Harunur Rashid, Additional Secretary at BEZA on 13.02.2019 to discuss progress of the project, "Transaction Advisory for Services for the Centralized Effluent Treatment Plant (CETP) at Mirsarai EZ – Contract Package No. BEZA S-123" and the Business Case report submitted by the Consultant, Deloitte			
Attendees			
BEZA	Mr. Harunur Rashid, Additional Secretary and Executive Member (Investment Promotion)- Chairperson for the meeting Dr. M. Emdadul Haque, Former Executive Member Mr. Malay Choudhury, PD, STCB Mr. Md. Hamidul Islam, DPD, Senior Assistant Secretary, STCB Mr. Md. Hasan Ullah, Deputy Secretary Mr. Abu Hena Md. Mustafa Kamal, Manager (Investment) Mr. AKM Mahbubur Rahman, Zone Development Consultant Mr. Shakil Ahmed, Environment Specialist and other officials from BEZA		
Deloitte & BETS	Mr. Sudeep Sinha, Deloitte Mr. Sourav Agarwal, Deloitte Mr. Shubham Tiwari, Deloitte Mr. Verinder Singh Thind, Deloitte Mr. Md. Dalim Hossen, Manager, Deloitte Mr. Md. Nurul Alam Siddique, Environmental expert, BETS Mr. Md. Mizanaur Rehman, BETS		
Others	Mr. Javed Bin Karim, Senior Advisor, 2030 WRG Mr. Md. Ahsan Kabir, General Manger (Investment Promotion), BEPZA		
Venue	Conference Room of BEZA, Dhaka	**Date**	13th February, 2019

The meeting started with a round of introduction of all attendees. The following was discussed during the meeting:

1. The study team made a presentation covering the following:-
    a. Projected quantity of effluent generated by the industries
    b. Design philosophy of the three project components
    c. Project Scoping Options
    d. Reuse of treated effluent
    e. Project Structuring Options
    f. Land Requirement

2. ***Projected quantity of effluent generated by the industries*** have been calculated using two approaches – Bottom-up approach and Top-down approach. The *Bottom-up approach* comprised

estimating effluent quantity of the industries based on the investment proposals submitted to BEZA and the *Top-down approach* comprised estimating effluent demand based on water demand calculated by IWM. Both approaches suggest a CETP of ultimate capacity of 48 MLD (32 MLD for BSMSN 2A zone and 16 MLD for BSMSN 2B zone). The capacity of the CETP is envisaged to increase gradually over the years based on the increase in effluent generation from the industries.

3. ***Design philosophy of the three project components*** is envisaged as follows:
    I. *CETP*: Civil works to be constructed in a single stage and the electromechanical equipment to be installed over the years.
    II. *Effluent Network*: Effluent network to be constructed in a single stage. Effluent network operations will be based on effluent load.
    III. *Treated effluent/reuse network*: Pumping station to be constructed in a single stage for full reuse capacity. Pump and rising main to be installed in stages.

4. ***Project Scoping Options:*** The preliminary treatment of effluent will be under the scope of respective industries. In this regard, Dr. M. Emdadul Haque, Former Executive Member, BEZA stated that to ensure successful CETP operations, the industries will be mandated for pre-treatment of the effluent through ETP.

    Further, the treatment at CETP and reuse (treated) water supply will be under the scope of CETP developer and as to who will develop and operate the effluent network, will be decided by BEZA based on information presented under point 6) below.

5. ***Reuse of treated effluent:*** BSRM Steel and Mc Donald Steel have indicated interest in consuming the reuse (treated) water from the CETP. About 18 MLD treated water from the CETP can be used by BSRM Power and Steel plant and Mc Donald Steel. While the study team also considered other reuse options, however, this option has been presented based on higher prima facie commitment of the users.

6. ***Project Structuring Options:*** Based on risk sharing arrangement between public and private parties and the components of the project, an assessment of various models for engaging private sector was undertaken and the following models were shortlisted –
    a. *Option 1: CETP + Reuse Pipeline on Hybrid Annuity based PPP (HAM) mode and Effluent Network in Construction & Maintenance Contract*
    b. *Option 2: All components on BOT mode*
    c. *Option 3: All components on HAM mode*
    d. *Option 4: CETP + Reuse Pipeline on HAM mode and effluent network on DBO mode*
    e. *Option 5: All components on DBO mode*

7. The study team compared the above project structuring options based on the following parameters: Replicability, Private Finance, Simplicity of Project Structure, Market acceptance and Contract management. The pros and cons of the above listed options were presented and the following was discussed:

    a. **Demand Risk**: Unlike Dhaka CETP project, BSMSN is a greenfield project. Therefore, the demand for effluent treatment is unclear and demand for offtake of reuse (treated) water will also develop over a period. Therefore, the demand risk may not be passed

onto the CETP developer and the same was evident in the investor meeting held on 18th December 2018.

b. **Finance Risk**: Recent experiences have shown private players have lesser interest to take finance risk. However, there emerged a collective view in the meeting that mobilizing private finance is important from BEZA's standpoint. It was understood that the option of developing the CETP on HAM basis can mobilize BDT 671 million of private finance and also passes the above defined parameters. Hence, development of the CETP on HAM basis was concurred upon.

c. **Scope of the CETP Developer:** The study team mentioned that integrating the effluent network with the CETP will have the advantage of single point responsibility, which BEZA will find easier to manage. However, there were alternative arguments, which were discussed.

(i) CETP developers generally lack expertise in laying effluent network, and (ii) traditionally development of effluent network is practised on item-rate/BOQ basis because quantity estimation at bid stage is more difficult.

In this regard, Mr. Md. Ahsan Kabir, General Manger (Investment Promotion), BEPZA stated that effluent network development was not part of the scope of work of the CETP developer in BEPZA industrial parks (EPZs).

The Chairperson noted that if development of effluent network is considered under the scope of BEZA, it will ease coordination while constructing and laying down infrastructure such as effluent network, water pipeline, gas pipeline, cables, roads, which can be planned properly.

The consultants further informed tariff related benefits in keeping the effluent network outside the scope of the CETP developer- it will avoid loading effluent network's cost onto the private developer which will allow a lower tariff to be kept.

The consultants agreed to detail this option (Option 1) in the final report.

d. Considering the above, *Option 1: CETP + Reuse Pipeline on HAM mode and Effluent Network under a separate Construction & Maintenance Contract* emerged in the meeting as the preferred project structuring option, wherein BDT 671 million of the project cost (BDT 1610 million) can be privately financed.

8. ***Land Requirement***: Deloitte informed that different CETP technologies have different area requirements and therefore area of the CETP site may be increased to 18 acres. This will facilitate more technology providers to participate in the bid process and help in inviting more bids. The Chairperson agreed to the suggestion.

9. The Chairperson whether the project would be more attractive to investors if the capacity of the CETP is increased to cater to effluents from BSMSN zone 2, zone 3, zone 4 and zone 5.

The study team responded as follows:

(i) the costs (transmission cost, deep excavation cost) would significantly rise and that is why there is increasing advent of decentralized CETPs

(ii) the present size of the CETP is already on the higher side when compared with other CETPs internationally

(iii) Additional land therefore needs to be planned for CETP(s) for zones 2, 3, 4 and 5 of BSMSN

when the Master Plan for these zones are being finalised.

10. **Action Point for BEZA**:
    a. BEZA will co-ordinate for internal approval for *Option 1: CETP + Reuse Pipeline on Hybrid Annuity based PPP (HAM) mode and Effluent Network under a separate Construction & Maintenance Contract* and provide such further direction to the study team.
    b. Land area of the CETP will be increased from 12 acres (presently) to 18 acres contiguous land at the same location.
    c. *BEZA's role as reuse (treated) water supplier*:
        I. Additionally, BEZA will coordinate internal approval for providing payment guarantee to the CETP developer for the amount of reuse treated water produced, provided characteristics of the reuse (treated) water measured at the consumer end of the reuse water pipeline meets prescribed standards.
        II. Further, BEZA will coordinate internal approval for signing agreements for offtake of reuse (treated) water between: i) BEZA and BSRM Power and Steel, (ii) BEZA and McDonald Steel.

11. BEZA asked the study team to hold discussions with banks, financial institutions and explore internationally available funds for CETP development during the next bid process phase of the project (that is preparation of bid documents phase).

The meeting ended with a vote of thanks to the chairperson.

3) Meeting with BEZA on 19th December, 2018

Draft Minutes of the Meeting held under the Chairpersonship of Mr. Md. Harunur Rashid, Additional Secretary at BEZA on 19.12.2018 to discuss progress of the project, "Transaction Advisory for Services for the Centralized Effluent Treatment Plant (CETP) at Mirsarai EZ – Contract Package No. BEZA S-123" and the findings for the Business Case report to be submitted by the Consultant, Deloitte			
Attendees			
BEZA	Mr. Harunur Rashid, Additional Secretary and Executive Member (Investment Promotion)- Chairperson for the meeting Dr. M. Emdadul Haque, Former Executive Member Mr. S. M. Nurul Alam, PD, STCB Mr. Md. Hamidul Islam, DPD, Senior Assistant Secretary, STCB Mr. Md. Hasan Ullah, Deputy Secretary Mr. Md. Mahbubur Rahman, Mr. Abu Hena Md. Mustafa Kamal, Manager (Investment) Mr. Md. Ahasan Ullah, Manager Mr. AKM Mahbubur Rahman, Zone Development Consultant Mr. Md. Abdul Quader Khan, Social Specialist Mr. Shakil Ahmed, Environment Specialist		
Deloitte & BETS	Mr. Sudeep Sinha, Deloitte Mr. Kushal Kr. Singh, Deloitte Mr. Sourav Agarwal, Deloitte Mr. Shubham Tiwari, Deloitte Mr. Verinder Singh Thind, Deloitte Mr. Md. Nurul Alam Siddique, Environmental expert, BETS Mr. Md. Dalim Hossen, Manager, Deloitte Mr. Md. Mizanaur Rehman, BETS Mr. Uizanur Rahman, MD, Deputy Team Lead, BETS Ms. Sumaiya, Water Supply Engineer, BETS		
Others	Mr. Javed Bin Karim, Senior Advisor, 2030 WRG Mr. Shoubhik, Mr. Mitchell- Consultants to 2030 WRG (over telecon)		
Venue	Conference Room of BEZA, Dhaka	**Date**	19th December, 2018

The meeting started with the introduction of M/s Deloitte Touche Tohmatsu India LLP (Deloitte) and BETS Consulting Services Ltd. (BETS) as consultants for the above project. The following was discussed during the meeting:

1. The consultants informed that
    a. To treat the effluent from BSMSN - 2A and BSMSN - 2B zones, a combined CETP of 48 MLD ultimate capacity (32 MLD for BSMSN - 2A and 16 MLD for BSMSN - 2B) will be required to be built. The capacity of the CETP is envisaged to increase gradually over the years based on the increase in effluent generation from the industries.

       In this regard, in the year when effluent load reaches 75% - 80% of the installed capacity, the CETP Operator will augment the installed capacity in the subsequent operating year.
    b. To accommodate the different prevailing/proven effluent treatment technologies, about 18 acres of land is required to be budgeted. Presently 12 acres of land has been allotted for the CETP which will be required to be ***increased to 18 acres*** (if both effluent load from BSMSN - 2A and BSMSN - 2B is considered). ***The Chairperson mentioned that additional land can be made available.***

c. Various water reuse options have been examined. BSRM Steel and Mc Donald Steel have indicated interest in consuming the reuse (treated) water from the CETP. About 18 MLD treated water from the CETP can be used by BSRM Power and Steel plant and Mc Donald Steel. The potential of treated water reuse may increase with other industries expressing their interest in using the treated water. In this regard an agreement will be required to be executed with them so that water offtake is guaranteed.

d. Design philosophy of the three project components will be as follows:
   I. *CETP*: CETP capacity to be developed in modules in stages. Therefore the electromechanical equipment to be installed/commissioned in stages. Civil works to be constructed in a single stage
   II. *Effluent Network*: Effluent network to be constructed in a single stage. Effluent network operations to be carried out based on effluent load
   III. *Treated effluent/reuse network*: 70% of treated effluent can be supplied for reuse. Pumping station to be constructed in a single stage for full reuse capacity. Pump and rising main to be installed in stages

e. Based on preliminary discussions with CETP developers, their area of expertise and review of recent tenders/projects, they would like the project scope for the CETP developer to include CETP, pumping station (within CETP premise) and reuse water pipeline till consumers, but not the effluent network(which requires different skillsets).

f. A financial analysis of the project and a sensitivity analysis for various pricing points; (base rate as 36.95 BDT/m^3 for CETP treatment of effluent and 26.40 BDT/m^3 for fresh water with 4% p.a. increase); availability of effluent loads etc was discussed. The financial analysis shows that the Project returns become significantly lesser when the effluent network gets added to the scope of the private player. Therefore a decision needs to be taken by BEZA on whether the effluent network could be taken up separately by BEZA and excluded from the scope of the CETP operator.

g. Analysis of various project structuring options suggest DBO, HAM and BOT models as the most suitable options available for the development of the project. The two most important risks (demand and finance risks) were discussed.
   I. Demand : Demand for effluent treatment is unclear and demand for offtake of treated (reuse) water will also develop over a period of time. Therefore, the demand risk may not be passed onto the CETP operator.
   II. Finance risk: Recent experiences (in the Indian context) have shown private players are unwilling to take finance risks.

   Therefore, BEZA may consider Design Build Operate (DBO) (i.e. BEZA takes all the financing risk) or Hybrid Annuity (HAM) (i.e. CETP Operator takes part of the financing risk and the rest of the financing risk is taken by BEZA)

h. to ensure successful CETP operations, the industries need to be mandated for pre-treatment of the effluent through ETP and regularly submit effluent characteristics report measured by installing metering devices at their premises

2. The consultants summarized their presentation with 4 decision/action points for BEZA
   a. **Land:** Presently 12 acres of land has been allotted for the CETP, which is sufficient for 32 MLD effluent load of BSMSN - 2A). This will be required to be increased to 18 acres if the effluent load of BSMSN - 2B is to be included as well.
   b. **Scope of the CETP Operator:** The effluent network reduces the overall Project viability and based on preliminary feedback from potential CETP bidders, they have

expressed reservations for including the effluent network in the Project scope. BEZA may consider having the effluent network outside the CETP Operator's scope and treat the Effluent treatment construction and maintenance as a separate project.

c. Project structuring options would primarily be determined by who would take the
    I. **Demand Risk:** The demand risk should not be taken by the CETP operator, keeping in perspective the lack of clarity on demand as was evident in the Investor meeting held on 18th December 2018
    II. **Finance Risk:** BEZA may consider DBO (mode of implementation) if it has access to low cost finance from Government of Bangladesh (BEZA informed that there is such a provision under discussion). If BEZA would like to share the financing risk, then Hybrid Annuity(mode of implementation) may be looked at.

3. Mr. Rahman, Ex. BEPZA, informed that
    a. in BEPZA EPZs, the industries are sometimes reluctant to install meters at their premise for measurement of effluent volume. They often cite excuses such as meters will get clogged and won't work
    b. homogenous effluent should be released by industries into the pipeline
    c. in BEPZA CETP projects, 10% of the effluent treatment revenue goes to BEPZA
    d. development of effluent network is a huge cost and it is not possible for a CETP developer to absorb that cost

4. BEZA asked the consultants as to whether there will be a separate pipeline for sewerage. The consultants responded that there will be a common conveyance system for both industrial effluent and sewerage because this helps in increasing the BOD level.
5. BEZA asked the consultant to hold discussions with GIZ for sludge disposal options. The consultant responded that the cost for sludge disposal has already been considered as part of costs and will undertaker further discussions with GIZ on the issue.
6. BEZA informed that a note for funding of CETP has been prepared by BEZA for Prime Minister's office and the consultants can obtain a copy of the same and study.
7. BEZA stated that all consultants and BEZA need to work together to make the project a success.

The meeting ended with a vote of thanks to the chairperson.

4) Meeting with Investors in BSMSN Economic Zone on 18th December, 2018

Draft Minutes of the Meeting held under the Chairpersonship of Mr. Md. Harunur Rashid, Additional Secretary and Executive Member, Investment Promotion at BEZA on 18.12.2018 to reconfirm information provided by investors of Bangabandhu Sheikh Mujib Shilpa Nagar (BSMSN) in their respective investment proposals			
Attendees			
BEZA	Mr. Harunur Rashid, Additional Secretary and Executive Member (Investment Promotion)- Chairperson for the meeting Dr. M. Emdadul Haque, Former Executive Member Mr. S.M.Nurul Alam, PD, STCB, BEZA Mr. Hamidul Islam, MD, DPD, STCB, BEZA Mr. Shakil Ahired, ES, STCB, BEZA Mr. Ahasan Ullah, MD, Manager, BEZA Mr. Abdus Salam Mandal, MD, Executive Engineer Mr. Abdul Quadeorkan, Soanl Consultant, STCB of BEZA Mr. Rakibul Hassan, Manager Project Mr. Khondoker Liaquat Ali, Procurement Specialist BEZA Mr. Mohammad Abu Yousuf, Manager (Admin) Mr. Mosharaf Hossain Bhuiya, Manager Accounts & Finance Mr. Engr. Aktaruzzaman, AGM Mr. Akhtarul Islam, Executive Director (admin & HR) Mr. Rezaul Kanim, AGM(Alf) Mr. Shakil Mahmus, Compliance Mr. Sakh Ahmed, Manager Mr. Shakil Mahmud, DGM		
Deloitte & BETS (Transaction Advisor Consultants)	Mr. Sudeep Sinha, Deloitte Mr. Shubham Tiwari, Deloitte Mr. Verinder Singh Thind, Deloitte Mr. Mizanaur Rehman, Deputy Team Lead, BETS Mr. Md. Dalim Hossen, Manager, Deloitte Ms. Sumaiya Binte, Water Supply Engineer, BETS		
Others	Mr. Javed Bin Karim, Senior Advisor, 2030 WRG Mr. Shaiful Alam, MD- Nippon & McDonald Steel Industry Mr. Shahabuddin, MD, DGIN (Land & Admin) McDonald Steel Mr. Kazi Anwar Ahmed, Head of Dhaka Corporate Office BSRM Group of Companies Mr. Bahamul Alam Biswas, MD, GM Everlast Minerals Limited Mr. Faaruk Hossain, MD, AM, Merchant, Melbourne Mr. Raihanul Abedin, MD, ED, Jamuna Space Tech J.V Mr. Golam Rasul, MD, Manager Commercial, Jahangir Steel Mill LTD. Mr. Engr. Maruf Ahamad, Chief Engineer, URMI group Mr. Golam Rasul, MD, Sanji Group of Companies Mr. Salim Bhuiyan,MD, ED (Eugg), RPCL Mr. Moshara P Hossain Bhuija, Manager, A/F BEZA Fashion Mr. Monower Hossain, MD, Sr. D/S BGMEA		
Venue	Conference Room of BEZA, Dhaka	**Date**	18th December, 2018

The meeting started with a round of introduction of BEZA officials, other government officials,

prospective investors in BSMSN and team from M/s Deloitte Touche Tohmatsu India LLP (Deloitte) and BETS Consulting Services Ltd. (BETS) as consultants for the above project.

The following was discussed during the meeting:

8. The consultants informed that the investor meeting has been organized to seek consultation on setting up a Central Effluent Treatment Plant (CETP) in BSMSN - 2A EZ to treat the effluent from the industries. The development of a CETP would benefit industries by: (i) helping them comply with prescribed environmental standards and promote water reuse (ii) providing economies of scale in effluent treatment (iii) allowing for lesser land allocation by industries for effluent treatment (iv) reducing the number of approvals
9. In this regard, the consultants distributed a survey questionnaire to the investors followed by a presentation to explain the survey questionnaire. The presentation agenda comprised: (i) Effluent generation by the industries (ii) Willingness to pay (iii) Preliminary treatment in Effluent treatment plant (ETP) by the industry and CETP inlet parameters, and (iv) Reuse of treated water
10. Regarding effluent generation, the consultants informed that water/effluent generation of various industries largely follows industry norms. However, in case of some LPG bottling industry & stitching industries have indicated low effluent volumes and water requirement. In order to understand the total effluent generation in BSMSN- 2A, BSMSN - 2B, the consultants requested investors to submit effluent generation information as per the survey questionnaire provided.
11. The consultants informed that the Dhaka and Chittagong Tariff rates were as follows:

(iii) Dhaka Tariff rates: a) Effluent Treatment (BEPZA) – BDT 36.95 per KL of effluent, b) Water Supply (DWASA) – BDT 33 per KL of treated surface water from WTP

(iv) Chittagong Tariff rates: a) Effluent Treatment (BEPZA) – BDT 45 per KL of effluent, b) Water Supply (CWASA) – BDT 26.25 per KL of treated surface water from WTP

The consultants requested investors to submit expected tariff details as per the survey questionnaire provided.

12. Regarding preliminary treatment, the consultants informed that some industries have indicated establishment of ETP for preliminary treatment within their premises in their Investment Proposals whereas others have not. The investors were informed by BEZA that the industries will be required to install an ETP, pump to discharge effluent and meter to measure effluent discharged to the CETP and a directive from BEZA has been passed in this regard.
    The investors were also informed about the prescribed effluent standards at the CETP inlet as per Central Pollution Control Board (CPCB), India which are also accepted internationally. The discharge from the industries will be required to meet similarly prescribed effluent standards for industries in BSMSN.

    The consultants requested investors to submit preliminary treatment related information as per the survey questionnaire provided.
13. Regarding water reuse, the consultants informed that treated wastewater from the CETP is used in power and steel plants (for cooling purposes), textile and chemical industries, and food industries (for washing purposes). BSRM Steel and Mc Donald Steel indicated interest in consuming the reuse water from the CETP.
    The consultants requested investors to provide reuse water requirements as per the survey questionnaire provided.
14. The investors raised the following queries:
    a. Is it mandatory to connect with the CETP?
    b. Effluent treatment tariff of BDT 36.95 per KL is high, so BEZA may consider BDT 30 per KL and inform tariff information to the investors.
    c. Effluent discharge standards from the industry and related guideline for setting up ETP?

d. BGMEA suggested that since recycling water is expensive, recharging using percolation pit may be considered.

Regarding the above issues, BEZA responded point-wise as follows:

a. In order to check bypass of untreated effluent, maintain professional control over effluent treatment and promote recycle and reuse of treated water, connection with CETP will be mandatory.

b. BEZA has a tariff policy according to which tariff will be determined.

c. Large land parcels are being allotted to industries so allocating land for ETP purpose should not be difficult. Two or three industries may setup a common ETP but no industry will discharge effluent without primary treatment.

d. A large reservoir is planned for water supply to the industries.

15. BEZA asked BGMEA to share the list of main polluters in BSMSN - 2B. BGMEA was also asked to provide contact information of investors in BSMSN - 2B zone so that the survey questionnaire could be sent to the investors absent from the meeting.

16. BEZA asked investors to respond on the survey information within 7 days' time.

The meeting ended with a vote of thanks to the chairperson.

5) Meeting with BEZA on 1st October, 2018

Draft Minutes of the Meeting held under the Chairpersonship of Mr. Md. Harunur Rashid, Additional Secretary and Mr. Executive Member, Investment Promotion at BEZA on 01.10.2018 to discuss progress of the project, "Transaction Advisory for Services for the Centralized Effluent Treatment Plant (CETP) at Mirsarai EZ – Contract Package No. BEZA S-123" and the findings of the Inception report submitted by the Consultant, Deloitte	
Attendees	
BEZA	Mr. Harunur Rashid, Additional Secretary and Executive Member (Investment Promotion)- Chairperson for the meeting Mr. S. M. Nurul Alam, PD, STCB Dr. Gazi Md. Saifuzzaman, Secretary Mr. Md. Moniruzzaman, General manager, IP Satya R. Madhav, Manager Mr. Md. Khurshid Alam Patwary, Manager Mr. Md. Mahbubur Rahman, Deputy Sec. Mr. Abu Hena Md. Mustafa Kamal, Manager (Investment) Mr. Dayananda Debrata, Manager Mr. Ummay Salma, Deputy Manager Mr. Sherjuti Barwa, PRO Ms. Farjana Alam, APD, STCB Mr. Md. Ahasan Ullah, Manager Mr. Md. Abdul Quader Khan, Social Specialist Mr. A. B. M. Sharif, Project management and monitoring specialist Dr. Gaze Md. Mohsin, TL, TAS Mr. Shakil Ahmed, Environment Specialist Mr. Md. Hamidul Islam, DPD, Senior Assistant Secretary, STCB Mr. Md. Hasan Ullah, Deputy Secretary Dr. M. Emdadul Haque
Deloitte & BETS	Mr. Sudeep Sinha, Deloitte Mr. Kushal Kr. Singh, Deloitte Mr. Sourav Agarwal, Deloitte Mr. Shubham Tiwari, Deloitte Mr. Verinder Singh Thind, Deloitte Mr. Md. Nurul Alam Siddique, Environmental expert, BETS Mr. Md. Dalim Hossen, Manager, Deloitte

	Mr. Md. Mizanaur Rehman, BETS Ms. Sumaiya, Water Supply Engineer, BETS		
Others	Mr. Ranjit Ku. Sen, Executive Member Mr. Shoheler Rehman Chowdhury Mr. AKM Mahbubur Rahman, Zone Development Consultant Mr. Mirza Md. Shafiqul Islam, Infrastructure Consultant Ms. Farzana Afroz, Urban Planner, Sheltech Mr. Md. Ashraful Islam, Legal Consultant, STCB Mr. Abdullah Al Mahmud Farik, DPD, Phase 1 Dr. Akhter Hussain Chaudhury Mr. Javed Bin Karim, Senior Advisor, 2030 WRG Mr. Ferous Hasan Khan, A. C. Architect Mr. Syed Nazmul Ahsen, Director (E.C), DOE		
Venue	Conference Room of BEZA, Dhaka	**Date**	1stst October, 2018

The meeting started with the introduction of M/s Deloitte Touche Tohmatsu India LLP (Deloitte) and BETS Consulting Services Ltd. (BETS) as consultants for the above project. The following was discussed during the meeting:

1. The consultants informed that they
    a. have met BEZA officials, WRG to understand project background and develop initial project understanding
    b. have conducted the site visit of Mirsarai EZ and met the Site Engineer at Mirsarai to understand status of on ground development
    c. have held consultative discussions with IWM to understand zone-wise water demand
    d. have reviewed the Prefeasibility Report for Mirsarai EZ, environment related notifications, BEZA Act, PPP Policy and other documents available on BEZA's website
    e. visited BEPZA and their Dhaka CETP to understand operational / commercial / regulatory aspects of CETP in Bangladesh.
    f. understand that the Masterplan for Mirsarai is under finalization and undergoing changes. As per the Masterplan, an area of 9 acres for CETP and 3 acres for STP has been allocated.
    g. have reviewed the investment proposals submitted by investors to BEZA for Mirsarai Economic Zone to understand water demand and wastewater/industrial effluent generation volume as submitted by the investors. Being an economic zone with multi-dimensional products, the water demand and wastewater/industrial effluent generation volume / characteristics are different for different kinds of industries. These details are missing in few investment proposals and only initial estimates seem to be provided in in other investment proposals. Hence, these details are required to be confirmed with the investors. In this regard, the consultants have already started meeting investors and have also requested BEZA to organize a consultation meeting with the investors.
2. Since majority of the companies envisaged to be set up in Zone 2A belong to textile industry, the consultants were advised to study the water requirement in different kinds of textile industries. In this regard, BEZA agreed to organize a consultation meeting with the investors**.**

3. The consultants were advised to study the Dhaka, Chittagong and Savar CETP as well as internationally recognized projects especially from developed countries to identify key issues, challenges and learnings.
4. The representative from Department of Environment suggested the following points should be part of the feasibility report so that the project can pass the environmental regulatory procedure:-
    a. Maximum area for CETP to take care of future expansion
    b. Technology – Analysis of the technologies, evaluation criteria to suggest the most economical/suitable.
    c. Costs involved for pre-treatment at industry using ETP.

    In this regard the Chairperson (for the meeting) indicated that BEZA would pass a directive to investors for upfront setting up and running an ETP at their industry premises.
5. The consultants informed that the developer chosen for the CETP project will move the application seeking environmental approval based on his chosen CETP technology and CETP project plan.
6. Following observations were made on the Inception Report:
    'Understanding of the Assignment' to be added in executive summary section as well as a separate chapter based on the TOR of the assignment.
    All developer related concessions offered by BEZA should be indicated
    The cited source in the report should indicate chapter number, page number and paragraph number
    BEZA Building Code, wastewater rules and regulations in other countries, draft environmental rules (2017) to be considered during the course of the project also the international buyers rules and regulations, IFC / World Bank Group Environmental Health and Safety Guidelines will be compared and analysed.
    Study should assess if the CETP can also cater to Mirsarai 2B and Mirsarai-1 (PPP mode development)

    The consultants were advised to incorporate the above comments and submit the final Inception Report.
7. The consultants were suggested to consider options for reuse of treated water from the CETP for other bulk customers, especially power plants also for gardening, toilet flashing, cooling and all possible reuse options
8. The consultants were further advised that the business case report will indicate a comparative analysis of PPP and EPC modes of project implementation for consideration of BEZA to then take a final view on the matter.
9. Baseline data has to be provided as an annexure from where the decision are been taken

The meeting ended with a vote of thanks to the chairperson.

6) Meeting with 2030 WRG, 22nd January, 2019

Draft Minutes of the Telecon with 2030 WRG on 22.01.2019			
Attendees	Mr. Javed Bin Karim, Senior Advisor, 2030 WRG Mr. Michel Hermannus Maria Leushuis, 2030 WRG Other representatives from 2030 WRG Mr. Shoubhik Ganguly, Rebel Group Mr. Sudeep Kumar Sinha, Partner, Deloitte Mr. Sourav Agarwal, Senior Manager, Deloitte; Mr. Shubham Tiwari, Senior Manager, Deloitte; Ms. Santoshi Kotni, Consultant, Deloitte; Mr. Ajayesh Mohanty, Consultant, Deloitte.		
Venue	Video Conference	**Date**	22nd January, 2019
Summary	The key objectives of the meeting were to discuss the findings the Draft Business Case Report prepared by Deloitte		
Discussion points			
Context	There are a mix of industries being planned to be set up in Bangabandhu Sheikh Mujib Shilpa Nagar (BSMSN) and the effluent volume from BSMSN - 2A is envisaged to be 32 MLD while that from BSMSN - 2B is envisaged to be 16 MLD. Thus a CETP of cumulative size 48 MLD is being proposed		
Project Components and Scope	Three project components have been identified: Effluent network CETP Reuse water pipeline Deloitte informed that while the CETP and reuse water pipeline can be under the scope of the CETP developer, the decision on including the effluent network under the developer's scope has to be taken by BEZA. Deloitte discussed the various pros and cons of having the effluent network within the scope of the CETP developer. Deloitte stated that they will explain those in more detail in the Draft Business Case Report 2030 WRG remarked that the project structure should be replicable in other economic zones across Bangladesh.		
Project Structure	Deloitte proposed three options for the project structure: Option 1: Development of CETP + Reuse Water Pipeline + Effluent Network on Hybrid Annuity based PPP mode (HAM) Option 2: Development of CETP + Reuse Water Pipeline on HAM and Effluent Network on Design Build & Operate (DBO) basis Option 3: Development of CETP + Reuse Water Pipeline + Effluent Network on DBO basis		

	The pros and cons of the options were discussed and Deloitte stated that they will explain those in more detail in the Draft Business Case Report.
Way Forward	2030 WRG informed that they will assist Deloitte in conducting further market sounding. In this regard, they offered to setup a video conference with FloWater and Marubeni. Deloitte shall present an analysis of the project structuring options in the Draft Business Case Report to assist decision making by BEZA. 2030 WRG mentioned that they would want to participate during Deloitte's discussions with BEZA on the draft business case report. They indicated that they have some prescheduled travel during second week of February, 2019 and therefore Deloitte may schedule their visit to Bangladesh in the subsequent week so that a meeting can be held at BEZA office to discuss the findings of the Draft Business Case Report.

Annexure 13B: Meetings with Original Equipment Manufacturers (OEMs)

The study team interacted with multiple Original Equipment Manufacturers (OEMs) to understand

a) their product offering to suit an economic zone featuring a variety of industry categories

b) competing technologies available in the market along with their preliminary design and cost aspects.

Sl. No.	OEM Name	Business	Key Remarks
1.	Xylem Analytics	Effluent Monitoring and Metering Device manufacturer	•Real-time online effluent monitoring of the industries may be mandated •Can bill industries as per quantity and quality of effluent produced • Multinational buyers sourcing goods from producers have mandates to develop the infrastructure of the producers • Cost of metering devices is around BDT 30 lacs (exclusive of taxes). The cost may be built into the licensing and clearance certificate of the industries •Meters are non-corrosive and have life expectancy of 8 to 10 years
2.	Ion Exchange	CETP Equipment provider	•MBR technology may be adopted to produce reusable water from the CETP •RO treatment along with evaporators to be installed for tertiary treatment • General indicative costs: ○ OPEX – BDT 45/m^3 to BDT 48/m^3 ○ CAPEX – BDT 4.5 crore/MLD to BDT 5 crore/MLD ○ Civil Construction – BDT 1.8 crore/MLD to BDT 2.4 crore/MLD
3.	Krofta Engineering Limited	CETP Equipment provider	•Global manufacturer and supplier of following products: ○ Dissolved Air Floatation (DAF) – removes Suspended solids and Oil from water ○ Belt Filter Press - sludge thickening and dewatering ○ Oil Water Separator - separation of free oil from wastewater ○ Multi Disc Screw Press - dewater oily water •The technology provided helps to minimize the space, chemical and power requirement of the effluent treatment plant

Other OEMs who were interacted to understand product offerings include Aldee Water, Lanxess, Jay Water, Permionics, Enexio, Gold Finch etc.

Annexure 13C: Meetings regarding Sludge Management

Meetings with the following organizations were held to understand the options available for sludge management and disposal from the CETP.

1) Meeting with UNIDO, 20th December, 2018

Draft Minutes of the Meeting dated 20th December, 2018 with UNIDO			
Attendees	Mr. Zaki Uz Zaman, PhD, UNIDO Country Representative, Bangladesh Mr. Sudeep Sinha, Partner, Deloitte Mr. Shubham Tiwari, Senior Manager, Deloitte Mr. Verinder Singh Thind, Water Expert		
Venue	UNIDO Office, Dhaka	**Date**	20th December, 2018
Summary	The objective of the meeting was to understand the findings of UNIDO regarding effluent treatment, sludge management and collection of relevant documents that will aid in the development of a multi-industry CETP		
Discussion points			
Eco Industrial Park	To convert industrial parks into Eco-Industrial Parks (EIPs), UNIDO along with the World Bank and GiZ have provided an international framework with the key performance requirements. The purpose of this framework is three-fold, namely: (i) to assist relevant stakeholders in developing and transitioning to EIPs; (ii) to consistently approach, encourage, and recognize EIPs; and (iii) to improve the performance, sustainability and inclusiveness of the industrial sector and move toward an international standard on EIPs. A practitioner's handbook has also been published to help governments in establishing their own national EIP frameworks.		
Tannery Effluent Treatment	UNIDO has published a document on effluent treatment in tannery industries. They have provided the basic principles involved in the treatment of tannery waste to help the tanners and tannery managers to comply with the environmental standards		
Sludge Management Projects	Sludge management for Central Leather Research Institute (CLRI), Chennai Sludge management along with energy generation in a tannery based industrial area in Pakistan		
Sludge management	It is observed that some sludge (80% to 90%) is used by cement industries in their furnaces as it contains carbon for combustion BSRM Power and Steel Plant and Mc Donald Steel may be contacted to confirm if they are willing to utilize the sludge in their furnaces		
Way Forward	UNIDO will hold a meeting on 23rd December 2018 on "Guidelines on Green EZ for Bangladesh". The key outcomes from the meeting may be noted and applied during the course of the project		

2) Meeting with Ramky Enviro Engineers, 20th December, 2018

Draft Minutes of the Meeting dated 26th December, 2018 with Ramky Enviro Engineers Limited			
Attendees	Mr. Subha Pramanik, Sr. Asst. Manager- Business Development, Ramky Enviro Engineers Limited Mr. Sudeep Sinha, Partner, Deloitte		
Venue	Ramky Enviro Engineers Limited	**Date**	26th December, 2018
Summary	The objective of the meeting was to determine the options available for Sludge Disposal from the CETP		
Discussion points			
About the organization	Ramky Enviro Engineers Limited has been mandated for sludge treatment and disposal across Bangladesh.		
Sludge Disposal	The sludge has to be dewatered in the drying bed for about a month within the CETP premises before disposal. The following two options were discussed for the disposal of sludge from the CETP: The sludge from the industries may be used for combustion in the furnaces of power plant and steel plant of BSRM Power and Steel and McDonald Steel The sludge may be sent to Ramky Enviro Engineers Limited for further treatment and disposal		
Treatment Cost	It costs around 800 BDT for treatment and disposal of 1 Metric Ton (MT) of sludge (excluding transmission of sludge to the treatment plant). It is estimated that about 14 MT of sludge can be transmitted by 1 truck and the cost of transmission is around 8000 BDT		

Annexure 14: Market Sounding

Annexure 14A: Meetings with CETP Developers/Operators

1. Preference of the CETP Developers for certain Project Structuring Options

Table 50: Preference of CETP Developers

Project Structuring Option	Prominent Respondents indicating the option as Most Preferred
EPC	Sigma Group, Degremont (Suez), Acciona, VA Tech Wabag, Jash Engineering, Akar Impex Pvt. Ltd., Punj Lloyd
DBO	Sigma Group, Degremont (Suez), Acciona, Jash Engineeering, Akar Impex Pvt. Ltd.
HAM	Delcot Ltd.
BOT	Chittagong Waste Treatment Plants Limited

Figure 27: No. of developers indicating the option as the Most Preferred Option

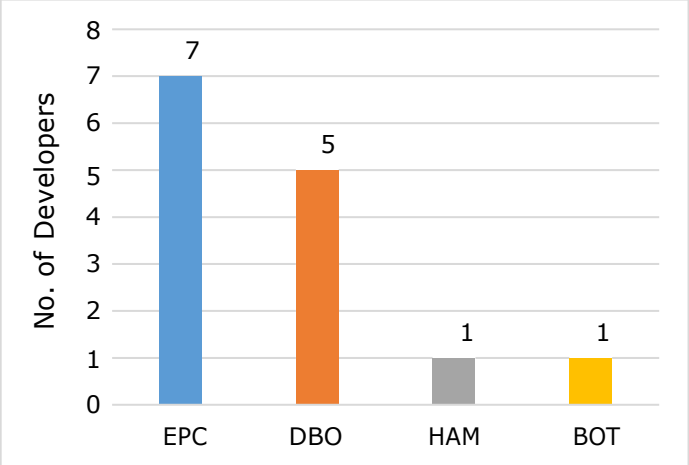
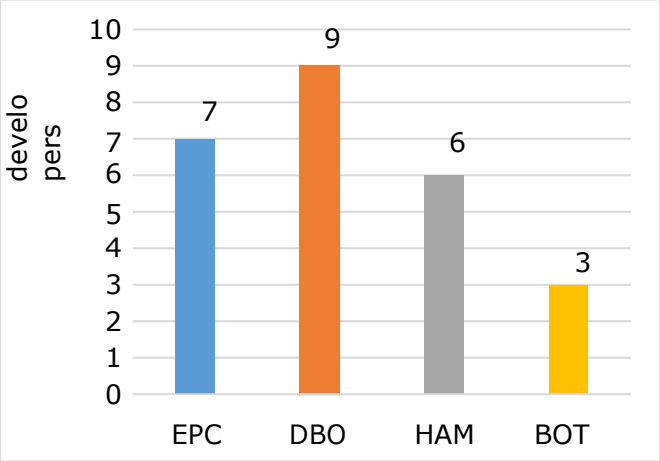


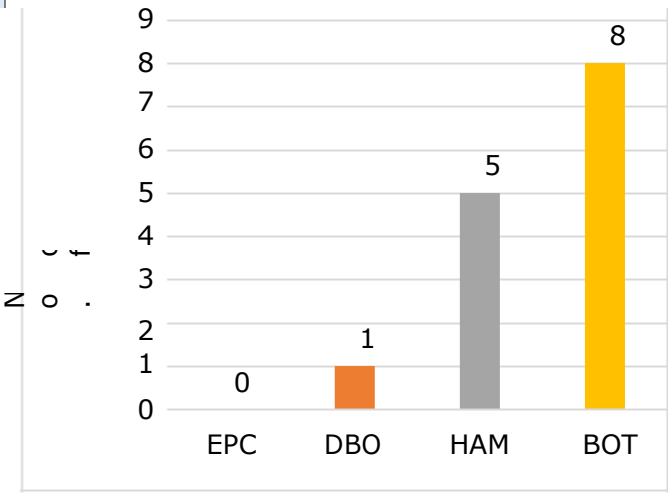
Figure 25: No. of developers indicating Openness to the option



2. CETP Developers indicating aversion for certain Project Structuring Options

Project Structuring Option	Prominent Respondents indicating aversion to adjacent Option
EPC	NA
DBO	Punj Lloyd
HAM	Chittagong Waste Treatment Plants Limited, Acciona, Degremont (Suez), VA Tech Wabag, Punj Lloyd
BOT	Sigma Group, Flagship Ecosystems, Acciona, Degremont (Suez), Jash Engineeering, Delcot Ltd., Akar Impex Pvt. Ltd., Punj Lloyd

Figure 26: No. of developers indicating Aversion to the Option



Brief Description of Developers

The table below provides a brief description of various national and international developers with expertise in water and wastewater treatment. The study team carried out market sounding activities with these developers to understand their view on various aspects of the project for development of the CETP in BSMSN – 2A Economic Zone.

Table 51: Brief Description of Developers

Sl. No.	Name of CETP Developer	Brief Description
1	Degremont (Suez)	Specialization in the treatment of sewage and sludge Degrémont has built 2,500 sewage treatment plants with the capacity to recycle 2.4 million cubic meters per day Operates under the brand Suez
2	Acciona	Spanish conglomerate group dedicated to the development and management of infrastructure (construction, water, industrial and services) and renewable energy A water treatment industry front-runner offering the design, construction and operation of drinking water treatment plants, desalination facilities, wastewater treatment plants and tertiary treatment plants for water reuse
3	VA Tech Wabag	WABAG's water saga spans over ninety years, making it an industry leader today in the field of total water management WABAG has a successful track record of executing over 6000 municipal and industrial projects globally with quality and commitment to timely delivery
4	Sigma Group (Sigma Engineers Ltd.)	Sigma Engineers Ltd. was established in 2003 Construction and commission of more than 1000 units of different types of treatment plants and systems, including the CETP at Comilla EPZ
5	Chittagong Waste Treatment Plants Limited	Investor & operator of Central Effluent Treatment Plant in Chittagong Export Processing Zone Provides effluent treatment service to all industries situated in CEPZ
6	Punj Lloyd Group	Diversified international conglomerate offering EPC services in Energy and Infrastructure
7	Jash Engineering Limited	Company manufacturing wide range of equipment for Water Intake Systems, Water and Waste Water Pumping Stations and Treatment Plants, Storm Water Pumping Stations, Water Transmission Lines, Power, Steel, Cement, Paper & Pulp, Petrochemicals, Chemical, Fertilizers and other process plants
8	Akar Impex Private Limited	Engaged in Design, Engineering, Equipment supply, Erection, Commissioning, Turnkey projects and Operation and maintenance contracts in the field of Water and Wastewater treatment Plants for the last 30 years
9	Delcot Limited (United Water (Suqian) Co. Ltd., China)	Owns and operates water supply and waste water treatment facilities and also provides engineering services related to water supply infrastructure and industrial waste water pre-treatment facilities Currently has projects with capacity to treat 2,100,000 m3 of water per day
10	Grontmij	Renamed as Sweco, based out of Europe, carry out projects in 70 countries annually throughout the world

Sl. No.	Name of CETP Developer	Brief Description
		Plan and design sustainable buildings, efficient infrastructure and provide access to clean water.
11	FloWater, Marubeni	FloWater provides complete water and wastewater solutions to serve the needs of businesses and organizations and has executed over 100 projects across Bangladesh Marubeni Group offers a variety of services, makes internal and external investments, and is involved in resource development throughout industries
12	Suez India Pvt. Ltd.	For over 30 years, SUEZ has been helping local authorities and industry to develop resource management solutions, particularly through contracts to build and operate facilities and to improve drinking water distribution services and by developing alternative resources, such as by reusing wastewater Over 250 drinking water and sewerage treatment plants built, of which 50 for industrial use.
13	Flagship Ecosystems	Developer and operator of the CETP at Dhaka EPZ for 30 years A company with investors from Bangladesh, French & Singapore
14	Xylem Analytics	Has operations and support in 6 continents operating from over 30 facilities Leading brand for quantitative and qualitative analysis of samples of wastewater through flowmeters and other metering devices
15	Ion Exchange	An Indian company in water and environment management, with a strong international presence Offers total water management O&M and BOO/T services
16	Krofta Engineering Limited	Supplier of Dissolved Air Flotation (DAF), Belt Filter Press, Oil Water Separator and Water & Effluent Treatment plant

1) Degremont (Suez), 19th February, 2019

Draft Minutes of the Market Sounding	
Representative	Mr. V D Babu, Sales Director, Degremont (Suez)
Date	19th February, 2019
Summary	The conference was organized as a part of Deloitte's market sounding activity to understand the view of Degremont on various aspects of the BSMSN CETP project
Discussion points	
Context	Deloitte set the context by making the following points: There are a mix of industries being planned to be set up in Bangabandhu Sheikh Mujib Shilpa Nagar (BSMSN) and a CETP is being planned to treat the effluent from the industries and provide treated water to the industries for reuse The effluent volume from BSMSN - 2A is envisaged to be 32 MLD while that from BSMSN - 2B is envisaged to be 16 MLD. Thus a CETP of size 48 MLD is being proposed There are three main components of the project – Effluent network, CETP and Reuse water pipeline The project structuring options available are Engineering Procurement and Construction (EPC), Design Build Operate (DBO), Hybrid Annuity Model (HAM), Build Operate Transfer (BOT) or a combination of two models
Scope of the developer	The developer informed: ○ They prefer the CETP alone as they are expertized in the development of CETPs ○ If the reuse pipeline also forms a part of the tender, then they can accommodate it ○ Prefer not to have the development of the effluent network within the scope of the CETP developer
Project Structure	The developer informed: ○ They prefer EPC or DBO mode of project structuring over other options ○ HAM is not preferred as it has approvals issues within the firm ○ BOT mode is not preferred as there is no offtake guarantee
Other Considerations	The following points were further made by the developer: For reuse of the treated water from the CETP in Power and Steel Plant, RO treatment has to be carried out. As the volume of effluent is high, evaporation of the RO reject might be very costly. Thus it is better to dispose the reject from RO treatment in the sea after meeting the environmental guidelines Along with the electromechanical works, the civil works may also be considered to be undertaken in phases.

2) Acciona, 19th February, 2019

Draft Minutes of the Market Sounding	
Representative	Mr. Leopolbo Lainz, Acciona
Date	19th February, 2019
Summary	The conference was organized as a part of Deloitte's market sounding activity to understand the view of Acciona on various aspects of the BSMSN CETP project
Discussion points	
Context	Deloitte set the context by making the following points: There are a mix of industries being planned to be set up in Bangabandhu Sheikh Mujib Shilpa Nagar (BSMSN) and a CETP is being planned to treat the effluent from the industries and provide treated water to the industries for reuse The effluent volume from BSMSN - 2A is envisaged to be 32 MLD while that from BSMSN - 2B is envisaged to be 16 MLD. Thus a CETP of size 48 MLD is being proposed There are three main components of the project – Effluent network, CETP and Reuse water pipeline The project structuring options available are Engineering Procurement and Construction (EPC), Design Build Operate (DBO), Hybrid Annuity Model (HAM), Build Operate Transfer (BOT) or a combination of two models
Scope of the developer	The developer informed: ○ They are currently involved in several projects in the Middle East and do not have a strategic inclination towards the Bangladesh market ○ They have to undergo internal discussions before commenting on the scope of the developer for the project
Project Structure	The developer informed: ○ EPC mode of project structuring is most preferred followed by DBO mode ○ HAM is specific to the Indian subcontinent and International lenders may not support it. Thus HAM is not preferred ○ BOT mode may be preferred if the demand risk and tariff collection risk is mitigated
Other Considerations	The following points were further made by the developer: Pretreatment standards need to be mandated for the industries: ○ Industries should be penalized for non-compliance ○ CETP operator to be waived off incase CETP doesn't match performance standards due to non-compliant inlet effluent

3) VA Tech Wabag, 19th February, 2019

Draft Minutes of the Market Sounding	
Representative	Mr. Rajneesh Singh, Marketing Lead - Southern Region, VA Tech Wabag
Date	19th February, 2019
Summary	The conference was organized as a part of Deloitte's market sounding activity to understand the view of VA Tech Wabag on various aspects of the BSMSN CETP project
Discussion points	
Context	Deloitte set the context by making the following points: There are a mix of industries being planned to be set up in Bangabandhu Sheikh Mujib Shilpa Nagar (BSMSN) and a CETP is being planned to treat the effluent from the industries and provide treated water to the industries for reuse The effluent volume from BSMSN - 2A is envisaged to be 32 MLD while that from BSMSN - 2B is envisaged to be 16 MLD. Thus a CETP of size 48 MLD is being proposed There are three main components of the project – Effluent network, CETP and Reuse water pipeline The project structuring options available are Engineering Procurement and Construction (EPC), Design Build Operate (DBO), Hybrid Annuity Model (HAM), Build Operate Transfer (BOT) or a combination of two models
Scope of the developer	The developer informed: ○ They prefer the CETP and reuse water pipeline only within the scope of the CETP developer ○ They can have the effluent network within their scope if it is within a small diameter from the CETP (a few kilometres)
Project Structure	The developer informed: ○ EPC mode of project structuring is most preferred followed by DBO mode ○ Approval for HAM mode is possible only in the Indian market. Thus HAM will not be possible in the Bangladesh market ○ BOT is not preferred due to the risks involved
Other Considerations	The following points were further made by the developer: Inlet effluent standards for the CETP can be similar to the Jajmau CETP project in India which has been awarded to VA Tech Wabag Qualification criteria for the project should be such that quality bidders bid for the project which can lead to healthy competition

4) Sigma Group (CETP Operator at Comilla EPZ), 11th February, 2019

Draft Minutes of the Market Sounding	
Representative	Mr. Sayed A Reza, Head, Sigma Group
Date	11th February, 2019
Summary	The conference was organized as a part of Deloitte's market sounding activity to understand the view of Sigma Group on various aspects of the BSMSN CETP project
Discussion points	
Context	Deloitte set the context by making the following points: There are a mix of industries being planned to be set up in Bangabandhu Sheikh Mujib Shilpa Nagar (BSMSN) and a CETP is being planned to treat the effluent from the industries and provide treated water to the industries for reuse The effluent volume from BSMSN - 2A is envisaged to be 32 MLD while that from BSMSN - 2B is envisaged to be 16 MLD. Thus a CETP of size 48 MLD is being proposed There are three main components of the project – Effluent network, CETP and Reuse water pipeline The project structuring options available are Engineering Procurement and Construction (EPC), Design Build Operate (DBO), Hybrid Annuity Model (HAM), Build Operate Transfer (BOT) or a combination of two models
Scope of the developer	Deloitte inquired if Sigma Group would be willing to have all project three project components within the scope of the CETP developer Sigma Group remarked that they are willing to have all three project components within their scope
Project Structure	Sigma Group informed: ○ EPC or DBO is more preferred over other options ○ HAM is acceptable if all payments are made by the government and are independent of Demand Risks ○ BOT is not preferred as there is demand risk
Other Considerations	The following information was shared by the developer: They have experience in effluent treatment and water treatment – currently executing water treatment in 7 industrial zones To supply treated water for reuse in power plants, the water has to be RO treated to reduce TDS BOD and COD have to be reduced prior to RO treatment

5) Chittagong Waste Treatment Plants Limited (CETP Operator at Chittagong EPZ), 8th February, 2019

Draft Minutes of the Market Sounding	
Representative	Mr. Md. Hasibur Islam, Managing Director, Chittagong Waste Treatment Plants Limited
Date	8th February, 2019
Summary	The conference was organized as a part of Deloitte's market sounding activity to understand the view of Chittagong Waste Treatment Plants Limited on various aspects of the BSMSN CETP project
Discussion points	
Context	Deloitte set the context by making the following points: There are a mix of industries being planned to be set up in Bangabandhu Sheikh Mujib Shilpa Nagar (BSMSN) and a CETP is being planned to treat the effluent from the industries and provide treated water to the industries for reuse The effluent volume from BSMSN - 2A is envisaged to be 32 MLD while that from BSMSN - 2B is envisaged to be 16 MLD. Thus a CETP of size 48 MLD is being proposed There are three main components of the project – Effluent network, CETP and Reuse water pipeline The project structuring options available are Engineering Procurement and Construction (EPC), Design Build Operate (DBO), Hybrid Annuity Model (HAM), Build Operate Transfer (BOT) or a combination of two models
Scope of the developer	The developer informed: ○ They are willing to have only the CETP and Reuse Pipeline under the tender ○ The development of the effluent network can be under a different tender
Project Structure	The developer informed: ○ Willing to have BOT for CETP + Reuse pipeline only, provided the tariff collection risk be borne by BEZA ○ EPC or DBO is preferred for development of Effluent Network as no returns can be generated from the effluent network ○ HAM is new to the Bangladesh market and need further assessment before commenting on the same
Other Considerations	The following information was shared by the developer: The tariff collection should be done by BEZA and a single payment should be done to the operator The land for CETP development should be given without any charge on a long term basis

6) Punj Lloyd Group, 7th February, 2019

Draft Minutes of the Market Sounding	
Representative	Mr. Akshay Kumar Singh, Punj Lloyd Group
Date	7th February, 2019
Summary	The conference was organized as a part of Deloitte's market sounding activity to understand the view of Punj Lloyd Group on various aspects of the BSMSN CETP project
Discussion points	
Context	Deloitte set the context by making the following points: There are a mix of industries being planned to be set up in Bangabandhu Sheikh Mujib Shilpa Nagar (BSMSN) and a CETP is being planned to treat the effluent from the industries and provide treated water to the industries for reuse The effluent volume from BSMSN - 2A is envisaged to be 32 MLD while that from BSMSN - 2B is envisaged to be 16 MLD. Thus a CETP of size 48 MLD is being proposed There are three main components of the project – Effluent network, CETP and Reuse water pipeline The project structuring options available are Engineering Procurement and Construction (EPC), Design Build Operate (DBO), Hybrid Annuity Model (HAM), Build Operate Transfer (BOT) or a combination of two models
Scope of the developer	The developer informed that all three project components can be a part of the scope of the CETP developer
Project Structure	The developer informed: ○ EPC mode of project structuring is preferred ○ DBO is not preferred as it involves pre-bid engineering which requires financing. ○ Not interested in HAM and BOT modes due to presence of Finance risk
Other Considerations	The following points were further made by the developer: Interested only in construction works and not in designing of the project. Tariff for effluent treatment will depend on the location and context Previously developed a CETP as a part of a bigger project in Qatar

7) Jash Engineering Limited, 7th February, 2019

Draft Minutes of the Market Sounding	
Representative	Mr. Rishi Chopra, Jash Engineering Limited (previous employee in Suez Environment)
Date	7th February, 2019
Summary	The conference was organized as a part of Deloitte's market sounding activity to understand the view of Jash Engineering on various aspects of the BSMSN CETP project
Discussion points	
Context	Deloitte set the context by making the following points: There are a mix of industries being planned to be set up in Bangabandhu Sheikh Mujib Shilpa Nagar (BSMSN) and a CETP is being planned to treat the effluent from the industries and provide treated water to the industries for reuse The effluent volume from BSMSN - 2A is envisaged to be 32 MLD while that from BSMSN - 2B is envisaged to be 16 MLD. Thus a CETP of size 48 MLD is being proposed There are three main components of the project – Effluent network, CETP and Reuse water pipeline The project structuring options available are Engineering Procurement and Construction (EPC), Design Build Operate (DBO), Hybrid Annuity Model (HAM), Build Operate Transfer (BOT) or a combination of two models
Scope of the developer	The developer informed: ○ The CETP and reuse pipeline can be within the scope of the CETP developer ○ There are two views on inclusion of effluent network within the developer's scope: ▪ Effluent network may be removed from the scope as very few companies have expertise in both CETP and effluent network ▪ Effluent network may be included if consortium/ sub contracting is allowed – this will avoid delay risks
Project Structure	The developer informed: ○ EPC or DBO mode of project structuring is preferred over other options ○ If given a choice, the developer will want to opt for options that possess no finance risk
Other Considerations	The following points were further made by the developer: The returns from the project should be around 15% - 20% with a 6 to 7 years payback period Pre-treatment by industries should be mandated so that the effluent reaching the inlet of the CETP is neutralized The tariff rate should be charged per kiloliter of effluent treatment

8) Akar Impex Private Limited, 5th February, 2019

Draft Minutes of the Market Sounding	
Representative	Mr. Taral Vaidya, Executive Director, Akar Impex Private Limited
Date	5th February, 2019
Summary	The conference was organized as a part of Deloitte's market sounding activity to understand the view of Akar Impex Private Limited on various aspects of the BSMSN CETP project
Discussion points	
Context	Deloitte set the context by making the following points: There are a mix of industries being planned to be set up in Bangabandhu Sheikh Mujib Shilpa Nagar (BSMSN) and a CETP is being planned to treat the effluent from the industries and provide treated water to the industries for reuse The effluent volume from BSMSN - 2A is envisaged to be 32 MLD while that from BSMSN - 2B is envisaged to be 16 MLD. Thus a CETP of size 48 MLD is being proposed There are three main components of the project – Effluent network, CETP and Reuse water pipeline The project structuring options available are Engineering Procurement and Construction (EPC), Design Build Operate (DBO), Hybrid Annuity Model (HAM), Build Operate Transfer (BOT) or a combination of two models
Scope of the developer	The developer informed that all three project components can be a part of the scope of the CETP developer
Project Structure	The developer informed: ○ DBO mode of project structuring is most preferred ○ HAM may be opted for if the Government can provide the requisite guarantees ○ BOT is not preferred due to the risks involved
Other Considerations	The following points were further made by the developer: Local currency risk should be avoided and the transaction should be in foreign currency Treating effluent from different industries together will require two stage RO treatment with multiple evaporators to produce reusable water. This can lead to higher capital costs and recurring costs Treatment of effluent through different streams by zoning industries based on the quality of effluent produced may be considered

9) Delcot Limited, 5th February, 2019

Draft Minutes of the Market Sounding	
Representative	Mr. Dayem Khandkar, Director, Delcot Ltd.
Date	5th February, 2019
Summary	The conference was organized as a part of Deloitte's market sounding activity to understand the view of Delcot Limited on various aspects of the BSMSN CETP project
Discussion points	
Context	Deloitte set the context by making the following points: There are a mix of industries being planned to be set up in Bangabandhu Sheikh Mujib Shilpa Nagar (BSMSN) and a CETP is being planned to treat the effluent from the industries and provide treated water to the industries for reuse The effluent volume from BSMSN - 2A is envisaged to be 32 MLD while that from BSMSN - 2B is envisaged to be 16 MLD. Thus a CETP of size 48 MLD is being proposed There are three main components of the project – Effluent network, CETP and Reuse water pipeline The project structuring options available are Engineering Procurement and Construction (EPC), Design Build Operate (DBO), Hybrid Annuity Model (HAM), Build Operate Transfer (BOT) or a combination of two models
Scope of the developer	The developer informed: ○ They are willing to have only the CETP and Reuse Pipeline under the tender ○ The development of the effluent network should not be within the scope of the CETP developer
Project Structure	The developer informed: ○ They are in the final signing stage for the Purbachal New Town Water Distribution PPP project on Hybrid Annuity Model – One of the first project on HAM in Bangladesh context ○ Based on their recent transaction, they are more willing for HAM as compared to DBO ○ BOT mode is not preferred
Other Considerations	The following points were further made by the developer: Payment should be in foreign currency as raising long term funds in local currency is difficult Returns from the project should be around 15% - 20% with 10 years payback period Pre-treatment of the effluent should be mandated for the industries – Greater tariff should be charged for variation from prescribed standards Land Risk should be mitigated and land should be made available for developing CETP and reuse water pipeline Have CETP experience in China through partners

10) Grontmij, 5th February, 2019

Draft Minutes of the Market Sounding	
Representative	Mr. Abul Basher Khan, Senior Engineer, Grontmij
Date	5th February, 2019
Summary	The conference was organized as a part of Deloitte's market sounding activity to understand the view of Grontmij on various aspects of the BSMSN CETP project
Discussion points	
Context	Deloitte set the context by making the following points: There are a mix of industries being planned to be set up in Bangabandhu Sheikh Mujib Shilpa Nagar (BSMSN) and a CETP is being planned to treat the effluent from the industries and provide treated water to the industries for reuse The effluent volume from BSMSN - 2A is envisaged to be 32 MLD while that from BSMSN - 2B is envisaged to be 16 MLD. Thus a CETP of size 48 MLD is being proposed There are three main components of the project – Effluent network, CETP and Reuse water pipeline
Scope of the developer	The developer informed that are willing to have all three project components within their scope They have previous experience in development of both the CETP and effluent network
Other Considerations	Pre-treatment by the industries is necessary before discharge of the effluent in the effluent network

11) FloWater, Marubeni & 2030 WRG, 24th January, 2019

Draft Minutes of the Market Sounding	
Representatives	Mr. Javed Bin Karim, Senior Advisor, 2030 WRG Mr. Mashino Ishida, Marubeni Mr. Mustafa A. K. Khan, Managing Director, FloWater
Date	24th January, 2019
Summary	The meeting was organized by 2030 WRG to facilitate market sounding with FloWater/Marubeni. The key objectives of the meeting were to: Understand the preferred project scope and project structure according to FloWater/Marubeni Understand project related concerns Gather suggestions / feedback on the way forward
Discussion points	
Context	Deloitte set the context of the meeting by making the following points: There are a mix of industries being planned to be set up in Bangabandhu Sheikh Mujib Shilpa Nagar (BSMSN) and a CETP is being planned to treat the effluent from the industries and provide treated water to the industries for reuse The effluent volume from BSMSN - 2A is envisaged to be 32 MLD while that from BSMSN - 2B is envisaged to be 16 MLD. Thus a CETP of size 48 MLD is being proposed There are three main components of the project – Effluent network, CETP and Reuse water pipeline
Scope of the developer	Deloitte inquired if FloWater/Marubeni whether effluent network should form part of the scope for the private developer Marubeni remarked that while they do not have expertise in development of effluent network, they are okay with the effluent network being part of the private developer's scope. They indicated an openness to partner with a local player to develop the same
Project Structure	Deloitte asked if the developer is willing to finance the project and what is the expected return and the payback period from the project Marubeni remarked that they have done projects under BOT/BOO and are willing to discuss other project structuring options as well. They would expect a return of around 20% and a payback period of less than 10 years.
Other Considerations	The following concerns were raised by the developer regarding the project: What is the timeline of the project Offtake of treated water at a single point – It is not realistic for the developer to manage many off takers. Therefore, there should be a few bulk off takers of the treated water. Local Currency Risk – The revenues from the project should be in USD to avoid the risk of local currency fluctuation Time duration for due diligence – As this will be the first project for Marubeni in Bangladesh, they will require adequate time (about 6 months) to perform the due diligence for the project

	The concerns of the developer were addressed as follows: Deloitte informed that BEZA has collected and shortlisted the proposals of the industries to be set up in BSMSN Economic zone. The CETP facility shall be built to treat the effluent from these industries. The concern regarding offtake shall be addressed Local currency risk shall be addressed 2030 WRG informed that Deloitte has been selected as transaction advisor for the project and shall carry out necessary project studies. Thus the time for due diligence required to be spent by bidders will be minimal.

12) Suez India Pvt. Ltd., 11th October, 2018

Draft Minutes of the Market Sounding	
Representative	Mr. Mukesh Grover, Sr. Vice President/ Chief Technical Officer, Treatment Infrastructure, Water, Recycling and Waste Recovery – Indian Subcontinent, Suez India Pvt. Ltd.
Date	11th October, 2018
Summary	The objective of the meeting was to understand the different aspects involved in the development of a multi-industry CETP
Discussion points	
Industry Mix	**Agro and Distillery Industry:** The BOD can go to as high as 50,000 mg/L but can be treated through aerobic and anaerobic processes, as the effluent is organic in nature. ASP and UASP technologies, although outdated, can be used to treat the waste. **Leather and Tannery Industry:** Although BOD levels aren't as high as agro industry, ASP and UASP technologies cannot be used as the effluent can kill the treating bacteria at the CETP due presence of chromium in the effluent. Hence it has to be removed at the pre-treatment facility at the factory **Suggestion:** To have one type of technology, the effluent need to be mixed in an equalization tank during primary treatment
Multi-Industry CETP	To treat the effluent from different industries in the same CETP, equalization tanks have to be used to mix all the effluents before treatment. The effluent should stay in the tank for an average 6 hours. The tank can have a depth of 4 m, partially under the ground and partially above the ground. The effluent can reach the tank through gravity pipeline system or through pumping systems. For a **40 MLD** plant, the area requirement for the **equalization tank** works out to be **2500 m^2** (0.62 acres) **Suggestion:** Final area to be computed keeping equalization tank in mind
Tariff Rate	The tariff rate charged for effluent treatment should depend on the effluent characteristics and pollution load from the particular industry. **Suggestion:** Different slabs of tariff rates can be built.
Use of Treated Water	About **75-80%** of the water received at the CETP is released as treated water that can be reused by power plants and other industries. It is a govt. mandate in India that power plants within 50 kms range of a STP should use the treated water from the STP Suez is providing 40 MLD tertiary treated water (RO Treated) to a power plant at a distance of 16 kms through a 700 mm diameter PCCP pipe which costed 25 crores. **Suggestion:**

	(i) The tertiary treated water from the CETP can be provided to the power plants in Mirsarai EZ (ii) Mandates can be passed by BEZA in this regard (iii) Other industries around the CETP can use the remaining treated water
Post treatment	The conc. Liquid waste post treatment can be diluted using treated water from CETP or Canal water **Suggestion:** (i) It is preferable to dilute the waste with canal water and not the usable treated water from the CETP. (ii) Sludge treatment – Mechanical dewatering to be proposed instead of drying bed since drying bed requires more area and the weather conditions in Mirsarai will create hindrances in the drying process.
Staggered capacity increase	The civil work has to be completed for the full capacity CETP while electromechanical work can be done based on the staggered increase in demand for treatment. **Suggestion:** (i) Variation order can be proposed in the tender document (ii) Different modules in the CETP can be built (each of 10-15 MLD) which can be operated based on the demand.

13) Flagship Ecosystems (CETP Operator at Dhaka EPZ), 1st September, 2018

Draft Minutes of the Market Sounding	
Representatives	Mr. Jim Silverman, Managing Director Md. Golam Rabbani, Deputy Chief Executive Officer (Former Secretary, Govt of Bangladesh)
Date	01st September, 2018
Summary	The Deloitte-BETS team visited Flagship's corporate office to understand their PPP experience and seek suggestions for the proposed project.
Discussion points	
Scope of the developer	○ The developer informed: ○ The CETP and reuse pipeline can be under the scope of the developer ○ Development of network from industry till gate of the CETP should be borne by BEZA. The network should be underground pipes and not be open drains.
Project Structure	○ The developer informed: ○ Open to HAM if guarantee is provided by the Government ○ BOT is not preferred
Other Considerations	○ Pretreatment Provisions required to be mandated by BEZA ○ Mandatory Pretreatment for more than 1000 COD / more than pH 10 at each industry because one doesn't know the kind and amount of pollution, industries can send to the CETP. ○ Food and Beverage Industries should remove oil and grease – To be mandated by BEZA ○ Leather Industry- Pre-screening to 100 micron ○ Control over non paying customers ○ BEZA should mandate that all sewage must flow to CETP ○ Before development of roads, the network should come up. This will eliminate the cost of road pavement digging to lay network and road digging works in case the network pipe crosses the road. ○ The idea of installing flowmeters at the factory to measure effluent discharge volume might not work because the effluent will spoil the normally available meters. ○ Using large diameter (4 ft) pipes will help in pre-blending the sewage ○ Project Development- ○ The industries would want the CETP and all enabling facilities to come up before and CETP developer would not like to invest and then wait for the effluent volume to increase. ○ One should not expect that the present CETP capacity should match the ultimate demand of the industrial zone because the industries could take upto 15 yrs to start operations. Therefore, capacity of the CETP should be linked with the next 5 yr demand and then as demand increases, capacity of the CETP can increase. ○ For the above plan, the design has to scalable – one needs to think about sizing of the CETP elements – some elements may have to be designed for full demand and some elements for Phase 1 demand. ○ Third Party Guarantor – to guarantee funds is important for investors.

	○ May consider zoning inside park to keep highly polluting industries in one area ○ Land allotment procedure needs to be understood. First Mirsarai 2A should fill up and then Mirsarai 2B ○ Use technologies that treat both sewage and effluent together

Annexure 14B: Meetings with Financial Institutions/ Banks

The study team has carried out market sounding activities with three financial institutions (FIs)/ banks to understand their broad terms of sanction for term loans and project evaluation framework for the development of the Centralized Effluent Treatment Plant (CETP) at Bangabandhu Sheikh Mujib Shilpa Nagar (BSMSN) EZ – Zone 2A.

Table 52: Interaction with Financial Institutions

Sl. No.	FI/ Bank	Personnel	Designation	Date
1	HSBC Bank	Mr. Muhammad Shohiduzzaman	Country Head, Global Trade and Receivables Finance, Bangladesh	10.03.2019
		Mr. Naushad Ekramullah	Country Head of Business Development, Global Trade and Receivable Finance	
2	Bangladesh Infrastructure Finance Fund Ltd. (BIFFL)	Mr. Sheikh Anower Sadat	AVP & Head of Large Infrastructure, Investment	12.03.2019
		Ms. Bushra Ahmed	Senior Officer, Investment	
3	The City Bank	Mr. Md. Manzur Ahmed Sarker	VP & Unit Head, Public Sector, PPP & Service Sector	12.03.2019
		Mr. Richard Pinto Rozario	Associate Relationship Manager	

Openness to Fund and Loan Tenure

The three banks have indicated an openness to fund the project depending on the project meeting certain evaluation criteria. A summary of their response and loan tenure is presented in the table below.

Table 53: Openness to fund the project

FI/ Bank	Openness to Fund	Loan Tenure
HSBC	Can fund if the project qualifies certain evaluation criteria	5-6 years preferred
BIFFL	Can fund upto 40% of project cost depending on certain evaluation criteria	Around 10 years but can vary based on project specifics such as cash flows
The City Bank	Funding dependent on evaluation of project specifics	Generally around 5 years

The following section presents the minutes of the meetings with these FIs/ banks.

1. HSBC, 10th March, 2019

Draft Minutes of the Meeting held with HSBC on 10.03.2019 to understand broad terms of sanction for term loans and project evaluation framework followed by banks/ financial institutions, for Centralized Effluent Treatment Plant (CETP) at Bangabandhu Sheikh Mujib Shilpa Nagar (BSMSN) EZ			
Attendees			
HSBC	Mr. Muhammad Shohiduzzaman, Country Head, Global Trade and Receivables Finance, Bangladesh, HSBC Mr. Naushad Ekramullah, Country Head of Business Development, Global Trade and Receivable Finance, HSBC		
Venue	Conference Room of HSBC, Dhaka	**Date**	10th March, 2019

The meeting started with a round of introduction of all attendees. The following was discussed during the meeting:

1. ***Initial screening of projects*** The CETP project could be treated as a Greenfield project. Some of the evaluation criteria that commercial banks could generally have for such projects are the following:
    a) evaluating sponsors and their track record
    b) evaluating the proposed technology and its sustainability
    c) proposed tenure of funding – generally term loans no longer than 5-6 years are preferred
    d) terms of contract in the PPP between relevant parties
    e) assessing the risk and liability of loan payback
    f) assessing whether the applicant has previous experience at the group level in case of multinationals

2. ***Classification of company*** BEPZA uses classification of companies in the export processing zones. A company is classified as Type A if it is 100% foreign owned along with other criteria. Some of the benefits available for Type A company are:
    a. Scope of funding in foreign currency
    b. Scope of billing in foreign currency

    It needs to be examined if BEZA could follow the same classification and if the developer/operator could enlist as such so that the same benefits can be availed.

3. ***Availability of sector fund*** In 2017, HSBC has promised USD 100 billion investment in green and sustainable initiatives globally. In such projects, generally the focus is less on profitability and more on sustainability, provided there is at least no losses incurred.

The meeting ended by thanking the HSBC personnel.

2. Bangladesh Infrastructure Finance Fund Ltd. (BIFFL), 12th March, 2019

Draft Minutes of the Meeting held with BIFFL on 12.03.2019 to understand broad terms of sanction for term loans and project evaluation framework followed by banks/ financial institutions, for Centralized Effluent Treatment Plant (CETP) at Bangabandhu Sheikh Mujib Shilpa Nagar (BSMSN) EZ			
Attendees			
BIFFL	Mr. Sheikh Anower Sadat, AVP & Head of Large Infrastructure, Investment, BIFFL Ms. Bushra Ahmed, Senior Officer, Investment, BIFFL		
Venue	Conference Room of BIFFL, Dhaka	**Date**	12th March, 2019

The meeting started with a round of introduction of all attendees. The following was discussed during the meeting:

5. ***Availability of fund:*** The financial institution has had multiple experience in financing and raising funds for large infrastructure projects. It is preferable for BIFFL to find matching finance from multilateral agencies to provide the CETP funding with concessional rates. The different interest rates for funds from some funding agencies are as follows:

    a) World Bank – interest rate around or below 6%
    b) ADB – interest rate around 6.5%
    c) JICA – interest rate around 4%
    d) BIFFL own fund – interest rate around 9%

    The tenures of international agency funds are generally up to 20 years. BIFFL funds are usually for around 10 years, but would depend on the project specifics.

6. ***Amount of fund*** BIFFL could finance up to 40% of the total project cost. With an estimated initial project cost of BDT 160.5 cr, the amount of funds available from this source would be BDT 64 cr.

7. ***Funding criteria*** One of the financing criteria for BIFFL is to generally follow cash flow based lending.

8. ***Project attractiveness*** It was mentioned by BIFFL that Minimum Revenue Guarantee (MRG) and take-out financing, along with Viability Gap Funding (VGF), could increase the attractiveness of the project to investors including commercial banks.

The meeting ended with thanking the BIFFL personnel.

3. The City Bank, 12th March, 2019

Draft Minutes of the Meeting held with The City Bank on 12.03.2019 to understand broad terms of sanction for term loans and project evaluation framework followed by banks/ financial institutions, for Centralized Effluent Treatment Plant (CETP) at Bangabandhu Sheikh Mujib Shilpa Nagar (BSMSN) EZ			
Attendees			
City Bank	Mr. Md. Manzur Ahmed Sarker, VP & Unit Head, Public Sector, PPP & Service Sector, City Bank Mr. Richard Pinto Rozario, Associate Relationship Manager, City Bank		
Venue	Conference Room of City Bank, Dhaka	**Date**	12th March, 2019

The meeting started with a round of introduction of all attendees. The following was discussed during the meeting:

1. ***Funding criteria*** Generally cash flow based financing is practiced by City Bank, a national commercial bank, with term loan tenures ranging around 5 years.

2. ***Risk mitigation*** The CETP plant's financial sustainability would be a major evaluation criteria. Guaranteed instalments or loan payback terms for the bank would be preferred to mitigate loan recovery risk.

   An arrangement like routing and maintaining the CETP project's all cash flows through City Bank accounts and then making further payments or adjustments from these bank accounts was cited as an example of risk mitigation mechanism.

3. ***Prior experience*** City Bank has had some project financing experience but not specifically for effluent treatment plants or in the PPP model. The project financing criteria would need to be decided on the basis of project specifics.

The meeting ended with thanking the City Bank personnel.

Annexure 15: Compliance with the Terms of Reference (ToR)

Compliance with the points mentioned in the Terms of Reference (ToR) of the signed agreement is presented in the table below.

Table 54: Compliance with the ToR

Sl. No.	Points from the ToR	Reference in Revised Business Case Report	Page No.
	a) Technical Feasibility Assessment		
1	Explore and market sensitize CETP opportunities, options, and technologies in Bangladesh;	Addressed in "*Annexure 14: Market Sounding*"	192-214
2	Identify, assess and evaluate CETP experiences in Bangladesh and similar industrial zones across the world;	Addressed in "*Annexure 4: National and International Case Studies*"	129-136
3	Review the technical study done on the CETP component of the Mirsarai Economic Zone based of the pre-feasibility study by BEZA;	Addressed in "*3.2: Land Use Allotment*" and "*Annexure 1: Industrialization in Mirsarai 2A Economic Zone as envisaged in the Pre-Feasibility Report*" of the Revised Inception Report (IR)	IR: 47-53; 116-120
4	Review of the layout plan from the Mirsarai 2A & 2B Economic Zone pre-feasibility study and identification of the most suitable location of the CETP and effluent discharge location in consideration of the topography, hydrology, geology, climate and land use of the site;	Addressed in "Chapter 2: Broad Project Contours" and "Annexure 7: Comments on Allocation of Land in the Economic Zone"	23-24; 141
5	The review shall include the re-evaluation of wastewater hydraulic flows and chemical and biological loads to determine the capacity and process design of the CETP;	Addressed in "*Chapter 2: Broad Project Contours*" and "*Annexure 10: Basis of Designing the CETP*"	23-31; 150-159
6	Review the design requirement of the CETP based on the identified site, wastewater characteristics and pre-treatment standards;	Addressed in "*Annexure 7: Comments on Allocation of Land in the Economic Zone" and "Annexure 10: Basis of Designing the CETP*"	141; 150-159
7	Review of the effluent discharge arrangement and effluent treatment system, including setting of pre-treatment effluent standards; The review should take into consideration the anticipated mix (sanitary and industrial) and composition of effluents in determining applicable discharge standards, end use of treated effluent, and under what conditions would pre-treatment at client facilities be required prior to discharge to the Mirsarai Economic Zone CETP.	Addressed in "*Annexure 6: Preliminary Treatment at the Industry*"	139-140
8	Evaluation of wastewater treatment technologies and reuse alternatives for the Mirsarai Economic Zone. The alternatives assessment should include a comparative analysis of provisioning a separate distribution network for reuse of treated wastewater from the CETP.	Addressed in "*Chapter 4: Reuse of Treated Effluent*" and "*Annexure 10: Basis of Designing the CETP*"	36-38; 150-159

Sl. No.	Points from the ToR	Reference in Revised Business Case Report	Page No.
9	Prepare a conceptual design for the common effluent treatment plant and wastewater collection networks(s). Include a preliminary comparative assessment for having a separate effluent collection network for high strength/difficult to treat wastewater streams, either for the whole collection network or part(s) of the Mirsarai Economic Zone where such industries may be clustered.	Preliminary sample drawings on the conceptual design of the CETP and effluent network is presented in "*Annexure 11*: *Sample Design of CETP and Effluent Network"*. The detailed drawings and designs will be provided along with the tender documents after the finalization of the contract structure.	160-161
10	The CETP shall fulfil all required parameters and requirements by National Environmental Standards, General and sector specific IFC/World Bank Group Environmental Health and Safety Guidelines; and any specific requirements of the ESIA;	Addressed in "*Annexure 3: Environmental Considerations*"	92-128
11	Determine operating and maintenance costs of the CETP (with and without reuse scenarios) to be used as inputs to the financial model;	Addressed in "*Chapter 6: Financial Assessment*"	49-59
12	Identify potential technical issues of the project and propose mitigating measures;	Addressed in "*Chapter 7: Remarks and Action Points*" of the BCR	60-62
13	The technical study shall document compliance with environmental requirements by providing, as separate outputs/reports, the necessary plans (i.e. environmental impact and mitigation).	Addressed in "*Annexure 3: Environmental Considerations*"	116-122
	b) Environmental Assessment		
14	Review the existing Environmental and Social Impact Assessment (ESIA) done for the Mirsarai Economic Zone to confirm adequacy for risks and impacts associated with the construction and operation of a CETP for the zone.	Addressed in "*Annexure 3. Environmental Considerations*"	116-122
15	Identify and prioritize closure of gaps with time and level of effort estimates.	Addressed in "*Annexure 3: Environmental Considerations*"	92-128
16	Review of applicable national and local environmental laws and international best practice.		
17	Identify potential environmental impacts and mitigation measures.		
18	Identify costs that need to be incorporated in the technical design to ensure compliance with applicable environmental laws.	Addressed in "*Annexure 2: Financial Analysis for Developing a 48 MLD CETP*" and "*Annexure 3. Environmental Considerations"*	85-91 126-127
19	Identify public consultation requirements.	Addressed in "*Annexure 3. Environmental Considerations*"	122-126
20	Identify how outstanding issues will be addressed in the feasibility study, if required.	Addressed in "*Annexure 3: Environmental Considerations*"	92-128

Sl. No.	Points from the ToR	Reference in Revised Business Case Report	Page No.
	c) Financial Analysis		
21	Determination of the tariff rate to be charged to the industries for provisioning water supply (fresh water and reuse water) and the tariff rate mechanism applicable to each stream for the project.	Addressed in "*Chapter 6: Financial Assessment*"	49-59
22	Determination of the tariff rate to be charged to the industries for providing effluent treatment services (with and without reuse) and the tariff rate mechanism applicable for the project.		
23	Develop a full financial model for financial feasibility assessment of the project and financing plan including timelines for implementation and funds flow requirement. The financial model shall include, but not limited to, demand forecasts, tariff modelling, shadow bid modelling and bid pricing analysis modelling.	Addressed in "*Chapter 6: Financial Assessment*" and "*Annexure 2: Financial Analysis for Developing a 48 MLD CETP*"	49-59; 85-91
24	The financial model shall accommodate several procurement options in order to assess the procurement method that would provide the best value-for-money (VfM) to BEZA.	Addressed in "*Chapter 5: Project Structuring*" and "*Annexure 1: Value for Money Assessment*"	39-48; 73-84
25	The financial model shall contain various funding and financing scenarios considering various procurement models and government support options producing financial projections required to evaluate VfM, bankability and affordability to users and the government.		
26	Determination of financial internal rate of return (FIRR) and discounted net present value (NPV) for both Project and equity perspectives. The financial analysis model shall be designed to provide for project structuring options including the imposition of appropriate project financing constraints including, but not limited to, debt service coverage ratio (DSCR) caps which optimize scenarios for the disbursement of available projected cash flows to potential project creditors. The financial analysis model should have capabilities to allow the conduct of sensitivity and scenario analysis for the purpose of quantifying the financial impacts of different structuring options.	Addressed in "*Annexure 2: Financial Analysis for Developing a 48 MLD CETP*" and "*Chapter 6: Financial Assessment*"	85-91; 49-59
27	Identify potential financial issues that need to be addressed by BEZA and propose mitigating measures.	Addressed in "*Chapter 7: Remarks and Action Points*"	60-62

Sl. No.	Points from the ToR	Reference in Revised Business Case Report	Page No.
	d) Risk Analysis		
28	Provide a qualitative assessment of the key risks for the Project (political, economic, technical, and environmental, and legislative). Identify broad risks over the whole life of the Project. Identify critical risks that have a high probability of occurrence, and/or a large financial impact. Assess availability of risk mitigation instruments such as insurance and other applicable financial instruments. Prepare a risk allocation matrix and identify potential risk management strategies.	Addressed in "*Chapter 5: Project Structuring*"	39-45
	e) Legal and Regulatory Analysis		
29	i) Project Institutional and Contractual Structure Carry out a legal review of the Project based on all relevant and applicable national and local laws and regulations, identify legal requirements and processes and prepare a strategy to implement the proposed Project under the chosen procurement arrangement. Assess the institutional arrangements for implementing the Project and define the contractual structure that will provide the best VfM to BEZA. Review and assess legal issues associated with the management of the environmental impacts of the Project. Identify the contractual implications associated with sourcing funds from the public and private sector. Provide an output specification, payment mechanism, Key Performance Indicators (KPIs) and risk allocation matrix. Identify the critical features of each of the contracts in the proposed contractual structure, and the conditions precedent. Identify contract management and dispute resolution arrangements for the contracts.	The BEZA Act and PPP Policy in Bangladesh have been studied from legal perspective and presented in "*Chapter 2: Overview of Policy Framework in Bangladesh*" of the Revised Inception Report (IR). Environment related concerns have been noted and will be addressed in tender document that will be prepared after finalization of the contract structure by BEZA Addressed in "*Chapter 5: Project Structuring*" and "*Annexure 1: Value for Money Assessment*" Further details shall be provided after the Contract Structure is finalized and the tender documents are prepared	IR: 13-24 39-45; 73-84
30	ii) (National level) Institutional and regulatory analysis Assess regulatory requirements, gaps and key issues and recommend ways how to address these, with a focus on facilitation further CETP development and roll-out in Mirsarai.	Addressed under studies carried out in Sl. No. 29 above	-
31	iii) Procurement Strategy Review legal and regulatory requirements for procurement and develop a procurement plan that provides a timetable for procurement activities and an estimated budget. Identify institutional strengthening and public consultation	The estimation of the budget for the project has been carried out and presented "*Chapter 6: Financial Assessment"* of the BCR. The timetable for procurement will depend on mode of procurement chosen by BEZA, hence decision is	49-59

Sl. No.	Points from the ToR	Reference in Revised Business Case Report	Page No.
	requirements. Prepare a timetable defining requirements to put measures in place and identify likely costs. Identify how outstanding issues will be addressed during subsequent phase(s) of the project.	requested from BEZA on procurement options presented in the BCR. Bid documents will address all events / circumstance which may arise in future.	
32	iv) Capacity Building Conduct at least 3 training events around business case, PPP structuring, bid docs/concession contract etc. The capacity building/training plan to be detailed as part of Inception Report.	The study team has explained about the risk assessment and project structuring options for the development of the CETP through three presentations dated 19.12.2018, 13.02.2019 and 28.03.2019. Once the contract structure is finalized and tender documents are prepared, the study team will conduct further training events on tender specific contract management for the CETP	-

Annexure 16: Compliance with comments received from BEZA and 2030 WRG

1) Compliance Sheet submitted to BEZA on 5th March, 2019

The Draft Business Case Report for the engagement "Business Case and Transaction Advisory Services for the Centralized Effluent Treatment Plant (CETP) at Mirsarai Economic Zone 2A" was submitted to BEZA on 31st January, 2019 and comments were received on the same during the meeting with BEZA on 13th February, 2019. The comments were addressed in the Business Case Report submitted to BEZA on 26th February, 2019. The compliance to these comments is presented in the table below.
It may be noted that the study team has maintained the compliance to the comments in this Revised Business Case Report and updated the respective sections based on the comments and feedback from BEZA.

Table 55: Compliance with comments pertaining to Draft Business Case Report

Comments pertaining to Draft Business Case Report			
Sl. No.	**Comment from BEZA on the Draft Business Case Report**	**Response in the Business Case Report submitted on 26th February, 2019**	**Page Number of report dated 26.02.19**
1	**Project Scope**: Integrating the effluent network with the CETP will have the advantage of single point responsibility, which BEZA will find easier to manage. However, there were alternative arguments made during the meeting for excluding the effluent network from the scope of the CETP Developer. These arguments were: CETP developers generally lack expertise in laying effluent network traditionally development of effluent network is practised on item-rate/BOQ basis because quantity estimation at bid stage is more difficult. if development of effluent network is considered under the scope of BEZA, it will ease coordination while constructing and laying down infrastructure such as effluent network, water pipeline, gas pipeline, cables, roads, which can be planned properly development of effluent network was not a part of the scope of the CETP developer in the Export Processing Zones (EPZ) under BEPZA	Addressed in "*Chapter 3: Project Development Scope*" under section "*3.3 - Components of project scope for the CETP developer and Industry*" and "*Chapter 5: Project Structuring" under section "5.4. - Critical comparison of the project structures" and "5.6 – Key Takeaways*"	32–33,39–45

	further, there are tariff related benefits in keeping the effluent network outside the scope of the CETP developer as it will avoid loading effluent network's cost onto the private developer which will allow a lower tariff to be kept.		
2	**Project Structure:** In the meeting, a collective view emerged that mobilizing private finance is important from BEZA's standpoint	Addressed in "*Chapter 5: Project Structuring*" under section "*5.4. - Critical comparison of the project structures*"	39-45
3	**Market Sounding:** The view of local and international CETP developers is required to be captured regarding the project scope and project structure	Addressed in "*Chapter 5: Project Structuring*" under section "*5.5. - Market Sounding on Project Structuring*" and "*Annexure 14: Market Sounding*"	42 – 44, 192 – 214
4	The project structuring option of "*CETP + Reuse Pipeline on Hybrid Annuity based PPP (HAM) mode and Effluent Network under a separate Construction & Maintenance Contract*" should be indicated in the report	The option has been presented in "*Chapter 5: Project Structuring*" under section "*5.4. - Critical comparison of the project structures*" and "*Chapter 6: Financial Assessment*" under section "*6.2. - Financial Impact on BEZA under various Project Structuring Options*" and section "*6.3. Determination of Tariff Rate*"	39-48, 49-59
5	Following action points for BEZA were discussed: BEZA will co-ordinate for internal approval for "*Option 1: CETP + Reuse Pipeline on Hybrid Annuity based PPP (HAM) mode and Effluent Network under a separate Construction & Maintenance Contract"* and provide such further direction to the study team. Land area of the CETP will be increased from 12 acres (presently) to 18 acres contiguous land at the same location. BEZA's role as reuse (treated) water supplier: ○ BEZA will coordinate internal approval for providing payment guarantee to the CETP developer for the amount of reuse (treated) water produced, provided characteristics of the reuse (treated) water measured at the consumer end of the reuse water pipeline meets prescribed standards.	Updated in "*Chapter 7: Remarks and Action Points*" under section "*7.2 Action points for BEZA.*"	62

	○ Further, BEZA will coordinate internal approval for signing agreements for offtake of reuse (treated) water between: i) BEZA and BSRM Power and Steel, (ii) BEZA and McDonald Steel To ensure successful CETP operations, BEZA will mandate the industries for pre-treatment of the effluent through ETP		
6	Provide the list of abbreviations	List of abbreviations has been provided	7 – 9

Table 56: Compliance with comments from BEZA on overall project

Comments pertaining to Overall Project			
Sl. No.	**Comments from BEZA**	**Response**	
7	Whether the project would be more attractive to investors if the capacity of the CETP is increased to cater to effluents from BSMSN zone 2, zone 3, zone 4 and zone 5	The study team responded as follows: the treatment of effluent from BSMSN zone 2A and zone 2B in the CETP has already been considered by the study team during the preparation of the Business Case Report. If the effluent from zone 3, zone 4 and zone 5 is included under the scope of the CETP, the costs (transmission cost, deep excavation cost) would significantly rise. This is a reason as to why there is increasing advent of decentralized CETPs the present size of the CETP is already on the higher side when compared with other CETPs internationally. Hence, a CETP integrating effluent from a large number of zones is not suggested additional land therefore needs to be planned for CETP(s) in zones 3, 4 and 5 of BSMSN when the Master Plan for these zones are being finalised.	
8	Discussions to be held with banks and financial institutions to explore internationally available funds for CETP development	Addressed in the "*2. Interaction with Financial Institutions/ Banks*" of the Compliance Report submitted to BEZA on 17th March 2019 and in "*Annexure 14B: Meetings with Financial Institutions/ Banks*" of this report (pg. 204-207)	

2) Compliance Report submitted to BEZA on 17th March, 2019

The Draft Business Case Report for the engagement was submitted to BEZA on 31st January, 2019. The comments received from BEZA and 2030 WRG on the report were addressed in the Business Case Report submitted to BEZA on 26th February, 2019 along with the Compliance Sheet submitted on 5th March, 2019. The compliance with other prior comments from BEZA and 2030 WRG in the Business Case Report submitted to BEZA is presented in the table below

It may be noted that the study team has maintained the compliance to the comments in this Revised Business Case Report and updated the respective sections based on the comments and feedback from BEZA.

Table 57: Compliance with prior comments from BEZA

Prior Comments from BEZA			
Sl. No.	**Prior Comments from BEZA**	**Response in the Business Case Report dated 26th February 2019 and Compliance Report dated 17th March 2019**	**Page No. in respective report**
1	Study of internationally executed case studies/ projects	Addressed in "*Annexure 4: National and International Case Studies*"	129 – 136
2	Area requirement for the CETP	Addressed in "*Chapter 2: Broad Project Contours*" under section "*2.3. Land Requirement*" and in "*Chapter 7: Remarks and Action Points*" under section "*7.2. Action points for BEZA*"	23, 62
3	Analysis of the technologies available for the development of CETP	Addressed in "*Annexure 10: Basis for Designing the CETP*" under the section "*The Levels of Treatment*"	150 - 159
4	Pre-treatment at ETP	Addressed in "*Annexure 6: Preliminary treatment by the industry*"	139 -140
5	Options for Reuse of Treated Water	Addressed in "*Chapter 4: Reuse of Treated Effluent"* and in "*Chapter 7: Remarks and Action Points*" under section "*7.2. Action points for BEZA*"	36-38, 62
6	Comparative analysis between PPP and EPC modes	Addressed in "*Chapter 5: Project Structuring*" and "*Annexure 1: Value for Money Assessment*"	39-49, 73-84
7	BEZA Building Code, wastewater rules and regulations in other countries, draft environmental rules (2017) to be considered during the course of the project also the international buyers rules and regulations, IFC / World Bank Group Environmental Health and Safety Guidelines will be compared and analyzed	Addressed in "Annexure 3: Environmental Considerations" of Business Case Report and in "2. Environmental Considerations for Development of CETP" of this Compliance Report	Business Case Report – 92 – 128; Compliance Report – 13-44

Table 58: Compliance with comments from 2030 WRG

Comments from 2030 WRG pertaining to Draft Business Case Report			
Sl. No.	**Comments from 2030 WRG on the Draft Business Case Report**	**Response in the Business Case Report dated 26th February 2019 and Compliance Report dated 17th March 2019**	**Page No. in respective report**
8	Study does not point out that a main advantage of a model with private finance (BOT or hybrid annuity) allows BEZA to leverage public money and thus increase the reach/portfolio of rolling out subsequent CETP's in other zones -2030 WRG did raise this during our conference call with Deloitte last month	Addressed in "*Chapter 5: Project Structuring*" under section "*5.4. Critical comparison of the project structures*"	39–48
9	The report compares several project structures for the three components (1) CETP; (2) Reuse Water Pipeline and (3) Effluent collection network a. Hybrid annuity model for all three is rejected by Deloitte because the model is new for the country, CETP players not comfortable with effluent network and effluent network and effluent network traditionally follow EPC/cash contract. b. Hybrid for (1) and (2) + EPC for (3) is rejected by Deloitte because contractor for (3) does not have performance risk and may delay the project and whole network. Also, low acceptability by market- However, this is not evidenced by market sounding. c. Hybrid for (1) and (2) + DBO for (3) is rejected by Deloitte because mix of commercial structures is too complicated for the bidders/CETP developers/Operators d. All 3 DBO accepted by market (???) but no private finance The report then leaves the choice on BEZA. The biggest flaw in this comparison is that there is no evidence of market consultation on the statements made. The only market consultation seems to indicate that the developer may consider financing at least a part of the capex. The market acceptance is largely dependent on Indian experience.	Addressed in "*Chapter 5: Project Structuring*" under section "5.4. Critical Comparison of the project structures": a. Option 3: Development of CETP + Reuse Water Pipeline + Effluent Network on HAM basis b. Option 1: Development of CETP + Reuse Water Pipeline on HAM basis and Effluent Network under a separate construction & maintenance contract c. Option 4: Development of CETP + Reuse Water Pipeline on HAM Basis and Effluent Network on DBO basis d. Option 5: Development of CETP + Reuse Water Pipeline + Effluent Network on DBO basis The decision to be taken by BEZA is addressed in "*Chapter 7: Remarks and Action Points*" under section "*7.2. Action points for BEZA*". Market consultation is addressed in "*Chapter 5: Project Structuring*" under section "*5.5. Market Sounding on Project Structuring*" and "*Annexure 14: Market Sounding*".	39 – 48, 62, 192 - 214

	10 Furthermore, issues identified with i.e. option3: Development of CETP + Reuse Water Pipeline + Effluent Network on HAM basis are weak: a. Model is relatively new for Bangladesh market. Yes, but it was also new in India for the Ganges river STP program and that seems to be working; b. CETP developers are essentially technology firms focusing in the area of effluent treatment, they do not possess expertise in the business of laying effluent network and would end up subcontracting the job of laying effluent network which comprises 30% of the overall project cost. So the bulk of capex/finance is in the CETP @ 70%, hence capex in network is relatively low and should be doable on subcontractor basis. It is better to have one point of contact who will deal with a network subcontractor, rather than BEZA project managing two separate contracts and having to deal will all sorts interface risk between CETP and network operator (construction AND operations). c. Traditionally development of effluent network is practiced on item-rate basis because quantity estimation at bid stage is difficult. Hence, development of effluent network may be challenging on HAM basis. This true for urban centers where there may be a lot of existing underground infrastructure (water pipes, electricity cables, telecoms) and uncertain/unknown geotechnical conditions. Mirsarai however is a greenfield development, so network should be straightforward to develop as there is no interference from other existing infrastructure and can be developed in planned straightforward manner. Maybe only, some field surveys like geotechnical is required prior to bidding, to ascertain ground conditions and lower the (construction) risk to a private operator.	Addressed in "*Chapter 5: Project Structuring*" under section "*5.4. Critical Comparison of the project structures - Option 3: Development of CETP + Reuse Water Pipeline + Effluent Network on HAM basis*"	39 – 48, 62

	It is further unclear why a water reuse network in a greenfield setting does NOT face similar issues, whereas an effluent collection network in the same greenfield setting does have unknown quantity at bid stage issues.	The reuse water pipeline is proposed for only a few industries and is a straight forward connection. On the other hand, development of the effluent network is complex because flow has to be maintainedby gravity. Further, proper coordination and planning is required while constructing and laying down infrastructure such as effluent network, water pipeline, gas pipeline, cables, roads etc.	
	Finally, the recommendation is to do the effluent network on DBO basis based on unit price rating. What design risk does the contract have, as quantities are excluded from this?	The decision to be taken by BEZA is addressed in "*Chapter 7: Remarks and Action Points*" under section "*7.2. Action points for BEZA*".	
11	a. There is only one private sector consultation with Flowater/ Marubeni, where the participants indicated that they are okay to consider private investment through BOT/BOO and other models. b. The analysis of financial risk is still anchored on Indian experience. The section mentions that Bangladeshi players are also reluctant to take financing risk but there is no stakeholder interaction evidenced supporting this hypothesis.	Addressed in "*Chapter 5: Project Structuring*" under section "*5.5. Market Sounding on Project Structuring*" and "*Annexure 14: Market Sounding*".	39-48, 192-214
12	There are no interactions with Banks or private sector stakeholders.	Addressed in "*Chapter 1: Introduction*" under section "*1.4. Stakeholder Consultation*" along with the following sections: Investors in BSMSN Economic Zone – Addressed in and "*Annexure 12A: Meetings with Client Side Stakeholders - 3) Meeting with Investors in BSMSN Economic Zone on 18th December, 2018*" OEMs and CETP Developers – Addressed in "*Chapter 5: Project Structuring*" under section "*5.5. Market Sounding on Project Structuring*" and "*Annexure 14: Market Sounding*" End Users for reuse of treated water –	Business Case Report - 18-22, 162-171, 44, 192-214, 36-38 Compliance Report – 9-12

		Addressed in "*Chapter 4: Reuse of Treated Effluent*" Financial Institutions/ banks - Addressed in "*1: Interaction with Financial Institutions/ Banks*" of this Compliance Report	
13	The financial analysis on this model is difficult to understand and conclusions of the assessment are not documented	Addressed in "*Chapter 6: Financial Assessment*" and detailed in "*Annexure 2: Financial Analysis For Developing A 48 MLD CETP*"	49-59, 85-91
14	The minutes of meeting annexed to the report seems to be incomplete, in light of the discussions. If the list of meetings is complete then it has gaps in terms of consultations with banks and private sector players (only one meeting is minuted)	Addressed in "*Chapter 5: Project Structuring*" under section "*5.5. Market Sounding on Project Structuring*" and "*Annexure 14: Market Sounding*" of the Business Case Report and "*1: Interaction with Financial Institutions/ Banks*" of this Compliance Report	Business Case Report – 39-48, 192-214; Compliance Report – 9-12
15	The cashflows to BEZA should be more detailed	Addressed in the cash flows submitted to 2030 WRG on 18th March 2019 and updated in "*Chapter 6.2. Financial Impact on BEZA under various Project Structuring Options*" of this Revised Business Case Report	Revised Business Case Report – 51-56

3) Compliance with comments received from BEZA on 9th April, 2019

The compliance to the additional comments received from BEZA on 9th April 2019 in this Business Case Report is presented in the table below.

Table 59: Compliance with comments received from BEZA

Sl. No.	Comments from BEZA	Reference in this Revised Business Case Report	Page No.
1	A conceptual design of CETP, effluent and sewage network is missing in the report	Preliminary sample drawings on the conceptual design of the CETP and effluent network is presented in "*Annexure 11*: *Sample Design of CETP and Effluent Network"*. The detailed drawings and designs will be provided along with the tender documents after the finalization of the contract structure.	160-161
2	In determination of Tariff system there is no discussion or comparison on Pollution (Parameter BOD, COD) Based tariff system	The Tariff rate has been determined based on quantity of effluent, ensuring 20% equity returns to the private operator/ developer and ensuring that the net project lifecycle cash flows for BEZA is zero (in NPV term). This is presented in "*Chapter 6.3 – Determination of Tariff Rate*" Moreover, a tariff mechanism based on pollution load is presented in "*Chapter 6.4*. *Tariff Rate Mechanism*" Further, the tariff mechanism followed in Dhaka EPZ which is based on Pollution Load of the industries is presented in "*Annexure 5: Pollution Load Across Industry*"	57-59; 137-138
3	Environmental investigation with a view to reduce environmental design and construction risk	The different environmental design and construction risks that can arise during the project and adequate mitigation measures that should be taken by the CETP developer for successful development of the project is presented in "*Annexure 3: Environmental Considerations*"	102-128
4	Review of existing Environmental and Social study	A review of different regulations related to Environment, Water Resources, Industry and Construction, relevant to the project along with a review of the existing EIA report is presented in "*Annexure 3: Environmental Considerations*"	102-128
5	Public consultation with local people in shape of Environmental Assessment	Identification of public consultation requirements regarding Environmental Assessment is presented in "*Annexure 3: Environmental Considerations*"	120-128
6	There is no specific pretreatment mechanism (BOD, COD etc. pollution load parameter value) for individual industries with specified enforcement mechanism in case of failure described in the report which BEZA should be	CETP Inlet Standards i.e discharge standards by the industries is presented in "*Annexure 10: Basis for Designing the CETP"* of the Business Case Report; Pre-treatment enforcement mechanism through aggressive	150-155

Sl. No.	Comments from BEZA	Reference in this Revised Business Case Report	Page No.
	adopted	wastewater monitoring along with suggestions for BEZA presented in "*Annexure 6: Preliminary treatment by the industry"* of the Business Case Report;	139-140
7	CETP discharge standard on the basis of International/Buyers standard and it's financial impact has not described	CETP discharge standards presented in "*Annexure 3: Environmental Considerations*". The financial implications for matching the discharge standards in the CETP has been considered in the preparation of financial model.	100-115
8	BEZA as a new organization has to be capacitated in CETP regards, methodologies for capacity building of BEZA and description of organizational structure of BEZA for handling CETP issues, training activities on CETP regard should be present in the report	The study team has explained about the risk assessment and project structuring options for the development of the CETP through three presentations dated 19.12.2018, 13.02.2019 and 28.03.2019. Once the contract structure is finalized and tender documents are prepared, the study team will conduct further training events on tender specific contract management for the CETP	-
9	A TOR compliance report has to be submitted along with the business case report	Addressed in "*Annexure 15: Compliance with the Terms of Reference (ToR)*"	215-219

4) Compliance with comments received from BEZA on 14th May, 2019

The compliance to the additional comments received from BEZA on 14th May 2019 in this Revised Business Case Report is presented in the table below.

Table 60: Compliance with additional comments received from BEZA

Sl. No.	Comments from BEZA	Reference in this Revised Business Case Report	Page No.
1	A conceptual design of CETP, effluent and sewage network is missing in the report	Addressed under "*Annexure 16: 3) Compliance with comments received from BEZA on 9th April, 2019*"	219-220
2	In determination of Tariff system there is no discussion or comparison on Pollution (Parameter BOD, COD) Based tariff system		
3	As per TOR, the report has to include environmental investigation with a view to reduce environmental design and construction risk. Review of existing Environmental and Social study, public consultation with local people in shape of Environmental Assessment of the area is to be present in the report;		
4	There is no specific pretreatment mechanism (BOD, COD etc. pollution load parameter value) for individual industries with specified enforcement mechanism in case of failure described in the report which BEZA should be adopted		
5	CETP discharge standard on the basis of International/Buyers standard and it's financial impact has not described		
6	BEZA as a new organization has to be capacitated in CETP regards, methodologies for capacity building of BEZA and description of organizational structure of BEZA for handling CETP issues, training activities on CETP regard should be present in the report		
7	A TOR compliance report has to be submitted along with the business case report		
8	In financial analysis of Business Case Model, the Net Present Value (NPV) calculated for all options is 0 (zero).	There are two different NPVs mentioned in the report- 1) NPV for private developer, 2) NPV for BEZA. NPV for BEZA has been kept at zero to determine base case tariff rates.	49-59
	The project depends on financially viable on the parameters of Internal Rate of Return (IRR), Benefit Cost Ratio (BCR) and NPV which should be mentioned in the Business Case Model report	NPV for the private developer (is not zero) is positive which is a positive signal. The NPV and IRR calculations are presented in "*Annexure 2: Financial Analysis for developing a 48 MLD CETP*"	85-91

Sl. No.	Comments from BEZA	Reference in this Revised Business Case Report	Page No.
		Both BCR and NPV gives similar conclusion and therefore can be interchangeably used to test viability. Since NPV calculations are already presented, BCR calculations do not seem necessary.	
9	In market sounding on project structuring, it is mentioned that most of the developers indicated EPC or DBO as their preferred option. It should be explained on the HAM mode would be preferable.	Since DBO and EPC are traditional procurement options, all the bidders were familiar with the same. Since HAM option is devoid of demand risk, it is increasingly gaining bidder interest and during the market sounding the bidders had indicated an openness for the same. Given the Value for Money advantage of HAM option vis-a-vis the traditional DBO and EPC modes, the HAM option emerges as the preferred option.	73-84
10	The market sounding activity with the CETP developers is provided in Annexure 13, the short brief description of the organizations should be mentioned	The Market Sounding exercise was carried out with various national and international developers with expertise in water and wastewater treatment. A short description of the developers is provided in *"Annexure 14A: Brief Description of Developers"*	192-210
11	For the determination of the cost of the project depends on the basis of technical analysis, so technical analysis should be done properly	(a) ***Basis of technical analysis & Project Cost***: The study team has undertaken site visits to BSMSN Economic Zone on 09.08.2018. Based on site conditions, and information provided in the master plan, a concept plan for CETP, Effluent Network and Reuse Water pipeline has been developed in accordance with prevailing engineering standards. Subsequently, costing of the design has been carried out using PWD rates of Bangladesh and market prices. (b) ***Project Cost in line with operational projects***: The project cost so determined is also found to be in-line with the project cost of operational CETPs (such as Dhaka CETP and certain foreign CETPs such as Qinghe Treatment Plant). (c) ***Project Cost is used to grant an administrative sanction to proceed with HAM/DBO based tendering***: Further, in HAM and DBO modes of project	150-159

Sl. No.	Comments from BEZA	Reference in this Revised Business Case Report	Page No.
		implementation, the design responsibility lies on the developer, and therefore, the project cost may vary with design and technology adopted by the developer. Therefore, it may be appreciated that in HAM and DBO modes, the project cost cannot be used as a tender estimate benchmark. In these modes, the project cost is used to (i) establish financial viability, (ii) grant an administrative sanction to proceed with HAM/DBO based tendering. Thus, the role of project cost in DBO/HAM mode is significantly different compared to EPC mode. (d) ***A thorough technical examination is carried out after appointment of the successful bidder***: The successful bidder will submit their detailed design, and technology option alongwith detailed project cost. It is at this stage that a thorough technical examination will be required to be carried out. This job will be entrusted with the Independent Engineer to be appointed by BEZA to supervise the construction works.	

5) Compliance with GIZ observations received from BEZA on 12th May, 2019

The compliance to the observations cited by GIZ on the Business Case Report, received from BEZA on 12th May 2019 is presented in the table below.

Table 61: Compliance with GIZ Observations received from BEZA

Sl. No.	Observation of GIZ	Reference in this Revised Business Case Report	Page No.
1	**Scope of TORs and Deloitte's report:** The TORS are as such well written and various requirements are well specified. However, the reports of Deloitte do not meet these requirements. As per TORs, Deloitte was required to look into very important considerations such as:		
	analysis and forecast of expected effluent volume and pollution loads,	Addressed in *"2.2 Projected Effluent Quantity"*	24-29
	appraisal of the technical scope and minimum technical and output specifications for the CETP and effluent/sewerage network at site,	Addressed in *"Annexure 10: Basis of Designing the CETP"*	150-159
	including the setting of pre-treatment effluent and CETP discharge standards,	Addressed in *"Annexure6: Preliminary Treatment at the Industry"*	139-140
	preparation of a conceptual design of CETP and sewerage network.	Addressed in *"Annexure 11: Sample Design of CETP and Effluent Network"*	160-161
	These are not addressed in the Deloitte's reports. Also, all the other points and tasks mentioned in the TOR are very crucial for arriving at conclusions on business model, environmental impact etc. For example, important points are: » Evaluation of wastewater treatment technologies and reuse alternatives. » Prepare a conceptual design for the common effluent treatment plant and wastewater collection network(s). » Environmental and Social Impact Assessment (ESIA). » Determination and comparison of various procurement and financing structures for the Project benchmarked against the principles of value-for-money for BEZA as well as bankability. » Conduct market sounding to test / confirm the appetite of Project developers, contractors, and lenders of the proposed Project structure, output	Addressed under *"Annexure 15: Compliance with the Terms of Reference (ToR)"*	215-219

Sl. No.	Observation of GIZ	Reference in this Revised Business Case Report	Page No.
	specifications, availability of local sources of finance, and payment mechanism, and » Confirmation of the legal basis of the proposed Project structure / PPP modality (in view of the applicable legal and regulatory framework for the Project). As per the scope of work, the consultant is required to undertake: » Market sensitization of CETP opportunities, options, technologies, etc. » Evaluation of CETP experiences in Bangladesh and similar industrial zones across the world, and » CETP options - technologies, size and project structuring arrangements between developer, BEZA and CETP operator. The available reports do not show that these very crucial aspects have been considered by Deloitte		
2	**Type of development in the zones and relevance:** 2A has 632 acres in processing area and 349 acres (55% of the total area) in non-processing & commercial area. 2B has 415 acres in processing area and 25 acres in non-processing area. Non-processing areas may have weak sewage while processing areas will have varied quality of wastewater depending on the sector (food processing, chemicals, textiles and engineering). Chemical sector and textiles sector may generate not-easily biodegradable and toxic wastewaters. The costing aspects have implications due to these variables. If this variability aspect is considered, it will become attractive and viable for industries and non-processing zones.	The effluent generation specific to the particular industry categories proposed to be set up in the Economic Zone has been considered based on the updated Master Plan dated 18th December 2018 . The effluent generation estimation has been carried out for both processing and non-processing areas.	-
3	**Quality of wastewater and pollution load:** Tariff/costing will have to vary by quality of wastewater as some sources have only weak sewage while others such as chemical industries have toxic wastewater. Wastewater quality aspects are not considered in the Deloitte report. Quality of wastewater in 2A and 2 B will vary from easily biodegradable nature to toxic nature depending on raw materials used and products manufactured by the industries. Quality of wastewater and pollution loads can be estimated from the WHO document on Rapid Assessment of Pollution at: https://apps.who.int/iris/bitstream/handle/10665/58750/WHO_PEP_GETNET_93.1-A.pdf;jsessionid=A6376617CDE27C111F4C5C7293A9CBF1?sequence=1. The best would be would to undertake a survey with the industries that are allotted	Based on the updated Master Plan dated 18th December 2018, the specific industries to be set up in the Economic Zone have been considered. The effluent characteristics specific to these industry categories have been considered for estimating the quality and quantity of effluent generation. A quality based tariff setting mechanism has been proposed in *"6.4 Mechanism for Estimation of Tariff Rate"* The study team has conducted	57-59 172-

Sl. No.	Observation of GIZ	Reference in this Revised Business Case Report	Page No.
	plots in 2A and 2 B and from the likely/targeted categories of industries that will come up.	surveys with the investors shortlisted for setting up their industries in the Economic Zone. Further, a Investor Meeting dated 18.12.2018 was held with the investors at the BEZA office, as presented in "*Annexure 13: Minutes of the Meeting*"	191
4	**Quantity of wastewater**: It is estimated based on plot area of the industry. This holds good for very crude initial estimates. For proper planning of CETP, it is recommended to initiate a questionnaire survey with the industries that are already allotted plots in 2A and 2B. Also, estimation of quantities can be made based on industry type and product manufactured by using the above referred WHO document. Realistic estimation of quantities is crucial as this has implications on the type of CETP as well as infrastructure requirements and costing.	The quantity of effluent has been estimated based on the plot area and also the particular type of industries to be set up in the Economic Zone. This was further augmented by a detailed survey with the shortlisted industries for the Economic Zone. The questionnaire for survey with the industries is attached in "*Annexure 12: Questionnaires*" Further, an Investor Meeting dated 18.12.2018 was held with the investors at the BEZA office, as presented in "*Annexure 13: Minutes of the Meeting*".	24-29 162-169 172-191
5	**Stormwater management:** The stormwater drainage and its management is not considered in the report. - The stormwater has potential to enter into CETP thereby adding load onto CETP. - Stormwater needs a plan for collection, draining, treating the run-off as it has potential to be contaminated, rain water harvesting/ponding etc. (standard for run-off treat is: 1 hr run off based on peak rainfall @ 80% coefficient of run-off needs to be collected and treated before disposal). - Stormwater drainage needs to be constructed and O&M undertaken.	Advisory related to Storm water management and water supply has been mentioned under "*7.2 Action Points for BEZA*"	62
6	**Planning of network and treatment systems:** The zones 2A and 2B have 931 acres and 440 acres. It is not advisable to have one single CETP for the entire zone. It adds up to complexities in treatment as well as O&M and increases costs due to longer networks.	A single CETP is proposed for 2A and 2B zones because: The location of the CETP is proposed at a lower contour level thus allowing gravitational	

Sl. No.	Observation of GIZ	Reference in this Revised Business Case Report	Page No.
		flow of effluent The location is at the border of Zones 2A and 2B, thus making conveyance cost lower	139-140
	Depending on the zoning of industries in the processing areas and activities in non-processing areas, the treatment system should be planned with a combination of centralised and decentralised treatment systems. This will help in optimising networks (conveyance, recycling and drainage) as well in installing cost-effective treatment systems. For example, the residential areas can have decentralised STPs or rootzone and similar treatment systems where in cost of treatment is loess, O&M is simpler and risks of recycling treated wastewater are lesser.	Further setting up of ETPs by the individual industries is proposed in *"Annexure 6: Preliminary treatment by the industry"*	
7	**Treatment technologies:** Treatment technologies and treatment options were not taken into consideration. Since there is a varied quality of effluent (non-processing areas, different industry sectors), the CETP will require a mix of treatment units. Choice of technologies and mix of treatment systems can help minimise risks of operational failures and also help reduce costs. The treatment system should be planned with a combination of centralised and decentralised treatment systems There is a need for an integrated plan for the entire zone 2A and 2B with a combination of centralised and decentralised treatment systems, and stormwater management system.	Addressed in *"Annexure 10: Basis of Designing the CETP"*	150-159
8	**Capital costs:** Capital costs of 1,600 million BDT for 48 mld and bout 1,260 million BDT for 32 mld are for CETP, conveyance and recycling networks. Costs appear to be on lower side.	Addressed in *"Annexure 16. 4) Compliance with comments received from BEZA on 14th May, 2019, point 11"*	220-238
9	**User charges/tariffs:** User charges/tariffs that will be collected from industries are specified to be 30 to 40 BDT per KL. This is a low cost in line with expectations from user industries (the report states that the industries are willing to pay this rate). However, the costs need to be rechecked if all costs are properly accounted – example, liability on capital investment, O&M costs, administrative costs (staff, lab, monitoring costs etc.) etc. The treatment costs also need to be offset with revenues from sale of treated wastewater.	All costs and sources of revenue have been considered in calculation of the tariff rate. Addressed in "*6. Financial Assessment*"	49-59
	4% annual hike is foreseen on tariffs. This means that there will an incremental cost adding to burden on industries after 5 to 7 years. Consider reducing tariffs by: including grant portions on capital costs, cost recovery from sale of treated wastewater, cost savings from usage of energy efficient pumps etc., installation of RE (solar PV etc.), choosing right treatment technologies etc.	4% annual hike in the tariff rate is as per the standards followed in DWASA. The tariff computation is based on 0 NPV for BEZA and includes the effect of various	

Sl. No.	Observation of GIZ	Reference in this Revised Business Case Report	Page No.
		cashflows (including grant, sale of treated water etc.) relating to the project. The cost savings from energy efficient pumps, installation of RE etc. is planned to be addressed in the tender documents which will allow design to be proposed by the bidder.	
10	**Administration aspects and controlling of CETP operator:** The functioning of the CETP needs to be overseen. The structure for this has not be defined in the report. Here are some questions:		
	- How will decisions be taken on fixing tariffs and making revisions to tariffs?	Tariff mechanism presented in "*6.4. Mechanism for Estimation of Tariff Rate*"	57-59
	- How to deal with defaulters and how to deal with appeals?	Addressed in "*6.4. Mechanism for Estimation of Tariff Rate*	57-59
	- Will industry and BEZA be represented on the board of the CETP Operator?	The CETP Operator will be a private developer who would operate the CETP under a contractual arrangement with BEZA.	
	- What will be the mechanisms if the CETP operator is not performing and needs to be terminated?	This shall be addressed through the KPI (Key Performance Indicator) clauses in the tender documents.	
	- What will be arrangements between the CETP Operator and the user industries?	The CETP operator shall operate as an effluent treatment service provider to the industries	
	- What are the obligations of the user industries, CETP operator and BEZA? - Who has the legal responsibilities liabilities?	These shall be addressed through the requisite clauses in the tender documents	
11	**Tendering and selection of CETP Operator:** As per TORs, Deloitte is required to, a) prepare business case and recommend a suitable contract structure, and b)	This Business Case Report has been prepared based on the assessment of the study team as per the	-

Sl. No.	Observation of GIZ	Reference in this Revised Business Case Report	Page No.
	prepare bid documents, carry out market sounding and transact the CETP and fresh water supply until commercial and, if applicable, financial close. The present document does not provide sufficient assessments to reach proper conclusions on suitable contract structure. The preparation of bod documents etc. is a complex but a very important tasks to get the right operator/contractor. After selecting the right business model by BEZA for the planning and designing, construction and operation of the CETP and the network, it is important to develop tender documents professionally so that qualified international CETP companies can be attracted. Standardised documents exist from Germany/EU for developing such tender documents. Relevant annexures such as the format of the contract, format of agreements for the operator and the user industries etc. are available. The existing documents of Deloitte are not sufficient for initiating a tender. Who will prepare the tender documents for appointing the CETP Operator? Who will undertake Bid Process management?	requirements of the ToR and comments received from BEZA. The various options available for the contract structure has been provided in this report and also discussed during the meetings with BEZA dated 19.12.18, 13.02.19, 28.03.19 and 10.04.19. Based on the project structuring option shortlisted by BEZA as per letter dated 14th May 2019, the study team shall prepare the tender documents.	

Annexure 17: Select Key Considerations submitted to BEZA on 09.07.2019

The Association "Deloitte-BETS" had submitted the Business Case Report for the Centralized Effluent Treatment Plant (CETP) at Bangabandhu Sheikh Mujib Shilpa Nagar (BSMSN) on 16.05.2019. A Market Consultation meeting was held on 30.06.2019 to inform potential bidders about the project. In line with the feedback received from the stakeholders in the consultation meeting, the following is proposed for BEZA's consideration and approval:

1. **Influent BOD standards for the proposed CETP:**

   The Master Plan of the region has undergone changes over time. In this regard, the study team also conducted a second round of conversations with the industries to understand their plans. The present industry mix and further inputs from the tenants has been used to arrive at the indicative effluent pretreatment requirements to be followed by the industries in the region. Based on discussions with industries, it emerges that bulk of the industries (91 out of 96 industries) have BOD levels of around 450 mg/L - 600 mg/L. If the effluent norms at the inlet of the CETP are kept at this level, the pretreatment requirements of these industries will significantly come down. Further, treatment at CETP offers relative economies of scale vis-à-vis treatment at multiple industry ETPs. Hence, to (i) lower the overall treatment cost, (ii) have minimal pretreatment requirements at the industry level, (iii) relative ease for industries and (iv) minimize efforts on monitoring the effluent quality of the industries, the CETP inlet can be kept at BOD level of 600 mg/L. In this way, industries can continue to concentrate at their core business and worry less about pretreatment. If the BOD level at the CETP inlet is kept at 600 mg/L, the project cost will likely increase by ~15% to 180 BDT crore and the effluent treatment tariff at the CETP will increase by ~19%-48% to around 40-49 BDT/KL. (Please refer to **Annexure-1** comprising scenario analysis)

   Thus, BEZA may take a view on:

   a) Increasing the BOD level at the inlet of the CETP from 350 mg/L to 600 mg/L
   b) Communicating to the proposed industries to match the inlet standards of the CETP along with provision of supporting infrastructure to monitor the quality & quantity of the effluent

2. **Tenure of the Project:**

   During the Market Consultation meeting, the Bidders and Financial Institutions mentioned about the non-availability of long term financing for infrastructure projects in Bangladesh. They suggested that financing of the project will be easier if tenure of the project is less than 15 years. Further, since the life of electromechanical equipment is usually ~15 years, the tenure of the project may be considered by BEZA to be reduced from 20 years to 15 years so that they are co-terminus. Therefore, the average tariff for certain scenarios has been worked out assuming net cash flows for BEZA remains zero (full cost recovery). These scenarios are presented in the table below. (These scenarios correspond to BOD level of 600 mg/L at the CETP inlet, as described in point 1 above.)

Case 1: Tentative Average Effluent treatment tariff rate (BDT/KL) (when rate of supply of reuse water is **20 BDT/KL**)

Increase in Tariff rate (%) per year	Tenure (in years)	
	20 years (2 years Construction + 18 years O&M	15 years (2 years Construction + 13 years O&M
4%	43.48	48.95
5%	38.01	**44.00** [1]

Case 2: Tentative Effluent treatment average tariff rate (BDT/KL) when rate of supply of reuse water is **25 BDT/KL**

Increase in Tariff rate (%) per year	Tenure (in years)	
	20 years (2 years Construction + 18 years O&M	15 years (2 years Construction + 13 years O&M
4%	41.40	46.87
5%	35.67	41.92

Presently, there is a 5% p.a. escalation for water and sewerage tariffs in DWASA and also for effluent treatment tariff at the CETP in Dhaka EPZ. The same is suggested to be adopted by BEZA.

BEZA may take a view on (i) changing the tenure of the project to 15 years to facilitate the inputs provided by Financial Institutions and potential bidders and (ii) allow a minimum tariff increase of 5% p.a. over the tenure of the project.

3. Provision for sovereign guarantee:

Bidders have cited examples of power sector PPP projects being implemented under the Bangladesh Power Development Board (BPDB)[2] for provisioning of sovereign guarantee through Implementation Agreements in Bangladesh. BEZA may take a view on provision of sovereign guarantee for the payments to be released by BEZA for the development of the CETP at BSMSN for Zone 2A and 2B.

4. Synchronizing water supply infrastructure with CETP infrastructure and setting tariff rate for water supply:

a) Water supply infrastructure is essential for the industries to be set up in BSMSN 2A and 2B. As generation of effluent wastewater is dependent on the water supplied to the industries, the potential bidders for the CETP infrastructure seek assurance from BEZA on yearwise water supply availability in the region. In this view, BEZA may coordinate and ensure synchronization of water supply contract with the project agreement for the development of the CETP. Further, such information (yearwise water supply) may be made available for inclusion in bidding documents.

[1] The weighted average tariff for effluent treatment across industries is 44 BDT/KL which will vary from 29.2 BDT/KL to 53.51 BDT/KL depending on the type of industry (*Polluters Pay principle*)

[2] Projects include (i) 5 MW waste to power generation facility at Jalkuri, Narayanganj; (ii) Coal fired power generation facility at Khelna; (iii) Grid tied solar power project at Rangunia, Chattogram

b) A decision may be taken by BEZA for setting the water tariff rate in BSMSN – 2A and 2B. This shall serve as a benchmark for setting the tariff rate for supply of reuse/ treated water to the proposed industries.

5. Agreement with industries for reuse of treated effluent:

BEZA may initiate discussions with prospective users of reuse/ treated water and seek commitment on water requirement from them. Thereafter, BEZA may coordinate internal approval for signing agreements for offtake of reuse water by the respective industries.

6. Site for Disposal of Sludge:

We understand that BEZA may appoint an integrated solid waste and sludge management agency, for BSMSN region. Hence, we understand that disposal of sludge (from CETP) will be the responsibility of this agency. BEZA may please clarify:

a) if the treatment of the sludge produced at the CETP will be under the scope of CETP developer or the agency appointed for solid waste and sludge management
b) the site and area for disposal of sludge produced by the CETP

7. Appointment of Independent Verification Agency for the project:

An Independent Verification Agency/ Project Engineer is normally appointed in PPP projects to broadly monitor the roles and responsibilities of the private player and the public authority; i.e

•monitor timely completion of construction of the project facilities
•concession agreement (contract) management
• recommending concessionaire payments during construction period monitoring effluent discharge flow (quality and quantity) from industries monitoring compliance with the KPIs during the O&M Period etc.

An indicative list of roles and responsibilities of the Independent Verification Agency/ Project Engineer is presented in **Annexure 2**.

Thus, BEZA may synchronize the contract for appointment of an Independent Verification Agency along with the project agreement for the development of the CETP.

8. Single Stage vis-à-vis Two Stage bidding process:

A decision may be taken by BEZA on whether the bidding process for the CETP tender should be single stage / two stage.

The relative advantages and disadvantages of these have been indicated in Annexure 3.

9. Foreign currency payment by BEZA:

During the meeting, certain international (potential) bidders requested that bidders be allowed to bid and receive payments from BEZA in foreign currency. This becomes particularly relevant due to lack of long term financing from local Financial Institutions. BEZA may take a view if bidders can be allowed to bid and receive payment in foreign currency and thereby should currency risk be absorbed by BEZA.

10. Status of land allotment to potential investors and their operational timeline:

The bidders have requested that BEZA may kindly share information on the:

a) status of land allotment to the potential tenants (investors) and the progress of land lease agreements with them
b) proposed operation timeline of the industries so that there is clarity on demand for effluent treatment

Annexure 17.1: Setting the CETP inlet BOD level at 600 mg/L

Background: In the Business Case Report submitted to BEZA, the total project cost for the project was envisaged to be 160.50 BDT crore. The tariff rate to be charged to the industries for the treatment at the CETP was envisaged to be around 33.60 BDT/KL. The costs were calculated based on the assumption that the BOD (Biological Oxygen Demand) level of the incoming effluent at the inlet of the CETP should be set at 350 mg/L.

Based on further discussions with industries/tenants, it emerges that bulk of the industries (91 out of 96 industries) may have BOD levels of around 450 mg/L - 600 mg/L, thus suggesting an increase in the BOD level at the inlet of the CETP to 600 mg/L.

Explanation: The BOD levels in the effluent of the different types of industries proposed to be set up in BSMSN 2A and BSMSN 2B is provided below

Type of Industry	Number of Industries	BOD level (mg/L)[1]
Textiles And Apparels	**82**	**460**
Engineering Goods	**9**	**594**
Food Processing	4	1342
Chemicals	1	1011

- **Scenario 1: CETP Inlet BOD at 350 mg/L**:
  - It is observed that all the industries will have to undergo BOD reduction to match the CETP inlet norms
  - This would burden all the 91 Textile and Apparels & Engineering Goods industries with additional cost of around 27 BDT/KL for pretreatment
  - Similarly, the remaining 5 industries with higher BOD levels will incur a pre-treatment cost of around 53 BDT/KL for pretreatment
  - Thus, the net cost to the industries will range from **61 BDT/KL** to **87 BDT/KL**
- **Scenario 2: CETP Inlet BOD at 600 mg/L**:
  - Increasing the inlet BOD level of the CETP increases the total project cost to around **185 BDT crore (15% increment)**
  - The tariff rate to be charged to the industries for the treatment at the CETP is envisaged to be around **40 to 49 BDT/KL**
  - However, in this scenario it was observed that 91 Textile and Apparels and Engineering Goods industries have their BOD levels within CETP inlet standards thus reducing the pretreatment cost to 3 BDT/KL **(89% decrement)**
  - The remaining 5 industries with higher BOD levels will incur a pre-treatment cost of around 29 BDT/KL **(45% decrement)** ○ Thus, the net cost to the industries will range from **43 BDT/KL** to **79 BDT/KL**

Implications: While the total project cost for the project increases by 15% in scenario 2, it emerges that the net cost to the industries is lower:

- The net cost to 91 proposed industries with low BOD levels decreases by ~14-30%
- The net cost to 5 proposed industries with high BOD levels decreases by ~10-20%

[1] Based on primary and secondary sources for similar industries

Annexure 17.2: Roles and Responsibilities of Independent Verification Agency/ Project Engineer

The role and functions of the Project Engineer shall include and not limited to the following:

i. Review, analysis and qualifying assessment of field investigations carried out and reported by the Concessionaire in respect of topographical surveys, hydraulic & hydrologic data verification, sub-surface investigation including laboratory testing and reports of geologists wherever applicable, investigation of construction material including lab testing.

ii. Review, analysis and qualifying assessment of Design Memorandums, specifications and construction drawings prepared and submitted by the Concessionaire.

iii. Conduct Kick Off meetings

iv. Review and Monitor the submissions of the Concessionaire such as:
   a. Work Schedule
   b. Detailed Survey report
   c. Basic Engineering
   d. Detailed design and Drawings for
      i. Civil Works
         1. Geo-tech reports
         2. Lab testing reports
         3. Third Party Inspection report ii. Mechanical and Electrical Works
      iii. Automation and Instrumentation works
      iv. Any other allied works
   e. QA/QC plans
   f. Environment Health and Safety Plan, material safety data and hazardous chemicals if any

v. review of the Drawings and Documents as set forth in ToR;

vi. Identification of Construction Milestones & Project progress monitoring and issue of Milestone Construction Certificates, Construction Completion Certificate, monitoring Trail run, recommendations for issuance of COD certificate by BEZA etc.

vii. To Assist BEZA for getting Statutory permissions

viii. Ensure compliance with Statutory provisions under various applicable laws

ix. Review, inspection, supervision and monitoring of Construction Works; conducting Tests on completion of construction and issuing Completion/ Provisional Certificate

x. Review, inspection and monitoring of O&M;

xi. determining, as required under the CETP Project Agreement, the costs of any works or services and/or their reasonableness;

xii. determining, as required under the CETP Project Agreement, the period or any extension thereof, for performing any duty or obligation;

xiii. Determining the Events of default and guidance on consequent Termination notices and Payment; or

xiv. Determine deficiencies in the commissioning & trial runs; prepare the final acceptance document for acceptance of commissioning & trial runs. Prepare & Issue Commercial Operation certificate through BEZA.

xv. Any other matter which is not specified in ((xii),(xiii), or (xiv) above and which creates an obligation or liability on BEZA beyond the provisions of the CETP Project Agreement.

xvi. The Project Engineer shall submit regular periodic reports, as specified in the TOR to BEZA, in respect of its duties and functions.

xvii. The Project Engineer shall aid and advise BEZA on any proposal for variation.

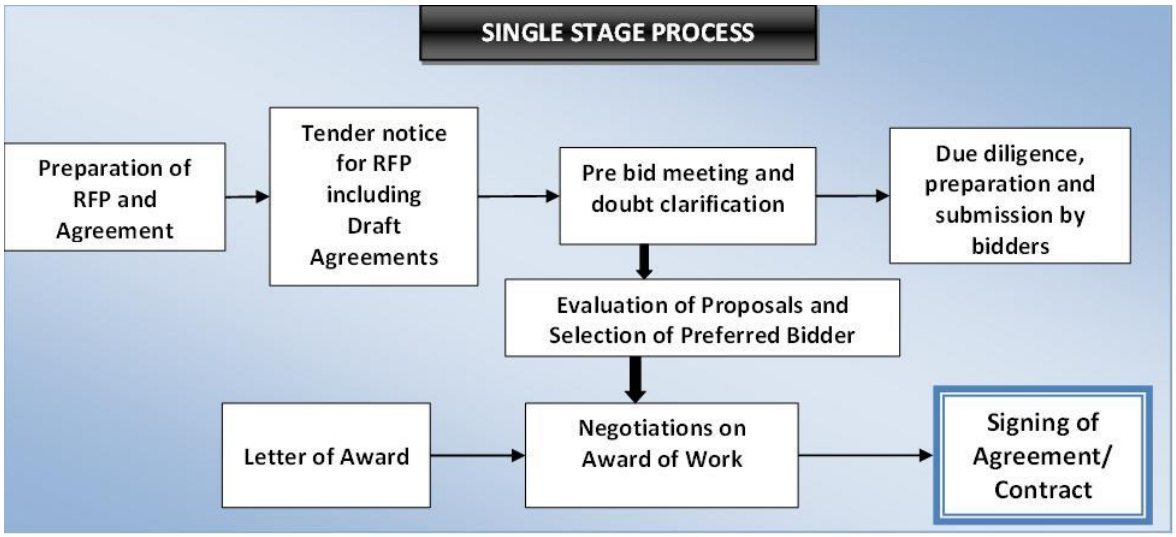
xviii. Assisting the Parties in resolution of Disputes xix. Assisting BEZA in the fulfilment of Hand back requirements

xix. Undertaking all other duties and functions.

Annexure 17.3: Single Stage Process vis-à-vis Two Stage Process

Single Stage Bidding Process

In single stage bidding process selection is on the basis of responses received on the RFP (Request for Proposal).



There are certain inherent advantages and disadvantages in single stage, which are indicated below:

Advantages of Single Stage Bidding Process

- **More clarity on the project scope:** RFP can be released after Concession Agreement has been finalised. The Authority will provide details of the Project and Bidders can take informed decision to bid or not to bid.

- **Encourage serious bidders to participate:** Bidders will have clarity not only on scope of the project but also on the terms and conditions of the contract before expressing their interest. Hence, this clarity will only encourage serious bidders will be interested in submitting the Bidders.

- **Setting the right eligibility criteria:** RFP can be released after project scope and concession agreement has been finalised. This will help the Authority in identifying the right set of bidders – developers v/s contractors v/s operators. Hence the Authority can decide on appropriate eligibility criteria to look for in potential bidders.

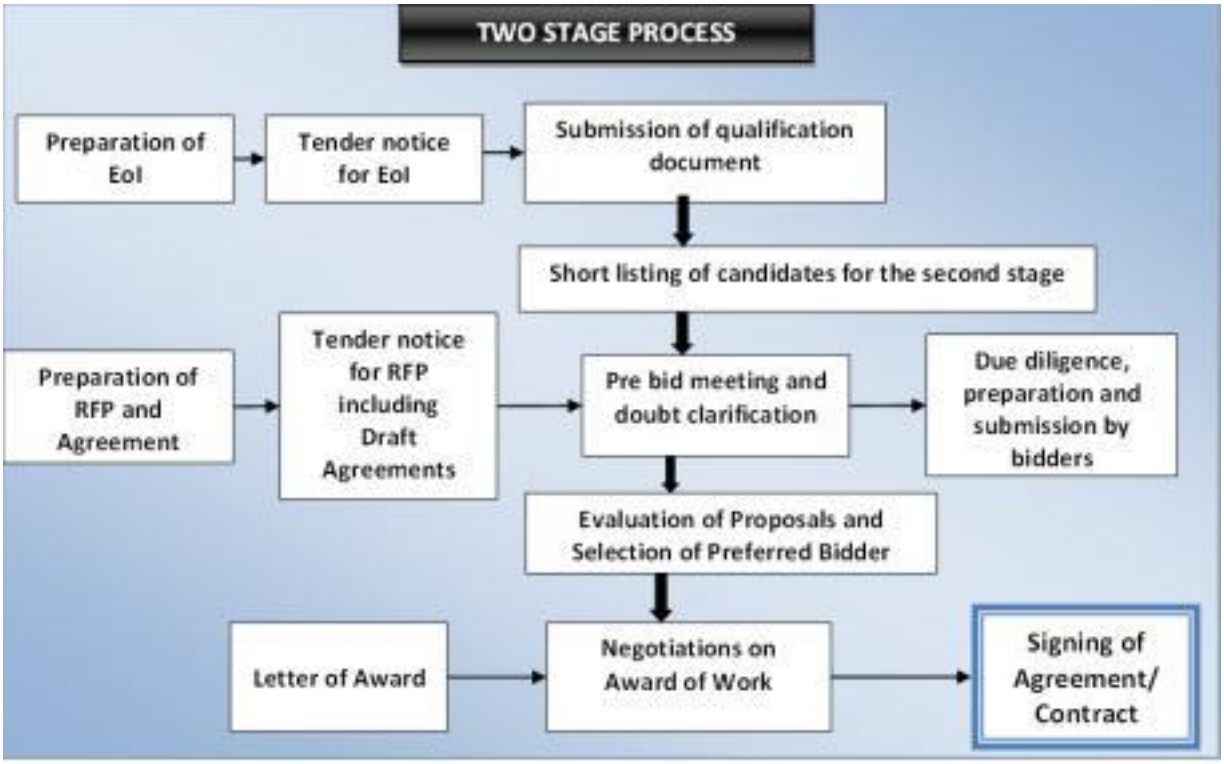
- **Time taken for Bid Process**: The time taken for a single stage process is lesser than a 2-stage process and can be an important consideration for BEZA in context of its other related activities.

Disadvantages of Single Stage Bidding Process

The Authority will be able to commence the bid process only when both RFP and Concession Agreement has been finalized and approved by the Authority and therefore requires fair level of clarity on project scope.

Two Stage Bidding Process

In two stage bidding process, Pre-Qualification or EOI (Expression of Interest) and RFP (Request for Proposal) are two integral stages.



The inherent advantages and disadvantages in two stage bidding process are indicated below:

Advantages of Two Stage Bidding Process

Methodical process of selection: After the pre-qualification (EOI stage), the RFP and concession agreement with its terms and conditions (the risk-sharing framework), detailed in the draft Bid Documents, is shared with the shortlisted bidders and can be discussed with the shortlisted bidders only.

Disadvantages of Two Stage Bidding Process

Delays in Selection Process: The Authority will have to give certain time for bidders to respond to each stage. Typically, time required to finally get the Concessionaire on board doubles.

Lack of clarity may adversely impact participation from serious bidders: Lack of clarity about the project scope at the EOI stage (not possible to work out schedules / details of the Project at EOI stage) may affect participation of some potentially serious bidders.

Non-serious bidders in the EOI stage: During the EOI stage, a whole lot of bidders may participate just to get the foot in the door.